Enclosure 3

Appendix E Applicant's Environmental Report Subsequent Operating License Renewal Point Beach Nuclear Plant Units 1 and 2

Attachment 2

(705 Total Pages, including cover sheets)

Appendix E

Applicant’s Environmental Report

Subsequent Operating License Renewal

Point Beach Nuclear Plant Units 1 and 2

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Abbreviations, Acronyms, and Symbols

422V+	0.422" VANTAGE+
$	dollar(s) (U.S.)
§	Section
°C	degrees Celsius
°F	degrees Fahrenheit
µCi	micro Curies
AADT	average annual daily traffic
AC	alternating current
AEA	Atomic Energy Act
AHI	Architecture and History Inventory
ALARA	as low as reasonably achievable
ALWR	advanced light water reactor
APE	area of potential effect
AQCR	air quality control region
ASI	archaeological sites inventory
ATWS	anticipated transient without scram
BGEPA	Bald and Golden Eagle Protection Act
BMP	best management practice
BTA	best technology available
Btu	British thermal unit
CAA	Clean Air Act
CC	component cooling
CCW	condenser cooling water
CDF	core damage frequency
CDP	census-designated place
CFR	Code of Federal Regulations

cfs	cubic feet per second
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CSP	concentrated solar power
CTH	County Highway
CVCS	chemical and volume control system
CWA	Clean Water Act (Federal Water Pollution Control Act)
CZMA	Coastal Zone Management Act
dB	decibel
dBa	A-weighted decibel
DDT	dichlorodiphenyltrichloroethane
DECON	dismantling and decontamination, one of three NRC decommissioning strategies
DHS	Department of Health Services
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DPH	Division of Public Health
DRO	diesel range organics
DSM	demand-side management
EAB	exclusion area boundary
EDG	emergency diesel generator
EFH	essential fish habitat
EIA	U.S. Energy Information Administration
EIC	Energy Information Center
EIS	environmental impact statement
ENTOMB	permanent entombment on site, one of three NRC decommissioning strategies

EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
EPU	extended power uprate
ER	environmental report
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FEMA	Federal Emergency Management Agency
FES	final environmental statement
FPL	Florida Power & Light
FPPA	Farmland Protection Policy Act
fps	feet per second
ft^3	cubic feet
g	gravitational force equivalent
GEIS	NUREG-1437, *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*
GHG	greenhouse gas
GPI	Groundwater Protection Initiative
gpd	gallons per day
gpd_a	average gallons per day
gpm	gallons per minute
gpm_a	average gallons per minute
GRO	gasoline range organics
HAP	hazardous air pollutant
HAPC	habitat areas of particular concern
I-43	Interstate 43
IGLD	international Great Lakes datum
IPA	integrated plant assessment
IPEEE	individual plant examination of external events

ISFSI	independent spent fuel storage installation
ISLOCA	interfacing systems loss-of-coolant accident
IVM	integrated vegetation management
kHz	kilohertz
km	kilometer(s)
KPS	Kewaunee Power Station
kV	kilovolt
LERF	large early release frequency
LLD	lower limit of detection
LLMW	low-level mixed waste
LLRW	low-level radioactive waste
LLW	low-level waste
LOCA	loss-of-coolant accident
LOS	level of service
LRA	license renewal application
mA	milliamperes
Mb	body-wave magnitude (earthquakes)
MB	maximum benefit
mb_lg	Short-period surface wave
MBTA	Migratory Bird Treaty Act
MBtu	million British thermal units
MDC	minimum detectable concentration
MEI	maximum exposed individual
MET	meteorological
MG	millions of gallons
MGD	million gallons per day
mg/kg	milligrams per kilogram

mg/L	milligrams per liter
MGM	millions of gallons per month
MGY	millions of gallons per year
MM	modified Mercalli intensity (seismic intensity scale)
mph	miles per hour
mrad	milliradiation absorbed dose
mrem	millirem
MRLC	Multi-Resolution Land Characteristics Consortium
MSLB	main steam line break
mSv	millisievert
MUR	measurement uncertainty recapture
mva	megavolt ampere
mw	moment magnitude
MW	megawatt
MWD/MTU	megawatt days per metric ton uranium
MWe	megawatts electric
mwr	moment magnitude regional
MWt	megawatts thermal
NA	not available/not applicable
NAAQS	National Ambient Air Quality Standards
NAVD88	North American Vertical Datum 1988
NCEI	National Centers for Environmental Information
NEE	NextEra Energy, Inc.
NEER	NextEra Energy Resources, LLC
NEI	Nuclear Energy Institute
NEPB	NextEra Energy Point Beach, LLC
NEPA	National Environmental Policy Act

NESC	National Electrical Safety Code
NFPA	National Fire Protection Association
NGCC	natural gas combined-cycle
NHPA	National Historic Preservation Act
NMFS	National Marine Fisheries Service
NMHC	non-methane hydrocarbons
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
NWS	National Weather Service
OL	operating license
ODCM	offsite dose calculation manual
OSHA	U.S. Occupational Safety and Health Administration
Pb	lead
PBN	Point Beach Nuclear Plant
pc/h	passenger cars per hour
PCB	polychlorinated biphenyl
pCi/l	picoCuries per liter
PCP	primary coolant pump
PILOT	payment in lieu of taxes
$PM_{2.5}$	particulate matter less than 2.5 micrometers in diameter
PM_{10}	particulate matter less than 10 micrometers in diameter
PM	particulate matter

ppm	parts per million
PRA	probabilistic risk assessment
PSD	public school district
psi	pounds per square inch
psig	pounds per square inch gauge
PV	photovoltaic
PWR	pressurized water reactor
RBCCW	reactor building closed cooling water
RCA	radiation control area
RCP	reactor coolant pump
RCRA	Resource Conservation and Recovery Act
RCS	reactor coolant system
rem	roentgen equivalent man
REMP	radiological environmental monitoring program
RHR	residual heat removal
ROW	right-of-way
RWST	refueling water storage tank
SAFSTOR	safe storage, one of three NRC decommissioning strategies
SAMA	severe accident mitigation alternative
SBCC	Site Boundary Control Center
SBO	station blackout
SEIS	supplemental environmental impact statement
SGTR	steam generator tube rupture
SHPO	state historic preservation officer
SLR	subsequent license renewal
SLRA	subsequent license renewal application

SMITTR	surveillance, monitoring, inspections, testing, trending, and recordkeeping
SMR	small modular reactor
SN	station number (WDOT)
SNF	spent nuclear fuel
SO_2	sulfur dioxide
SO_x	sulfur oxides
SPCC	spill prevention, control and countermeasure
SSA	sole source aquifer
SSC	systems, structures, and components
STC	source term category
STH	State Highway
SU	standard units
SW	service water
SWPPP	stormwater pollution prevention plan
TD	total depth
TEDE	total effective dose equivalent
TLD	Thermoluminescent dosimetry
UFSAR	updated final safety analysis report
UO_2	uranium dioxide
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USCB	U.S. Census Bureau
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VOC	volatile organic compound

WDA	Wisconsin Department of Administration
WDNR	Wisconsin Department of Natural Resources
WDOT	Wisconsin Department of Transportation
WDR	Wisconsin Department of Revenue
WET	whole effluent toxicity
WHPD	Wisconsin Historic Preservation Database
WHS	Wisconsin Historical Society
WNHI	Wisconsin Natural Heritage Inventory
WPDES	Wisconsin Pollutant Discharge Elimination System

1.0 INTRODUCTION

1.1 Purpose of and Need for Action

The U.S. Nuclear Regulatory Commission (NRC) licenses the operation of domestic nuclear power plants in accordance with the Atomic Energy Act of 1954, as amended, and NRC implementing regulations. NextEra Energy Point Beach, LLC (NEPB) owns and operates the Point Beach Nuclear Plant (PBN) Units 1 and 2 pursuant to NRC operating licenses (OLs) DPR-24 and DPR-27, respectively. Based on a license renewal application (LRA) submitted in 2004, the NRC issued renewed OLs in December 2005, providing authorization to operate for an additional 20 years beyond the original 40-year licensed operating term. The renewed Unit 1 OL shall expire on October 5, 2030, and the renewed Unit 2 OL shall expire on March 8, 2033. PBN is located on the western shore of Lake Michigan in Manitowoc County, WI, approximately 15 miles north-northeast of Manitowoc, WI.

NEPB has prepared this environmental report (ER) in conjunction with its application to the NRC for a subsequent renewal of the PBN OLs, as provided by the following NRC regulations and guidance:

- Title 10, Energy, Code of Federal Regulations (CFR), Part 54, Requirements for Renewal of Operating Licenses for Nuclear Power Plants, Section 54.23, Contents of Application—Environmental Information [10 CFR 54.23]
- Title 10, Energy, CFR, Part 51, Environmental Protection Requirements for Domestic Licensing and Related Regulatory Functions, Section 51.53, Postconstruction Environmental Reports, Subsection 51.53(c), Operating License Renewal Stage [10 CFR 51.53(c)]
- NUREG 1555, Supplement 1, Standard Review Plans for Environmental Reviews for Nuclear Power Plants, Supplement 1, Revision 1: Operating License Renewal

The NRC has defined the purpose and need for the proposed action, renewal of the OLs for nuclear power plants such as PBN, as follows (NRC 2013a, pp. 1-3 and 1-4):

> *The purpose and need for the proposed action (issuance of a renewed license) is to provide an option that allows for baseload power generation capability beyond the term of the current nuclear power plant operating license to meet future system generating needs. Such needs may be determined by other energy-planning decision-makers, such as state, utility, and, where authorized, federal agencies (other than the NRC). Unless there are findings in the safety review required by the Atomic Energy Act or the National Environmental Policy Act (NEPA) environmental review that would lead the NRC to reject a license renewal application, the NRC does not have a role in the energy-planning decisions of whether a particular nuclear power plant should continue to operate.*

The renewed OLs would allow an additional 20 years of operation for the PBN units beyond their current licensed operating terms. The subsequent renewed license for PBN Unit 1 would expire at midnight on October 5, 2050, and the subsequent renewed license for PBN Unit 2 would expire at midnight on March 8, 2053.

NEPB has prepared Table 1.1-1 to verify conformance with regulatory requirements. Table 1.1-1 indicates the sections in the PBN subsequent license renewal (SLR) ER that respond to each requirement of 10 CFR 51.53(c) and 10 CFR 51.45.

Table 1.1-1 Environmental Report Compliance with License Renewal Environmental Regulatory Requirements (Sheet 1 of 3)

Description	Requirement	ER Section(s)
Environmental Report—General Requirements [10 CFR 51.45]		
Description of the proposed action	10 CFR 51.45(b)	2.1
Statement of the purposes of the proposed action	10 CFR 51.45(b)	1.1
Description of the environment affected	10 CFR 51.45(b)	3.0
Impact of the proposed action on the environment	10 CFR 51.45(b)(1)	4.0
Adverse environmental effects which cannot be avoided should the proposal be implemented	10 CFR 51.45(b)(2)	6.3
Alternatives to the proposed action.	10 CFR 51.45(b)(3)	2.6, 7.0, and 8.0
Relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity	10 CFR 51.45(b)(4)	6.5
Irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented	10 CFR 51.45(b)(5)	6.4
Analysis that considers and balances the environmental effects of the proposed action, the environmental impacts of alternatives to the proposed action, and alternatives available for reducing or avoiding adverse environmental effects	10 CFR 51.45(c)	2.6, 4.0, 7.0, and 8.0
Federal permits, licenses, approvals, and other entitlements which must be obtained in connection with the proposed action and description of the status of compliance with these requirements	10 CFR 51.45(d)	9.1
Status of compliance with applicable environmental quality standards and requirements which have been imposed by federal, state, regional, and local agencies having responsibility for environmental protection, including, but not limited to, applicable zoning and land-use regulations, and thermal and other water pollution limitations or requirements	10 CFR 51.45(d)	9.5
Alternatives in the report including a discussion of whether the alternatives will comply with such applicable environmental quality standards and requirements	10 CFR 51.45(d)	9.7
Information submitted pursuant to 10 CFR 51.45(b) through (d) and not confined to information supporting the proposed action but also including adverse information	10 CFR 51.45(e)	4.0. 6.3, 7.0, 9.3, and 9.5

Table 1.1-1 Environmental Report Compliance with License Renewal Environmental Regulatory Requirements (Sheet 2 of 3)

Description	Requirement	ER Section(s)
Operating License Renewal Stage [10 CFR 51.53(c)]		
Description of the proposed action including the applicant's plans to modify the facility or its administrative control procedures as described in accordance with §54.21. The report must describe in detail the affected environment around the plant, the modifications directly affecting the environment or any plant effluents, and any planned refurbishment activities	10 CFR 51.53(c)(2)	2.1, 2.3, 2.4, 3.0, and 4.0
Analyses of the environmental impacts of the proposed action, including the impacts of refurbishment activities, if any, associated with license renewal and the impacts of operation during the renewal term, for applicable Category 2 issues, as discussed below	10 CFR 51.53(c)(3)(ii)	4.0
Surface Water Resources		
Surface water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river)	10 CFR 51.53(c)(3)(ii)(A)	4.5.1
Groundwater Resources		
Groundwater use conflicts (plants with closed-cycle cooling systems that withdraw makeup water from a river)	10 CFR 51.53(c)(3)(ii)(A)	4.5.2
Groundwater use conflicts (plants that withdraw more than 100 gallons per minute [gpm])	10 CFR 51.53(c)(3)(ii)(C)	4.5.3
Groundwater quality degradation (plants with cooling ponds at inland sites)	10 CFR 51.53(c)(3)(ii)(D)	4.5.4
Radionuclides released to groundwater	10 CFR 51.53(c)(3)(ii)(P)	4.5.5
Aquatic Resources		
Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)	10 CFR 51.53(c)(3)(ii)(B)	4.6.1
Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds)	10 CFR 51.53(c)(3)(ii)(B)	4.6.2
Water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river.	10 CFR 51.53(c)(3)(ii)(A)	4.6.3

Table 1.1-1 Environmental Report Compliance with License Renewal Environmental Regulatory Requirements (Sheet 3 of 3)

Description	Requirement	ER Section(s)
Terrestrial Resources		
Water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup water from a river)	10 CFR 51.53(c)(3)(ii)(A)	4.6.4
Effects on terrestrial resources (non-cooling system impacts)	10 CFR 51.53(c)(3)(ii)(E)	4.6.5
Special Status Species and Habitats		
Threatened, endangered, and protected species and essential fish habitat	10 CFR 51.53(c)(3)(ii)(E)	4.6.6
Historic and Cultural Resources		
Historic and cultural resources	10 CFR 51.53(c)(3)(ii)(K)	3.8 and 4.7
Human Health		
Microbiological hazards to the public (plants with cooling ponds or canals or cooling towers that discharge to a river)	10 CFR 51.53(c)(3)(ii)(G)	4.9.1
Electric shock hazards	10 CFR 51.53(c)(3)(ii)(H)	4.9.2
Environmental Justice		
Minority and low-income populations	10 CFR 51.53(c)(3)(ii)(N)	3.11.2 and 4.10.1
Cumulative Impacts		
Cumulative impacts	10 CFR 51.53(c)(3)(ii)(O)	4.12
Postulated Accidents		
Severe accidents	10 CFR 51.53(c)(3)(ii)(L)	4.15.2
All Plants		
Consideration of alternatives for reducing adverse impacts for all Category 2 license renewal issues	10 CFR 51.53(c)(3)(iii)	7.3
New and significant information regarding the environmental impacts of license renewal of which the applicant is aware	10 CFR 51.53(c)(3)(iv)	4.0 and 5.3

1.2 Environmental Report Scope and Methodology

NRC regulations for domestic licensing of nuclear power plants require reviews of environmental impacts from renewing an OL. NRC regulation 10 CFR 51.53(c) requires that an applicant for license renewal submits with its application a separate document (Appendix E of the application) entitled, "Applicant's Environmental Report—Operating License Renewal Stage." In determining what information to include in the PBN SLR applicant's ER, NEPB has relied on NRC regulations and the following supporting documents to provide additional insight into the regulatory requirements:

- Generic Environmental Impact Statement for License Renewal of Nuclear Plants (GEIS), Revision 1 (NRC 2013a), and referenced information specific to transportation (NRC 1999)
- NRC supplemental information in the *Federal Register* notice for the 2013 final rule updating 10 CFR Part 51 (78 FR 37282)
- Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses (NRC 1996a)
- Regulatory Guide 4.2, Supplement 1, Revision 1, Preparation of Environmental Reports for Nuclear Power Plant License Renewal Applications (NRC 2013b)

The NRC included in 10 CFR Part 51 the list of 78 NEPA issues for license renewal of nuclear power plants that were identified in the 2013 GEIS (Appendix B to Subpart A of 10 CFR Part 51, Table B-1). Attachment A lists the 78 issues from 10 CFR Part 51, Subpart A, Appendix B, Table B-1 and identifies the section in this ER in which NEPB addresses each applicable issue.

1.3 Point Beach Nuclear Station Licensee and Ownership

In September of 2007, FPL Energy Point Beach, LLC, completed the acquisition of PBN from the Wisconsin Electric Power Company. FPL Energy Point Beach, LLC, changed its name to NEPB in 2010. NEPB is an indirect wholly-owned subsidiary of NextEra Energy Resources, LLC (NEER), which is an indirect wholly-owned subsidiary of NextEra Energy, Inc. (NEE). NEPB is the licensed owner and operator of PBN (NRC 2007a). NEE has seven operating nuclear reactors in Florida, New Hampshire, and Wisconsin that provide millions of homes with electricity. PBN produces about one-sixth of all the electric power in Wisconsin (NEE 2020).

NEE and its subsidiaries are subject to regulation in numerous respects by various commissions and other state and local governmental agencies of the states in which it operates. PBN is owned and operated by NEPB, the licensee and applicant.

2.0 PROPOSED ACTION AND DESCRIPTION OF ALTERNATIVES

2.1 The Proposed Action

In accordance with 10 CFR 51.53(c)(2) a license renewal applicant's ER must contain a description of the proposed action. The proposed action is to renew for a second time, and for an additional 20-year period, the OLs for PBN Units 1 and 2, which would preserve the option for NEPB to continue operating PBN and provide reliable baseload power for the proposed SLR operating term. For PBN Unit 1, the proposed action would extend the OL from October 5, 2030, to October 5, 2050. For PBN Unit 2, the proposed action would extend the OL from March 8, 2033, to March 8, 2053.

NEPB does not anticipate any SLR-related refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process. The relationship of refurbishment to SLR is described in Section 2.3.

Changes to surveillance, monitoring, inspections, testing, trending, and recordkeeping (SMITTR) would be implemented as a result of the 10 CFR Part 54 aging management review for PBN. Potential SMITTR activities are described in Section 2.4. There are no plans associated with SLR to modify the facility or its administrative controls other than the procedures necessary to implement the aging management programs described in the integrated plant assessment.

2.2 General Plant Information

> *The environmental report must contain a description of the proposed action, including the applicant's plans to modify the facility or its administrative control procedures. This report must describe in detail the affected environment around the plant and the modifications directly affecting the environment or any plant effluents. [10 CFR 51.53(c)(2)]*

PBN Units 1 and 2 are located in east central Wisconsin on the western shore of Lake Michigan, approximately 29 miles (see Table 3.11-1) southeast of Green Bay and about 90 miles north-northeast of Milwaukee (PBN 2019a, Section 2.0). The principal structures at PBN are two reactor containment buildings (one for each unit), and the following, which are shared: auxiliary building, pumphouse, turbine building (including the control room), emergency diesel generator building, and service buildings (PBN 2019a, Section 1.2.1). Main structures outside the power block are the gas turbine building, technical support center, energy information center, site boundary control center, nuclear engineering services office facility, transporter building, independent spent fuel storage installation (ISFSI), steam generator storage facility, sewage treatment plant, firing range, general training center, warehouses, 345-kilovolt (kV) switchyard, meteorological towers, and a pumphouse. Figure 3.1-1 shows the general features of the facility and the exclusion area boundary (EAB). As discussed in Section 3.1.2, the PBN EAB includes the area within the site boundary in which the plant personnel have the authority to determine all activities, including exclusion or removal of personnel and property from the area. Additionally, the U.S. Coast Guard has established a permanent security zone where water vessel traffic is restricted in the portion of the navigable waters of Lake Michigan adjacent to PBN Units 1 and 2.

As noted in Section 3.1.4, the Point Beach and Two Creeks solar power generation facilities are currently under construction and will utilize a portion of the PBN property within the site boundary for operations.

2.2.1 Reactor and Containment Systems

2.2.1.1 Reactor System

As shown in Figure 3.1-1, PBN is a two-unit (Units 1 and 2) plant. Unit 1 achieved commercial operation in December 1970. Unit 2 achieved commercial operation in October 1972. Each unit was initially designed to produce a reactor thermal output of 1,518.5 megawatts thermal (MWt). All steam and power conversion equipment, including each turbine generator, was originally designed to permit generation of 523.8 megawatts (MW) of gross electrical power. Since being placed into commercial operation, each unit has undergone a low-pressure turbine retrofit modification that increases the unit design output to 537.96 megawatts electric (MWe). In addition, a measurement uncertainty recapture (MUR) power uprate has been implemented for both units. The MUR uprate increased licensed reactor thermal power to 1,540 MWt and turbine generator output to approximately 545 MWe. (PBN 2019a, Section 1.0)

In 2011, an extended power uprate (EPU) increased the reactor thermal power to 1,800 MWt, and the turbine generator output to approximately 640 MWe. For EPU, modifications were made to both units' high-pressure turbines, instrumentation and controls, and the associated steam, condensate, and feedwater paths. (PBN 2019a, Section 1.0)

The nuclear power plant incorporates two Westinghouse closed-cycle pressurized water nuclear steam supply systems and turbine-generator systems utilizing dry and saturated steam. Equipment includes systems for the processing of radioactive wastes, handling of fuel, electrical distribution, cooling, power generation structures, and all other onsite facilities required to provide a complete and operable nuclear power plant. Subsequent to EPU, all plant safety systems, including containment and engineered safety features, are designed and evaluated for operation at the 1,800 MWt power rating of the reactor. (PBN 2019a, Section 1.0)

For each unit, the nuclear steam supply system consists of a pressurized water reactor, reactor coolant system, and associated auxiliary fluid systems. The reactor coolant system is arranged as two closed reactor coolant loops connected in parallel to the reactor vessel, each containing a reactor coolant pump and a steam generator. An electrically heated pressurizer is connected to one of the loops. (PBN 2019a, Section 1.2.2)

PBN Units 1 and 2 were upgraded to the 14x14, 0.422" VANTAGE+ (422V+) fuel design. This design uses the larger, 0.422-inch outer diameter fuel rod (PBN 2019a, Section 3.3). The reactor utilizes a multi-region cycled core design, with fuel assemblies containing slightly enriched uranium dioxide (UO_2) fuel clad with ZIRLO™ or optimized ZIRLO™ tubing (PBN 2019a, Section 3.0). The reactor core utilizes 121 fuel assemblies with 179 UO_2 rods per assembly with reload cycles based on an 18-month operating cycle design. (PBN 2019a, Table 3.2-1)

The fuel assemblies are positioned and supported vertically in the core between the upper and lower core plates and arranged in a roughly circular cross-sectional pattern. The assemblies are all mechanically compatible and similar in design, but contain fuel of different enrichments depending on the location of the assembly within the core. Each reload core is designed to utilize fresh and previously burned fuel in a low-leakage loading pattern. (PBN 2019a, Section 3.2.3)

A low-leakage type of fuel management is employed which utilizes highly burned fuel in all assembly locations on the periphery. Use of highly burned fuel and absorber rods in core peripheral locations results in reduced power in peripheral assemblies which is offset by power increases in the remaining fuel assemblies. (PBN 2019a, Section 3.3)

The rods are divided into two categories according to their function. The rods which compensate for changes in reactivity due to variations in operating conditions of the reactor, such as power or temperature, comprise the control group of rods. The other rods provide additional shutdown reactivity and are termed shutdown rods. The total shutdown worth of all the rods is specified to provide adequate shutdown with the most reactive rod stuck out of the core. (PBN 2019a, Section 3.2.1.1)

The reactor core fuel loading and programming is designed to yield an equilibrium cycle (normal cycle) burnup of approximately 19,000 megawatt-days per metric ton of uranium (MWD/MTU) and lead rod average burnup of 62,000 MWD/MTU for an 18-month fuel cycle. (PBN 2019a, Table 3.2-1)

The core will have sufficient reactivity to produce the design power level and lifetime without exceeding the control capacity or shutdown margin. As per the requirements of 10 CFR 50.68(b)(7), PBN is currently licensed for maximum enrichment of 5 percent U-235, with equilibrium enrichment of 4.4–4.95 percent to allow for tolerances. (PBN 2019a, Section 9.4.1 and Table 3.2-1)

The reactor is controlled by a coordinated combination of chemical shim and mechanical control rods. Complete supervision of both the reactor and turbine generator is accomplished from the control room. Units 1 and 2 share the control room located as an integral part of the turbine hall. (PBN 2019a, Section 1.2.3)

2.2.1.2 Containment System

Each reactor and its primary cooling system is housed in a containment building, together with the associated steam generators and circulation system (NMC 2004a, Section 3.1.1). The reactor containment is a steel-lined concrete cylinder with prestressed tendons in the walls and dome, anchored to a reinforced concrete foundation slab which is supported by steel H-piles driven to refusal in the underlying bedrock (PBN 2019a, Section 1.2.1)

The plant design provides a common gallery containing the principal radioactive waste systems and the control room between the two units, which lie north and south of the common gallery in a single structure. The containment structures are enclosed in vinyl-coated steel buildings that are colored to blend with the green and brown Wisconsin countryside (NMC 2004a, Section 3.1.1).

The containment is designed to withstand the internal pressure accompanying a loss-of-coolant accident, is virtually leak-tight, and provides adequate radiation shielding for both normal operation and accident conditions (PBN 2019a, Section 1.2.1). The reactor containment is designed to adequately retain fission products under the most severe analyzed accident conditions (PBN 2019a, Section 1.2).

The reactor containment completely encloses the entire reactor and reactor coolant system and ensures that an acceptable upper limit for leakage of radioactive materials to the environment is not exceeded even if gross failure of the reactor coolant system occurs. The structure provides biological shielding for both normal and accident situations. The containment structures of Units 1 and 2 are designed to maintain leakage no greater than 0.2 percent per 24 hours of containment air weight at a design pressure of 60 pounds per square inch (psi) above atmospheric pressure (psig) and 286°F. Under hypothetical accident conditions with two of four air recirculation units operating, public exposure will be maintained well below 10 CFR 50.67 values. (PBN 2019a, Sections 5.1.1. and 5.5.3).

2.2.2 Maintenance, Inspection, and Refueling Activities

Various programs and activities at the site maintain, inspect, test, and monitor the performance of plant equipment and are detailed throughout the updated final safety analysis report (UFSAR). These programs and activities include, but are not limited to, those implemented to achieve the following:

- Meet the requirements of 10 CFR Part 50, Appendix B (Quality Assurance), Appendix R (Fire Protection), Appendices G and H (Reactor Vessel Materials).
- Meet the requirements of 10 CFR 50.55a Codes and Standards, which invoke the American Society of Mechanical Engineers, Boiler and Pressure Vessel Code, Section XI, In-service Inspection and Testing Requirements.
- Meet the requirements of 10 CFR 50.65, the maintenance rule.
- Maintain water chemistry in accordance with Electric Power Research Institute (EPRI) guidelines.

Additional programs include those implemented to meet technical specification surveillance requirements; those implemented in response to NRC generic communications; and various periodic maintenance, testing, and inspection procedures necessary to manage the effects of aging on structures and components.

Maintenance activities conducted at PBN include inspection, testing, and surveillance to maintain the current licensing basis of the plant and ensure compliance with environmental and safety requirements. Certain program activities are performed during the operation of the units, while others are performed during scheduled refueling outages. Long-term outages are scheduled for refueling and for certain types of repairs or maintenance, such as replacement of a major component. PBN refuels each unit on a nominal 18-month, staggered schedule. (NRC 2005, Section 2.1.6)

2.2.3 Cooling and Auxiliary Water Systems

Each PBN unit has three main cooling water systems, as do other pressurized water reactors. The primary system is a closed loop that removes heat from the reactor and passes through a steam generator, where it transfers heat through non-contact cooling to the secondary system before returning to the reactor. The primary system maintains its water under pressure so that the water does not flash to steam. Secondary system water flashes to steam in the steam generator, and the steam turns the turbine to generate electricity. After exiting the turbine, secondary system water passes through a condenser, where it cools and condenses into liquid before returning to the steam generator to complete the secondary loop.

PBN utilizes a once-through cooling system for both units that draws water from and discharges to Lake Michigan. The cooling system removes waste heat from the condensers, as well as other plant equipment, and discharges through separate flumes for each unit (NMC 2004a, Section 3.1.2).

PBN also has five onsite wells that mostly provide potable water.

2.2.3.1 Circulating Water System

The circulating water intake system, common to both units, is designed to provide a reliable supply of Lake Michigan water, regardless of weather or lake conditions, to the suction of four circulating water pumps, two screen wash pumps, six service water pumps, two fire water pumps, and one jockey fire pump. Cooling water is drawn from a submerged intake crib located 1,750 feet offshore in a water depth of 22 feet in Lake Michigan. The structure consists of two annular rings of 12-inch structural steel H pile driven to a minimum depth of 23 feet below lakebed and reinforced with walers fabricated from 12-inch structural steel H pile. The annulus is filled with individually placed limestone blocks having two approximately parallel surfaces and weighing between 3 and 12 tons. The structure has an outside diameter of 110 feet, an inside diameter of 60 feet. Water enters the intake crib primarily through the 60-foot opening above the intake cones. The 60-foot opening is covered with a high-density polyethylene trash rack having approximately 7-inch by 18-inch openings. The intake crib has been designed to reduce the likelihood of ice blockage during the winter. (PBN 2019a, Section 10.1.1)

Water flows from the intake crib to the pumphouse forebay through two 14-foot diameter, corrugated, galvanized, structural plate pipes buried to a minimum depth of 3 feet below the lakebed. Flow through either pipe can be reversed during winter operation to recirculate warm condenser discharge water to the intake to prevent freezing in the system. (PBN 2019a, Section 10.1.1). Pumphouse plan and section views are shown in Figures 2.2-2 and 2.2-3, respectively.

Water flows from the forebay through bar grates and 3/8-inch mesh travelling screens, where small debris and trapped fish can be removed before they enter the circulating water system, to the suction of the pumps (NMC 2004a, Section 3.1.2; PBN 2019a, Section 10.1.1). Vertical bar racks (3/8-inch by 4 inches with 2¼-inch spacing on center) are located in the inshore forebay.

Eight traveling water screens (3/8-inch mesh, 11 feet wide) are located at the pump house where small debris and trapped fish can be removed before they enter the circulating water system. An 80-psi screen wash is used to clean the traveling screens, which discharges to the lake via a return trough with a debris basket. (NEE 2018a, Section 3.1)

A high frequency acoustic deterrent system surrounds the crib to reduce alewife[1] impingement. The acoustic array consists of 16 integrated projector assemblies uniformly spaced around the outer circumference of the crib. The deterrent signal consists of high frequency broad band (122-128 kilohertz [kHz]) pulses, 0.5 second in duration, at 1-second intervals (NEE 2018a, Section 3.1).

The circulating water system circulates water from Lake Michigan through the main condensers to condense the steam exhausting from the turbines. The water is discharged back to the lake through discharge flumes. Two circulating water pumps per unit are used to circulate the water during warm weather. During cold months, only one circulating water pump per unit is operated. The circulating water system also supplies cooling water to the condensate cooler for maintaining the main generator hot gas temperature. (PBN 2019a, Section 10.1.1)

The circulating water is periodically treated to control biological fouling in system piping and in the condensers. Sodium hypochlorite, Nalco 73551 (bio-detergent), and Nalco 3DT121 (silt dispersant) are added to the system intermittently to prevent the buildup of slime and algae and to minimize zebra mussel colonization. Sodium bisulfite is simultaneously injected at the outlet end of the condensers to dechlorinate the discharge circulating water. Any future treatments must be evaluated and performed within the requirements of Wisconsin Department of Natural Resources (WDNR) discharge permit under the Wisconsin Pollutant Discharge Elimination System (WPDES). (PBN 2019a, Section 10.1.1)

At peak capacity, water is circulated at a maximum rate of 375,000 gallons per minute (gpm) (833 cubic feet per second [cfs]) through each condenser, then returned to the lake. The

[1] Alewives are invasive pelagic exotic planktivores that under certain conditions school in large, dense shoals that can result in their ingestion in large numbers. Their entrainment in large numbers can threaten safe plant operation.

primary circulation of the cooling system is first through the intake structure to the forebay, then to the condensers and other equipment. Finally, cooling water exits the plant via flumes back to Lake Michigan. (Figure 2.2-1)

The system was designed to control the formation of needle ice within the intake structure during the winter months by use of warm water feedback. The feedback of effluent flow back through the pumphouse forebay is controlled as necessary to prevent icing of the intake during severe cold weather.

2.2.3.2 Service Water System

During normal plant operation, two or three service water pumps are in continuous operation to cool various plant components such as the main turbine lubricating oil coolers, containment coolers, component cooling (CC) water heat exchangers, and the spent fuel pool heat exchangers. During normal full power operation of both units, the combined service water system flow is approximately 16,000 gpm (23 million gallons per day [MGD]), and the discharge is routed to the discharge flume of the operating unit(s). (Figure 2.2-1)

Additionally, the service water system is designed to provide sufficient flow to support the heat removal requirements of components required to mitigate the consequences of a loss of coolant accident in one unit, while supporting the normal flow of the unaffected unit. Although service water is required to mitigate other plant accidents as well, a loss-of-coolant accident combined with normal operation of the unaffected unit is the most limiting event for the heat load imposed on the service water system. (PBN 2019a, Section 9.6.1)

2.2.3.3 Fire Protection System

The water supply for fire protection is taken from Lake Michigan and can be supplied from either a motor-driven or diesel-driven fire pump. The fire pumps are located in the service water pump room of the circulating water pumphouse. The individual fire pumps take their suction from independent bays of the circulating water pumphouse. Additionally, the Warehouse 7 well supplies fire suppression water to the warehouse, if needed.

The two main PBN fire pumps are vertical centrifugal pumps rated at 2,000 gpm at 125 psig net discharge head and are designed for automatic or manual starting. The entire fire protection system is maintained pressurized by a small jockey pump, with the main fire pumps in standby and started automatically on low pressure. Therefore, during normal plant operation, the fire protection system is dead-headed with no flow and no withdrawal from Lake Michigan.

An underground 10-inch diameter, cement-lined (cathodically protected, polyethylene wrapped around the diesel generator building) cast-iron fire main encircles the plant and is supplied by the fire pumps.

Periodic tests and inspections of the fire main, valves, hydrants, hydrant hose houses, pumps, and associated equipment are conducted in accordance with established procedures. The pressure integrity of the system is continuously monitored by the pressure sensing of the fire pump starting circuits.

2.2.3.4 Component Cooling Water Systems

The CC loop serves as an intermediate system between the reactor coolant and service water systems during cooldown, transferring heat from the reactor coolant to the service water system. This double barrier arrangement reduces the potential for leakage of radioactive reactor coolant to the service water system. (PBN 2019a, Section 9.1.2)

During normal full power operation, one component cooling pump and one component cooling heat exchanger accommodate the heat removal loads. The standby pump and the shared heat exchangers provide 100 percent backup. (PBN 2019a, Section 9.1.2)

During normal operation, the heat load on the component cooling system is minimal, and it adds a negligible amount of heat to the service water system. When a reactor is shut down and cooled below 350°F, the component cooling system is used to cool the reactor coolant (via the residual heat removal [RHR] system) to remove decay heat from the reactor core. While this condition established the design for the component cooling system and RHR systems, the heat rejected to service water is a minor fraction of the heat rejected to Lake Michigan during normal power operation via the circulating water system. Therefore, the volumetric and thermal environmental impact is bounded by normal power operation.

In the event of an accident, the CC system would also be used to remove decay heat from the reactor core via the RHR system. Under these conditions, the anticipated heat loading would be even less than during plant cool down at the start of a normal refueling outage. Therefore, the volumetric and thermal environmental impacts of operation would be bounded by normal power operation. (PBN 2019a, Section 6.2.2)

2.2.3.5 Thermal Effluent Disperson

The cooling water from the plant (both circulating water and service water) is discharged through two flumes consisting of well-braced steel sheet piling driven 40 feet into the lakebed and protected by riprap (PBN 2019a, Section 2.5.2). Discharge flumes were originally designed to release a combined maximum of 680,000 gpm at a mean temperature increase of 11.5°C (20.7°F) above the intake water temperature at the maximum flow rate (PBN 2008, Section 1.1). Each unit discharges the non-contact cooling water to Lake Michigan via its own outfall located approximately 200 feet from the shoreline. During the winter, the cooling water from one of the units can be discharged via a deicing line to the intake crib to prevent the formation of frazil ice. (PBN 2008, Section 2.1)

Subsequent to EPU, there was no change in pumping capacity and mean discharge temperature increased by 2°C (3.6°F), from 11.5°C (20.7°F) to 13.5°C (24.3°F) (PBN 2008, Section 4.5). The EPU increased the maximum heat load output by approximately 14 percent to 8,273 million British thermal units (MBtu)/hour from the original design heat load of 7,094 MBtu/hour (PBN 2008, Section 5.1). The EPU was reviewed and approved by the NRC in 2011, and PBN's renewed WPDES permit reflects the changes to the cooling water system (NEE 2018a, Section 4.1). The PBN discharge permit (Attachment B) limits waste heat rejected to Lake Michigan from PBN to 8,273 MBtu/hour. Based on the previous 5 years (2015–2019), heat rejected to Lake Michigan from PBN is below 8,273 MBtu/hour.

Thermal plumes are generally larger during spring and autumn than in the winter or summer. Sinking plumes develop during the winter, while floating plumes generally develop in the spring and summer. Small surface plumes develop during peak summer stratification when the intake temperatures from the bottom of the lake are considerably cooler than the surface waters where the heated discharge is released. (PBN 2008, Section 1.3)

Discharge velocity of the circulating water is less than 4 feet/second. It is expected that this jet action will promote mixing with colder water in the immediate vicinity of the discharge flume and a rapid reduction in pronounced differential temperatures. In addition, observations at power station discharges in Lake Michigan at Gary, Indiana, and Waukegan, Illinois, have shown that the wave action and shore currents are very effective in breaking up any tendency to pronounced stratification and isolation of the warm water. It is expected that this action, together with the jet momentum entrainment of colder water, will cause all temperature effects to be indiscernible within less than one mile from the point of discharge. (PBN 2019a, Section 2.5.3)

The EPU increased the surface area of the 6.0°C contour from 27 to 39 acres; the 4.0°C contour would increase from 79 to 105 acres; and the 2.0°C contour would increase from 315 to 390 acres. These increases in surface areas of the three plume contours are relatively small compared to the surface area available for mixing. Additionally, the representative important species evaluation showed that the predicted impact of the warmer and larger thermal plume as a result of the EPU at PBN would be negligible. (PBN 2008, Section 1.3)

PBN carried out extensive pre- and post-operational studies on the thermal effects of PBN on Lake Michigan. These studies were compiled and summarized in a successful Clean Water Act (CWA) Section 316(a) demonstration. (WDNR 2012a) The wastewater flow path is shown in Figure 2.2-1.

2.2.3.6 Groundwater Withdrawals (Domestic Water Supply System)

PBN has five groundwater wells onsite that are used for potable water. The majority of potable water used at PBN is drawn from a 257-foot deep main well located at the southwest corner of the plant yard. As discussed in Section 3.6.3.2, the Energy Information Center well provides drinking water for the Energy Information Center, the site boundary control center well provides drinking water at the site boundary control center, the Warehouse 6 well provides drinking water for Warehouse 6. In 2019, the highest monthly withdrawal for all site well pumps combined was 385,253 gallons, for an average of less than 9 gpm throughout the month.

2.2.4 Meteorological Monitoring Program

The PBN meteorological (MET) monitoring system is designed to fulfill the requirements of NUREG-0737, Item III.A.2.2, Meteorological Data. The MET monitoring system meets the criteria of Regulatory Guide 1.23, Onsite Meteorological Programs, dated February 17, 1972, for programmatic aspects. The MET monitoring system instrumentation meets the criteria of Regulatory Guide 1.97, Revision 2, and is classified as Type E, Category 3. The MET monitoring system consists of three towers, two of which are located onsite, with the third located about 9 miles inland. Two onsite MET tower locations are illustrated in Figure 3.1-1. The towers are separated from nearby obstructions by distances equal to at least 10 times the obstruction height to minimize disturbances in the wind field being measured. All instrument booms extend at least two tower widths from the tower and are oriented into the predominant wind direction. Temperature sensor aspirator shields are pointed horizontally, to the north, to minimize the tower's effect on measurements and the effect of solar radiation on the sensor.

A significant meteorological phenomenon affecting areas bordering a large body of water is the lake breeze. This phenomenon can result in the formation of a thermal internal boundary layer, which can adversely affect the dispersion of atmospheric contaminants under certain conditions. The effect of Lake Michigan upon meteorology in the vicinity of PBN was a major consideration in siting the individual monitoring towers.

The primary MET monitoring tower consists of a 45-meter tower instrumented with equipment at the 10- and 45-meter levels. This tower is located approximately 850 meters south-southeast of PBN and about 40 meters inland of the Lake Michigan shoreline. The 45-meter level of the tower approximates the height of elevated plant releases. The 10-meter level is designed to provide meteorological data representative of ground level releases. This tower's location is such that it should almost always be in the same meteorological regime as the plant with respect to localized lake effects.

The backup MET monitoring tower is installed approximately 500 meters northwest of the plant and approximately 300 meters inland of the Lake Michigan shoreline. This tower is instrumented at the 10-meter level to provide wind speed, wind direction, and sigma theta as backup information in the event of a failure at the primary tower. The backup tower site was chosen so that it would usually be in the same meteorological regime as the plant, with respect to localized lake effects.

The inland MET monitoring tower is located about 9 miles inland from PBN. This tower is designed to provide information on the penetration of lake breezes inland from the shoreline.

Wind speed and wind direction are measured at the 10-meter level at all three towers, and also at the 45-meter level of the primary tower. Wind speed and direction is monitored using a sonic wind sensor system. Sigma theta is computed digitally at the tower sites, from each 10-meter level wind direction signal, by the onsite data logger. Meteorological parameters monitored at PBN are listed in Table 2.2-1.

Reference and differential temperature equipment consist of a four-wire platinum resistance temperature device at each of the two monitoring levels at the primary tower (10 and 45 meters). Reference temperature is also measured at the inland tower site. The resistance temperature devices are located within mechanically aspirated thermal radiation shields to ensure exposure to a representative air sample and are connected to a linear bridge and data logger which provides signal conditioning and digital output signals.

The RS-232 digital output for each parameter from the data logger is input to a modem for transmission to the control room. Each modem transmits the digital data to receiver modems located in the PBN control room. Private signal cables are used for linking the primary and backup site transmitters with the control room receivers. A VHF multi-use radio service radio modem is used as the data link for the inland tower.

The receiver modems are connected to data loggers, which transmit the data to analog output modules. Each parameter is then input in parallel to an electronic recorder and the plant process computer.

In addition to the monitored meteorological data, status and alarm information are transmitted to the plant control room. The data logger continuously monitors the output from each measured parameter. If the output from any parameter exceeds the operating range for that parameter, the data logger flags the data and transmits an error alarm. In addition, the temperature sensor aspirators are equipped with a system which transmits an alarm signal in the event of a cutoff in flow.

A stainless-steel enclosure(s) mounted at the base of the tower is provided at each monitoring tower site for housing the data processing equipment. All signal protection circuits, data logger, modem, radio, and necessary power supplies are contained in the enclosure.

Visual field site inspections are to be performed at each monitoring site on at least a monthly basis. The inspections check the physical integrity of the site, appearance of the sensors for any obvious signs of weather damage or faulty operation and verifies that the signal conditioning equipment is operating properly.

To ensure the accuracy of the monitoring system, the meteorological monitoring instruments are calibrated on a semi-annual schedule. Calibrations are also performed after major equipment malfunctions, equipment modifications, and equipment replacements.

Based on the previous 5 years (2015–2019), the meteorological data recovery rate at PBN has been greater than 90 percent (PBN 2019a). Meteorology and air quality at PBN are discussed in detail in Section 3.3.

2.2.5 Power Transmission System

2.2.5.1 In-Scope Transmission Lines

As required by 10 CFR Part 51, Table B-1 and NRC Regulatory Guide 4.2 (NRC 2013b, Section 2.2), transmission lines subject to evaluation of environmental impacts for license renewal are those that connect the nuclear power plant to the switchyard where electricity is fed into the regional power distribution system and power lines that feed the plant from the grid during outages.

Transmission lines that should be considered in-scope for this SLR application (SLRA) to connect the plant to the transmission system are only those lines from the PBN turbine building to the 345- kV switchyard and 19-kV bus supply bunker. All in-scope transmission lines are located completely within the PBN site boundary, as shown in Figure 2.2-4.

The main transmission lines to PBN operate at 345-kV alternating current (AC). PBN has two main generators that produce electrical power at 19-kV AC. The output of the main generators is stepped up to 345-kV AC by the main transformers 1/2-X01. (PBN 2019a, Section 8.1)

The 345-kV system does not perform any safety related function and is classified as non-safety related. The 345-kV distribution system performs the following functions (PBN 2019a, Section 8.1.1):

- Transmits power generated at PBN to the 345-kV grid.
- Provides standby power to PBN auxiliaries during unit(s) startup, shut down, and after reactor trip.
- Provides a reliable source of normal power to PBN engineered safeguards equipment.
- Acts as an interconnecting terminal for the four 345-kV lines at PBN.

The design of the system is such that sufficient independence or isolation between the various sources of electrical power is provided to guard against concurrent loss of all auxiliary power. Safety-related auxiliary electrical loads are normally powered from offsite power supplies (through the high voltage and low voltage station auxiliary transformers) to ensure continuity of power during plant transients. (PBN 2019a, Section 8.1.1)

In each unit, electrical energy generated at 19-kV AC is transformed to 345-kV AC by the main transformer banks, (rated 756 megavolt ampere [MVA] at 65°C rise) and delivered through the unit output circuit breaker (rated at least 345 kV, 15,000 MVA, 2 KA) to the 345-kV switchyard. As shown in Figure 2.2-4, the 345-kV switchyard is located on the west side of PBN adjacent to the protected area fence. The electrical output of both units is integrated into northeast Wisconsin's 345-kV AC transmission system, which presently has 345-kV interconnections with other Wisconsin utilities as well as utilities in Illinois and Minnesota. (PBN 2019a, Section 8.1.2)

The 345-kV system and the gas turbine (G05) are the sources of power to the 13.8-kV system. The 13.8-kV electrical distribution system is the intermediate voltage power distribution system, which provides the normal offsite power supply to the 4.16 kV safeguard buses during power operations and during plant startup, shutdown, and following main generator trips. The 13.8-kV system also supplies the safe shutdown buses, various plant support loads, G05 auxiliaries, 345-kV switchyard auxiliaries, nuclear engineering services building, training building, and sewage treatment plant. (PBN 2019a, Section 8.2)

The 13.8-kV system does not perform any safety-related functions. The 13.8-kV system distributes power from the gas turbine to those loads required during a station blackout to achieve and maintain safe reactor shutdown. (PBN 2019a, Section 8.2.1)

The 13.8-kV system supplies offsite power to PBN via the 4.16-kV and 480V systems. The 13.8-kV system is divided into three buses designated H01, H02, and H03. The H02 bus supplies Unit 1 and is normally served by the high voltage station auxiliary transformer 1X03. The H02 bus supplies power to the low voltage station auxiliary transformer 1X04. In a like manner, the H03 bus supplies Unit 2 and is normally served by the high voltage station auxiliary transformer 2X03. The H03 bus supplies power to the low voltage station auxiliary transformer 2X04. The units can be interconnected to alternate supplies by arranging bus tie breakers to connect H02 to H01 and H03 to H01. The power generated by the gas turbine also can be delivered to either unit by arranging the13.8-kV tie breakers of the H01, H02, and H03 buses. (PBN 2019a, Section 8.2.2)

The normal offsite power supply for safeguards equipment is supplied from the 345-kV AC transmission system via the high voltage and low voltage station auxiliary transformers (X03) and (X04), respectively. The 13.8-kV system can also be used to provide offsite power to non-safety-related electrical loads via the X03 and X04 transformers during startup and shutdown, although this is not the normal alignment. Each low voltage station auxiliary transformer can supply all the auxiliary loads for its unit. (PBN 2019a, Section 8.2.3)

Two separate outside sources can serve either unit's low voltage station auxiliary transformer. The primary source of power to the safeguards buses for each unit is a low voltage station auxiliary transformer aligned with its respective high voltage station auxiliary transformer. Alternate power may also be supplied by aligning the 13.8-kV buses to the opposite unit's high voltage station auxiliary transformer or to the gas turbine generator. Transfer from the normal to the alternate high voltage station auxiliary transformer is accomplished automatically if the normal high voltage station auxiliary transformer is tripped. (PBN 2019a, Section 8.2.3)

The system is designed to minimize, to the extent practical, the likelihood of a simultaneous loss of offsite power to Units 1 and 2 due to any single credible incident to any component or at any location. This is achieved by physical separation of the bus sections, transformers, duct runs, manholes, cables, etc. The H01, H02, and H03 switchgear sections are located in the 13.8-kV switchgear building. This building is divided using one-hour firewalls into separate rooms for each bus which include local panels for relaying and control. (PBN 2019a, Section 8.2.3)

2.2.5.2 Vegetation Management Practices

The in-scope transmission lines are within the PBN site boundary, as shown in Figure 2.2-4. The transmission lines cross the PBN industrial area, where vegetation is sparse and only minimal vegetation management is needed.

2.2.5.3 Avian Protection

Threatened and endangered species potentially occurring near PBN, or within counties in a 6-mile radius of PBN, are described in Section 3.7.7. As discussed in the site environmental program, PBN's interaction with birds is addressed in accordance with the Wildlife Management Program.

2.2.5.4 Public

All in-scope transmission lines are located completely within NEPB-owned property. Therefore, the public does not have access to this area and, as a result, no induced shock hazards exist for the public.

2.2.5.5 Plant Workers

NUREG-1437 suggests that occupational safety and health hazard issues are generic to all types of electrical generating stations, including nuclear power plants, and are of small significance if the workers adhere to safety standards and use protective equipment (NRC 2013a, Section 3.9.5.1).

PBN maintains safety-specific policies for all work conducted at electrical transmission locations. PBN's electrical safety procedure establishes the electrical safety practices to implement an effective electrical safety program and applies to all personnel performing electrical work at PBN under the authority of NEPB.

2.2.6 Radioactive Waste Management System

PBN uses liquid, gaseous, and solid radioactive waste management systems to collect and process the liquid, gaseous; and solid wastes that are the byproducts of the operation of PBN. These systems process radioactive liquid, gaseous, and solid effluents to maintain levels as low as reasonably achievable (ALARA) before they are released to the environment. The PBN waste management system meets the design objectives of 10 CFR Part 50, Appendix I, and controls the processing, disposal, and release of radioactive liquid, gaseous, and solid wastes. (NRC 2005, Section 2.1.4)

The waste disposal system collects and processes all potentially radioactive reactor plant wastes for disposal within limitations established by applicable governmental regulations. The waste disposal system includes the waste liquid, waste gas, and solid waste systems. The waste disposal system outside containment is common to both units. Liquid and gaseous wastes are sampled and analyzed to determine the quantity of radioactivity, with an isotopic breakdown, if necessary. Depending on the results of the analysis, these wastes are processed further as required. (PBN 2019a, Section 11.0)

Solid wastes are shipped to a waste processor for volume reduction before disposal at a licensed burial site. Spent resins and filters are stored or packaged for shipment to a licensed offsite processing or disposal facility. (NRC 2005, Section 2.1.4)

Liquid and gaseous wastes are released under controlled conditions. Radiation monitors are provided to maintain surveillance over the release operation, and a permanent record of activity releases is provided by radiochemical analysis of known quantities of waste. The system is capable of processing all wastes generated during continuous operation of the primary system, assuming that fission products escape to the reactor coolant by diffusion through defects in the cladding of one percent of the fuel rods. (PBN 2019a, Section 11.0)

The plant design provides a common gallery containing the principal radioactive waste systems and the control room between the two units, which lie north and south of the common gallery in a single structure (NMC 2004a, Section 3.1.1). The system is primarily controlled from a central panel in the auxiliary building. However, some equipment is provided with local control panels. Malfunction of the system is alarmed in the auxiliary building and annunciated in the control room. All system equipment is located in or near the auxiliary building, except for the reactor coolant drain tanks, which are located in the reactor containments. (PBN 2019a, Section 11.0)

The waste disposal system obtains cooling water from the Unit 2 component cooling system. This cooling supply is automatically isolated by a Unit 2 containment isolation. Loss of the cooling supply will cause an automatic shutdown of the waste disposal system equipment that could be damaged by a loss of cooling. (PBN 2019a, Section 11.0)

The offsite dose calculation manual (ODCM) for PBN describes the methods used for calculating the concentration of radioactive material in the environment and the estimated potential offsite doses associated with liquid and gaseous effluents from PBN. The ODCM also specifies controls for release of liquid and gaseous effluents to ensure compliance with the NRC regulations. (NRC 2005, Section 2.1.4)

Fuel assemblies that have exhausted a certain percentage of their fuel and are removed from the reactor core for disposal contain spent fuel. The spent fuel is currently stored onsite in the spent fuel pool in the auxiliary building adjacent to the containment building or in dry cask storage containers at the onsite ISFSI. (NRC 2005, Section 2.1.4). Spent fuel is stored in the PBN ISFSI under a separate license.

NEPB's waste management policy is to maintain radioactive waste effluent at the lowest practical level. In keeping with this policy, the radioactive waste disposal system is designed, to the extent possible in accordance with maintenance practices, to maintain releases of radioactive material and radiation exposures to unrestricted areas as far below the limits of 10 CFR Part 20 as is practical. Normally, no radioactive waste stream is discharged from the station without having first been processed through the waste disposal system.

2.2.6.1 Liquid Waste Processing Systems

The waste liquid system collects, processes, and prepares for disposal the potentially radioactive liquid wastes produced as a result of reactor operation (PBN 2019a, Section 11.1). Liquid wastes are generated primarily by plant maintenance and service operations, and consequently, the quantities and activity concentrations of influents to the system vary (PBN 2019a, Section 11.1.2).

During normal plant operation, the waste disposal system processes liquids from the following sources (PBN 2019a, Section 11.1.2):

- Equipment drains, vents, and leaks;
- Chemical laboratory drains;
- Radioactive laundry and hot shower drains;
- Decontamination area drains;
- The chemical and volume control system (CVCS);
- Sampling system drains and local sample sinks;
- Normal letdown;
- Steam generator blowdown (if required by radioactivity content);
- Floor drains from the controlled areas of the plant;
- Liquids used to transfer solid radwaste;
- Steam generator storage facility sump (if required by radioactivity content); and
- Warehouse 7 sump (if required by radioactivity content).

The system also collects and transfers liquids from the sources listed below directly to the CVCS, to the auxiliary building sump, or back to the refueling water storage tank (depending on fluid content) for processing (PBN 2019a, Section 11.1.2).

- Pressurizer relief tank;
- Reactor coolant pump secondary seals;
- Excess letdown (during startup);
- Accumulators;
- Valve and reactor vessel flange leak-offs; and
- Refueling canal drains.

There is one reactor coolant drain tank inside each containment with the two reactor coolant drain tank pumps located outside each containment. The reactor coolant drain tanks serve as a drain collecting point for the reactor coolant systems and other equipment located inside the reactor containments. The tank contents can be discharged to the CVCS holdup tanks, the auxiliary building sump, or the RWSTs. (PBN 2019a, Section 11.1.2)

Where possible, other waste liquids drain to the waste holdup tank by gravity flow. Other waste liquids drain to the sump tank and are discharged to the waste holdup tank by pumps operated to control the level in the tank. The waste holdup tank receives radioactive liquids from the CVCS, sump tank, chemical drain tank, auxiliary building sump, intermediate and operating floor drains, laundry and hot shower tank, and optionally either unit's steam generator(s). Laundry and hot shower waste is pumped from the laundry and hot shower tank to the waste holdup tank via the laundry pump for processing with other waste liquids. The waste holdup tank contents may be drained to the sump tank or pumped to the filtration/demineralization system. (PBN 2019a, Section 11.1.2)

Liquids requiring cleanup before release are processed in batches by a filtration/demineralization system. The filtration/demineralization system is the primary means of processing radioactive liquid waste effluents. Through the use of deep bed filtration vessels and demineralization vessels, the filtration/demineralization system is designed to remove suspended particulate and ionic impurities from radioactive liquid waste. The system is common to both units. The filtration/demineralization system has a maximum process capacity of 35 gpm. Exhausted filtration and demineralization media from this system is dewatered and packaged for shipping. (PBN 2019a, Section 11.1.2)

Normally, steam generator blowdown does not require processing due to the high fuel integrity and steam generators which have very low leakage. However, if blowdown sampling showed elevated activities, the blowdown can be processed through the waste holdup tank and filtration/demineralization system until the levels are low enough to release. (PBN 2019a, Section 11.1.3)

All routine liquid radioactive releases are made from waste disposal system distillate tanks or from CVCS monitor tanks. Prior to release, samples of the tank contents are taken and analyzed for radioactivity by chemistry personnel. Results of analysis, waste liquid volume, dilution flow available, discharge rate, and total activities are recorded on a waste discharge permit. If analysis confirms that the activity level is suitable for discharge, the processed liquid is pumped through a flow meter and a radiation monitor to the service water discharge header. (PBN 2019a, Section 11.1.2)

The radiation monitoring system monitors the effluent, closing the discharge valve if the amount of radioactive material in the effluent exceeds preset values. These values are established using the methodology described in the ODCM. (NRC 2005, Section 2.1.4)

During release of liquid radioactive waste, the following conditions shall be met (PBN 2019a, Section 11.1.3):

- At least one condenser circulating water pump shall be in operation and the service water return header shall be lined up to the unit(s) whose circulating water pump is operating.
- If the gross activity monitor in the discharge line is not operable or if the discharge is made via a pathway without a radiation monitoring system monitor, the volume of liquid to be released is to be isotopically quantified pursuant to the ODCM prior to release and periodically sampled during release.

PBN does not anticipate any increase in liquid waste releases beyond normal operations, during the proposed SLR operating term.

2.2.6.2 Gaseous Waste Disposal System

PBN ventilation is designed to maintain gaseous effluents to levels as low as reasonably achievable. This is done by a combination of holdups for decay of short-lived radioactive material, filtration, and monitoring. Gases from the primary containment system are held in decay tanks for up to 45 days prior to release through the auxiliary building ventilation stack. Gases from other areas of the plant, such as the spent fuel pool, radioactive waste handling area, auxiliary building, service building, and chemistry laboratory are filtered and monitored prior to release. The primary release points at PBN are the auxiliary building vent stack, the Units 1 and 2 containment purge stacks, and the drumming areas vent stack. These four release points are equipped with shutoff valves that close if the activity levels exceed the alarm set point of the monitor. The basis for the value of the alarm set point is discussed in the ODCM. The unmonitored release point is the exhaust from the turbine building, where airborne radioactive material is not expected. Areas of the plant that could contain low levels of radioactive contaminants in the event of primary to secondary leakage, such as the turbine building, are not provided with high-efficiency particulate air filters or carbon absorber equipment, because releases from these areas are insignificant. (NRC 2005, Section 2.1.4.2)

During plant operations, gaseous wastes will originate from (PBN 2019a, Section 11.2.2):

- Degassing reactor coolant discharged to the CVCS;
- Displacement of cover gases as liquids accumulate in various tanks;
- Miscellaneous equipment vents and relief valves; and
- Sampling operations and gas analysis for hydrogen and oxygen in cover gases and gas decay tanks.

The following main components are used in the waste gas system (PBN 2019a, Section 11.2.2):

- Condenser air ejector filtration
- Gas decay tanks

- Waste gas compressors
- Gas analyzer

Should the plant gas inventory and requirements become unbalanced, this treated gas may be discharged under controlled conditions to the atmosphere following sampling and analysis. Decay of short-lived isotopes from a leaking steam generator to the condenser air ejector is accomplished by providing decay ductwork and an in-line filtration system for condenser air ejector exhaust gases prior to release. The effect of primary-to-secondary system leakage is minimized by treatment of steam generator blowdown by use of vent condensers on the steam generator blowdown tanks. (PBN 2019a, Section 11.2.2)

Gaseous wastes consist primarily of hydrogen stripped from coolant discharged to the CVCS holdup tanks during boron dilution, nitrogen and hydrogen gases purged from the CVCS volume control when degassing the reactor coolant, and nitrogen from the closed gas blanketing system. (PBN 2019a, Section 11.2.3)

Before a tank is discharged to the environment, it is sampled and analyzed to determine and record the radioactivity to be released, and then is discharged to the plant vent at a controlled rate through a radiation monitor. Results of analysis, waste gas volume, dilution flow available, discharge rate, and total activity are recorded on a waste discharge permit. During release, a trip valve in the discharge line is closed automatically by a high radioactivity level indication in the plant vent. (PBN 2019a, Section 11.2.2)

During release of gaseous radioactive waste to the plant vent, the following conditions shall be met (PBN 2019a, Section 11.2.3):

- At least one primary auxiliary building exhaust stack fan will be in operation.
- The plant vent radioactivity monitor shall be operating.

PBN does not anticipate any increase in gaseous waste releases beyond normal operations during the proposed SLR operating term.

2.2.6.3 Solid Radwaste System

The solid waste system design and operation are directed toward minimizing releases of radioactive materials to unrestricted areas. The equipment is designed and operated to process solid radioactive wastes which result in a form which minimizes potential harm to personnel or the environment. Handling areas are appropriately monitored, and safety features are incorporated to preclude releases in excess of the limits of 10 CFR Part 20. (PBN 2019a, Section 11.3)

The solid waste system at PBN is designed to package and/or solidify radioactive waste for shipment to an approved offsite burial facility. Nonfuel solid wastes result from treating and separating radionuclides from gases and liquids and from removing contaminated material from various reactor areas. Solid wastes also consist of reactor components, equipment, and tools removed from service, chemical laboratory samples, spent resins, used filter cartridges, radioactively contaminated hardware, as well as compacted wastes such as contaminated protective clothing, paper, rags, and other trash generated from plant design modifications and operations and routine maintenance activities. (NRC 2005, Sections 2.1.4. and 2.1.4.3)

Spent resins from the demineralizers and filter cartridges are packaged and stored onsite until shipment offsite for disposal. Miscellaneous materials such as paper, plastic, wood, and metal are collected and shipped offsite for vendor-supplied volume reduction (i.e., incineration, super-compaction, metal melt, deconstruction, etc.) followed by disposal. (PBN 2019a, Section 11.3.2)

Spent resins from CVCS and other system demineralizers are flushed to a shielded, lined stainless steel storage tank located in the auxiliary building basement. When the tank is full, the resin is dewatered and liquids from the dewatering operation are sent to the waste holdup tank. Following resin dewatering, the tank and its shield are transferred by the seismically qualified auxiliary building crane to the new fuel storage area where the resin is sluiced to a disposable cask liner. Spent filtration media and resin from the filtration/demineralization system is sluiced directly to a disposable cask liner in the truck access area. When a disposable liner is full, the liner is dewatered to meet disposal site or processor criteria. The disposable liner is then shipped offsite for processing or shipped offsite for disposal at a suitable burial site. (PBN 2019a, Section 11.3.2)

Dry radioactive waste may be stored in steel shipping containers in designated locations in the outside yard portion of the radiation control area (RCA) before shipment. Also, boxes loaded with dry active waste are stored in the outside yard area of the RCA before shipment. Routine surveys and inspections are performed to verify the control of radioactive material and container integrity. (NRC 2005, Section 2.1.4.3)

The quantity of solid radioactive waste shipped from PBN is reported in an annual monitoring report in accordance with the ODCM (PBN 2019a, Section 11.3.3).

Disposal and transportation of solid waste are performed in accordance with the applicable requirements of 10 CFR Parts 61 and 71, respectively. There have been no releases to the environment from radioactive solid wastes generated at PBN. (NRC 2005, Section 2.1.4.3)

PBN does not anticipate any increase in solid waste releases beyond normal operations during the proposed SLR operating term.

2.2.6.3.1 Spent Resin Handling Operations

Every effort is made to minimize the amount of spent resin generated. Segregation of lower-activity resins from higher-activity resins is also performed when possible to reduce costs of disposal. (NEE 2013, Section 5.7)

Items taken into consideration in the management of spent resins include the following (NEE 2013, Section 5.7):

- Plant demineralization vessels are not loaded with resin unless the demin is required to be in use.
- Resin beds are completely depleted before being sluiced for disposal.
- When possible, low-activity resins are processed for directed release ("Green Is Clean" processing) when applicable.
- When possible, lower-activity vendor-supplied waste liquid processing system resins are segregated from spent resin sluice tanks.
- Spent resin from in-plant demineralizer vessels are sluiced to and stored in spent resin tanks. The Radiation Protection/Radwaste Department or other designated departments operates the resin transfer system, which moves resins from the spent resin tanks to high integrity containers that are shipped for disposal. Spent resin tank levels and spent resin inventory are tracked by the Radiation Protection/Radwaste Department for purposes of radwaste accrual.

2.2.6.4 Ultimate Disposal Operations

All packages containing radioactive non-fissionable material, and the procedures used to prepare these for offsite shipment, are in accordance with U. S. Department of Transportation (DOT) regulations. All shipments are made in accordance with the state, NRC, and DOT regulations, and appropriate PBN and NEPB fleet procedures. Radiation protection/radwaste verifies that the receiving facility is authorized to receive radioactive waste and to conduct surveys in support of the shipment. (NEE 2013, Section 5.2). As discussed earlier, the quantity of radioactive waste shipped from PBN is reported in an annual monitoring report in accordance with the ODCM.

2.2.6.5 Low-Level Radioactive Waste

Low-level radioactive waste (LLRW) is classified as Class A, Class B, or Class C (minor volumes are classified as greater than Class C). Class A includes both dry active waste and processed waste (e.g., dewatered resins). Classes B and C normally include processed waste and irradiated hardware. PBN has contracts with following listed vendors for disposal of LLRW:

- Class A waste is governed under a "life of plant" contract with Energy Solutions and is transported to facilities in Clive, UT, and the Bear Creek and Gallaher Road facilities in Oak Ridge, TN.
- Class B/C waste is sent to a Waste Control Specialist facility in Andrews, TX, for direct disposal.
- Class B/C filters are sent to Energy Solutions for shredding and disposal.

- Class B/C resin is sent to the Resin Solutions facility in Erwin, TN, for processing prior to disposal.

In 2019, LLRW was shipped to the Energy Solution's facilities in Oak Ridge, TN, and Clive, UT (PBN 2020a, Table 4-2). Currently, PBN has no waste greater than Class C stored onsite. Disposal of waste greater than Class C is the responsibility of the federal government.

2.2.6.6 Low-Level Mixed Waste

Mixed waste is radioactive waste that contains or consists of waste constituents that the U.S. Environmental Protection Agency (EPA) lists as hazardous waste. Therefore, any mixed waste is under the regulatory requirements of the NRC and the EPA. Every effort is made to minimize or eliminate mixed waste generation through product substitution and process modification, when possible. (NEE 2013, Section 5.6)

If generated, low-level mixed wastes are transported to an offsite facility licensed to accept and manage the wastes in accordance with appropriate site and company procedures. Currently PBN has four to five drums of mixed waste stored onsite. This waste was generated during the recent outage.

2.2.7 Nonradioactive Waste Management System

The Resource Conservation and Recovery Act (RCRA) governs the disposal of solid waste. Solid and hazardous wastes in Wisconsin are regulated and administered by the WDNR (NRC 2005, Section 2.1.5). PBN generates nonradioactive waste as a result of plant maintenance, cleaning, and operational processes that occur at the site.

Various nonradioactive wastewater management and disposal activities are conducted at PBN. These include collection, treatment, and disposal of the following principal effluents: sanitary waste, demineralizer regeneration neutralization tank discharge, steam generator blowdown, reverse osmosis reject wastewater, microfiltration unit backwash, water treatment plant backwash, potable water treatment system filter backwash, heating system condensate, and wastewater from various sumps and floor drains. The vacuum fabric filter system removes suspended solids to provide final clarification prior to discharge. (NRC 2005, Section 2.1.5)

After the appropriate treatment processes, the wastewater streams are discharged to Lake Michigan and monitored and regulated according to PBN's WPDES permit (Attachment B). (NRC 2005, Section 2.1.5). Permit information is provided in Table 9.1-1.

Sanitary wastewater is treated in an onsite treatment system. The effluent is commingled with other wastewater and subsequently discharged with the cooling water discharges. Waste liquid sludge is hauled offsite for disposal. The sludge is taken to the Green Bay or Manitowoc wastewater treatment plants for disposal. (NRC 2005, Section 2.1.5)

In 2019, a total of 152,300 gallons in 27 shipments were made to the Manitowoc sewage wastewater treatment plant. All sludge and equalization basin discharges were analyzed to the environmental lower limit of deductions. Naturally occurring radionuclides such as Ra-226 and K-40 were present in all samples. For the 27 shipments in 2019, the total Ra-226 and K-40 were 91.7 micro Curies (µCi) and 116 µCi, respectively. Small concentrations of H-3 (ranging from non-detectable to 317 picoCuries per liter [pCi/L]) were found in 21 of the shipments for a total of 91.0 µCi. Based on the daily flow at the Manitowoc plant, the H-3 discharge concentration would be on the order of 0.112 pCi/L, or 175,000 times lower than the EPA drinking water limit of 20,000 pCi/L. (PBN 2020a, Section 2.6)

In 1988, pursuant to 10 CFR 20.302(a), PBN received NRC approval for the disposal of sewage sludge, which may contain trace amounts of radionuclides, by land application on acreage within the site. Land application of sewage sludge is regulated by the WDNR. PBN has not land-applied sewage sludge for over a decade. Therefore, PBN has not renewed its WDNR permit to dispose of sewage sludge in this manner. (PBN 2020a, Section 2.6)

Nonradioactive and nonhazardous waste materials such as excess dirt and debris from past construction activities, including clean soil, broken pavement, and building materials, have been collected at an onsite spoil pile at the PBN site. The spoil pile is established and maintained in accordance with PBN spoils pile management plan. PBN has an exemption from WDNR regulations pertaining to solid waste management. (PBN 2009a) The spoil pile is stabilized by years of natural vegetative growth. A visual inspection of the pile is conducted annually to check for erosion as part of the stormwater pollution prevention plan (SWPPP). (NRC 2005, Section 2.1.5)

NEPB's procedure for the management of industrial and hazardous waste (NEE 2019) provides stepwise guidance for handling, transportation, recordkeeping, management, and reporting of hazardous and non-hazardous wastes. This procedure (NEE 2019) also summarizes the regulatory provisions and best management practices (BMPs) based on current understanding of the applicable law and regulations and NEPB's current business practices. PBN is classified by the EPA and the WDNR as a small quantity generator of hazardous waste (NEE 2010). This means that less than 2,200 pounds of hazardous waste is produced in any single month.

PBN maintains a log of approved waste vendors currently used to manage and dispose of hazardous, nonhazardous, and recyclable wastes generated at PBN. The PBN solid waste quick guide provides direction on the disposition of non-radioactive solid waste. Veolia North America, LLC, is utilized to dispose of hazardous and nonhazardous waste; GFL Environmental Inc. is utilized to dispose of used oils, glycols etc.; Norsec Recycling of De Pere, WI, is utilized for e-waste; and Waste Management is utilized for asbestos. Nonradioactive hazardous and nonhazardous waste type and quantities over the most recent 5 years (2015–2019) are provided in Table 2.2-2.

For most hazardous waste records, the regulations require that records be retained for at least 3 years from the date the hazardous waste for which the record pertains is last shipped offsite (NEE 2019).

Table 2.2-1 Meteorological Parameters Monitored at PBN

Parameter	Primary Tower (elevation level)	Backup Tower (elevation level)	Inland Tower (elevation level)
Wind Speed	45 m, 10 meters	10 meters	10 meters
Wind Direction	45 m, 10 meters	10 meters	10 meters
Vertical Temperature Difference	(10-45) meters	None	None
Sigma Theta	10 meters	10 meters	10 meters
Reference Temperature	10 meters	None	4 meters

Table 2.2-2 Nonradioactive Waste Quantities at PBN, 2015–2019 (Sheet 1 of 9)

Waste	Weight/ Volume	Units	Waste Vendor
2019 Hazardous Waste			
UN1950, waste aerosols, flammable (each not exceeding 1L capacity), (aerosol), 2.1, limited quantity	57	Pounds	Veolia ES Technical Solutions
UN1953, waste flammable liquids, n.o.s., (IPA (isopropyl alcohol) (<98% concentration), mineral spirits),3, II	15	Pounds	Veolia ES Technical Solutions
UN3082, waste environmentally hazardous substance, liquid, n.o.s., (ethylened glycol, oil, lubricating),9, III	98	Pounds	Veolia ES Technical Solutions
NA3082, hazardous waste, liquid, n.o.s. (silver, water, alkyl dimethylbenzyl ammonium chloride), 9, III	206	Pounds	Veolia ES Technical Solutions
UN3086, waste toxic solids, oxidizing, n.o.s., (potassium chromate), 6.1 (5.1). II	4	Pounds	Veolia ES Technical Solutions
UN3264, waste corrosive liquid, acidic, inorganic, n.o.s., (nitric acid (<=20%), lead), 8, II	8	Pounds	Veolia ES Technical Solutions
UN2924, waste flammable liquids, corrosive, n.o.s., (Stoddard solvent, methanol),3(8), II	22	Pounds	Veolia ES Technical Solutions
UN3264, waste corrosive liquid, acidic, inorganic, n.o.s., (battery acid, <=51%, HCL solution), 8, III	17	Pounds	Veolia ES Technical Solutions
UN3267, waste corrosive liquid, basic, organic, n.o.s., (ethanolamine, ammonia solutions (>10% bu,35% ammonia), 8, III	33	Pounds	Veolia ES Technical Solutions
UN1263, waste paint, 3, II	77	Pounds	Veolia ES Technical Solutions
UN3264, waste corrosive liquid, acidic, inorganic, n.o.s., (sulfuric acid solution, (0.1N-2.5N), 8, II	62	Pounds	Veolia ES Technical Solutions
UN3266, waste corrosive liquid, basic, inorganic, n.o.s., (sodium hydroxide, solution), 8, III, RQ (D002)	55	Gallons	Veolia ES Technical Solutions
NA3077, hazardous waste solid, n.o.s., (aluminum oxide, chromium), 9, III	2,055	Pounds	Veolia ES Technical Solutions
UN1993, waste flammable liquids, n.o.s., (IPA (isopropyl alcohol) (<93% concentration), PVC fitting cover/jacketing adhesive), 3, II	13	Pounds	Veolia ES Technical Solutions
UN2922, waste corrosive liquids, toxic, n.o.s. (acetic acid solution (10-50% in water) glycolic acid), 8(6.1), II	4	Pounds	Veolia ES Technical Solutions
UN3267, waste corrosive liquid, basic, organic, n.o.s., (sodium hydroxide solution, Teta (triethylenetetramine)), 8, II	22	Pounds	Veolia ES Technical Solutions
2019 Total (Hazardous Waste)	**3,093**	**Pounds**	

Table 2.2-2 Nonradioactive Waste Quantities at PBN, 2015–2019 (Sheet 2 of 9)

Waste	Weight/ Volume	Units	Waste Vendor
2019 Non-Hazardous Waste			
UN2315, polychlorinated biphenyls, liquid, 9, III, RQ	93	Kilogram	Veolia ES Technical Solutions
UN2315, polychlorinated biphenyls, liquid, (ballasts) 9, III	86	Kilogram	Veolia ES Technical Solutions
Universal Waste – mercury-containing lamps	2,445	Pounds	Veolia ES Technical Solutions
UN3506, Mercury contained in manufactured articles, 8, (6.1) Universal Waste	5	Pounds	Veolia ES Technical Solutions
Diesel-impacted soil and or debris cleanup	6	Ton	Waste Management
Soil contaminated with diesel fuel (non-hazardous)	6,000	Pounds	Waste Management
UN3082, environmentally hazardous substance, liquid, n.o.s., (ethylene glycol, epoxy resins), 9, III	233	Pounds	Veolia ES Technical Solutions
UN3082, environmentally hazardous substance, liquid, n.o.s., (ethoxylated alcohols), 9, III	22	Gallons	Veolia ES Technical Solutions
Non-regulated material, non-RCRA, non-DOT, (aluminum oxide)	52	Pounds	Veolia ES Technical Solutions
Non-regulated material, non-RCRA, non-DOT, (aluminum oxide, silicone dioxide, amorphous)	167	Pounds	Veolia ES Technical Solutions
Non-regulated material, non-RCRA, non-DOT, (grease)	45	Pounds	Veolia ES Technical Solutions
Non-regulated material, non-RCRA, non-DOT, (sodium acetate)	46	Pounds	Veolia ES Technical Solutions
2019 Total (Non-Hazardous Waste)	**21,563**	**Pounds**	

Table 2.2-2 Nonradioactive Waste Quantities at PBN, 2015–2019 (Sheet 3 of 9)

Waste	Weight/ Volume	Units	Waste Vendor
2018 Hazardous Waste			
UN2809, waste mercury, 8(6.1), III, RQ(D009)	24	Pounds	Veolia ES Technical Solutions
UN1950, waste aerosols, flammable (each not exceeding 1L capacity), (aerosol), 2.1, limited quantity	56	Pounds	Veolia ES Technical Solutions
UN1992, waste flammable liquid, toxic, n.o.s, (PVC fitting cover/jacketing adhesive, mineral spirits), 3 (6.1), II	77	Pounds	Veolia ES Technical Solutions
UN1479, waste oxidizing solid, n.o.s., (silver nitrate, sodium persulfate), 5.1, II	7	Pounds	Veolia ES Technical Solutions
UN3086, waste toxic solids, oxidizing, n.o.s., (potassium dichromate), 6.1 (5.1). 1, RQ	6	Pounds	Veolia ES Technical Solutions
UN1791, waste hypochlorite solutions, (sodium hypochlorite), 8, III, RQ (D009)	129	Pounds	Veolia ES Technical Solutions
UN3266, waste corrosive liquid, basic, inorganic, n.o.s., (sodium metasilicate, anhydrous), 8 III	7	Pounds	Veolia ES Technical Solutions
UN1993 waste flammable liquids, n.o.s., (cyclohexane loctite 3873) 3, II	11	Pounds	Veolia ES Technical Solutions
UN2810, waste toxic liquids, organic, n.o.s., (phenylarsine oxide titrants, sodium fluoride), 6.1, III, RQ (D004)	27	Pounds	Veolia ES Technical Solutions
UN2920, waste corrosive liquids, flammable, n.o.s. (glacial acetic acid, hydrazine, aqueous solution (<37% hydrazine)), 8(3), II, RQ	10	Pounds	Veolia ES Technical Solutions
UN3264, waste corrosive liquid, acidic, inorganic, n.o.s., (HCL SLN, iodine), 8, II	10	Pounds	Veolia ES Technical Solutions
Silver waste	17	Pounds	
2018 Total (Hazardous Waste)	**581**	**Pounds**	

Table 2.2-2 Nonradioactive Waste Quantities at PBN, 2015–2019 (Sheet 4 of 9)

Waste	Weight/ Volume	Units	Waste Vendor
2018 Non-Hazardous Waste			
UN2315, polychlorinated biphenyls, liquid, (ballasts) 9, III	32	Kilogram	Veolia ES Technical Solutions
UN2315, polychlorinated biphenyls, liquid, 9, III, RQ	320	Kilogram	Veolia ES Technical Solutions
UN3432, polychlorinated biphenyls, solid, 9, III	2	Kilogram	Veolia ES Technical Solutions
Non-hazardous used oil	2,550	Gallons	Future Environmental
Used oil filter pick-up	6	Pounds	Future Environmental
Non-hazardous drum pick-up	440	Gallons	Future Environmental
Universal Waste – mercury-containing lamps	770	Pounds	Veolia ES Technical Solutions
Non-regulated material, non-RCRA, non-DOT., (silica, crystalline, silicones)	1,182	Pounds	Veolia ES Technical Solutions
Non-regulated material, non-RCRA, non-DOT., (Nalco Dynecol)	723	Gallons	Veolia ES Technical Solutions
Non-regulated material, non-RCRA, non-DOT., (cation exchange resin)	430	Pounds	Veolia ES Technical Solutions
Non-regulated material, non-RCRA, non-DOT., (resin beads)	200	Pounds	Veolia ES Technical Solutions
Non haz non-reg by DOT sludge (wastewell)	3,000	Gallons	Future Industrial
UN2315, polychlorinated biphenyls, liquid, 9, PGIII, ERG 171	16,591	Kilogram	Hydrodec North America, LLC
2018 Total (Non-Hazardous Waste)	**88,381**	**Pounds**	

Table 2.2-2 Nonradioactive Waste Quantities at PBN, 2015–2019 (Sheet 5 of 9)

Waste	Weight/ Volume	Units	Waste Vendor
2017 Hazardous Waste			
UN1993, waste flammable liquids, n.o.s. (ink, printers, flammable), 3, II	7	Pounds	Veolia ES Technical Solutions
UN2920, waste corrosive liquids, flammable, n.o.s. (ethylenediamie, IPD (isophorone-diamine)), 8 (3), II	340	Pounds	Veolia ES Technical Solutions
UN2920, waste corrosive liquids, flammable, n.o.s. (poly (hexamethylene diisocyanate),1,2-xylene), 8 (3), II	386	Pounds	Veolia ES Technical Solutions
UN2920, waste corrosive liquids, flammable, n.o.s., (tetraethylenepentamine, 1,2-xylene), 8 (3), II	440	Pounds	Veolia ES Technical Solutions
UN2922, waste corrosive liquids, toxic, n.o.s., (hydrazine dihydrochloride, chlorine water (saturated)), 8 (6.f), II	26	Pounds	Veolia ES Technical Solutions
UN3086, waste toxic solids, oxidizing, n.o.s., (potassium dichromate), 6.1(5.1), I	7	Pounds	Veolia ES Technical Solutions
UN3093, waste corrosive liquids, oxidizing, n.o.s.,(nitric acid (<=20%), aluminum nitrate nonahydrated), 8(5.1), II	8	Pounds	Veolia ES Technical Solutions
UN1950, waste aerosols, flammable (each not exceeding 1L capacity, (aerosol), 2.1, RQ (d001), limited quantity	45	Pounds	Veolia ES Technical Solutions
UN1993, waste flammable liquids, n.o.s. (alcohol, petroleum distilate fractions), 3, II	187	Pounds	Veolia ES Technical Solutions
UN1263, waste paint-related material, 3, II	4,320	Pounds	Veolia ES Technical Solutions
UN1992, waste flammable liquids, toxic, n.o.s., (petroleum distillated (naptha), octamethylcyclotetrasiloxane), 3(6.1), II	185	Pounds	Veolia ES Technical Solutions
UN3266, waste corrosive liquid, basic inorganic, n.o.s., (sodium hydroxide, sodium metacilicate), 8, III, RQ (D002)	550	Pounds	Veolia ES Technical Solutions
UN1263, waste paint related material, (mineral spirits, petroleum distillate fractions), 3, II, RQ (D001)	2,260	Pounds	Veolia ES Technical Solutions
UN1993, waste flammable liquids, n.o.s. (IPA (isopropyl alcohol) (<98% concentration), paint thinner), 3, II	43	Pounds	Veolia ES Technical Solutions
UN1263, waste paint related material, (methyl amyl ketone, 1,6-hexamethylene diisocyanate based polyisocyanate), 3, II	953	Pounds	Veolia ES Technical Solutions
UN1268, waste petroleum distillates, n.o.s. (hydrotreated light petroleum distillates), 3, III, RQ (D001)	152	Pounds	Veolia ES Technical Solutions
2017 Total (Hazardous Waste)	**9,909**	**Pounds**	

Table 2.2-2 Nonradioactive Waste Quantities at PBN, 2015–2019 (Sheet 6 of 9)

Waste	Weight/ Volume	Units	Waste Vendor
2017 Non-Hazardous Waste			
Used oil (non-hazardous)	1,500	Gallons	Future Environmental
Universal waste mercury-containing lamps	5,465	Pounds	Veolia ES Technical Solutions
UN3261, corrosive solid, acidic, organic, n.o.s., (glycolic acid), 8, II	5	Pounds	Veolia ES Technical Solutions
UN2315, polychlorinated biphenyls, liquid, 9, III, RQ	64	Kilogram	Veolia ES Technical Solutions
UN2315, polychlorinated biphenyls, liquid, (ballasts) 9, III	66	Kilogram	Veolia ES Technical Solutions
UN2693, bisulfites, aqueous solutions, n.o.s., 8, III	110	Gallons	Veolia ES Technical Solutions
UN3082, environmentally hazardous substance, liquid, n.o.s., (ethylene glycol, oil, lubricating), 9, III	218	Pounds	Veolia ES Technical Solutions
UN3082, environmentally hazardous substance, liquid, n.o.s., (ethoxylated alcohols), 9, III	110	Gallons	Veolia ES Technical Solutions
Non-regulated material, non-RCRA, non-DOT	144	Pounds	Veolia ES Technical Solutions
Non-regulated material, non-RCRA, non-DOT, (cation exchange resin)	2,000	Pounds	Veolia ES Technical Solutions
UN3082, environmentally hazardous substance, liquid, n.o.s., (ethoxylated alcohols), 9, III	1,440	Pounds	Veolia ES Technical Solutions
Non-regulated material, non-RCRA, non-DOT (calcium carbonate, citric acid)	213	Pounds	Veolia ES Technical Solutions
Non-regulated material, non-RCRA, non-DOT (calcium carbonate, sodium lauryl sulfate solution (10-30% in water))	160	Pounds	Veolia ES Technical Solutions
Non-regulated material, non-RCRA, non-DOT (praestol 189K flocculant)	420	Pounds	Veolia ES Technical Solutions
UN2315, polychlorinated biphenyls, liquid, 9, III, RQ	91	Pounds	Veolia ES Technical Solutions
UN3432, polychlorinated biphenyls, solid, 9, III	2	Pounds	Veolia ES Technical Solutions
2017 Total (Non-Hazardous Waste)	**24,316**	**Pounds**	

Table 2.2-2 Nonradioactive Waste Quantities at PBN, 2015–2019 (Sheet 7 of 9)

Waste	Weight/ Volume	Units	Waste Vendor
2016 Hazardous Waste			
UN1950, waste aerosols, flammable (each not exceeding 1 l capacity) (aerosols) 2.1 limited quantity	43	Pounds	Veolia ES Technical Solutions
UN1263, waste paint-related material, including paint thinning, drying, removing, or reducing compound, 3, II RQ D001	875	Pounds	Veolia ES Technical Solutions
UN1993, waste flammable liquids n.o.s. (mineral spirits, paint thinner) 3, II	59	Pounds	Veolia ES Technical Solutions
UN1498, waste sodium nitrate, 5.1, III	3	Pounds	Veolia ES Technical Solutions
UN3264, waste corrosive liquid, acidic, inorganic, n.o.s. (sulfuric acid <51%, hydrochloric acid solution) 8, II	27	Pounds	Veolia ES Technical Solutions
UN3267, waste corrosive liquid, basic organic, n.o.s. (monoethanolamine, sodium hydroxide, solid (dry flake, bead, or granular), 8, II	27	Pounds	Veolia ES Technical Solutions
UN2672, waste ammonia solution, 8, III	9	Pounds	Veolia ES Technical Solutions
UN2922, waste corrosive liquids, toxic n.o.s. (nitric acid (5%), chromium (8 (6.1) II	9	Pounds	Veolia ES Technical Solutions
UN3267, waste corrosive liquid, basic, organic n.o.s. (ethanolamine, ammonia solution (>10% but <35% ammonia)) 8, II	61	Pounds	Veolia ES Technical Solutions
UN1436, waste zinc powder (zinc dust) 4.3 (4.2), I	20	Pounds	Veolia ES Technical Solutions
UN1650, waste potassium cyanide, solid, 6.1, I	1	Pounds	Veolia ES Technical Solutions
UN3287, waste toxic liquid inorganic, n.o.s.,(ammonium chloride, phenylarsine oxide), 6.1,II	159	Pounds	Veolia ES Technical Solutions
UN2927, waste toxic liquids, corrosive, organic, n.o.s. (hydrazine dihydrochloride phenylarsine oxide) 6.1, 8, II	18	Pounds	Veolia ES Technical Solutions
NA3077, hazardous waste solid, n.o.s. (lead debris) 9, III, RQ (D008)	123	Pounds	Veolia ES Technical Solutions
UN2809, waste mercury, 8 (6.1), III RQ (D009)	2	Pounds	Veolia ES Technical Solutions
UN1993, waste flammable liquids, n.o.s. (2-butoxyethanol, ethyl benzene), 3, II	21	Pounds	Veolia ES Technical Solutions
UN1993 waste flammable liquids, n.o.s. (acetone, ethanol), 3, II	123	Pounds	Veolia ES Technical Solutions
UN1993, waste flammable liquids, n.o.s. isoporoanol (<98% concentration), (toluene),3, II	206	Pounds	Veolia ES Technical Solutions

Table 2.2-2 Nonradioactive Waste Quantities at PBN, 2015–2019 (Sheet 8 of 9)

Waste	Weight/ Volume	Units	Waste Vendor
UN2031, waste nitric acid other than red fuming, with not more than 20% nitric acid (nitric acid <2% chromium) 8, II	7	Pounds	Veolia ES Technical Solutions
2016 Total (Hazardous Waste)	**1,793**	**Pounds**	
2016 Non-Hazardous Waste			
Universal waste mercury-containing lamps	3,076	Pounds	Veolia ES Technical Solutions
UN2315, polychlorinated biphenyls, liquid (ballasts) 9, III	71	Kilogram	Veolia ES Technical Solutions
Polychlorinated biphenyls (PCB debris), RQ (polychlorinated biphenyls)	178	Kilogram	Veolia ES Technical Solutions
Non-regulated material, non-RCRA, non-DOT (turbine oil)	20	Gallons	Veolia ES Technical Solutions
Non-regulated material, non-RCRA, non-DOT (manganous sulfate, sodium acetate)	155	Pounds	Veolia ES Technical Solutions
Non-regulated material, non-RCRA, non-DOT (pro-strip non-corrosive floor stripper)	110	Gallons	Veolia ES Technical Solutions
Non-regulated material, non-RCRA, non-DOT (titanium dioxide)	121	Pounds	Veolia ES Technical Solutions
Non-regulated material, non-RCRA, non-DOT water, oil)	204	Gallons	Veolia ES Technical Solutions
Non-regulated material, non-RCRA, non-DOT (cation exchange resin)	1,454	Pounds	Veolia ES Technical Solutions
used oil	1,350	Gallons	Future Environmental
UN2315, polychlorinated biphenyls, liquid, 9, III, RQ	5,308	Kilogram	Veolia ES Technical Solutions
UN3262, corrosive solid basic inorganic, n.o.s. (sodium hydroxide, 8, III	74	Pounds	Veolia ES Technical Solutions
UN3506, mercury contained in manufactured articles, 8, (6.1)	8	Pounds	Veolia ES Technical Solutions
Non-regulated material, non-RCRA, non-DOT (butyl carbitol)	1,259	Pounds	Veolia ES Technical Solutions
UN2315, polychlorinated biphenyls, liquid, (ballasts), 9, III	36	Pounds	Veolia ES Technical Solutions
UN3289, toxic liquid, corrosive inorganic n.o.s. (hydrazine dichloride, sodium oxalate) 6.1 (8), II	17	Pounds	Veolia ES Technical Solutions
UN3261, waste corrosive solid, acetic organic n.o.s. (glycolic acid) 8, II	8	Pounds	Veolia ES Technical Solutions

Table 2.2-2 Nonradioactive Waste Quantities at PBN, 2015–2019 (Sheet 9 of 9)

Waste	Weight/ Volume	Units	Waste Vendor
UN3495, Iodine (iodine), 8, (6.1) III	18	Pounds	Veolia ES Technical Solutions
Polychlorinated biphenyls (PCB debris), RQ, (polychlorinated biphenyls)	135	Kilogram	Veolia ES Technical Solutions
2016 Total (Non-Hazardous Waste)	**29,418**	**Pounds**	
2015 Hazardous Waste[(a)]	560	Pounds	
2015 Non-Hazardous Waste[(a)]	22,151	Pounds	

a. For 2015, total hazardous and non-hazardous amounts are provided instead of a detailed breakdown according to waste type.

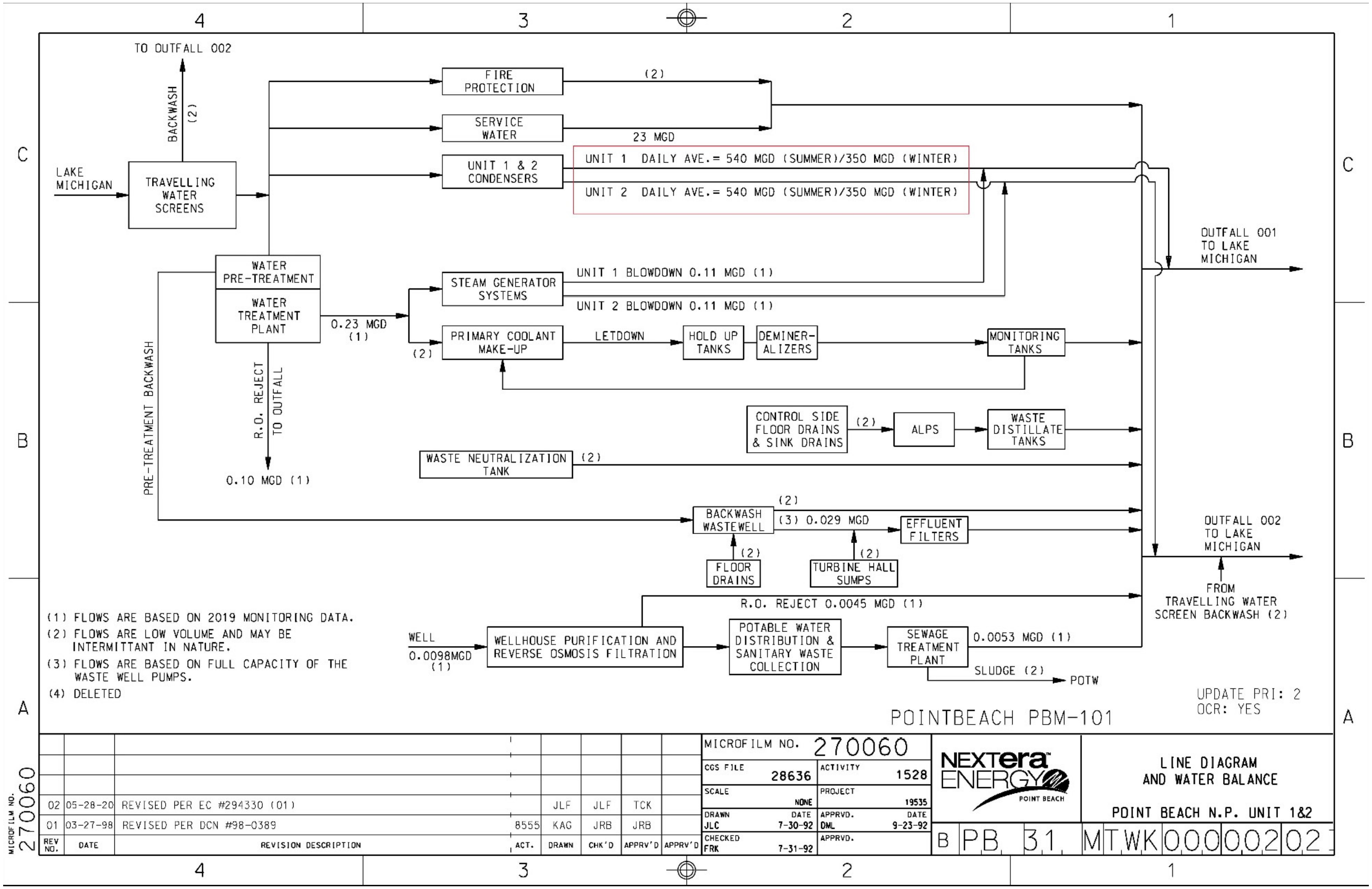


Figure 2.2-1 PBN Typical Water Balance

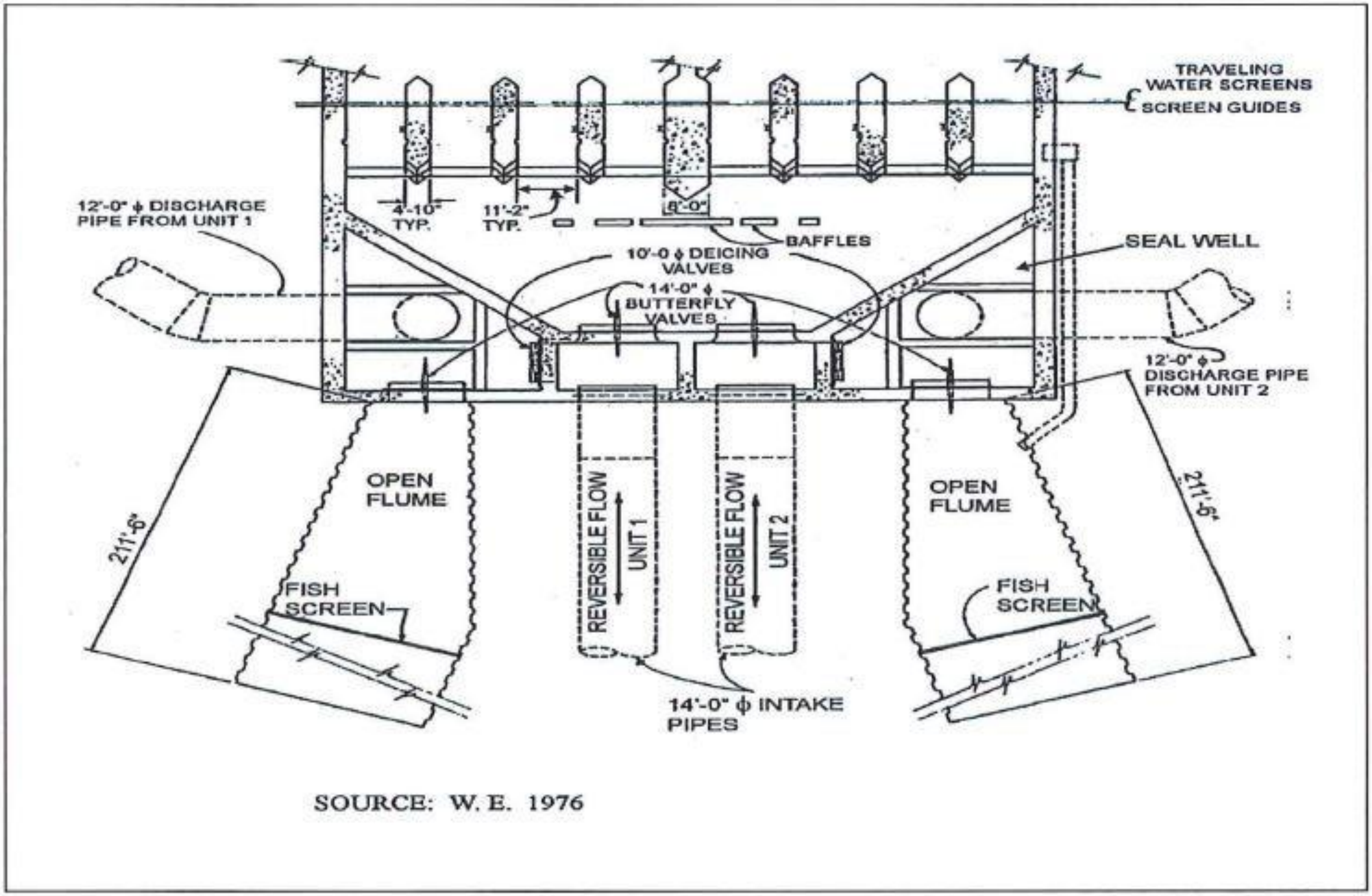


Figure 2.2-2 PBN Pumphouse—Plan View

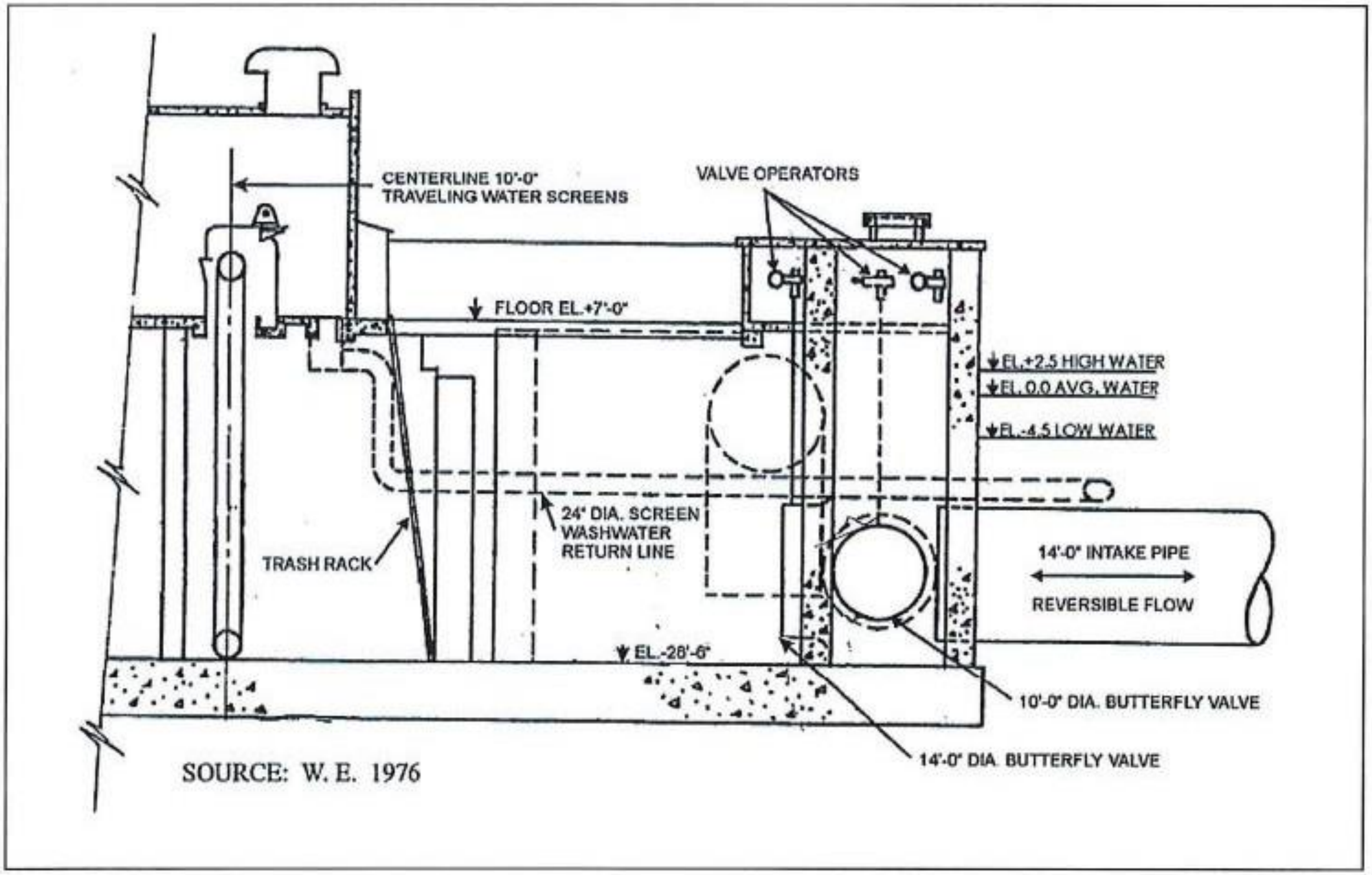


Figure 2.2-3 PBN Pumphouse—Section View

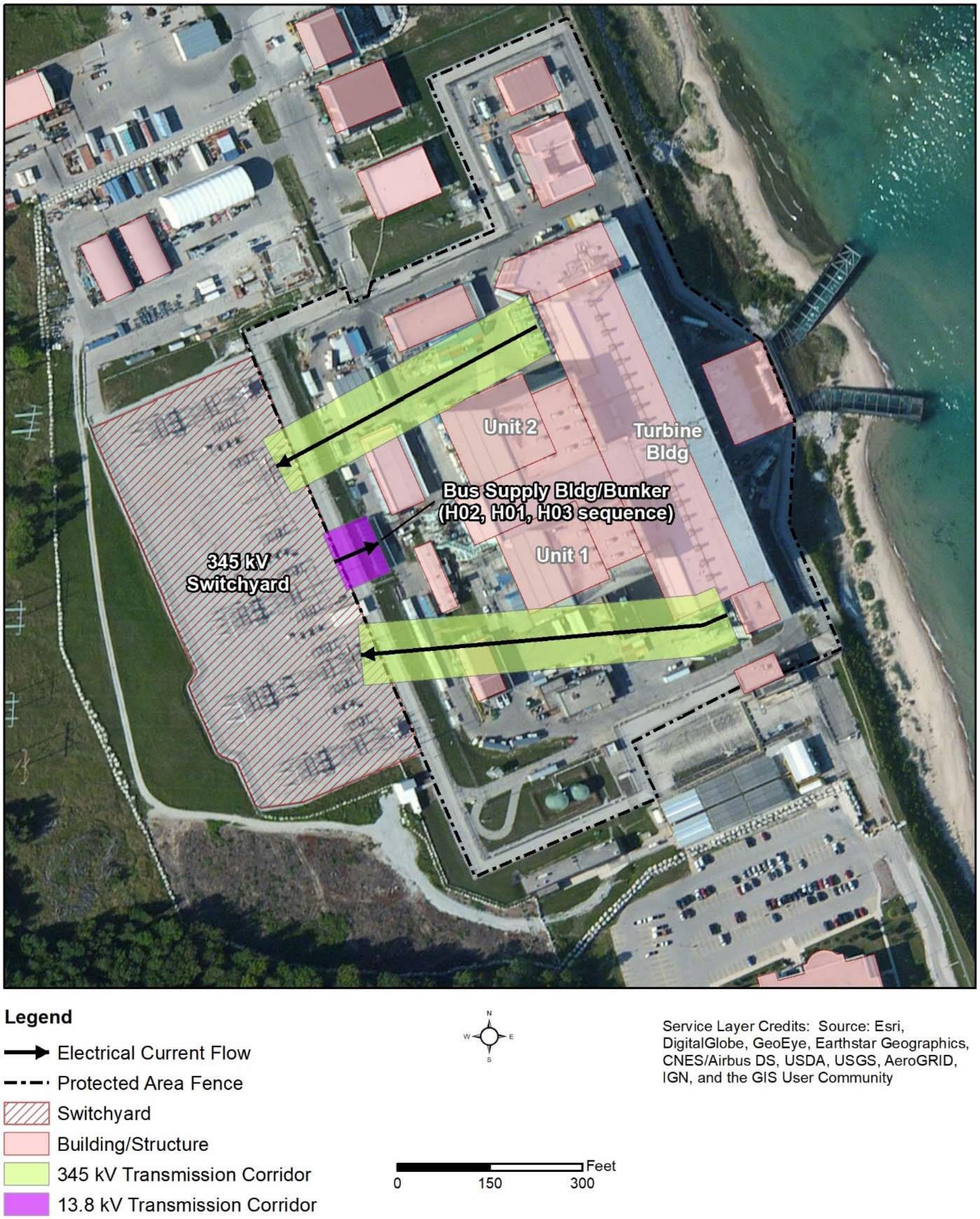


Figure 2.2-4 In-Scope Transmission Lines

2.3 Refurbishment Activities

In accordance with 10 CFR 51.53(c)(2), a license renewal applicant's ER must contain a description of the applicant's plan to modify the facility or its administrative control procedures as described in accordance with § 54.21. If SLR-related refurbishment is planned at a facility, the applicant's ER would include analysis for environmental impacts of the proposed refurbishment activity. [10 CFR 51.53(c)(3)(ii)].

The incremental aging management activities implemented to allow operation of a nuclear power plant during a renewal term are assumed to fall under one of two broad categories. One of these categories involves refurbishment actions, which usually occur infrequently and possibly only once in the life of the plant for any given item. The other category is SMITTR actions, most of which are repeated at regular intervals and schedules."

The NRC requirements for the renewal of OLs for nuclear power plants include preparation of an integrated plant assessment (IPA) [10 CFR 54.21]. The IPA must identify systems, structures, and components (SSCs) subject to an aging management review. The objective of the IPA is to determine whether the detrimental effects of aging could preclude certain SSCs from performing in accordance with the current licensing basis during the additional 20 years of operation requested in the SLRA. An example of an SSC subject to aging is the reactor vessel.

PBN's IPA, which NEPB conducted under 10 CFR Part 54 and is described in the body of the SLRA, has identified no SLR-related refurbishment or replacement actions needed to maintain the functionality of SSCs, consistent with the current licensing basis, during the proposed SLR operating term. NEPB does not anticipate the continued operation of PBN to result in any environmental impact greater than SMALL.

2.4 Programs and Activities for Managing the Effects of Aging

In accordance with 10 CFR 51.53(c)(2), a license renewal applicant's ER must contain a description of the applicant's plans to modify the facility or its administrative control procedures as described in accordance with § 54.21.

The programs for managing the effects of aging on certain structures and components within the scope of SLR at the site are described in the body of the SLRA (see Appendix B of the PBN SLRA). The evaluation of structures and components required by 10 CFR 54.21 identified the activities necessary to manage the effects of aging on structures and components during the proposed SLR operating term.

2.5 Employment

The non-outage workforce at the PBN site consists of approximately 681 employees, including 506 NEPB workers and an additional 175 supplemental staff comprised of security workforce and one-off project support staff. Since the PBN uprate, overall plant staffing levels have been reduced due to increased efficiencies in NEPB's operations and general staff attrition and retirement. There are no plans to add additional permanent employees to support plant operations during the proposed SLR operating term, and as noted in Section 2.3, no SLR-related refurbishment activities have been identified. Neither are there plans to add additional permanent operational staff to support SMITTR activities during the proposed SLR operation period.

During refueling outages, which usually last approximately 25 days per unit, there are typically an additional 800 contract employees onsite. Refueling and maintenance outages for the two PBN units are on an 18-month cycle, with one unit scheduled for the spring and the other for the fall.

Table 2.5-1 PBN Permanent Employee Residence Information, March 2020 (Sheet 1 of 2)

State/County	City/Town	Permanent Full-Time Employees	County Total
IOWA (2)			
Jefferson			**1**
	Waterloo	1	
Linn			**1**
	Robins	1	
MICHIGAN (1)			
Dickinson			1
	Vulcan	1	
WISCONSIN (503)			
Brown			**160**
	Bellevue	3	
	De Pere	27	
	Denmark	28	
	Green Bay	90	
	Greenleaf	2	
	Hobart	3	
	Howard	1	
	New Franken	1	
	Pulaski	1	
	Suamico	2	
	Wrightstown	2	
Calumet			**3**
	Brillion	2	
	Sherwood	1	
Door			**4**
	Brussels	1	
	Egg Harbor	1	
	Sturgeon Bay	2	
Fond du Lac		1	**1**
	Waupun	1	
Kewaunee			**63**
	Algoma	7	
	Casco	1	
	Kewaunee	38	
	Luxemburg	17	

Table 2.5-1 PBN Permanent Employee Residence Information, March 2020 (Sheet 2 of 2)

State/County	City/Town	Permanent Full-Time Employees	County Total
Manitowoc			**250**
	Cato	1	
	Cleveland	1	
	Francis Creek	3	
	Kiel	1	
	Manitowoc	84	
	Maribel	7	
	Mishicot	36	
	Newton	1	
	Reedsville	8	
	Saint Nazianz	1	
	Town of Manitowoc	1	
	Two Rivers	97	
	Valders	3	
	Whitelaw	6	
Milwaukee			**1**
	Bayside	1	
Oconto			**2**
	Abrams	1	
	Sobieski	1	
Outagamie			**9**
	Appleton	5	
	Combined Locks	1	
	Greenville	1	
	Kaukauna	1	
	Oneida	1	
Sheboygan			**8**
	Elkhart Lake	1	
	Howards Grove	2	
	Kohler	1	
	Sheboygan	4	
Winnebago			**2**
	Menasha	2	
		Total	**506**

Note: PBN employee place of residence information is for NEPB permanent staffing and does not include a breakdown for non-outage contract staff, nor temporary refueling outage workers. Contract employee settlement patters are assumed to generally follow the county settlement patters indicated by permanent PBN staff.

2.6 Alternatives to the Proposed Action

The proposed action as described in Section 2.1 is for the NRC to subsequently renew the PBN renewed OLs for an additional 20 years. Because the NRC decision is to renew or not renew the existing PBN renewed OLs, the only fundamental alternative to the proposed action is the no-action alternative, which would result in the NRC not renewing the PBN renewed OLs. Because PBN provides a significant block of long-term baseload capacity, it is reasonable to assume that the decision not to renew the PBN licenses would involve replacement of its 1,200 MWe of generation. NEPB has considered a range of replacement power alternatives from which to select those alternatives to be further analyzed for replacement of PBN baseload power generation.

2.6.1 Alternatives Evaluation Process

NEPB developed the following set of evaluation criteria to review PBN replacement alternatives:

- The purpose of the proposed action (SLR) is to provide an option for the continued generation of 1,200 MWe of baseload power beyond PBN's current license term to meet future system generating needs.
- Alternatives evaluated in this ER would need to provide baseload generation.
- Alternatives considered must be fully operational by 2030 considering development of the technology, permitting, construction of the facilities, and connection to the grid.
- Alternatives must be electricity-generating sources that are technically feasible and commercially viable.

2.6.2 Alternatives Considered

Using a screening process based on the above criteria, NEPB considered the full range of alternatives considered in the GEIS in light of the need to meet the criteria.

The following generation sources were selected as reasonable replacement alternatives based on capability to provide reliable baseload power:

- New Nuclear Alternative:
  - Option 1: Advanced light water reactor (ALWR) with mechanical draft cooling towers located at the PBN site.
  - Option 2: Cluster of small modular nuclear reactors with mechanical draft cooling towers located at the PBN site.
- Combination Alternative:
  - Configuration of natural gas combined cycle units with mechanical draft cooling towers located at the PBN site.

  - Expansion of Point Beach Solar (alternative array location and other open space within Point Beach Solar and PBN boundaries).

The alternatives selected as reasonable replacement baseload generation alternatives are presented in Section 7.2.1.

NEPB determined the following alternatives were not considered reasonable replacements in comparison to renewal of the PBN OLs:

- Purchased power
- Plant reactivation or extended service life
- Conservation and energy efficiency measures (demand-side management programs)
- Wind
- Solar
- Geothermal
- Hydropower
- Biomass
- Fuel cells
- Wave and current energy
- Petroleum-fired plants
- Coal-fired plants

The alternatives not selected as reliable baseload generation for replacing the PBN generation are presented in Section 7.2.2.

3.0 AFFECTED ENVIRONMENT

PBN Units 1 and 2 is owned and operated by NEPB and located in east central Wisconsin in rural Manitowoc County on the western shore of Lake Michigan. Plant property associated with the site boundary comprises approximately 1,260 acres, all of which is owned by NEPB. (PBN 2019a, Section 2.1) Two solar power generation facilities, Point Beach solar (proposed 100 MW) and Two Creeks solar (proposed 150 MW), are also in the process of being developed on NEPB property within and adjacent to the PBN site boundary. (PSC 2018; PSC 2019a).

3.1 Location and Features

PBN is approximately 29 miles southeast of the city of Green Bay, WI (see Table 3.11-1), and about 90 miles north-northeast of Milwaukee. The international boundary between Canada and United States is approximately 200 miles northeast of the site. The plant is located in the northeastern corner of Manitowoc County, WI, in the Two Creeks Township, at longitude 87° 32.5' W and latitude 44° 17.0' N. (PBN 2019a, Sections 2.0, 2.1, and 2.4) Figure 3.1-1 shows the PBN site boundary, facility structures, switchyard, and the EAB. Topographic features adjacent to PBN and within the site boundary are shown in Figure 3.1-2.

3.1.1 Vicinity and Region

The vicinity of PBN is defined as the area within a 6-mile radius of a center point established equidistant between the Unit 1 and Unit 2 containment structures. As seen in Figure 3.1-3, along with Lake Michigan, the vicinity includes portions of Manitowoc and Kewaunee counties. The area within the vicinity is largely rural, characterized by farmland, woods, and small residential communities (NMC 2004a, Section 2.1). In terms of population, Manitowoc County is a medium-sized county located in the Manitowoc, WI, micropolitan area (NACo 2020). As shown in Table 3.11-2, Manitowoc County's 2018 estimated population was 79,074, a decrease from 81,442 in 2010, and 82,887 in 2000 (USCB 2020a). In population, Kewaunee County is a small-sized county in the Green Bay, WI, metropolitan area (NACo 2020). Kewaunee County's estimated population in 2018 was 20,383, a decrease from 20,574 in 2010, but slight increase from 20,187 in 2000 (USCB 2020a).

Table 3.11-1 provides a list of communities located within a 50-mile radius of PBN. The city of Manitowoc is the largest city in Manitowoc County and located approximately 15 miles south-southwest of PBN. The city of Manitowoc had an estimated population of 32,627 in 2018, a decrease from 33,736 in 2010 and 34,053 in 2000. The nearest community to PBN is the town of Two Creeks, WI, approximately 2 miles northwest of the site in Manitowoc County. In 2018, Two Creeks had an estimated population of 436, a slight decrease from 437 in 2010 and 551 in 2000. Also located within the PBN vicinity, approximately 6 miles west-southwest of the plant in Manitowoc County, is the village of Mishicot, WI. In 2018 Mishicot had an estimated population of 1,388, a decrease from 1,442 in 2010 and 1,422 in 2000. No Kewaunee County communities are located within the vicinity of PBN. (USCB 2020b; USCB 2020c)

The region of PBN is defined as the area within a 50-mile radius of the established plant center point. As seen in Figure 3.1-4 and described in Table 3.11-2, all or parts of 12 counties are located within the 50-mile radius of PBN, all within Wisconsin. The highest population by county in the region is Brown County, WI, which increased in size to an estimated 263,378 persons in 2018, an increase from 248,007 in 2010 and 226,778 in 2000. (USCB 2020a) As of 2018 there was one city within the 50-mile region with a population of over 100,000 persons and this was Green Bay, WI (see Table 3.11-1). Along with Green Bay, there are five Wisconsin communities in the region with a population of over 25,000, including the cities of Appleton, De Pere, Manitowoc, Neenah, and Sheboygan. (USCB 2020b) A portion of the state of Michigan is also included within the 50-mile radius; however, this portion is located in Lake Michigan and the U.S. Census Bureau (USCB) does not report any permanent population for this area (see Section 3.11).

As seen in Figure 3.1-3 and Figure 3.1-4, Lake Michigan is the predominant physical feature in the region. Nearby industrial facilities within the 6-mile vicinity include the Point Beach and Two Creeks solar power facilities, described in Section 3.0 and Section 3.1.4, and the Kewaunee Power Station (KPS), located approximately 5 miles north of PBN in Kewaunee County, WI. As discussed further in Section 3.1.4, KPS is a nuclear power plant currently undergoing decommissioning (NRC 2020a).

The Interstate 43 (I-43) transportation corridor runs north and south across Wisconsin, providing access to the cities of Green Bay, Manitowoc, and Sheboygan. PBN staff and plant visitors arrive at the southern entrance of the plant by traveling east on Nuclear Road to Lake Shore Road (Figure 3.1-3). Nuclear Road intersects State Highway (STH) 42 approximately 1 mile west of the plant. The mainly north-south STH 42 connects the communities of Manitowoc, Two Rivers, Two Creeks, and Kewaunee, with County Highway (CTH) V providing access to STH 42 from the town of Mishicot (see Section 3.9.6). While there is rail service in the region, there is no rail system providing service to PBN. (USDOT 2020a).

The closest port to PBN is the Port of Manitowoc. The port handles bulk commodities, newly constructed yachts, and passengers on the Lake Michigan car ferry. The port is also home to a marine contracting firm that services Lake Michigan ports in Wisconsin and Michigan. The car ferry dock located at the port provides seasonal ferry service across Lake Michigan from Manitowoc to Ludington, MI. (Two Creeks 2019; WCPA 2020).

There are two airfields within approximately 10 miles of the plant: Goins Airport (private use) and Woodland Airstrip Ultralight Flightpark (private use). The Manitowoc County Airport, located approximately 13 miles south-southwest of PBN, is the closest public use airport to the plant. The nearest full-service airport to PBN is Green Bay-Austin Straubel International Airport, southwest of Green Bay, WI. (AirNav 2020)

3.1.2 Station Features

Overall terrain at the PBN site is gently rolling to flat with elevations varying from 3 to 58 feet above plant datum. The land surface at PBN slopes gradually toward Lake Michigan from the higher glacial moraine areas west of the site. The major surface drainage features are two small creeks which drain to the north and the south, as shown in Figure 3.1-1 and Figure 3.1-2. (PBN 2019a, Sections 2.0 and 2.2)

The PBN EAB includes the area within the site boundary in which the plant personnel have the authority to determine all activities including exclusion or removal of personnel and property from the area. At PBN, the outer boundary of the EAB is the same as the site boundary. The Manitowoc County Sheriff's Department and Wisconsin State Patrol assists PBN staff in keeping members of the general public from entering the PBN exclusion area. The U.S. Coast Guard has established a permanent security zone where water vessel traffic is restricted in the portion of the navigable waters of Lake Michigan adjacent to PBN Units 1 and 2. (GovInfo 2020) The nearest residence to PBN is located approximately 1.2 miles west from the designated center point described in Section 3.1.

As presented in Figure 3.1-3, there is an active lease between NEPB and solar plant operators for the land area to be utilized within the site boundary (see Section 3.1.4). NEPB also has individual lease agreements for agricultural use within the site boundary.

3.1.3 Federal, Native American, State, and Local Lands

As shown in Figure 3.1-5 and Figure 3.1-6, there are a variety of national, state, and local parks, wildlife management areas, designated state forests, and recreational trail systems located in the PBN 50-mile region. As described in Table 3.1-1, there are 10 public use lands within the 6-mile vicinity of PBN. The closest to PBN is the Two Creeks Park, Two Creeks Town Park, and a segment of the Ice Age National Scenic Trail system. (ArcGIS 2020; GDW 2020; IATA 2020; NPS 2020a; USCB 2020d; USDA 2020a; USL 2020; WDNR 2020a).

The state of Wisconsin has 11 federally recognized American Indian nations and tribal communities. Within the PBN 50-mile region, the Oneida Nation has tribal lands located southwest of the city of Green Bay in Outagamie and Brown counties. (WSTRI 2020) No military installations were identified in the PBN region (USDA 2020a).

3.1.4 Federal and Non-Federal Related Project Activities

Since the initial PBN license renewal was finalized, the plant has undertaken a few minor construction or maintenance activities at the site. These include a 2011 warehouse installation for radwaste storage, a 2012–2013 water treatment installation in an existing warehouse, onsite security hut installations, and installation of a breakwater wall along the Lake Michigan shoreline in 2019.

No major changes to PBN Units 1 and 2 operations, refurbishment, or plans for future expansion of plant infrastructure during the proposed SLR operating term are anticipated. The possible need to expand the size of the ISFSI, and the scope of any such expansion, cannot be determined at this time, as it would depend on the status of the U.S. Department of Energy's (DOE) future performance of its obligation to accept spent nuclear fuel (SNF) or the availability of other interim storage options. Consequently, the possibility of such expansion is currently uncertain. If ISFSI expansion were needed, PBN expects that the expansion would occur generally west of the existing facility within the ISFSI-defined area and would cause no significant environmental impact.

Currently under construction in Manitowoc and Kewaunee counties are the Point Beach and Two Creeks solar power generation facilities (see Figure 3.1-3). While independent power producers, the solar facilities have lease and easement agreements with NEPB and will utilize a portion of the PBN property located within the site boundary for operations. (PSC 2019a; PSC 2018). The Two Creeks solar facility is currently under construction and operation is scheduled to begin December 2020. Construction of the Point Beach solar facility began in the summer of 2020, with operation scheduled to begin in October 2021.

As presented in Section 3.1.1, the KPS is located approximately 5 miles north of PBN (see Figure 3.1-3). This nuclear plant operated from December of 1973 to May 7, 2013, and is currently undergoing post-shutdown decommissioning activities. KPS completed transfer of spent fuel from its spent fuel pool to its ISFSI in June 2017. Major decommissioning and dismantling activities are scheduled to begin in 2069. (NRC 2020a)

An additional federal project has been identified as taking place in the vicinity of PBN. The National Oceanic and Atmospheric Administration (NOAA) Office of National Marine Sanctuaries has proposed designation of the Wisconsin Shipwreck Coast National Marine Sanctuary along Wisconsin's Lake Michigan coast. The proposed sanctuary would be located adjacent to Sheboygan, Manitowoc (bordering PBN), and portions of Ozaukee and Kewaunee counties in the state of Wisconsin. NOAA is currently undertaking the designation process for final approval. (NOAA 2020a)

In Manitowoc County off I-43, the Cherney Maribel Caves County Park is building a pavilion and recreational facilities, with expectations the site will grow as a tourism destination. Regarding local economic conditions, a Meijer Super Center opened in 2020 in the city of Manitowoc, and is expected to create 300 positions. (HTR 2020)

Table 3.1-1 Federal, State, and Local[(a)] Lands Totally or Partially within a 6-Mile Radius of PBN

Name	Management	Distance[(b)]	Direction	Nearest Place	County
Two Creeks Town Park	Local	2	NNW	Two Creeks	Manitowoc
Two Creeks Park	State	2	NNW	Two Creeks	Manitowoc
Ice Age National Scenic Trail[(c)]	Federal	2	SSE	Mishicot	Manitowoc/Kewaunee
Pietroske Waterfowl Production Area[(d)]	Federal	3	South	Mishicot	Manitowoc
Two Creeks Waterfowl Production Area	Federal	3	West	Two Creeks	Manitowoc
Two Creeks Buried Forest State Natural Area	State	3	North	Two Creeks	Manitowoc
Point Beach State Forest[(e)]	State	4	South	Mishicot	Manitowoc
Randolph Street Mini Park	Local	5	WSW	Mishicot	Manitowoc
Rawley Point Lighthouse	Federal	5	SSE	Mishicot	Manitowoc
Mishicot Village Park	Local	6	WSW	Mishicot	Manitowoc

(ArcGIS 2020; GDW 2020; IATA 2020; NPS 2020a; USCB 2020d; USDA 2020a; USL 2020; WDNR 2020a)

a. List is based on best available public information and includes lands that are totally or partially located within a 6-mile radius of PBN.

b. Distances are approximate miles (rounded to the nearest mile and calculated based on the PBN center point and land centroid data).

c. The distance reported for this portion of the Ice Age Trail is based on the closest point to the PBN center point.

d. The distance reported for the Pietroske Waterfowl Production Area is based on the closest point of the northern parcel boundary to the PBN center point.

e. The distance reported for Point Beach State Forest is based on the closest point of the property boundary to the PBN center point.

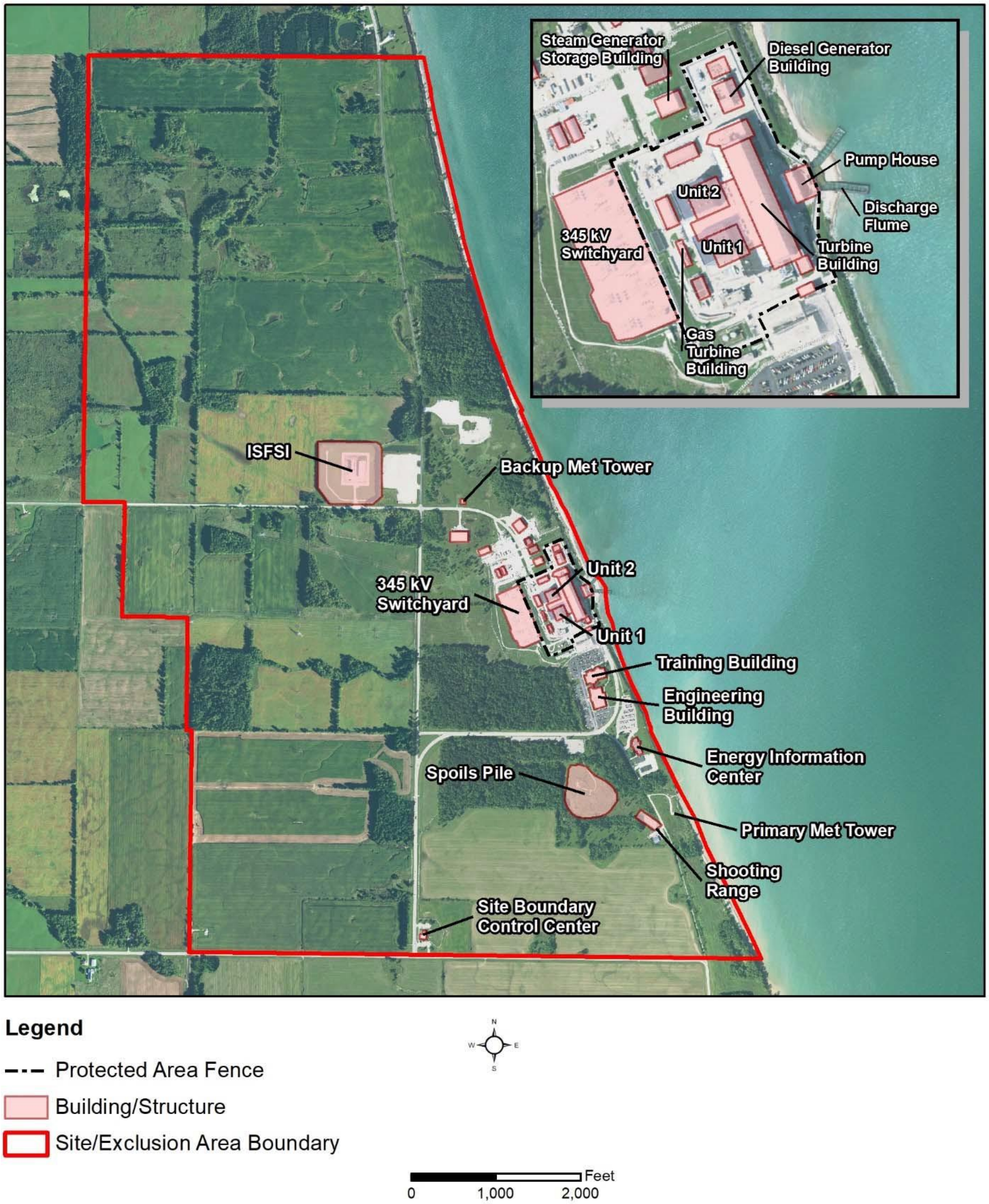


Figure 3.1-1 PBN Plant Layout

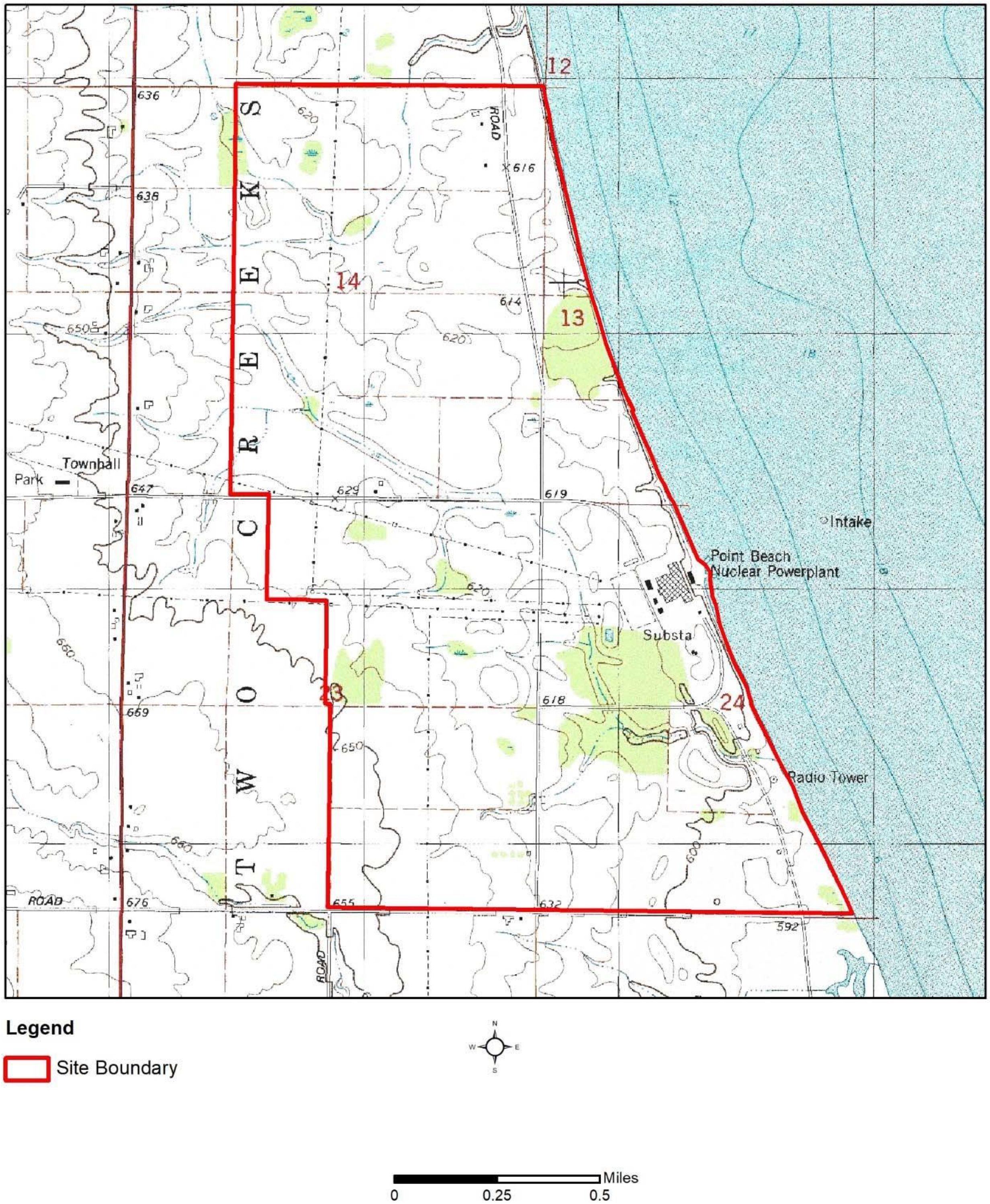


Figure 3.1-2 PBN Area Topography

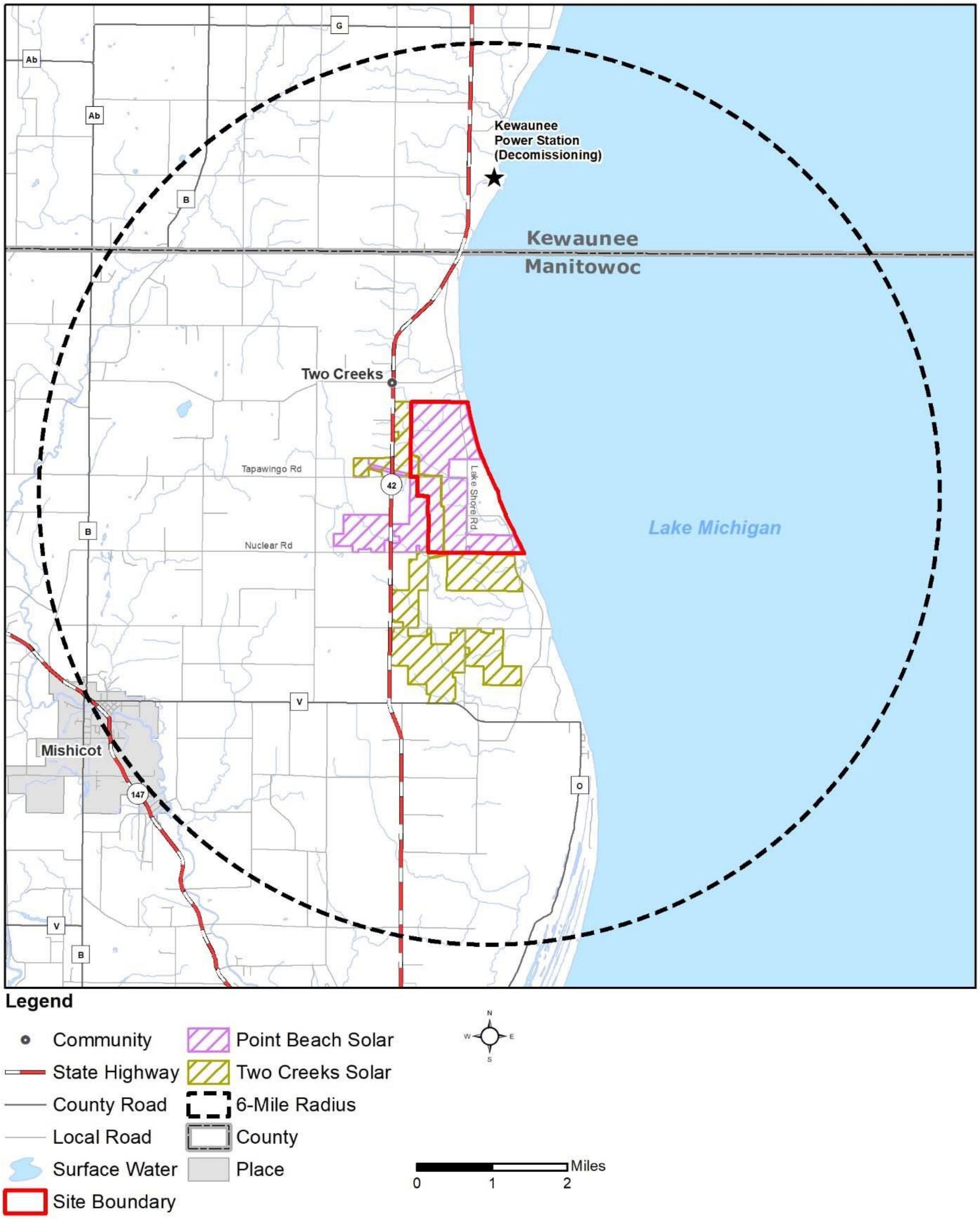


Figure 3.1-3 PBN Site and 6-Mile Radius

Figure 3.1-4 PBN Site and 50-Mile Radius

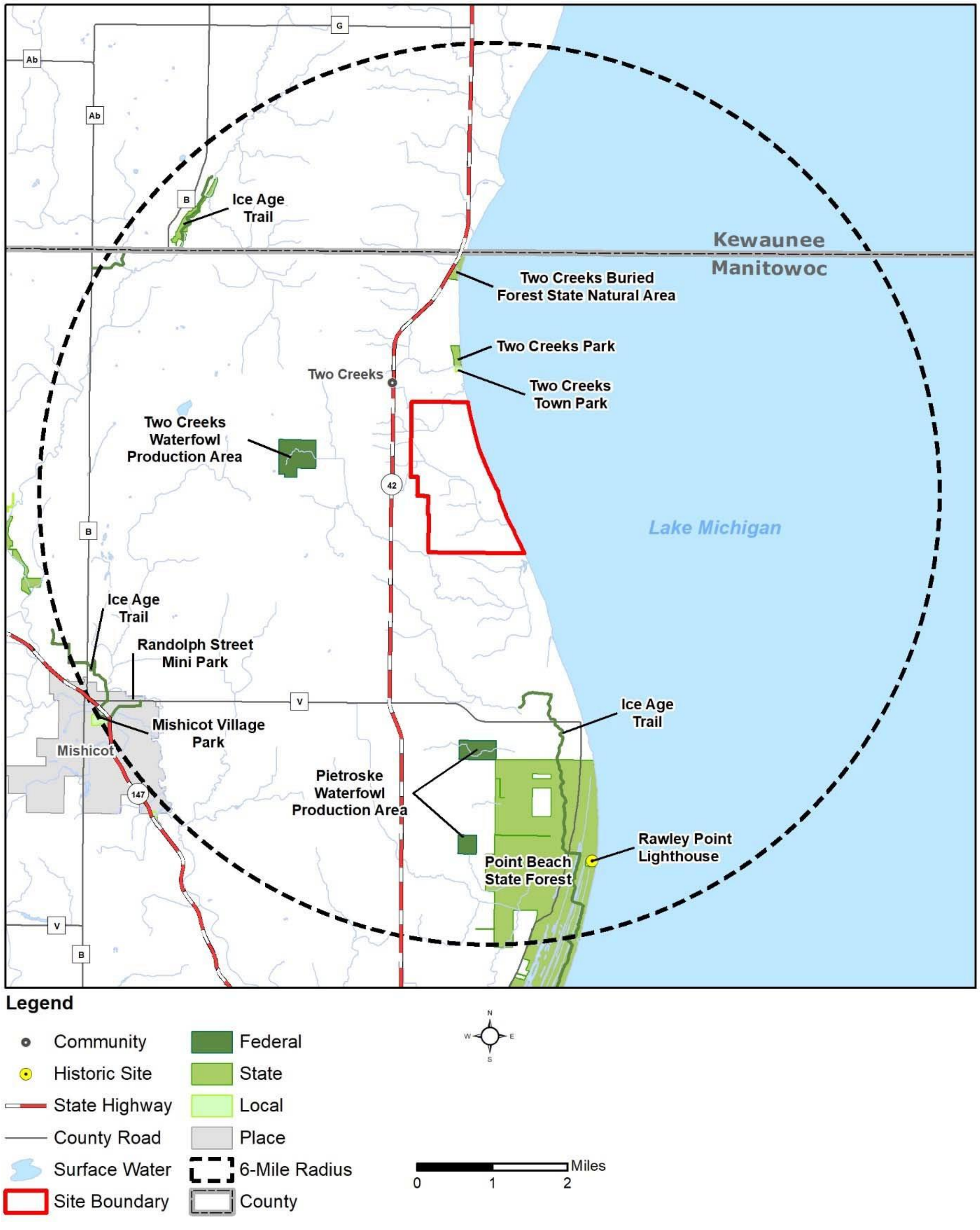


Figure 3.1-5 Federal, State, and Local Lands within a 6-Mile Radius of PBN

Figure 3.1-6 Federal, State, and Local Lands within a 50-Mile Radius of PBN

3.2 Land Use and Visual Resources

Land use descriptions focus on Manitowoc and Brown counties, WI, because as described in Section 2.5, approximately 81 percent of the permanent PBN workforce resides in these two counties.

3.2.1 Onsite Land Use

PBN is located on the western shores of Lake Michigan in Manitowoc County, WI. The site encompasses approximately 1,260 acres of shoreline in the northeastern corner of the county. The local terrain is gently rolling to flat, with elevations varying from 3 to 58 feet above plant datum. (PBN 2019a, Sections 2.1 and 2.2) The nearest communities to PBN are Two Creeks, WI, approximately 2 miles to the northwest and Mishicot, WI, approximately 6 miles west-southwest of the site (Figure 3.1-3). As described in Table 3.11-1, the city of Green Bay, WI, is the largest population center in the region and is approximately 29 miles northwest of PBN.

As shown in Table 3.2-1 and illustrated in Figure 3.2-1, the largest land use/land cover category within the PBN site boundary is cultivated crops, which cover approximately 60 percent of the site. Pasture/hay and developed areas (including areas developed for plant operation and roads) are the next largest land use/land cover categories, with approximately 16.2 percent and 10.7 percent, respectively. The remaining land use/land cover categories found onsite comprise approximately 13.5 percent. (MRLC 2020)

PBN and adjacent areas are zoned as an exclusive agriculture district according to the Town of Two Creeks Comprehensive Plan (Two Creeks 2019). The principal uses of the exclusive agriculture district include agriculture and essential services. PBN was granted a variance and has zoning approval and a permit through Manitowoc County, which is responsible for regulating land uses and zoning. The existing land use type for PBN is reported as industrial. (Manitowoc County 2020a; Two Creeks 2019)

NEPB owns all land within the site boundary and has a lease and easement agreement with the onsite solar power generation facility. NEPB also has individual lease agreements for agricultural use within the site boundary. No activities unrelated to the PBN operations are permitted within the site boundary without NEPB approval. Neither are there any anticipated plans to explore for subsurface minerals within the site during the proposed SLR operating term. Certain activities related to the solar facilities have been approved, but NEPB maintains legal authority to determine all activities on the property.

As noted in Section 3.1.4, the Point Beach and Two Creeks solar power generation facilities are currently under construction and will utilize a portion of the PBN property within the site boundary for operations. Land within the solar array fence line will be considered impacted; however, it is expected that revegetation, with the exception of facility access roads, will occur. (PSC 2019a)

3.2.2 Offsite Land Use

As seen in Tables 3.11-2 and 3.11-3, while Manitowoc County's population decreased between 2010 and 2018, total county population is projected to increase through 2053. Brown County has seen an increase in total population since 2010, and this trend is expected to continue through 2053.

As described in Section 3.1, the vicinity (6-mile radius) surrounding PBN includes portions of Manitowoc and Kewaunee counties, WI. The land use/land cover categories within the vicinity of PBN are illustrated in Figure 3.2-2. Lake Michigan is the predominate natural feature in the vicinity, and as noted in Table 3.2-2, open water is the largest land use/land cover category at approximately 45 percent. The next largest land use/land cover categories in the vicinity are cultivated crops (33 percent); woody wetlands (8.8 percent); and pasture/hay (7.5 percent). Developed lands are the fifth largest land use/land cover category identified within the vicinity, at approximately 3 percent. The remaining nine land use/land cover categories found within the vicinity comprise approximately 3 percent. (MRLC 2020)

Manitowoc County occupies approximately 377,149 acres of land, of which 231,609 acres (61.4 percent) are proportioned to farmland. The 2017 census of agriculture reports that the county had a total of 1,171 farms, with an average farm size of 198 acres. Approximately 1,051 farms produce crops, with primary crops reported as forage (56,096 acres), soybeans (32,370 acres), corn for grain (27,236 acres), wheat (12,633 acres), oats (2,365 acres), and barley (414 acres). Livestock is also an important product in the county, with livestock commodities such as cattle and calves (462 farms), layers (102 farms), sheep and lambs (54 farms), hogs and pigs (39 farms), and broilers and other meat-type chickens (28 farms) reported. Other agricultural uses of farmland within the county included woodlands (20,617 acres; 595 farms), pasturelands (12,547 acres; 474 farms), and permanent pasture and rangeland (7,079 acres; 379 farms). (USDA 2020b)

Brown County occupies approximately 339,258 acres of land, of which 192,007 acres (56.6 percent) are proportioned to farmland. In 2017 it was reported that the county had a total of 975 farms, with an average farm size of 197 acres. Approximately 855 farms produce crops, with primary crops reported as forage (52,903 acres), soybeans (29,479 acres), corn for grain (25,663 acres), wheat (7,632 acres), oats (1,562 acres), and barley (85 acres). Livestock is also an important product in the county, with livestock commodities such as cattle and calves (424 farms), layers (87 farms), sheep and lambs (47 farms), hogs and pigs (44 farms), and broilers and other meat-type chickens (11 farms). Other agricultural uses of farmland within the county included pasturelands (11,388 acres; 447 farms), woodlands (9,240 acres; 352 farms), and permanent pasture and rangeland (8,107 acres; 377 farms). (USDA 2020b)

The State of Wisconsin's Department of Administration allows for cities, counties, and local governments to prepare comprehensive land use plans. These plans serve as a guide to a community's physical, social, and economic development, and are intended to "provide a rational basis for local land use decisions with a twenty-year vision for future planning and community decisions". Comprehensive planning legislation 66.1001 requires comprehensive plans to address the following nine elements:

- Issues and opportunities
- Intergovernmental cooperation
- Implementation
- Agriculture, natural, and cultural resources
- Housing
- Economic development
- Transportation
- Utilities and community facilities
- Land use

As of January 1, 2010, state statute 66.1001 also requires the enactment or amendment of a local government's official mapping, subdivisions, or zoning ordinance be consistent with that community's comprehensive plan. Comprehensive plans must be updated no less than once every 10 years, according to state statute 66.1001(2)(i). (WDOA 2020) Twenty-year comprehensive plans are in place for the town of Two Creeks, Manitowoc County, and Brown County, and reflect the planning efforts of local and county governments, as well as public involvement in the planning process. (Brown County 2020a; Manitowoc County 2020b; Two Creeks 2019)

The town of Two Creeks, in the township where PBN is located, has developed a 20-year comprehensive land use plan with the overall goal of protecting physical elements of the landscape that define the rural environment and characteristics of the town. The plan addresses existing and future agriculture, housing, transportation, utilities, and economic development. Two Creeks relies on Manitowoc County to regulate land uses through zoning and works with the county to update and amend zoning classifications and districts. (Two Creeks 2019)

Manitowoc County's comprehensive plan addresses future development and preservation concerns that may have impacts on the county. The plan is used in conjunction with adopted community comprehensive plans, county and local zoning and land use ordinances, and other supporting planning materials and implementation tools as part of a framework that guides future housing, public services, transportation, and economic development while preserving the county's vast agricultural land, natural features and resources, and rural character. (Manitowoc County 2020b)

Manitowoc county is primarily rural and agricultural. Over 85 percent of the county is classified as undeveloped according to a land inventory survey conducted in 2008, and is comprised of farmland, woodlands, water features, and natural areas. However, with the county's proximity to larger metro areas like Green Bay and Fox River Valley and favorable living conditions, the county anticipates that residential, commercial, and industrial use will continue to grow throughout the 20-year planning period. According to land use projections, 7,779 acres of land will be needed to account for this new development, and a percentage of that acreage will be taken out of current agriculture production and existing open space and woodlands (Manitowoc County 2020b).

Brown County developed a comprehensive plan to manage future growth in the county by promoting and encouraging development that is orderly, compact, and efficient, and which maintains a balance between the preservation of environmentally sensitive areas and agricultural lands with continued residential, commercial, and industrial development. (Brown County 2020a) Brown County has experienced growth in both commercialization and industrialization, but has traditionally relied on agriculture, the dominant land use in terms of amount and percentage since the late 1800s. According to the 2001 Brown County land use inventory, 51.5 percent of the county was categorized as agricultural in 2000. However, there has been a slow but steady decrease in agriculture as the county has become more urbanized. From 1980 to 2000, Brown County's agricultural land use decreased by approximately 25 percent. Growth in the population of the Green Bay metropolitan area, as well as many of the smaller towns and villages, has directly contributed to the increased conversion of agricultural land to developed land use. According to the land use inventory, residential was the largest developed land use at 13 percent, followed by transportation (7.4 percent), industrial (1.9 percent), and commercial (1.5 percent). (Brown County 2020a) Brown County anticipates these land uses will continue to grow throughout the 20-year planning period and beyond in response to population increases.

3.2.3 Visual Resources

As presented in Section 3.1, PBN is located on the western shore of Lake Michigan in rural Manitowoc County, WI. Figure 3.1-1 shows the building site layout and boundary in association with Lake Michigan. The surrounding area is rural residential intermixed with woodlands, wetlands, and open spaces. The nearest resident to PBN is located approximately 1.2 miles west from the site center point.

The tallest structures onsite are the reactor containment buildings, which are approximately 63 feet in height (NRC 2005). Predominant visual features at PBN are the reactor containment buildings, the associated auxiliary, service and turbine buildings, and transmission lines. Site structures located within the EAB of the plant are set back from the shoreline of Lake Michigan, with the exteriors of the containment buildings colored green and brown to blend with the surrounding environment. Though the plant and its associated lighting is visible from Lake Michigan and portions of STH 42, there are no plans for refurbishment that would create new visual impacts during the proposed SLR operating term. (NRC 2005) Therefore, PBN would continue to have minimal visual impact on the neighboring properties and from the viewpoint from Lake Michigan.

Table 3.2-1 Land Use/Land Cover, PBN Site

Category	Acres	Percent
Open Water	0.67	0.1
Developed, Open Space	18.46	1.5
Developed, Low Intensity	44.03	3.5
Developed, Medium Intensity	37.58	3.0
Developed, High Intensity	35.14	2.8
Barren Land (Rock/Sand/Clay)	26.46	2.1
Deciduous Forest	20.24	1.6
Mixed Forest	33.14	2.6
Pasture/Hay	204.83	16.2
Cultivated Crops	753.92	59.6
Woody Wetlands	88.96	7.0
Emergent Herbaceous Wetlands	1.33	0.1
Total	**1,264.76**[a]	**100.0**

a. The acreages presented in this table are based on the Multi-Resolution Land Characteristics Consortium (MRLC) land use/land cover data. These data are presented in a raster (pixel-based) format and because of their square geography, they do not exactly match the PBN site boundary. This geographic variation creates a small difference between total acreage reported in Table 3.2-1 compared to the PBN site acreage stated throughout the ER. (MRLC 2020)

Table 3.2-2 Land Use/Land Cover, 6-Mile Radius of PBN

Category	Acres	Percent
Open Water	32,659.10	44.8
Developed, Open Space	977.20	1.3
Developed, Low Intensity	1025.02	1.4
Developed, Medium Intensity	177.47	0.2
Developed, High Intensity	73.39	0.1
Barren Land (Rock/Sand/Clay)	364.50	0.5
Deciduous Forest	473.26	0.6
Evergreen Forest	91.85	0.1
Mixed Forest	478.59	0.7
Shrub/Scrub	87.40	0.1
Grassland/Herbaceous	46.93	0.1
Pasture/Hay	5,480.69	7.5
Cultivated Crops	24,191.20	33.2
Woody Wetlands	6,378.28	8.8
Emergent Herbaceous Wetlands	357.61	0.5
Total	**72,862.49**	**100.0**

(MRLC 2020)

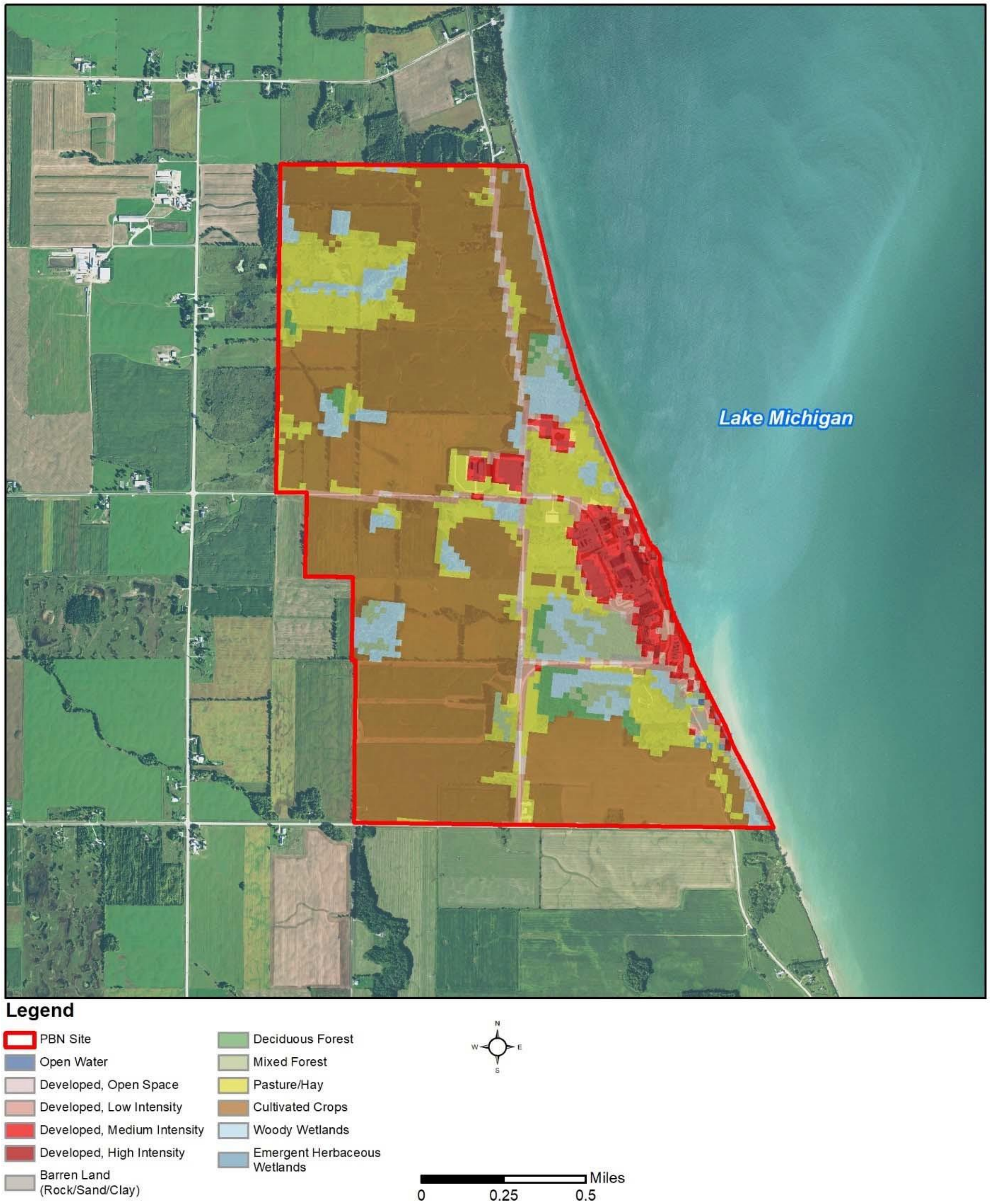


Figure 3.2-1 Land Use/Land Cover, PBN Site

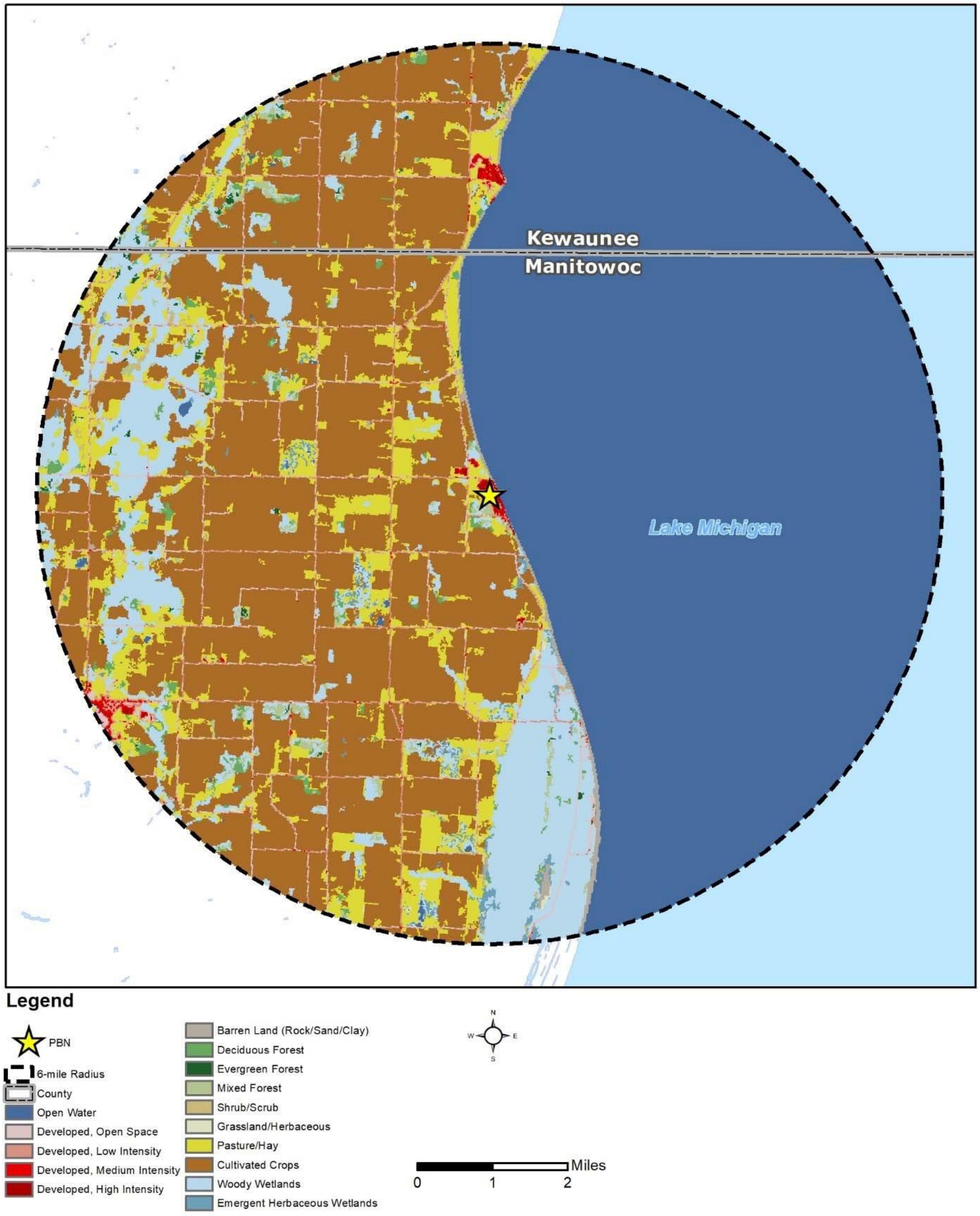


Figure 3.2-2 Land Use/Land Cover, 6-Mile Radius of PBN

3.3 Meteorology and Air Quality

The meteorology, climate, and air quality of PBN were previously evaluated during the PBN Units 1 and 2 initial license renewal approval processes (NRC 2005, Section 2.2.4). PBN is located on the western shore of Lake Michigan near Manitowoc, WI. The climate of the region is influenced by the west-to-east flow of storms along the northern portion of the United States and from the southwest to the Great Lakes. Lake Michigan influences the wind and temperature regimes in the vicinity of PBN (NRC 2005, Section 2.2.4). A high-level overview of the plant layout is provided in Figure 3.1-1.

Climatological data presented below have been provided to represent a range of meteorological conditions considered typical for the PBN site region. The Green Bay (KGRB) weather station is the closest first-order National Weather Service (NWS) data collection station to PBN with a significant period of meteorological data, and thus has been used to describe the representative climatic conditions. Green Bay (KGRB) climatological information has been used in previous PBN licensing environmental reviews, thus making its continued use appropriate for comparison. (NRC 2005, Section 2.2.4)

3.3.1 General Climate

The Green Bay (KGRB) station is located at the Green Bay (KGRB) Austin Straubel International Airport. The station is situated in eastern Wisconsin near the western shore of Lake Michigan and the city of Green Bay (KGRB). The climate is modified by surrounding topography, which primarily includes Green Bay (KGRB), Lake Michigan, and Lake Superior. To a lesser extent, the slightly higher surrounding terrain terminating in the Fox River Valley modifies the area climate as well. This results in a narrow temperature range associated with lake effects and cloudiness. (NCDC 2020a)

Most of the precipitation occurs from May through September and usually occurs during thunderstorms. Weather-related impacts associated with these storms can include high winds, excessive precipitation, and lightning. The mild temperatures, with the majority of precipitation occurring during growing season, is beneficial to the dairy and agricultural industries. Typically, the winters are long in Green Bay (KGRB); however, the extremes are never as severe as the northern location would indicate. Snowstorms are the primary winter weather-related hazard. (NCDC 2020a) The coldest weather in Green Bay (KGRB) normally occurs in January, when low temperatures (°F) usually average 8.0°F, and high temperatures average 24.2°F. Freezing temperatures, less than 32°F, occur 157 days on average, but seldom lower than 0°F. On average, there are only 19 days a year that reach 0°F. Summertime high temperatures above 90°F are uncommon, and only occur about three times a year. Precipitation averages about 30 inches per year and snowfall averages about 51 inches per year (NCDC 2020a).

The PBN site is located on the western shore of lake Michigan near Manitowoc, WI. The terrain is generally flat with rolling hills. For detailed meteorological information about PBN, please see Section 3.3.2. The climate of the site is influenced by the west to east flow of storms along the northern portion of the United States and from the southwest to the Great Lakes. Lake Michigan influences both the wind and temperature. The site is well-ventilated with infrequent calms. Prevailing winds during spring and summer are onshore lake breezes. Beginning in the summer, wind flows from the south-southwest and appears to be reinforced by offshore flows from the west-southwest and west-northwest in the fall. During the winter, wind flows from the northwest through south-southwest. (NRC 2005)

3.3.2 Meteorology

As discussed in Section 3.3, the climatological conditions for the PBN region and site have been evaluated during the PBN LRA and by the NRC. For the proposed SLR of PBN, NEPB completed a review of the most recent meteorological information available from public sources and from PBN monitoring to confirm the conclusions of those previous reviews remain valid. Due to historical technical data system limitations, hourly meteorological data for PBN prior to November 27, 2001, are not available. A summary of NEPB's evaluation is provided below.

3.3.2.1 Wind Direction and Speed

In the spring, the prevailing wind at the PBN site is from the north-northeast and south and the south-southwest during the summer season. The predominant wind direction during the fall is south and south-southwest, and from the west during the winter season. The average wind speed for the past 5 years is 8.8 miles per hour (mph) which compares well with the 35-year average of 8.8 mph at Green Bay (KGRB). (NCDC 2020a)

For Green Bay (KGRB), the 42-year period of record data shows the annual prevailing wind direction (i.e., the direction from which the wind blows most often) is from 280 degrees (i.e., from the west). Monthly prevailing winds are from the west and southwest during the winter. During the spring, the wind direction is from the northeast. In the summer and fall, the mean prevailing wind is from the southwest. As listed in Table 3.3-1, the mean wind speed over the past 35-year period of record was 8.8 mph. A maximum 3-second wind speed of 66 mph was recorded in June 2007. (NCDC 2020a)

Mean monthly wind speeds at the PBN site are provided in Table 3.3-2, based on an 18-year record (November 2001–January 2020) of measurements from the onsite meteorological monitoring system, lower level (32.8 feet above ground level). The average wind speed on an annual basis was 9.3 mph, indicating the site wind speeds are slightly higher than Green Bay (KGRB). The onsite monitoring data indicate the wind at PBN is from the south-southwest for a significant period of time (especially during June through November), and from the north-northeast (April and May). Seasonal wind rose diagrams for the period 2014–2018 are provided in Figures 3.3-1, 3.3-2, 3.3-3, 3.3-4, and 3.3-5.

3.3.2.2 Temperature

Representative regional temperature averages and extremes are available from the Green Bay (KGRB) monitoring station. The local climate data summary for the Green Bay (KGRB) area indicates that the mean daily maximum temperature is highest during July (81.0°F) and decreases to the seasonal low in January (24.2°F). The Green Bay (KGRB) area experiences normal temperatures above 90°F approximately 3.1 days per year in June, July, and August. The highest temperature of record (103°F) occurred in July 1995. The mean daily minimum temperature is above 50°F in June, July, and August, and is at its lowest in January, when the mean daily minimum decreases to 8.0°F. Record low temperatures below 0°F have been recorded in January, February, March, November, and December, with below freezing temperatures normally occurring approximately 156.8 days per year in every month except June, July, and August. The lowest temperature of record by the Green Bay (KGRB) station is -31°F, occurring in January 1951. (NCDC 2020a) Monthly and annual daily mean temperature data and temperature extremes for the Green Bay (KGRB) area are summarized in Table 3.3-3.

Average daily temperatures in the area of PBN are 21.2°F in January and 67.7°F in July, with annual extremes of approximately -21.6°F low and 95.3°F high. Monthly and annual daily mean temperature data and temperature extremes for the PBN area are summarized in Table 3.3-4. The 5-year average for PBN (44.4°F) was about the same as the normal temperatures for Green Bay (KGRB) (44.5°F) and the 2001–2020 PBN site (44.7°F) temperatures. While not specified in the LRA ER, the average temperature for 2004 (44.3°F) is consistent with the 5-year and 20-year average temperature values (NCDC 2020a).

3.3.2.3 Precipitation

The precipitation records of normal rainfall totals for the Green Bay (KGRB) area indicate that precipitation of 0.01 inches or more occurs on average for 123 days per year, with 8.4 or more days per month receiving at least some precipitation. The annual average precipitation at the Green Bay (KGRB) station is 29.52 inches per year. Precipitation recorded at the station is cyclic, with the lowest amount occurring during the winter then peaking in June with average monthly precipitation amounts with a mean of approximately 3 to 4 inches falling from May through September. The highest seasonal precipitation occurs during the summer (approximately 36.4 percent falling June, July, and August), which also coincides with record events where more than 4.9 inches have occurred in a 24-hour period. As shown by the extreme values in Table 3.3-5, there is considerable variability in total monthly amounts from year to year. While the summer months may experience significant rainfall events, those months can also be very dry. The maximum 24-hour precipitation total recorded at Green Bay (KGRB), 4.9 inches, occurred in June 1990. Green Bay (KGRB) received a record minimum monthly rainfall total (0.04 inches) in February 1969. (NCDC 2020a)

Because onsite rainfall measurement is not required by regulation, precipitation is not recorded at the PBN site. However, Manitowoc, WI, located approximately 15 miles south-southwest of PBN, has a weather station with a robust precipitation dataset. The over 80 years of station data (1932–2015) indicates that the average monthly precipitation is highest in June (3.56 inches) and is lowest in February (1.29 inches) (Table 3.3-6). The Manitowoc data also indicate that while significant rainfall may occur during June through September, rainfall amounts during these months can vary significantly from year to year. Based on data collected over the 30-year period, the Manitowoc station receives approximately 0.3 inches of precipitation per year less than the Green Bay (KGRB) station. (NCDC 2020b)

Table 3.3-6 indicates that the precipitation at Manitowoc station has a similar pattern as the Green Bay (KGRB) station—i.e., cyclic, with a peak in June and the lowest amount occurring during the winter. The average monthly precipitation amounts range from 1.39 inches in February to 3.56 inches in June (NCDC 2020b).

3.3.2.4 Snow and Glaze

In the Green Bay (KGRB) area, temperatures go below freezing 156.8 days per year. Green Bay (KGRB) receives on average approximately 51.4 inches of snow per year. Ice storms are infrequent in this region of Wisconsin (NRC 2005). Since 1990, annual snowfall has ranged from as little as 31.2 inches to 92.6 inches (2010–2011). (NCDC 2020a) Snowfall at the site is not recorded by PBN. Between 2011 and 2015, based on the Manitowoc station records, temperatures went below freezing (32°F) 128 days per year average. For the same time period, Manitowoc received on average approximately 27.1 inches of snow per year (NCDC 2020b).

3.3.2.5 Relative Humidity and Fog

The closest available fog data for the PBN region are from the NWS observation station at the Green Bay (KGRB) Austin Straubel International Airport. The local climatological data for Green Bay (KGRB) indicate an average of 20.2 days per year of heavy fog. Heavy fog is defined by the NWS as fog which reduces visibility to 0.25 mile or less. (NCDC 2020a) Fog at the PBN site is not recorded by PBN.

3.3.2.6 Severe Weather

3.3.2.6.1 Thunderstorms

Climatological records show that the area is subject to occasional storms, including destructive winds. (NRC 1999, Section 2.2.4) Thunderstorms are frequent during the late spring, summer, and early fall months, with the greatest occurrence during the months of June and July. The mean number of days with thunderstorms in each month for Green Bay (KGRB) is provided in Table 3.3-7. Based on National Centers for Environmental Information (NCEI) records, Manitowoc County, WI, has recorded 75 significant thunderstorm events since 1960, with most of the thunderstorms occurring in June, July, August, and September. (NCEI 2020)

3.3.2.6.2 Tornadoes

Tornadoes are infrequent in the PBN region; the probability of one striking the site is about 4.0 x 10^{-4} per year (NRC 2005, 1437, Section 2.2.4). Based on NCEI records, a total of 21 tornadoes have been recorded in Manitowoc County, WI since 1957. The records show that the intensity of the storms was limited to F0, EF1, F1, and F2, with one exception. A tornado of F4 magnitude was recorded on July 5, 1994. (NCEI 2020) Storm intensity values are defined using the Fujita scale, which was revised in 2007. The intensity values for all storms occurring after the revision use the enhanced Fujita scale (NOAA 2020b).

3.3.2.6.3 Hurricanes

The NCEI does not have any record of a hurricane in Manitowoc County, WI, since 1950. (NCEI 2020)

3.3.2.7 Atmospheric Stability

Atmospheric stability is a meteorological parameter that describes the dispersion characteristics of the atmosphere. It can be determined by the difference in temperature between two heights. A seven-category atmospheric stability classification scheme (ranging from A for extremely unstable to G for extremely stable) based on temperature differences is set forth in the NRC's Regulatory Guide 1.23, Revision 1 (NRC 2007b). When the temperature decreases rapidly with height (typically during the day when the sun is heating the ground), the atmosphere is unstable and atmospheric dispersion is greater. Conversely, when temperature increases with height (typically during the night as a result of the radiative cooling of the ground), the atmosphere is stable, and dispersion is more limited. The stability category between unstable and stable conditions is D (neutral), which would occur typically with higher wind speeds and/or higher cloud cover, irrespective of day or night. (NRC 2013c, Section 2.9.1.4).

Based on a 5-year average (2014–2018), onsite temperature difference data recorded at PBN indicate that stable atmospheric conditions (E to G) occurred about 46.9 percent of the time and unstable conditions (A to C) occurred about 20.7 percent of the time. The remaining observations (about 32.4 percent) fell into the neutral (D) category. Stability class distributions at PBN covering the period 2014–2018 are presented in Table 3.3-8 (NCDC 2020a).

3.3.3 Air Quality

3.3.3.1 Clean Air Act Nonattainment Maintenance Areas

The Clean Air Act (CAA) was established in 1970 [42 U.S. Code (USC) § 7401 et seq.] to reduce air pollution nationwide. The EPA has developed primary and secondary national ambient air quality standards (NAAQS) under the provisions of the CAA. The EPA classifies air quality within an air quality control region (AQCR) according to whether the region meets or exceeds federal primary and secondary NAAQS. An AQCR or a portion of an AQCR may be classified as being in attainment or non-attainment, or it may be unclassified for each of the six criteria pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), particulate matter ($PM_{2.5}$, fine particulates; and PM_{10}, coarse particulates), ozone, and sulfur dioxide (SO_2).

Emissions from nonradiological air pollution sources, including the criteria pollutants, are controlled through compliance with federal, state, and local regulations. Non-attainment areas are any areas that do not meet the air quality standard defined by federal, state, and local agencies. Attainment areas are areas that meet the air quality standard or cannot be classified (depending on the pollutant and other factors). A maintenance area is an area that formerly exceeded the attainment criteria values but currently does not exceed the attainment criteria values. (EPA 2020a)

There are no Class I federal areas in which visibility is an important value, as designated in 40 CFR, Part 81, Subpart D, within 100 miles of PBN. (NRC 2005, Section 2.2.4)

The PBN region falls within one intrastate AQCR. This AQCR is the Lake Michigan intrastate AQCR (Wisconsin) (40 CFR 81.67) and consists of 17 counties (Brown, Calumet, Door, Fond du Lac, Green Lake, Kewaunee, Manitowoc, Marinette, Marquette, Menominee, Oconto, Outagamie, Shawano, Sheboygan, Waupaca, Waushara, and Winnebago). As of July 15, 2019, the shoreline of Manitowoc, northern Milwaukee, Ozaukee, and Sheboygan counties was designated as an 8-hour ozone (2015) non-attainment area. The areas are classified as marginal. Inland Sheboygan County was designated as 8-hour ozone (2008) non-attainment area effective on July 15, 2019 (84 FR 33699), and classified as "moderate" (77 FR 30088). All other counties within 50 miles of PBN are in attainment. Non-attainment areas are illustrated in Figure 3.3-6.

3.3.3.2 Air Emissions

The WDNR issues air pollution control operation permits for air emissions as required by Chapter NR 407, Wisconsin Administrative Code and Title V of the federal CAA. PBN holds a conditional operating permit to operate a stationary oil-fired turbine, two stack boilers, and nine diesel generators in accordance with the provisions of Air Pollution Control Operation Permit No. 436034500-P32. (WDNR 2018a) Because PBN utilizes a once-through cooling system for condenser cooling purposes, there are no cooling towers or associated particulate emissions. (NRC 2005, Section 2.0)

The permitted emission sources at PBN are regulated by the applicable regulations cited in the permit. In addition, the emissions reports submitted to the WDNR each year contain tabular summary information related to each permitted emissions unit, and criteria pollutants and applicable hazardous air pollutants are summed and reported for each station in the annual update and emission statement submitted to the WDNR. Annual emissions for the 5 years from 2014–2018 are listed in Table 3.3-9.

As discussed in Chapter 9, there has been one notice of violation or non-compliance associated with PBN air emissions from 2014–2019. The non-compliance issue was closed by WDNR on November 30, 2018. For additional details, see Section 9.5.2.1.

As stated in Section 2.3, no SLR-related refurbishment or other SLR-related construction activities have been identified. In addition, NEPB's review did not identify any future upgrade or replacement activities necessary for plant operations (e.g., diesel generators, diesel pumps) that would affect PBN's current air emissions program. Therefore, no increase or decrease of air emissions is expected over the proposed SLR operating term.

Studies have shown that the amount of ozone generated by even the largest industry transmission lines in operation (765 kV) would be insignificant (NRC 2013c, Section 4.3.1.1). As discussed in Section 2.2.5, the in-scope transmission lines at PBN are 19-kV and 345-kV.

Therefore, the amount of ozone generated from in-scope transmission lines at PBN is anticipated to be minimal.

3.3.4 Greenhouse Gas Emissions and Climate Change

No PBN data exist for mobile emission sources such as visitors and delivery vehicles. Therefore, NEPB calculated greenhouse gas (GHG) emissions on those direct (stationary and portable combustion sources in Table 3.3-11 as reported in PBN’s annual updates and air emissions statements) and indirect (workforce commuting) plant activities where information was readily available. GHG emissions generated at PBN are presented in Table 3.3-10. As discussed in Section 9.5.2.3, PBN maintains a program to manage stationary refrigeration appliances at the plant to recycle, recapture, and reduce emissions of ozone-depleting substances, including perfluorocarbons, and is in compliance with Section 608 of the CAA. Because the amounts are not expected to contribute to the values in the table, NEPB did not include potential emissions as the result of leakage, servicing, repair, and disposal of refrigerant equipment in the values listed in Table 3.3-11.

Table 3.3-1 Regional Wind Conditions, Green Bay (KGRB), WI

Measurement	Period of Record (years)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Mean speed (mph)	35	9.6	9.5	9.7	10.4	9.2	8.0	7.1	6.6	7.5	8.8	9.4	9.2	8.8
Prevailing direction (degrees from)	42	280	220	50	50	50	220	220	220	220	220	220	280	280
Max 3-second speed (mph)	22	49	52	57	54	55	66	64	62	55	53	59	54	66
Max speed year of occurrence	—	2013	2011	2017	1997	2017	2007	2017	2015	2011	2014	1998	2015	June 2007

(NCDC 2020a)

Table 3.3-2 PBN Wind Conditions, 2001–2020

Measurement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Mean speed (mph)	10.8	10.4	12.5	11.0	9.6	7.5	6.7	6.5	7.1	8.9	10.0	10.8	9.3
Prevailing direction (degrees from)	270	230	190	20	20	200	200	200	200	200	200	260	20

Table 3.3-3 Regional Temperatures, Green Bay (KGRB), WI

Measurement	Period of Record (years)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Mean daily maximum (°F)	69	24.2	28.1	38.8	53.9	67	76.3	81	78.7	70.5	58.3	42.7	29.3	54.1
Highest daily maximum (°F)	69	53	65	82	89	97	98	103	99	95	88	74	64	103
Year of occurrence	—	2002	2017	2012	1980	2018	1988	1995	1988	1955	1963	2008	2001	July 1995
Mean daily minimum (°F)	69	8.0	11.0	21.8	33.9	44.4	54.1	58.8	56.9	48.6	38.5	27.1	14.6	34.8
Lowest daily minimum (°F)	69	-31	-28	-29	7	21	32	40	38	24	15	-9	-27	-31
Year of occurrence	—	1951	1996	1962	1954	1966	1958	1965	1967	1949	1966	1976	1983	January 1951

(NCDC 2020a)

Table 3.3-4 PBN Site Temperatures, 2001–2020

Measurement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Monthly average (°F)[a]	21.2	22.7	31.8	41.0	50.5	60.6	67.7	67.4	61.1	49.3	37.5	26.6	44.7
Highest daily maximum (°F)	54.0	58.2	76.8	82.0	86.4	93.3	95.3	91.1	91.2	85.3	69.5	60.7	95.3
Year of occurrence	2002	2017	2007	2003	2018	2005	2012	2005	2013	2002	2016	2001	2012
Lowest daily minimum (°F)	-21.6	-15.2	-9.5	1.7	13.3	39.9	48.8	46.6	28.4	26.6	6.7	-12.7	-21.6
Year of occurrence	2019	2006	2019	2003	2003	2003	2014	2004	2007	2006	2014	2016	2019

a. Calculated average of all temperature measurements for each month and of all measurements for the period November 2001–January 2020.

Table 3.3-5 Regional Precipitation, Green Bay (KGRB), WI

Measurement	Period of Record (years)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Normal monthly precipitation (inches)	30	1.13	1.11	1.85	2.63	2.93	3.88	3.5	3.37	3.04	2.44	2.13	1.51	29.52
Maximum monthly precipitation (inches)	69	3.65	3.56	4.68	6.24	8.31	10.29	9.51	9.04	7.8	5.16	5.32	5.71	10.29
Year occurred	—	2008	1953	1977	2011	2004	1990	2010	1975	1965	2009	1992	2015	June 1990
Maximum 24-hour (inches)	69	1.14	1.78	1.83	3.24	3.28	4.9	4.65	4.6	2.99	3.68	2.3	2.57	4.9
Year occurred	—	1980	1966	1998	1994	1973	1990	2000	1975	1964	1954	1985	2015	June 1990
Minimum monthly precipitation (inches)	69	0.12	0.04	0.15	0.49	0.06	0.31	0.83	0.59	0.28	T	0.11	T	0.04
Year occurred	—	1981	1969	1999	1989	1988	1976	1981	2008	1976	1952	2007	1952	February 1990

(NCDC 2020a)

T = trace amount

Table 3.3-6 Manitowoc Station Precipitation Records, 1931–2015

Measurement	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
Normal monthly precipitation (inches)	1.38	1.26	1.83	2.86	2.96	3.56	3.02	3.22	3.03	2.37	2.26	1.63	29.2
Maximum monthly precipitation (inches)	5.04	3.60	5.19	7.65	8.65	10.34	8.77	9.48	12.56	5.71	7.69	4.49	46.3
Year occurred	1999	1938	1977	1993	2004	2008	2006	1975	1986	2013	1934	1959	1959
Minimum monthly precipitation (inches)	0.06	0.00	0.03	0.36	0.60	0.40	0.42	0.17	0.16	0.15	0.10	0.00	13.8
Year occurred	1981	1969	2005	1946	1951 1981	1964	1939	1969	1979	1952	1996	1943	1949

(NCDC 2020b)

Table 3.3-7 Regional Thunderstorms, Green Bay (KGRB), WI, Mean Days per Month

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
0.1	0.1	1.1	2	3.6	6.1	6.1	5.4	3.6	1.6	0.4	0.1	30.2

(NCDC 2020a)

Table 3.3-8 PBN Stability Class Distributions

Average Percent Frequency of Occurrence by Stability Class Pasquill Stability Class[a]							
Year	**A**	**B**	**C**	**D**	**E**	**F**	**G**
2014–2018	12	4.2	4.5	32.4	26.5	10.9	9.5

a. Classes are as follows (NRC 2007b, Regulatory Guide 1.23, Table 1):

Class A: Extremely unstable

Class B: Moderately unstable

Class C: Slightly unstable

Class D: Neutral

Class E: Slightly stable

Class F: Moderately stable

Class G: Extremely stable

Table 3.3-9 PBN Permitted Air Emission Sources (Sheet 1 of 2)

Emission Source[a]	Description	Capacity Rating	Permit Conditions[b]
A. Stack S01, Process P01	Westinghouse – Model W251G distillate oil-fired stationary gas turbine	361 MBtu/hour	SO_2: may burn only distillate fuel oil with sulfur content of less than 0.0015 percent (15 ppm) by weight NO_x: 0.1232 lb/gal, 237,000 gal/month PM: 22.0 lb/hour, 0.10 lb/MBtu PM_{10}: 22.0 lb/hour $PM_{2.5}$: 9.0 lb/hour Opacity: <=20 percent or number 1 on the Ringlemann chart May only be used at the request of MISO, for operational testing, and in response to emergencies.
B. Stacks S02 & S03, Processes P02 & P03[c]	General Motors – Model 20-645-E4 diesel generators	(2) 28.3 MBtu/hour	SO_2: may burn only distillate fuel oil with sulfur content of less than 0.0015 percent (15 ppm) by weight PM: (2) 11.5 lb/hour, 0.50 lb/MBtu Opacity: <=40 percent or number 2 on the Ringlemann chart Limited to 200 hours per year.
C. Stacks S04 & S05, Processes P04 & P05[c]	General Motors – Model 20-645-E4 diesel generators	(2) 28.3 MBtu/hour	SO_2: may burn only distillate fuel oil with sulfur content of less than 0.0015 percent (15 ppm) by weight PM: (2) 2.9 lb/hour, 0.15 lb/MBtu Opacity: <=20 percent or number 1 on the Ringlemann chart Limited to 200 hours per year.
D. Stack S08, Boilers B01 & B02[d]	Cleaver-Brooks – Model CB 198-600 distillate oil-fired horizontal fire tube boilers	(2) 25.1 MBtu/hour	SO_2: may burn only distillate fuel oil with sulfur content of less than 0.0015 percent (15 ppm) by weight PM: (2) 1.7 lb/hour, 0.60 lb/MBtu Opacity: <=40 percent or number 2 on the Ringlemann chart CF% < 10 percent/year with tuneups every 5 years Limited to 200 hours per year for operational testing and in response to emergencies.

Table 3.3-9 PBN Permitted Air Emission Sources (Sheet 2 of 2)

Emission Source[a]	Description	Capacity Rating	Permit Conditions[b]
E. Stack S06, Process P06[c] Stack S07, Process P07[c]	Cummins Engine Company – diesel engines	5.6 & 2.8MBtu/hour	SO_2: may burn only distillate fuel oil with sulfur content of less than 0.0015 percent (15 ppm) by weight PM: 2.8 lb/hour for P06 and 1.4 lb/hour for P07, 0.50 lb/MBtu Opacity: <=40 percent or number 2 on the Ringlemann chart May only be used as a black start generator; limited to 200 hours per year for specific listed purposes.
F. Stack S09, Process P09[c, e]	Cummins Engine Company – diesel engine model CFP7E-F40	1.6 MBtu/hour	SO_2: may only be fired with diesel fuel that meets the requirements of 40 CFR 80.510(b) for nonroad diesel fuel. PM: 0.2 g/KWh and 0.15 lb/MBtu NO_x + NMHC: 4.0 g/KWh 112.4 lbs/hour/engine, 3.2 lbs/MBtu/engine 56.2 tons/year for ES-4 through ES-7 Opacity: <=20 percent or number 1 on the Ringlemann chart Limited to 200 hours per year for specific listed purposes
G. Stack S13, Process P13[c, e]	Cummins Engine Company – emergency diesel engine	3.89 MBtu/hour	SO_2: may only be fired with diesel fuel that meets the requirements of 40 CFR 80.510(b) for nonroad diesel fuel. PM: 0.2 g/KWh NO_x + NMHC: 4.0 g/KWh CO: 3.5 g/KWh Opacity: May exceed 20 percent or number 1 on the Ringlemann chart under listed conditions Limited to 200 hours per year
H. Stack S25, Process P25[c]	Generac – SG100 LPG emergency generator	149 HP	SO_2: may only be fired with propane. PM: 0.15 lb/MBtu Opacity: 20 percent or number 1 on the Ringlemann chart Limited to 200 hours per year

(WDNR 2018a, Permit No. 436034500-P32)

a. Emission source unit reference is from WDNR 2018a.

b. For a full discussion of Air Permit Conditions see WDNR 2018a, Permit No. 436034500-P32.

c. Stationary combustion sources also subject to 40 CFR Part 63, Subpart ZZZZ—National Emissions Standards for Hazardous Air Pollutants for Stationary Reciprocating Internal Combustion Engines.

d. Also subject to 40 CFR Part 63, Subpart JJJJJJ – National Emission Standards for Hazardous Air Pollutants for Industrial, Commercial, and Institutional Boilers Area Sources.

e. Also subject to 40 CFR Part 63 subpart IIII, Subpart IIII fulfills subpart ZZZZ.

NMHC = non-methane hydrocarbons; NO_x = nitrogen oxides; ppm = parts per million

Table 3.3-10 PBN Reported Annual Air Emissions Summary, 2014–2018

Annual Emissions (pounds/year)		
Year	**NO_X**	**O_3**
2014	25,578	125
2015	20,982	262
2016	15,196	299
2017	23,683	202
2018	17,472	267

Table 3.3-11 PBN Annual GHG Emissions Inventory Summary, 2014–2018

Carbon Dioxide Equivalent (CO_2e) Emissions[(a)], Metric Tons					
Emission Source	**2014**	**2015**	**2016**	**2017**	**2018**
Combustion Sources[(b)]	596	843	751	745	1,009
Workforce Commuting[(c)]	3,135	3,135	3,135	3,135	3,135
TOTAL	**3,731**	**3,978**	**3,886**	**3,880**	**4,144**

a. GHG calculated emissions are based on the following:

b. Fuel usage for combustion sources shown in the PBN annual compliance certification reports for 2014–2018 indicated by the referenced sources of Table 3.3-10; EPA Table 1 GHG Emission Factors for Greenhouse Gas Inventories – Distillate Fuel Oil No. 2; and 40 CFR Part 98 Table A-1 to Subpart A Global Warming Potentials.

c. Workforce commuting calculations are based on the following:

1. Statistical information from the USCB indicates that 3.1 percent of Wisconsin workers in the transportation and warehouse and utilities industry carpool to work (USCB 2020e). Number of PBN employees as of January 2020 was 681. Utilizing the 3.1 percent USCB carpool statistic, a value of 667 passenger vehicles per day was utilized.

2. The EPA's GHG equivalencies calculator the CO^2e/year to be 3,135 metric tons for 667 vehicles (EPA 2020b).

3. Carbon dioxide has a global warming potential (100-year time horizon) of "1" based on Table A-1 to Subpart A of 40 CFR Part 98.

4. Formula 4,294 metric tons CO^2e/year × 1 (global warming potential).

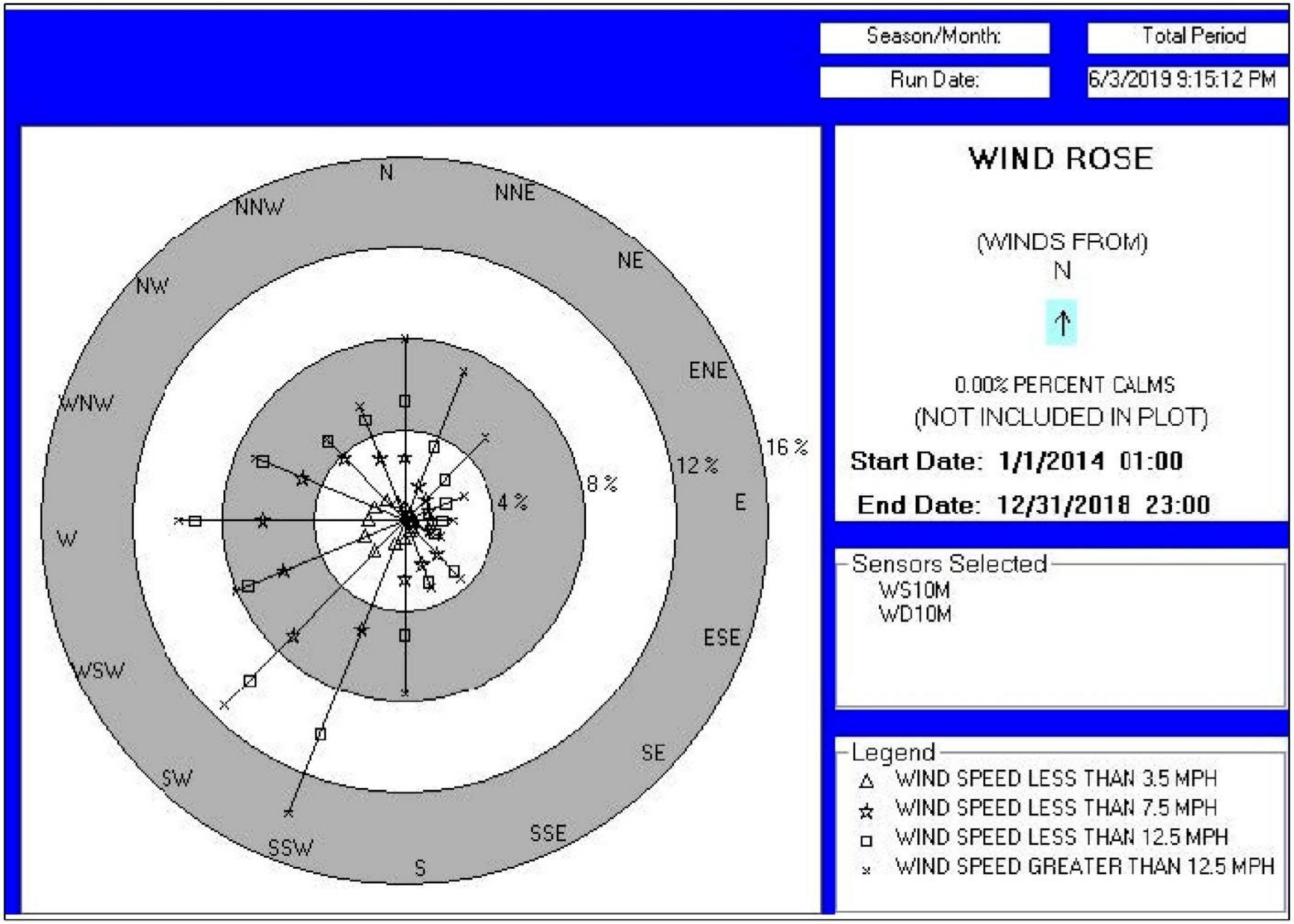


Figure 3.3-1 2014–2018 PBN Wind Rose

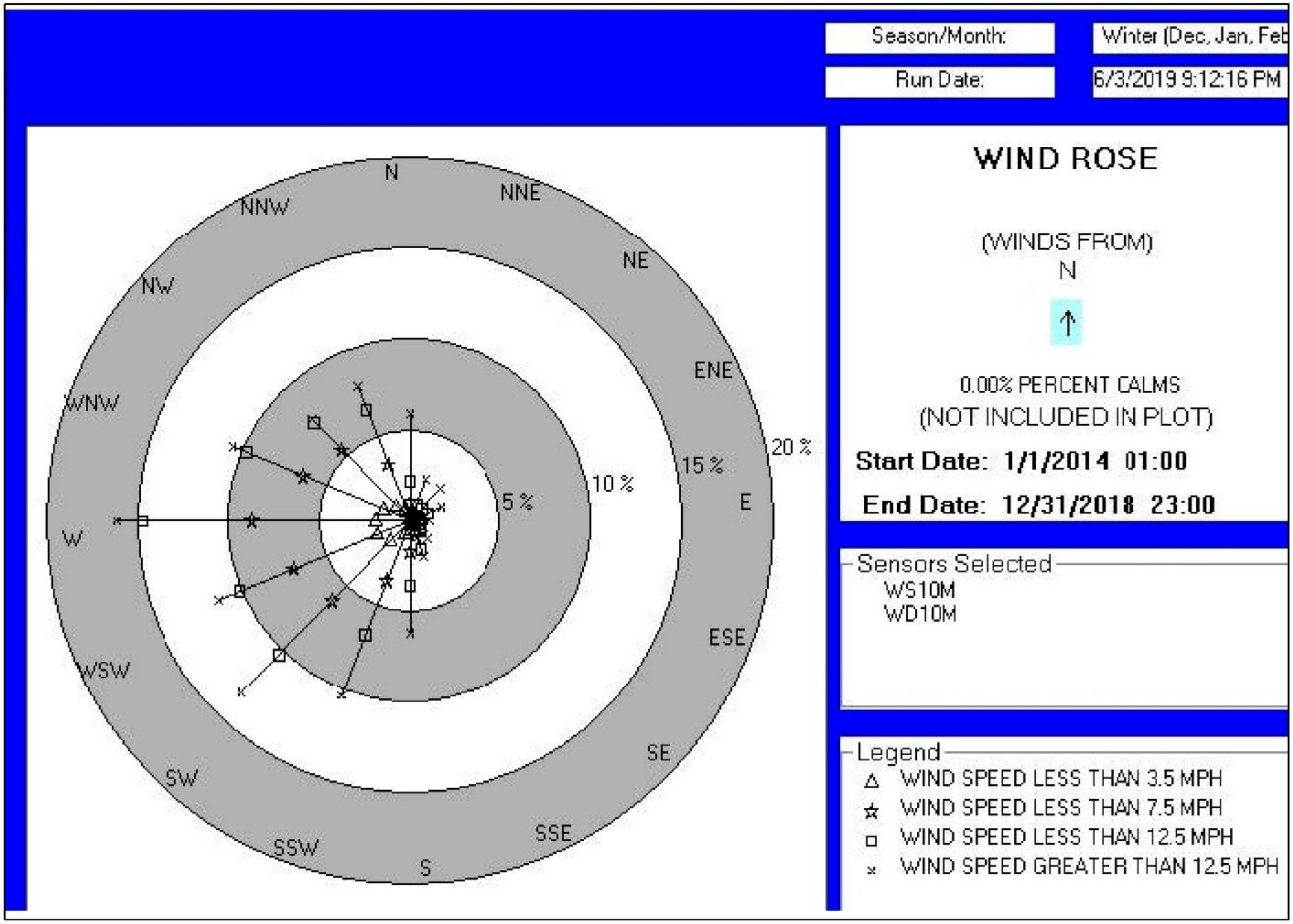


Figure 3.3-2 2014–2018 PBN Winter Wind Rose

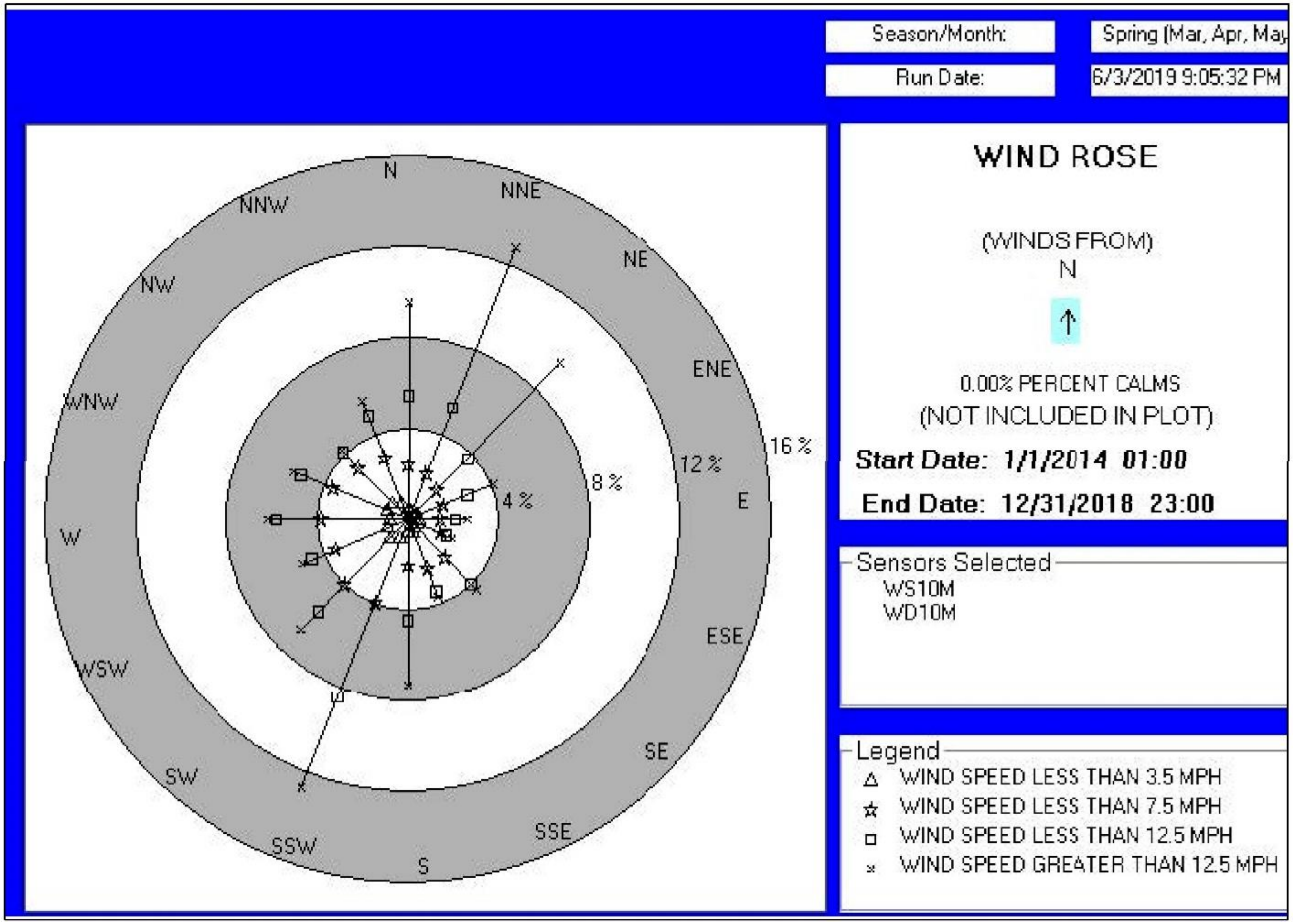


Figure 3.3-3 2014–2018 PBN Spring Wind Rose

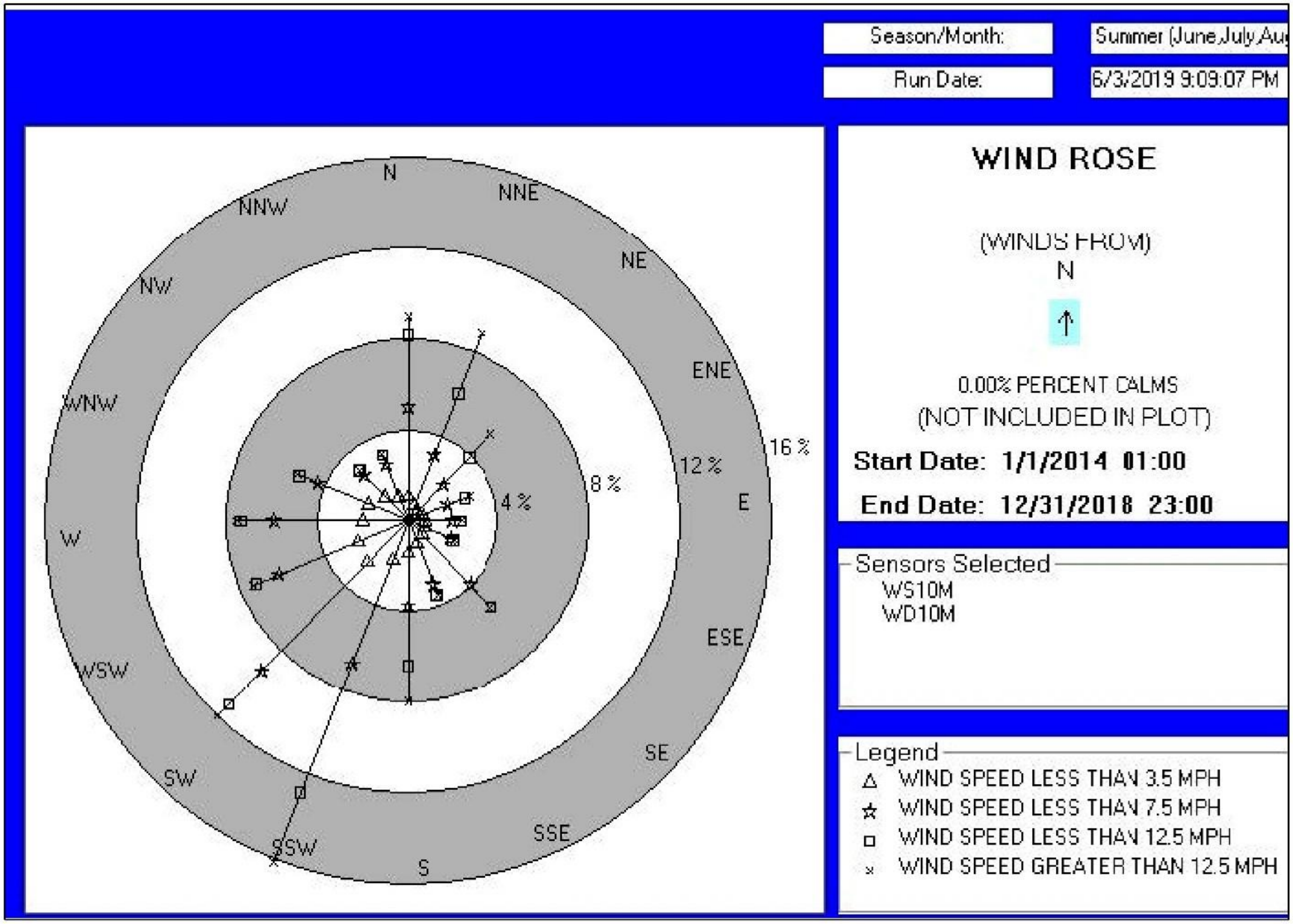


Figure 3.3-4 2014–2018 PBN Summer Wind Rose

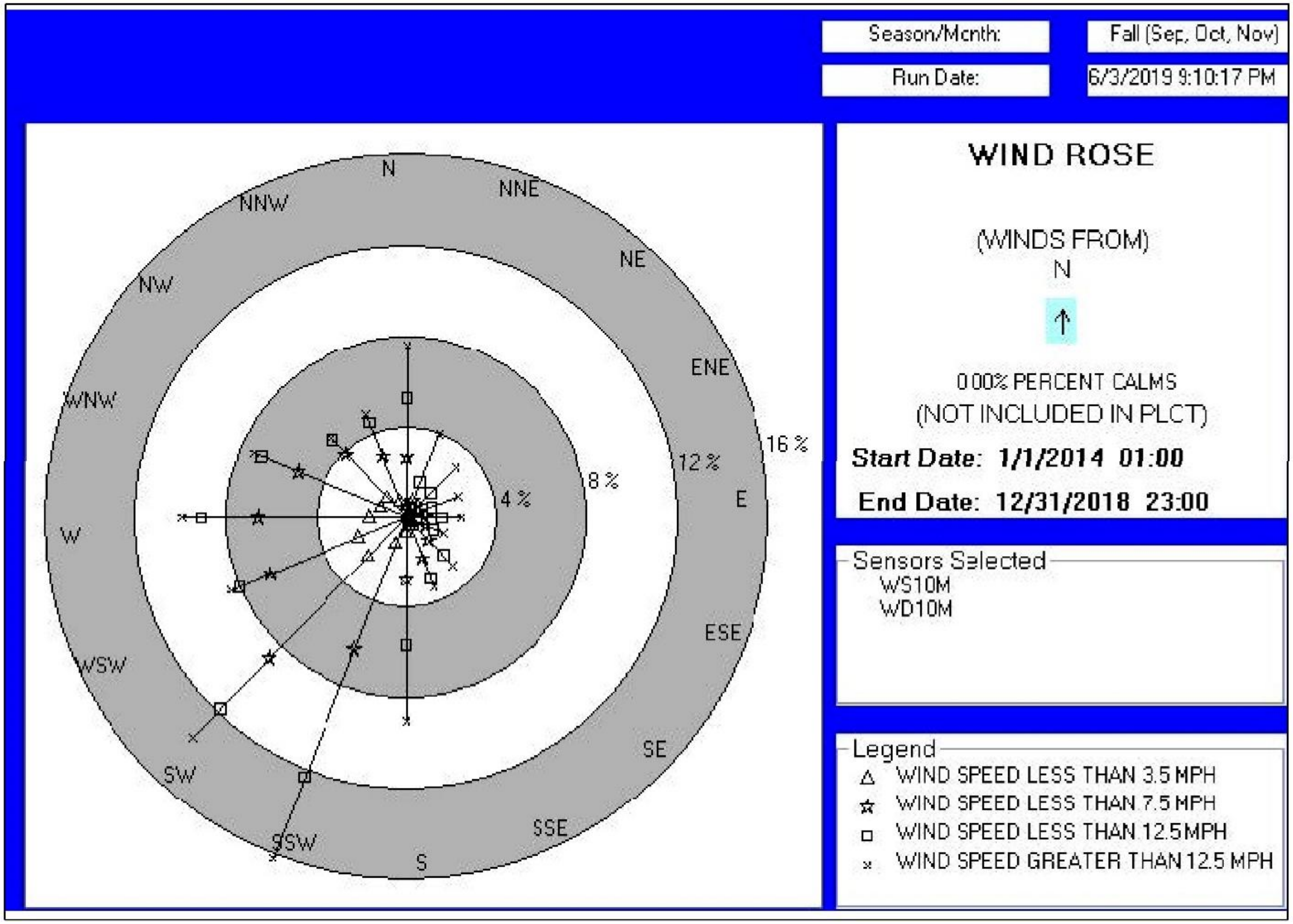


Figure 3.3-5 2014–2018 PBN Fall Wind Rose

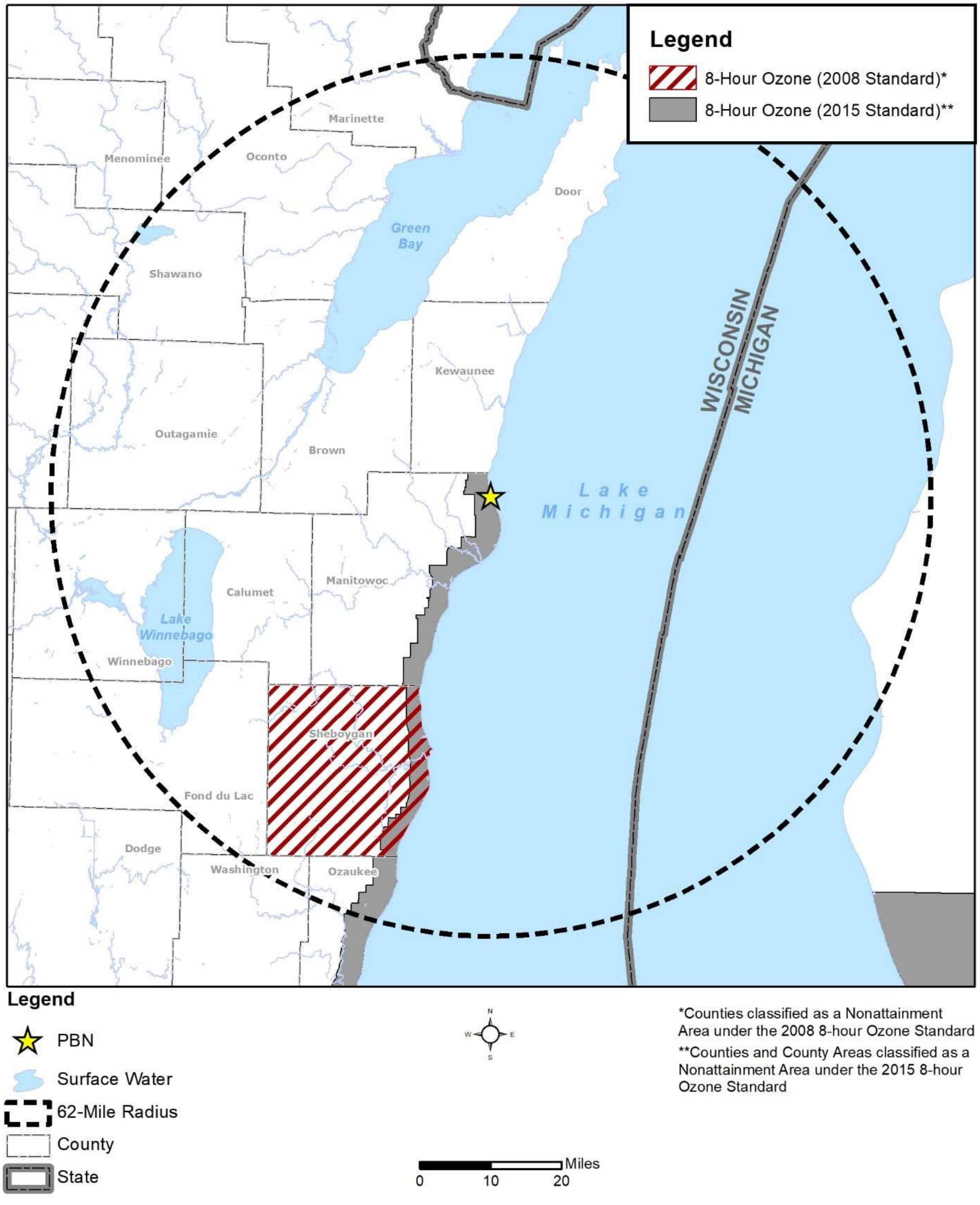


Figure 3.3-6 Nonattainment and Maintenance Areas, 50-Mile Radius of PBN

3.4 Noise

Noise is produced at PBN from industrial plant operations and site activities. Industrial background noise at PBN is generally from emergency diesel generator (EDG) operations, turbine generators, transformers, loudspeakers, transmission lines, firing range, and the main steam safety valves. The loudest sound emitted from PBN plant systems would be from a limited-duration monthly testing of EDGs. As shown in Figure 3.1-1, EDG building is located north of the turbine building. Two additional EDGs are located inside the turbine building, with the exhaust stack routed to the turbine building roof.

The zoning of the PBN site is designated as exclusive agricultural by Manitowoc County. PBN is also located within the limits of jurisdiction of the Town of Two Creeks, which utilizes the zoning map developed by the Manitowoc County and lists land use as industrial. The Manitowoc County code and the Town of Two Creeks 2039 comprehensive land use plan does not establish maximum permissible sound limits for receiving land use categories. (Manitowoc County 2020c; Two Creeks 2019)

Sound levels from normal plant operations at PBN range from a low of 47 A-weighted decibel (dBA) scale to a high of 100 dBA. EDGs are tested monthly, at about 3 hours each time, with occasional endurance runs for 24 hours. Peak sound levels are 105–110 dBA, during the EDG operations. The EDG building is located approximately 4,400 feet from the closest point of the site boundary in the west-southwest direction. These sound levels are recorded inside the buildings; sound levels outside the buildings are substantially less. Periodic use of the firing range is another onsite activity that creates occasional noise. The firing range is approximately 1,495 feet from the closest point of the site boundary in the south direction. The nearest residence is located approximately 1.2 miles west from the center point between the Units 1 and 2 reactor containment buildings.

Because PBN is located in a rural area (away from urban areas), it is unlikely that noise levels from PBN would affect offsite residences. This is further substantiated by the fact that during the most recent 5 years (2014–2019), no noise complaints have been received from offsite residences by PBN as it relates to PBN plant operational and outage activities. Therefore, no noise issues affecting offsite residences are anticipated during the proposed SLR operating term because noise levels at PBN are expected to remain the same as under current operating conditions.

Noise from operations at the PBN is barely noticeable, except very close to the reactor containment buildings and within the site boundary. No noise from normal plant operations reaches the residential areas around the town of Two Creeks. (NRC 2005)

Internal noise complaints from plant staff are rare. Only one noise complaint has been made by PBN staff in the last 5 years. This complaint concerned noise from the tool room at PBN and was addressed by adding soundproofing panels to the walls, even though the levels never exceeded 80 decibels (dB). No cases of threshold shifts requiring U.S. Occupational Safety and Health Administration (OSHA) reportability have occurred in the past 10 years.

NEPB's hearing conservation procedure requires the implementation of noise control methods in all facilities and at all jobsites where employees are exposed to noise levels at or above the 8-hour time weighted average of 85 decibels. NEPB considers any area in which an individual may receive equal to or greater than an 8-hour time-weighted average of 90 dB measured on the A scale of a sound level meter as a high noise area. The procedure also requires annual audiometric exams to identify any hearing threshold shifts. (NEE 2018b)

PBN monitors noise at and around the plant site for occupational and ambient effects on an as-needed basis. This includes scheduled activities such as outages or systems testing. PBN or its subcontractors perform noise studies for these scheduled activities. Noise levels at PBN are anticipated to remain the same as under current operating conditions during the proposed SLR operating term.

3.5 Geologic Environment

3.5.1 Regional Geology

The site is in eastern Wisconsin bordering the western shore of Lake Michigan, which falls within the Central Lowland physiographic province (Figure 3.5-1). The Central Lowlands province is the largest of the physiographic provinces in the continuous United States, spanning 585,000 miles. The region is largely level and rises less than 1,000 feet above sea level in the east and 2,000 feet above sea level to the west (NPS 2020b). This province is bordered to the north by the Canadian Shield, which is a vast province of Precambrian and predominantly crystalline rocks. The crystalline rock surface is an ancient erosional surface that yielded vast quantities of sediments through geologic time. Sediments derived from the Canadian Shield were deposited as extensive sequences of sandstone, shale, and limestone or dolomite that comprise the present-day sedimentary rock aquifers and confining beds in the Central Lowlands and elsewhere (Olcott 1992).

The Central Lowlands were subject to repeated Pleistocene glaciations and can be divided into regions based on glacial features, including the Great Lakes, Small Lakes, Driftless Area, Till Plains, Dissected Till Plains, and Osage Plains. The PBN site is in the Great Lakes region in the northern Central Lowlands. The Great Lakes are the result of repeated glacial scouring. The shape and orientation of the lakes is a product of pre-glacial streams and weak rocks bordering resistant rocks that influenced the path of advancing ice. The Great Lakes reach depths of more than 330 feet below sea level. Underlying glacial deposits are largely horizontal Paleozoic sandstones, shales, limestones, conglomerates, and coals. (NPS 2020b)

The PBN is located on the western flank of the Michigan Basin, which is a broad downwarp ringed by discontinuous outcrops of more resistant formations. The bedrock formations are limestones, dolomites, and sandstones with subordinate shale layers. The rocks form a succession of extensive layers that are relatively uniform in thickness. The bedrock strata dip gently towards Lake Michigan from 15 to 35 feet per mile. The geologic structure of the region includes an outcrop of gently dipping Paleozoic-age sedimentary rock strata in a horseshoe pattern around the Canadian Shield. (PBN 2019a, Section 2.8)

3.5.2 Site Geology

The U.S. Geological Survey (USGS) online map of the geology of Wisconsin maps Silurian carbonates, which are undivided, underlying soils on the PBN site. The major lithologic constituent is dolomite. The Silurian system includes the Cayugan, Niagaran, and Alexandrian series. Figure 3.5-2 depicts the geological map of the PBN site and surrounding areas (USGS 2020a).

The uppermost bedrock underlying the PBN site is Niagara dolomite. Bedrock does not outcrop on the site; it is covered by glacial till and lake deposits. The thickness, texture, and type of deposits are variable. The soils contain expansive clay minerals and have moderately high base exchange capacity. Although the character of the glacial deposits may vary greatly within relatively short distances, a generalized section through the overburden soils adjacent to Lake Michigan at the site consists of the following sequence (PBN 2019a, Section 2.8):

1. An upper layer of brown clay silt topsoil underlain with several feet of brown silty clay with layers of silty sand.
2. A layer of 20 feet of reddish-brown silty clay with some sand and gravel and occasional lenses of silt.
3. A layer of 25 feet of reddish-brown silty clay with layers of silty sand and lenses of silt.
4. A layer of 50 feet of reddish-brown silty clay with some sand and gravel, the lower portion of which contains gravels, cobbles, and boulders resting on a glacial eroded surface of Niagara Dolomite bedrock.

Soils in the area primarily consist of glacial lacustrine deposits extending to depths ranging from 50 to 100 feet below ground surface. The lacustrine soils are underlain by approximately 600 feet of undifferentiated Silurian dolomite, the upper portion of which is the Niagara dolomite. Below the Silurian dolomite is Ordovician shale and dolomite followed by Cambrian sandstone. Precambrian granite lies beneath the sandstone. The bedrock units dip to the east and represent the western portion of the Michigan basin, which is centered in the lower peninsula of Michigan (AECOM 2017 Section 2.3). Below is a summary of bedrock formations underlying the PBN site (PBN 2019a, Table 2.8-1).

- Quaternary recent deposits consist of sand, silt, peat, and gravel. Pleistocene deposits include glacial drift, which is mostly till with clay, silt, sand, gravel, and boulders.
- Silurian bedrock, Niagara Dolomite, is dominate, thin-bedded to massive, and contains some coral reefs and chert.
- Ordovician bedrock is subdivided into several formations.
    - The Maquoketa Shale consists of shale and dolomitic shale.
    - The Galenea Dolomite, Decorah Formation, and Platteville Formation consist of dolomite with some shale and a sandy base.
    - The St. Peter Sandstone consists of fine- to medium-grained sandstone and is dolomitic in places.
    - The Prairie du Chien Group consists of dolomite with sandy and shaly zones in places.
- Cambrian bedrock consists of the Trempealean Formation, Franconia Sandstone, and the Dresbach Group, which are fine- to coarse-grained sandstone with some shale and dolomite beds.
- Precambrian bedrock consists of undifferentiated granite and quartzite.

In August 2007, a drill crew installed six soil borings/groundwater monitoring wells on the PBN site. Soil borings were advanced to depths between 18 and 25 feet below ground surface (AECOM 2008 Section 2.1). A columnar geologic cross section was prepared using the data obtained from the subsurface investigation. It is shown in Figures 3.5-3a and 3.5-3b.

3.5.3 Soils

3.5.3.1 Onsite Soils and Geology

Shallow soils in the area are primarily composed of glacial lake deposits consisting of silt, sand, and clay extending to depths ranging from 50 to 100 feet below ground surface (AECOM 2008, Section 1.2.4). Stratigraphy was comprised of an approximate one-foot thick topsoil layer across the site. Below the topsoil, a silty clay, described as glacial till, extended to about 13 to 15 feet below the original ground surface. Below the till, a 25- to 30-foot thick layer of lacusterine silty clay was observed. Beneath the lacustrine unit, an approximate 50-foot thick layer of glacial till (silty clay) and a layer of glacial outwash (sand and gravel) were present above the Silurian Dolomite of the Niagara Formation. (AECOM 2017, Section 3)

Soil units that occur within the PBN site property boundary are described in detail in Table 3.5-1 and shown in Figure 3.5-4. They are also summarized below (USDA 2020c):

- Cosad loamy fine sand, 0-3 percent slopes
- Kewaunee loam, 2-6 percent slopes
- Kewaunee loam, 6-12 percent slopes, eroded
- Lutzke sandy loam, 2-6 percent slopes
- Manawa silt loam, 0-3 percent slopes
- Manawa-Kewaunee-Poygan complex, 0-4 percent slopes
- Poygan silty clay loam, 0-2 percent slopes, occasionally ponded, drained
- Poygan silty clay loam, 0-2 percent slopes, occasionally flooded, drained
- Tustin loamy fine sand, 2-6 percent slopes
- Udorthents
- Wauseon sandy loam, 0-2 percent slopes

Soil and subsurface layers have a high clay content, which inhibits percolation and drainage to Lake Michigan (PBN 2019a, Section 2.0). Overall ground surface at the site is gently rolling to flat with elevations varying from 3 to 58 feet above the plant datum. The land surface slopes gradually toward the lake from the higher glacial moraine areas west of the site. Higher ground adjacent to the lake, however, diverts the drainage to the north and south. Site drainage is poor due to the high clay content of the soil combined with the pockmarked surface (PBN 2019a, Section 2.2).

3.5.3.2 Erosion Potential

Based on information from the U.S. Department of Agriculture (USDA), all soil units listed in Table 3.5-1 that are subject to erosion have a slight to moderate erosion potential (USDA 2020c).

Low bluffs face the Lake Michigan shore with evidence of marked erosion near the center of the site. At this point, the beach is narrow (ranging in width from 20 to 50 feet) with bare mud slopes showing active erosion due to lake storms. In this area, shoreline recession ranges from 2.5 to 5 feet per year. Special protection is provided to control further recession of the shoreline at the site. (PBN 2019a, Section 2.2).

The shoreline of Lake Michigan on the PBN property consists of mostly narrow (20 to 100 feet wide depending on lake level) bare beaches leading from the water's edge to low bluffs created by years of erosion. Riprap was placed along the edges of the bluffs to reduce the effects of erosion, which was occurring at a rate of 2.5 to 5 feet per year in 1972. The shoreline on the PBN property does not contain any sand dunes. (NMC 2004a, Section 2.4)

PBN maintains and implements a SWPPP that identifies potential sources of pollution reasonably expected to affect the quality of storm water, such as erosion, and identifies BMPs used to prevent or reduce the pollutants in stormwater discharges. These practices, as they relate to erosion, include covering material storage areas or diverting drainage via curbing or silt fencing; repairing and improving vegetation and soil cover; implementing WDNR construction erosion control technical standards and training contractors during construction activities; and directing fire water flushing and testing water to non-erodible surfaces or to air. (PBN 2018a, Appendix C)

Due to the topography of the area and the minimal possibility of erosion, no new erosion BMPs are proposed. They will be added as necessary, however, based upon activities and observations at the facility. (PBN 2018a, Section 5).

3.5.3.3 Prime Farmland Soils

USDA Natural Resources Conservation Service maps show areas of prime farmland surrounding and within the developed portion of the PBN site. Prime farmlands and prime farmlands if drained take up about 94 percent of the site. The small area that is not prime farmland (about 6 percent of the site) is in the plant area located in the east-central portion of the site (USDA 2020c). Farming is the predominant activity in this sparsely populated area of the state, and PBN is situated in a productive dairy farming and vegetable canning region (PBN 2019a, Section 2.0).

Although areas of the site are designated prime farmland, PBN would not be subject to the Farmland Protection Policy Act (FPPA) because the act does not include federal permitting or licensing for activities on private or non-federal lands. Soil units designated as farmland are identified in Table 3.5-1.

3.5.4 Seismic History

The PBN site is situated in a region that has experienced only infrequent minor earthquake activity. The severity of an earthquake is described by two methods, the modified Mercalli (MM) intensity scale and the Richter magnitude scale. The MM intensity is a subjective measure of observed damage from an earthquake at a particular location. The Richter magnitude scale is an estimate of the total amount of energy released by an earthquake. The accuracy of locating the epicenters of earthquakes in the region has improved with the increase in the number and sensitivity of modern seismographs.

Earthquake epicenters from 1970 through March 2020 with a Richter magnitude greater than 3.0 within a 400-kilometer (km) radius of the site are listed in Table 3.5-2 and shown in Figure 3.5-5.

The north-central United States is a relatively inactive earthquake area. There is no instrumental or verifiable record of large intensity shocks (above MM VII) within 200 miles of the site, and there is no record of damaging earthquakes with epicenters within 100 miles of the site. (PBN 2019a, Section 2.9; USGS 2020b)

None of the maps presently available, including the tectonic map of the United States, shows the presence of faults on which the earthquakes of eastern Wisconsin may have originated. It seems highly unlikely that a regional zone of fracture of any magnitude is present but unmapped. There is a strong possibility that local earthquakes are manifestations of the release of residual stresses remaining in the rock since the glacial periods. The Wisconsin drift sheet is the youngest of these, having occurred only a few thousand years ago. (PBN 2019a, Section 2.9)

Neither the seismic history of the site nor the regional tectonics indicate that a large intensity earthquake is to be expected near the proposed site, and the large earthquakes which have occurred at great distances have had but little effect at the site (PBN 2019a, Section 2.9).

Because the constantly operating stress-relieving mechanism suggested above may produce a small shock anywhere in the affected region, a small intensity earthquake very close to the proposed site is postulated (PBN 2019a, Section 2.9).

The USGS's national seismic hazard map shows that the PBN site is in a region that has a 2 percent probability of exceedance in 50 years (1 in 2,500 years) for a defined peak ground acceleration between 0.04 and 0.08 gravitational force equivalent (g) (Petersen et al. 2020). There are no recent USGS publications related to recent seismic activity in the central United States. In addition, the Wisconsin Geological and Natural History Survey does not include recent seismic studies in its list of publications. However, the national seismic hazard map and the list of earthquakes within 200 miles of the PBN site confirm that the north-central United States is in a relatively inactive earthquake area.

Table 3.5-1 Onsite Soil Unit Descriptions[(a)] (Sheet 1 of 4)

Map Unit Symbol[(a)]	Soil Unit Name	Description	Farmland Designation
CoA	Cosad loamy fine sand, 0-3 percent slopes	The Cosad component makes up 3.2 percent of the map unit. Slopes are 0-3 percent. This component is found on lake and till plains. The parent material consists of sandy outwash over clayey lacustrine deposits. Depth to a restrictive layer is greater than 80 inches. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is very low to moderately low. Available water to a depth of 7.1 inches is moderate. Runoff class is high. This soil is occasionally flooded. It is occasionally ponded. The frost-free period is 130-170 days. The depth to water table is 0 to 12 inches. Non-irrigated land capability classification is 3w. This soil does not meet hydric criteria.	Farmland of statewide importance
KnB	Kewaunee loam, 2-6 percent slopes	The Kewaunee component makes up 36.7 percent of the map unit. Slopes are 2-6 percent. This component found on till plains. The parent material consists of clayey till and/or calcareous, dense clayey till. Depth to a restrictive layer is 20 to 40 inches to densic material. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low to moderately high. Available water to a depth of 4.1 inches is low. Runoff class is was not reported. This soil is not flooded. It is not ponded. The frost-free period is 110-140 days. The depth to water table is greater than 80 inches. Non-irrigated land capability classification is 2e. This soil does not meet hydric criteria.	All areas are prime farmland
KnC2	Kewaunee loam, 6-12 percent slopes, eroded	The Kewaunee component makes up 1.9 percent of the map unit. Slope are 6-12 percent. This component is on moraines and till plains. The parent material consists of thin loamy drift over calcareous clayey till. Depth to a restrictive layer is greater than 80 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low to moderately high. Available water to a depth of 8.6 inches is moderate. Runoff class is high. This soil is not flooded. It is not ponded. The frost-free period is 130-170 days. Depth to the water table is about 60-80 inches. Non-irrigated land capacity classification is 3e. The soil does not meet hydric criteria.	Farmland of statewide importance

Table 3.5-1 Onsite Soil Unit Descriptions[(a)] (Sheet 2 of 4)

Map Unit Symbol[(a)]	Soil Unit Name	Description	Farmland Designation
LuB	Lutzke sandy loam, 2-6 percent slopes	The Lutzke component makes up 0.3 percent of the map unit. Slopes are 2-6 percent. This component is on stream terraces and outwash plains. The parent material consists of loamy alluvium over calcareous sandy and gravelly outwash. Depth to a restrictive layer is greater than 80 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high to high. Available water to a depth of 2.8 inches is very low. The depth to the water table is about 60-80 inches. Runoff class is high. This soil is not flooded. It is not ponded. The frost-free period is 130-170 days. Non-irrigated land capability classification is 3e. This soil does not meet hydric criteria.	Farmland of statewide importance
MbA	Manawa silt loam, 0-3 percent slopes	The Manawa component makes up 15.8 percent of the map unit. Slopes are 0-3 percent. This component is on drainageways and ground moraines. The parent material consists of thin loess over clayey till and/or calcareous, dense clayey till. Depth to a restrictive layer is 20-40 inches to densic material. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately low to moderately high. Available water to a depth of 3.1 inches is low. Runoff class is not reported. This soil is not flooded. It is not ponded. The frost-free period is 141-190 days. Depth to the water table is about 0-12 inches. Non-irrigated land capacity classification is 2w. The soil does not meet hydric criteria.	Prime farmland if drained
McB	Manawa-Kewaunee-Poygan complex, 0-4 percent slopes	The Manawa, Kewaunee, and Poygan components make up 22.9 percent of the map unit. Slope are 0-4 percent. The landform for this component was not reported, but it is positioned on footslopes. The parent material consists of thin loess over clayey till and/or calcareous, dense clayey till. Depth to a restrictive layer is 20-25 inches to densic material. The natural drainage class is somewhat poorly drained. Water movement in the most restrictive layer is moderately low to moderately high. Available water to a depth of 3.1 inches is low. Runoff class is not reported. This soil is not flooded. It is not ponded. The frost-free period is 144-175 days. Depth to the water table is about 0-12 inches. Non-irrigated land capacity classification is 2w. The soil does not meet hydric criteria.	Prime farmland if drained

Table 3.5-1 Onsite Soil Unit Descriptions[(a)] (Sheet 3 of 4)

Map Unit Symbol[(a)]	Soil Unit Name	Description	Farmland Designation
Po	Poygan silty clay loam, 0-2 percent slopes, occasionally ponded, drained	The Poygan component makes up 8.4 percent of the map unit. Slopes are 0-2 percent. This component is on depressions. The parent material consists of silty and clayey till. Depth to a restrictive layer is greater than 80 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately low to moderately high. Available water to a depth of 5.1 inches is low. Runoff class is not reported. This soil is not flooded. It is occasionally ponded. The frost-free period is 130-170 days. Depth to the water table is about 0 inches. Non-irrigated land capacity classification is 2w. The soil meets hydric criteria.	Prime farmland if drained
PwA	Poygan silty clay loam, 0-2 percent slopes, occasionally flooded, drained	The Poygan component makes up 0.3 percent of the map unit. Slope are 0-2 percent. This component is on flood plains. The parent material consists of silty and clayey lacustrine deposits. Depth to a restrictive layer is greater than 80 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately low to moderately high. Available water to a depth of 5.1 inches is low. Runoff class is not reported. This soil is occasionally flooded. It is not ponded. The frost-free period is 130-170 days. Depth to the water table is about 0 inches. Non-irrigated land capacity classification is 2w. The soil meets hydric criteria.	Prime farmland if drained
TuB	Tustin loamy fine sand, 2-6 percent slopes	The Tustin component makes up 2.4 percent of the map unit. Slope are 2-6 percent. This component is on stream terraces. The parent material consists of sandy outwash over calcareous clayey till. Depth to a restrictive layer is greater than 80 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is very low to moderately low. Available water to a depth of 7.2 inches is moderate. Runoff class is high. This soil is not flooded. It is not ponded. The frost-free period is 130-170 days. Depth to the water table is more than 80 inches. Non-irrigated land capacity classification is 3e. The soil does not meet hydric criteria.	All areas are prime farmland

Table 3.5-1 Onsite Soil Unit Descriptions[(a)] (Sheet 4 of 4)

Map Unit Symbol[(a)]	Soil Unit Name	Description	Farmland Designation
Ud	Udorthents	Udorthents make up 5.8 percent of the map unit. Slopes are 0-60 percent. Udorthents are areas of disturbed soils where the upper soil material has been removed, filled, or graded. Depth to a restrictive layer is greater than 80 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is very low to high. Runoff class is very high. This soil is not flooded. It is not ponded. The frost-free period is 130-170 days. Depth to the water table is about 60-80 inches. Non-irrigated land capacity classification is 7e. The soil does not meet hydric criteria.	Not prime farmland
We	Wauseon sandy loam	The Wauseon component make up 2.4 percent of the map unit. Slope are 0-2 percent. This component is on drainageways on till and lake plains, and depressions on till and lake plains. The parent material consists of loamy and sandy glaciolacustrine deposits over clayey till. Depth to a restrictive layer is greater than 80 inches. The natural drainage class is very poorly drained. Water movement in the most restrictive layer is very low to moderately low. Available water to a depth of 7.8 inches is moderate. Runoff class is low. This soil is not flooded. It is frequently ponded. The frost-free period is 130-170 days. Depth to the water table is about 0 inches. Non-irrigated land capacity classification is 3w. The soil meets hydric criteria.	Prime farmland if drained

(USDA 2020c)

a. See Figure 3.5-4 for map unit symbols.

Table 3.5-2 Historic Earthquakes >3.0 Mb, 1970–2020[a]

Earthquake Date	Local Time	Latitude	Longitude	Magnitude	Distance from PBN in kilometers (miles)	Approximate Location
9/15/1972	12:22 am	41.645	-89.369	4.04 mw	328 (204)	Illinois
9/9/1985	5:06 pm	41.848	-88.014	3 mb_lg	274 (170)	Illinois
1/14/1988	12:23 pm	46.559	-89.621	3.6 mb_lg	301 (187)	Michigan
9/2/1994	4:23 pm	42.798	-84.604	3.5 mb_lg	288 (179)	Michigan
9/2/1999	11:17 am	41.721	-89.433	3.5 mb_lg	323 (201)	Illinois
6/28/2004	1:10 am	41.46	-88.9	4.2 mwr	333 (207)	10 km NW of Ottawa, Illinois
2/10/2010	4:59 am	41.969	-88.498	3.8 mwr	269 (167)	8 km NW of Village of Campton Hills, Illinois
1/26/2012	5:35 pm	41.576	-85.49	3 mb_lg	344 (214)	Indiana
11/4/2013	1:35 pm	41.7999	-87.8247	3.2 mb_lg	277 (172)	1 km NW of Summit, Illinois
5/2/2015	11:23 am	42.2357	-85.4285	4.2 mwr	285 (177)	5 km S of Galesburg, Michigan
6/30/2015	10:42 am	42.1464	-85.0459	3.3 mb_lg	312 (194)	11 km NE of Union City, Michigan

(USGS 2020b)

a. All earthquakes within 400 km with a magnitude of greater than 3.0.

mw = moment magnitude; mwr = regional; mb_lg = short-period surface wave

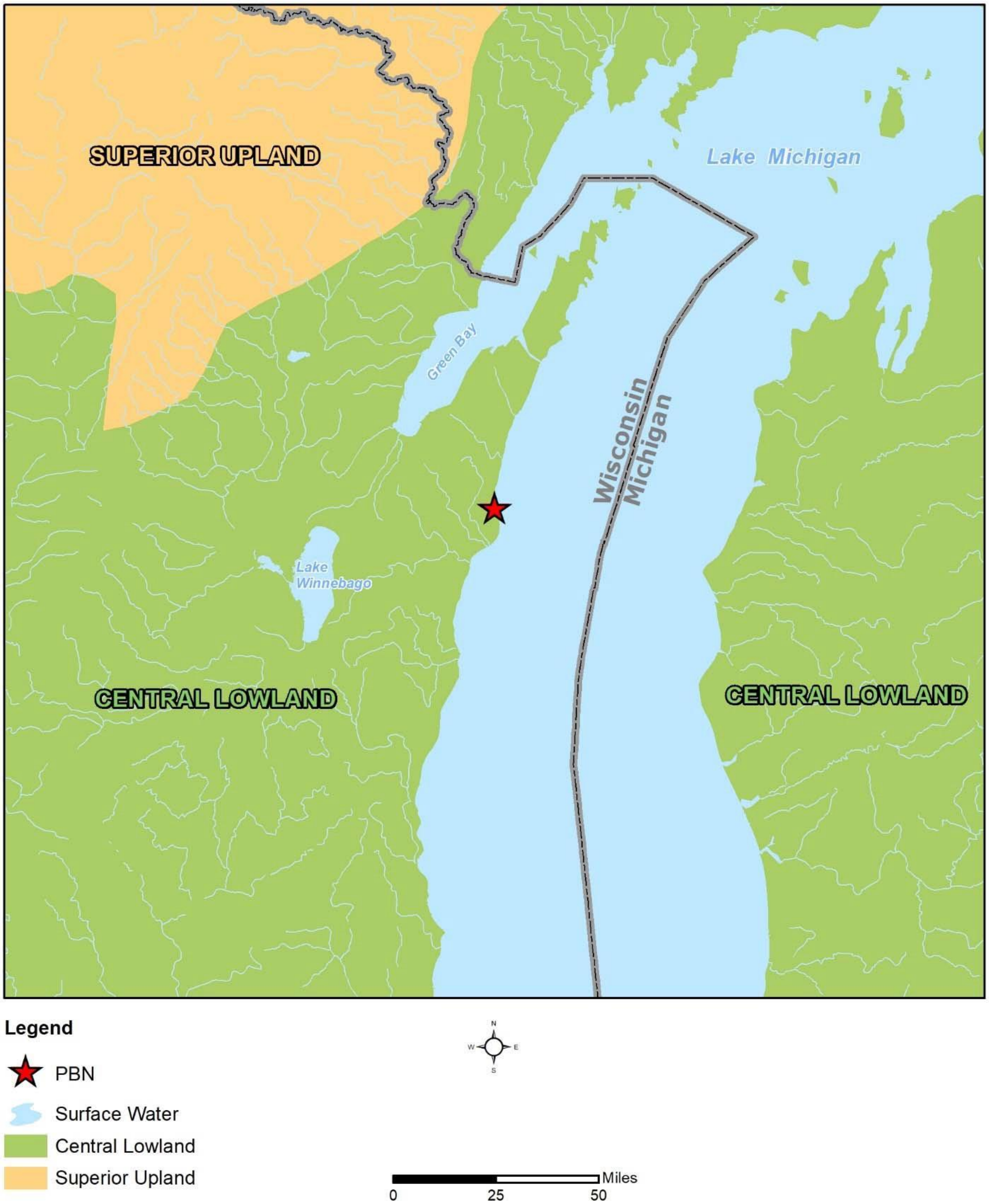


Figure 3.5-1 Physiographic Provinces

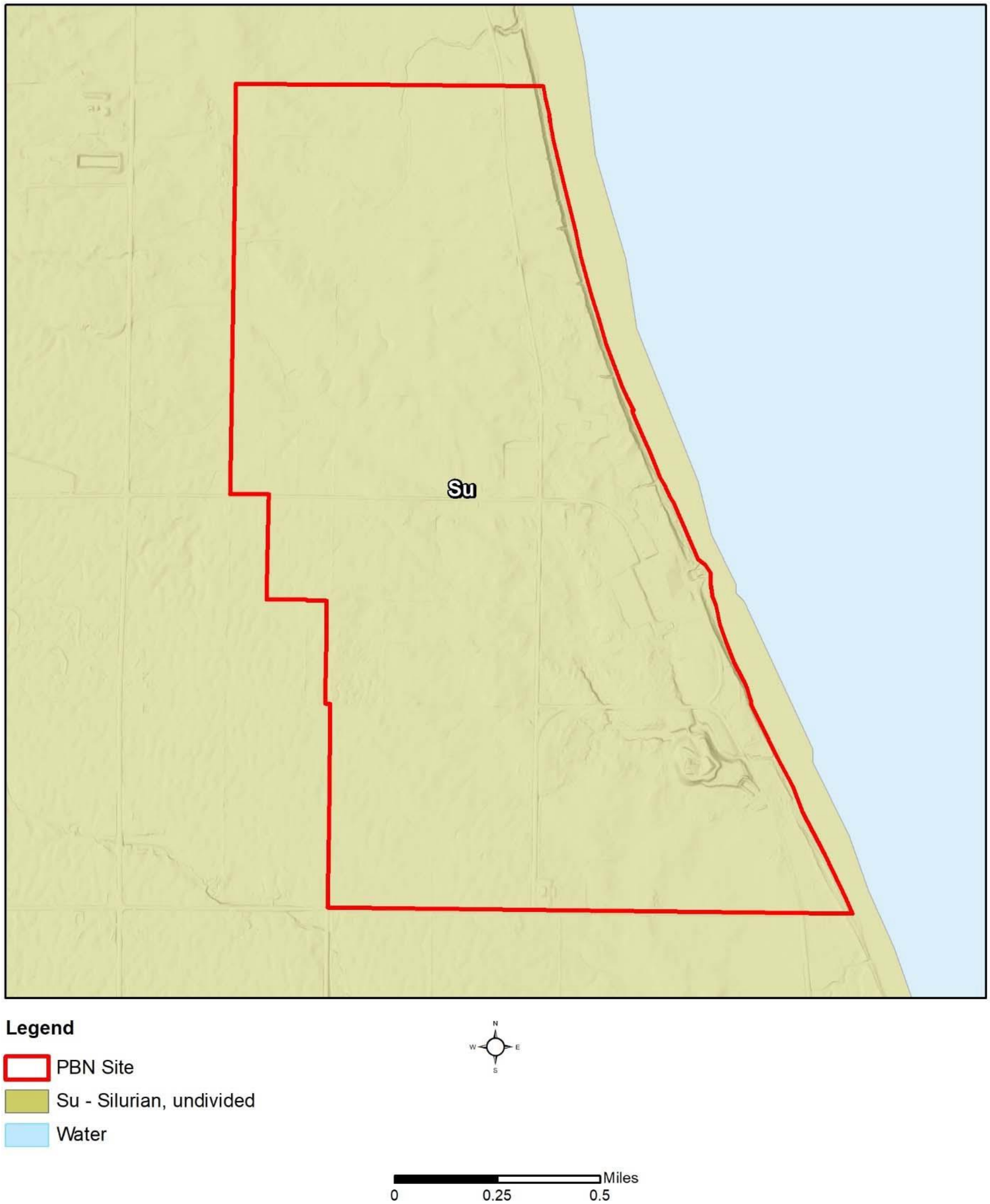


Figure 3.5-2 PBN Surficial Geology

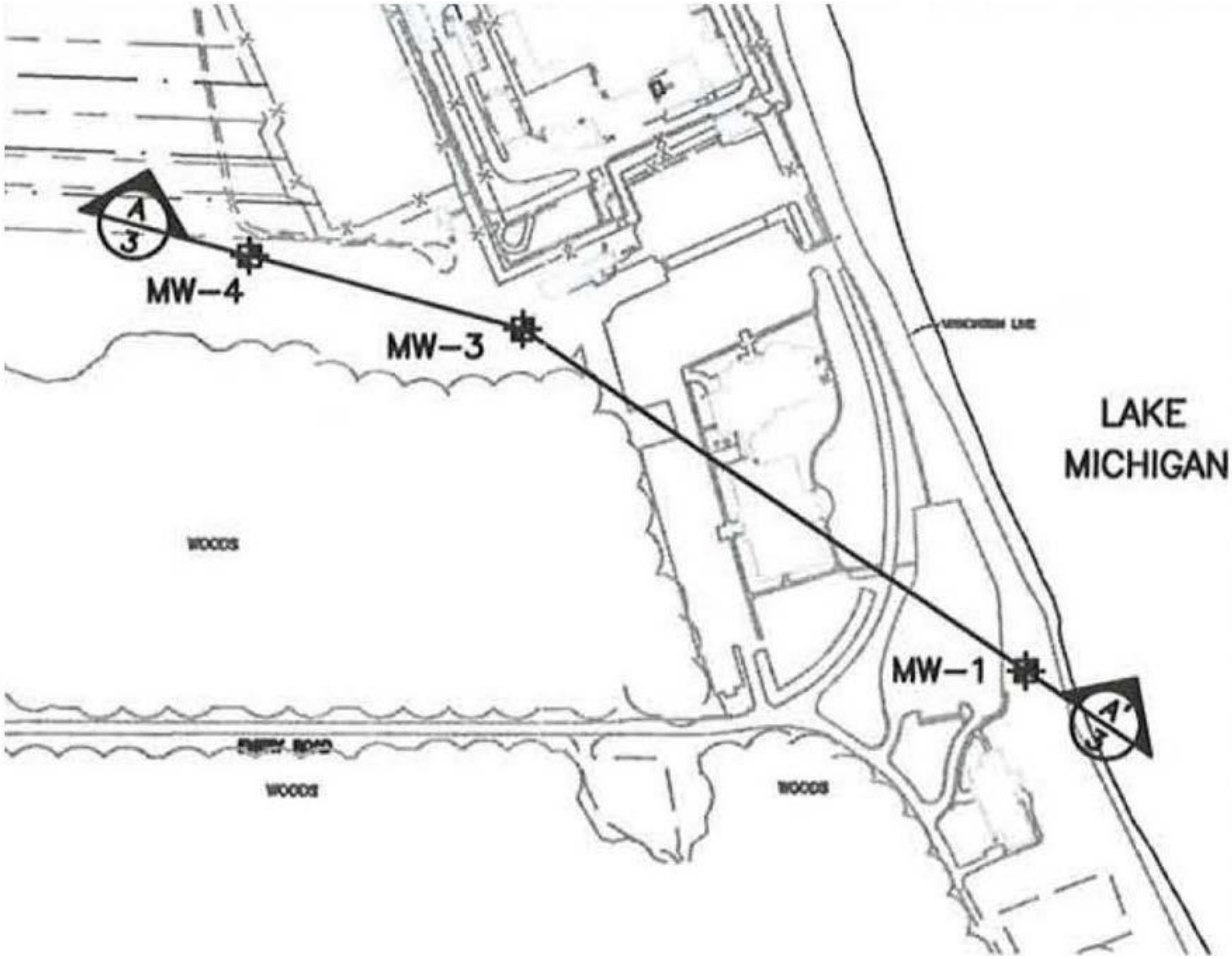


Figure 3.5-3a Cross Section Inset

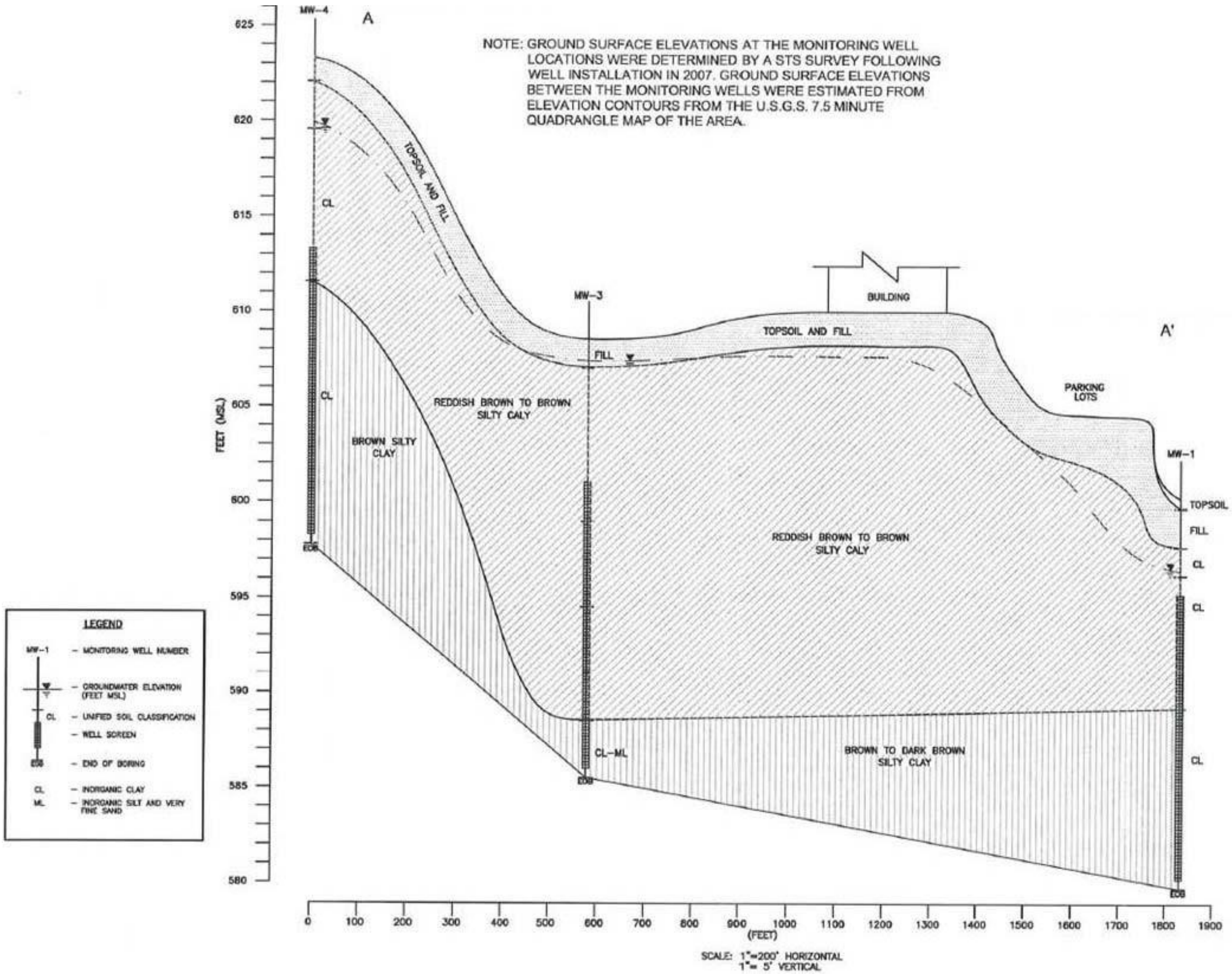


Figure 3.5-3b Cross Section

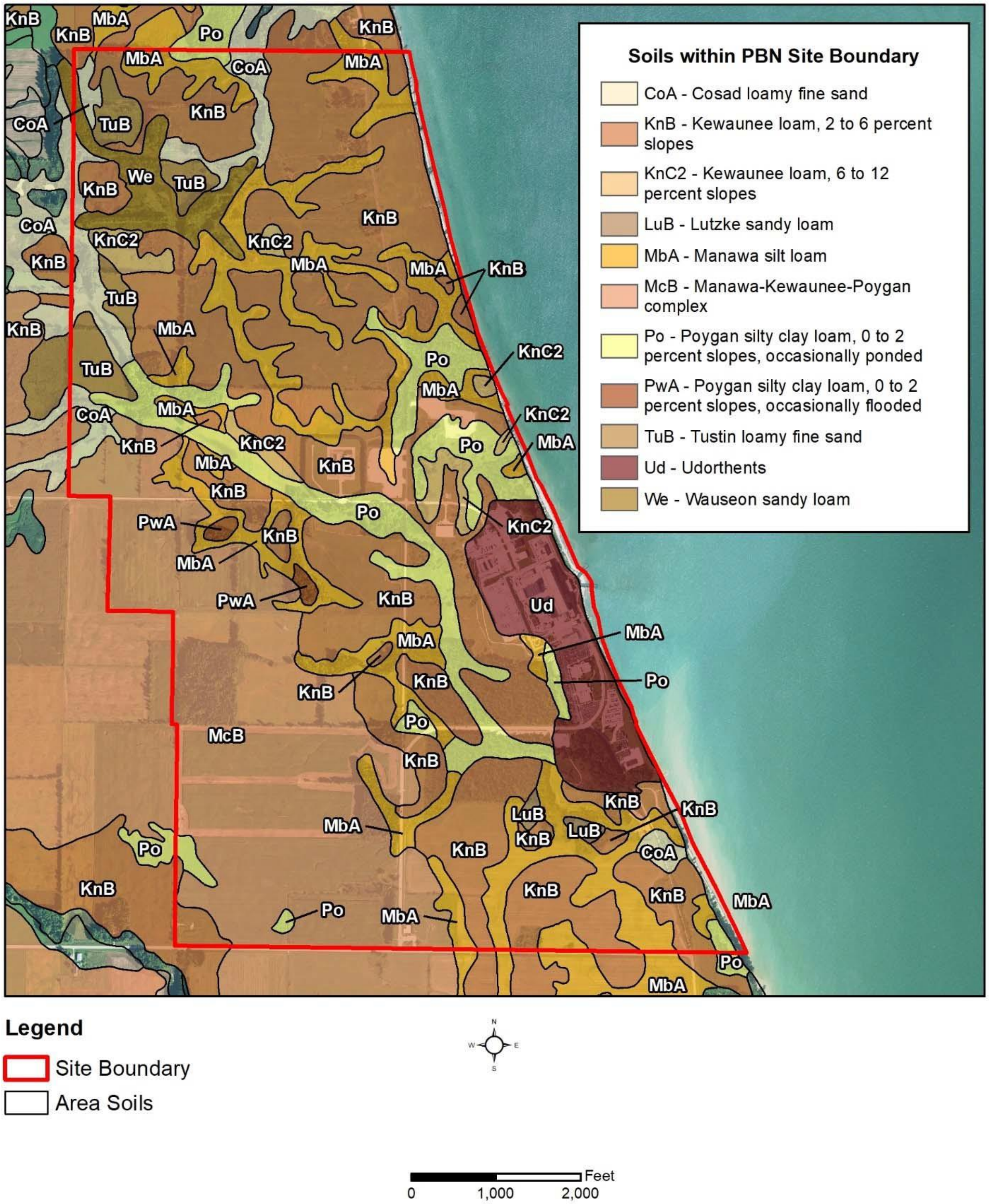


Figure 3.5-4 Distribution of Soils

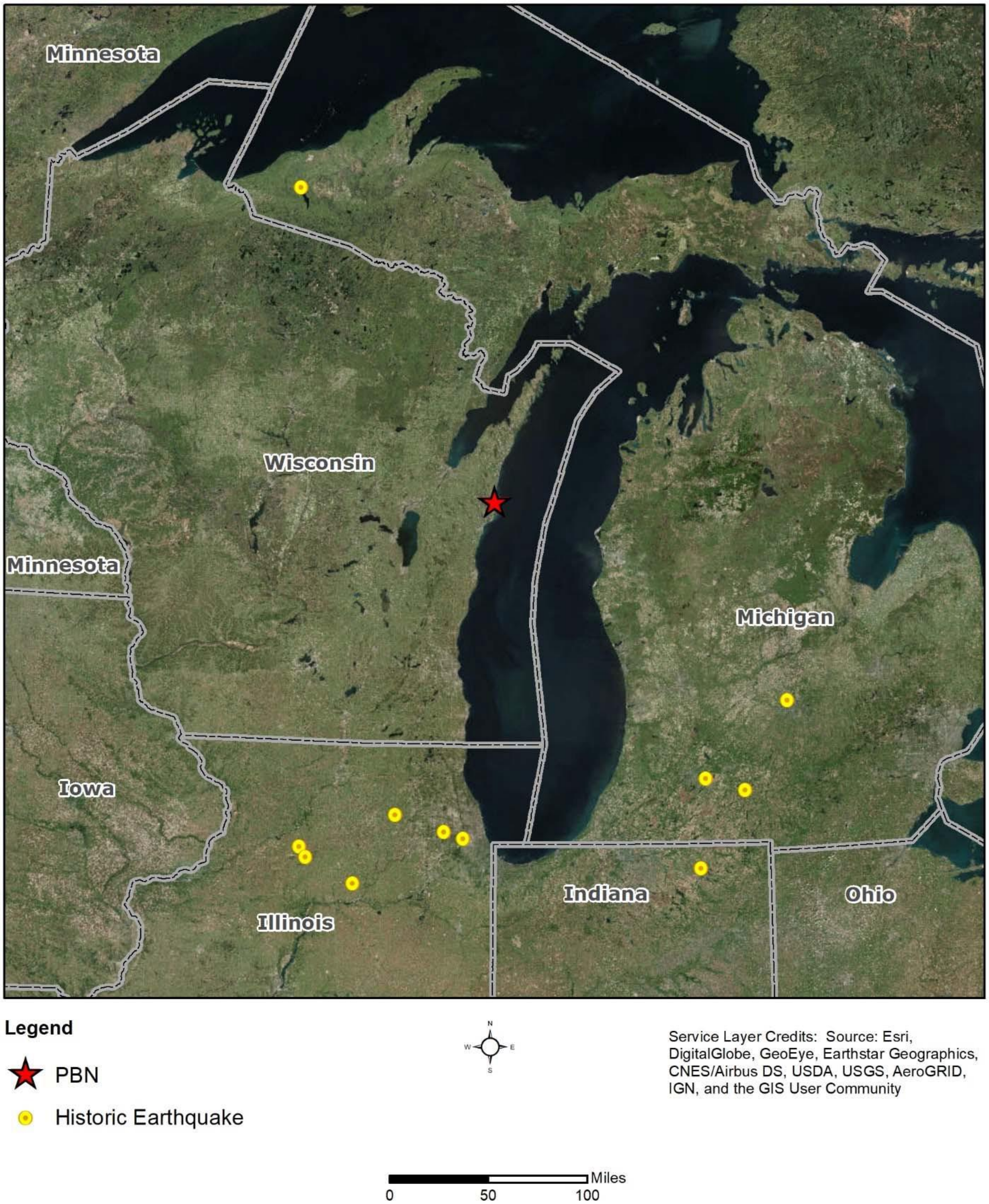


Figure 3.5-5 Historic Earthquakes

3.6 Water Resources

3.6.1 Surface Water Resources

PBN is located in the town of Two Creeks in the northeastern corner of Manitowoc County, WI, on the west shore of Lake Michigan about 30 miles southeast of the center of the city of Green Bay, and 90 miles north-northeast of Milwaukee (Figure 3.1-3). The site comprises approximately 1,260 acres owned by NEPB. Lake Michigan is the primary hydrologic feature with which the plant interacts (Figure 3.6-1). (PBN 2019a, Section 2.1)

Lake Michigan is the third largest in surface area of the Great Lakes. It is 307 miles long from north to south and has an average width of 70 miles. It has a maximum depth of 923 feet, an average depth of 325 feet, and covers an area of 22,300 square miles. The total volume of water in Lake Michigan is approximately 1,400 cubic miles. The water level in Lake Michigan depends primarily on the runoff from its drainage basin. (PBN 2019a, Section 2.5.1)

Overall ground surface at PBN is gently rolling to flat with elevations varying from 3 to 58 feet above plant datum (PBN 2019a, Section 2.2). Plant datum (plant elevation zero) is defined as 580.2 feet above the international Great Lakes datum of 1955 (IGLD 1955), and is equal to 580.9 feet IGLD 1985, the datum currently used by the U.S. Army Corps of Engineers (USACE) to report Lake Michigan water level. (PBN 2019a, Section 2.5.1) The land surface slopes gradually toward Lake Michigan from the higher glacial moraine areas west of the site. Higher ground adjacent to the lake, however, diverts the drainage to the north and south. The major surface drainage features are two small creeks draining to the north and south. One creek discharges into the lake about 1,500 feet north of the northern corner of the site and the other near the center of the site. During the spring, ponds of water occupy many shallow depressions. Site drainage is poor due to the high clay content of the soil combined with the pockmarked surface. (PBN 2019a, Section 2.2)

Low bluffs face the Lake Michigan shore with evidence of marked erosion near the center of the site. At this point the beach is narrow (ranging in width from 20 to 50 feet) with bare mud slopes showing active erosion due to lake storms. In this area, shoreline recession ranges from 2.5 to 5 feet per year. Special protection is provided to control further recession of the shoreline at the site. (PBN 2019a, Section 2.2)

In the general vicinity of the site, the 30-foot depth contour of the lake is between 1.0 and 1.5 miles offshore, and the 60-foot depth contour is 3.0 to 3.5 miles from the shore. Surface currents in Lake Michigan are generated primarily by wind stress on the water surface. The lake surface wind-driven currents have speeds averaging 1 to 2 percent of the wind speeds. Thus, an average wind speed of 15 mph over the lake would generate an average surface current of about 0.15 to 0.3 mph. Such currents may persist for several days after the wind has died down. On large water surfaces, the wind-driven current is theoretically 45° to the right of the wind vector, due to the rotation of the earth. On the west side of Lake Michigan, the current is largely parallel to the shore and more nearly 22° to the right of the prevailing wind. The predominant current direction near the western shore during the period of greatest stratification is in the northerly direction. However, temporary reversals of the general trend may take place. (PBN 2019a, Section 2.5.1)

Waves are responsible for most of the littoral drift on Lake Michigan. In this specific area, the predominant drift appears to be to the north. Under unfavorable conditions, littoral drift may have a pronounced effect on the advance or retreat of certain shorelines. (PBN 2019a, Section 2.5.1)

The cooling water for both condenser units in PBN's condenser cooling water (CCW) system is withdrawn through a submerged intake crib located 1,750 feet offshore in about 22 feet of water. Water flows from the intake structure to the pumphouse forebay through two 14-foot diameter, corrugated, galvanized, structural plate pipes buried to a minimum depth of 3 feet below the lakebed. Water depth in the forebay is approximately 28 feet. The intake water passes through vertical bar racks consisting of 3/8-inch by 4-inch bars, spaced with 2 ¼-inch gaps. One 59-foot wide rack is provided for each unit. Water then flows through the eight traveling water screens (3/8-inch square mesh) in the pumphouse, each of which is approximately 11 feet wide. The screen wash (80 psi) is filtered through a collection basket with 3-inch square openings and returned to the lake via a 24-inch diameter steel pipe with an outlet in the Unit 2 discharge flume, approximately 80 feet from the collection basket. The eight traveling water screens are operated intermittently on an as-needed basis. The duration of each rinse is 30 minutes. Rinsing is performed more often when debris accumulates. (Sigma 2008, Appendix A)

Deicing is performed by reversing flow in one of the intake pipes to return warm discharge water to the intake crib. Part or all the cooling water discharge of one unit can be redirected to the crib. The other intake pipe then supplies the water to both units. Deicing is performed during the winter months. From March or April until November, the plant usually operates on four circulating water pumps, with a maximum design flow of about 750,000 gpm. During the remainder of the year, two pumps are used for a design flow rate of about 430,000 gpm. Maximum recirculation flow to the intake crib is approximately 200,000 gpm. It should be noted that recirculated water does not discharge directly to the lake, but only to the intake crib. (Sigma 2008, Appendix A)

The PBN makeup water system starts with Lake Michigan water from the service water system and processes it into high quality demineralized water for use in plant systems. Pretreatment uses a microfiltration system which consists of three independent units that can each supply 250 gpm of product water for a total capacity of 750 gpm. The accumulated solids are routinely removed (approximately every 20 to 30 minutes) through a backwash system. The microfilter membranes are chemically cleaned (approximately monthly) to remove hardened filtered solids that normal backwashing cannot remove. Sulfuric acid, citric acid, sodium hypochlorite, and sodium bisulfite are used for the chemical cleaning process. Both the backwash and chemical cleaning processes discharge to the waste well which eventually enters the circulating water system for discharge to Lake Michigan. (Sigma 2008, Appendix A) The modular water treatment plant is capable of producing 400 gpm of quality de-ionized water for uses on the secondary and primary side of PBN as well as miscellaneous uses. The water treatment plant effluent supplies water to the demineralized water system headers (which in turn supply the reactor makeup water system) and to the condensate storage tanks.

3.6.1.1 Potential for Flooding

The PBN site includes approximately 2 miles of continuous frontage on the western shore of Lake Michigan (NRC 2005, Section 2.1.1). Protection of the plant is provided against flooding, waves, and storms as well as ice build-up along the shore (PBN 2019a, Section 2.5.2) However, the site is inherently resistant to external flooding risks. Lake bottom contour, construction of the bank, and distance from shore can be credited for mitigating the effects of wave run-up events. Property slope can be credited for mitigating the effects of precipitation events and for providing a relief path for internal flooding. (PBN 2019a, Appendix A) The nominal water level in Lake Michigan at the time of the original license submittal was -2 feet relative to the plant datum. A maximum water level was recorded in 1886 at 1.7 feet and the minimum recorded to date occurred in 1964 at -4.8 feet. The site is, on average, about 20 or more feet above plant elevation zero and there is no record that it has been flooded by the lake. The maximum analyzed value for high lake level is 1.7 feet. Operators will take actions to commence the orderly shutdown of any operating reactor per abnormal operating procedure direction prior to reaching the analyzed limit. (PBN 2019a, Section 2.5.2)

Based on Federal Emergency Management Agency (FEMA) data, the majority of the PBN property is located outside the 0.2 percent annual chance floodplain (100-year flood level). A small area within drainage channels along the southeastern property line has been designated as within the 0.2 percent annual chance floodplain (North American Vertical Datum 1988 [NAVD88]). (Figure 3.6-2). (FEMA 2020)

The license basis level for protection of critical equipment from lake flooding is 9.0 feet. This is an acceptable and bounding value as each lake flooding source when evaluated individually, or in the combined effects review, provides resultant flood levels conservatively below this threshold, thereby satisfying the General Design Criteria 2 requirement to include "an appropriate margin for withstanding forces greater than recorded to reflect uncertainties about the historical data and their suitability as a basis for design." (PBN 2019a, Section 2.5.2)

The limiting design basis lake flood event is a combination of the maximum lake level, the maximum wave run-up, and a conservative value for the wind setup effect. The calculated level reaches 7.25 feet on the riprap shoreline and 8.42 feet on the vertical surfaces of the intake structure. (PBN 2019a, Section 2.5.2) The plant design and equipment layout provide additional protection from postulated internal and external flooding sources. (PBN 2019a, Appendix A)

3.6.1.2 Surface Water Discharges

3.6.1.2.1 WPDES-Permitted Outfalls

Chemical additives approved by the WDNR are used to control pH, scale, and corrosion in plant systems, and to control biofouling of plant equipment. Process wastewaters are monitored and discharged to Lake Michigan via WPDES Outfalls 001, 002, and 004 in accordance with the PBN WPDES permit reissuance No. WI-0000957-08-0. The current WPDES permit authorizes discharges from 10 outfalls (three external outfalls and seven internal outfalls). (WDNR 2012a) The outfalls are depicted in Figure 3.6-3, and their associated effluent limits are listed in Table 3.6-2.

3.6.1.2.2 Stormwater Runoff

There are no rivers or large streams on or near the site. The surface water on the site flows directly to Lake Michigan either through the storm sewer system or through two small creeks which drain the site. Natural drainage and site topography have proven adequate to remove water from precipitation flooding sources. (PBN 2019a, Section 2.2) Four stormwater retention ponds are located north of PBN between PBN and two parking lots. Three ponds receive flow from parking lot run-off. A fourth retention pond receives flow from both parking lot run-off and building eves.

Underground sumps service the underground power and control conduits and collect stormwater and groundwater. These are inspected on a regular basis by PBN personnel or their designated contractor and drained to semi-pervious areas or grassy swales in the area. The main stormwater culvert in the area is a grass-covered ditch that conducts stormwater from east of the G-05 (combustion turbine) building south to east of Warehouse 1 where the stormwater discharges to the Outfall #6 collection system. (PBN 2018a, Section 7)

Stormwater discharges associated with PBN industrial activities are regulated and controlled through WPDES Permit No. WI-S067857-4 issued by the WDNR. PBN also maintains and implements a SWPPP that identifies potential sources of pollution, such as chemical, oil, radioactive hazardous and special waste storage, vehicle fueling, and erosion, etc., that would reasonably be expected to affect the quality of stormwater and identifies BMPs that will be used to prevent or reduce the pollutants in stormwater discharges (PBN 2018a). PBN conducts stormwater runoff visual monitoring on a quarterly basis (when there is a flow) at 13 stormwater outfalls (Outfalls 01-09, Parking Lots A-C, Warehouse 7) which receive runoff from the entire industrial area and conducts screening through visual observations for pollutants as specified in the SWPPP. (PBN 2018a)

3.6.1.2.3 Sanitary Wastewaters

Sanitary wastes from the plant and administration building are treated in a package extended aeration, activated sludge plant. The raw sewage pump station contains a macerator to grind large solids in the waste into small particles. The raw sewage is pumped to an equalization basin located at the influent end of the package extended aeration activated sludge unit in the sewage treatment building. The equalization basin uses variable speed feed pumps to reduce surges in flow to the activated sludge plant. (Sigma 2008, Appendix A)

The aeration basin has an approximate capacity of 20,000 gallons and a detention time of about 27 hours at 17,500 gallons per day (gpd) flow. Aeration is provided through 12 diffusers. Air to the diffusers is provided by three rotary positive displacement blowers. Effluent from the aeration basin flows by gravity to a final clarifier in the sewage treatment building. An air ejector pump transports the sludge collected in the clarifier to the influent end of the aeration basin as returned activated sludge. Waste activated sludge from the clarifier is pumped to the waste sludge storage basin using timed operation wasting pumps. Waste sludge is continuously aerated. (Sigma 2008, Appendix A)

Effluent from the final clarifier flows by gravity into a channel beneath the floor of the sewage treatment building. Water level in the channel is maintained with a 11 degree V-notch weir. An ultrasonic level probe is installed in the channel to continuously measure the flow over the weir. An automatic flow proportional sampler is provided for the clarifier effluent. Positive displacement chemical feed pumps are provided for feeding the following:

1. Liquid polymer to the final clarifier influent for improved solids settling.
2. Caustic soda to the aeration basin for pH control.

The treated effluent flows by gravity to the effluent sump pump station immediately north of the lift stations. This sump also collects water from the power plant's potable reverse osmosis reject and iron/carbon filter with final discharge to the cooling water discharge via wastewater effluent point 105. A local licensed septage hauler periodically removes the sludge off site for ultimate disposal. (Sigma 2008, Appendix A)

3.6.1.2.4 Dredging

According to PBN personnel, no periodic maintenance dredging has occurred at PBN and no dredging activities in the vicinity of the intake and discharge are anticipated. However, PBN has authorization from the USACE to perform bank stabilization activities on the shoreline of Lake Michigan near PBN (USACE 2020a).

3.6.1.2.5 Compliance History

As presented in Chapter 9, over the 5-year period from 2015–2019, there have been no notices of violation or non-compliances issued by the WDNR associated with PBN wastewater discharges to receiving surface waters. However, PBN had permit non- compliances from 2016 to 2019 for total suspended solids, biochemical oxygen demand, and total residual halogens exceedances documented in the discharge monitoring reports submitted monthly to the WDNR. NEPB contacted the WDNR wastewater engineer to provide notification of this exceedance. The WDNR engineer indicated that allowing the system to develop and recover would be the best option. PBN has implemented that approach, including operational changes recommended by the WDNR. The system is monitored on a daily basis and appears to be recovering.

3.6.1.2.6 Lake Water Temperatures Reporting

Cooling water intake and discharge water temperatures for each unit are measured by PBN and the raw data are averaged for each month. The averaged values for 2015–2019 are plotted in Figure 3.6-4 (intake) and Figure 3.6-5 (discharge).

Thermal stratification has an insignificant effect on the dilution of released fission products by lake water currents. Discharge velocity of the circulating water is less than 4 feet/second. It is expected that this jet action will promote mixing with colder water in the immediate vicinity of the discharge flume and a rapid reduction in pronounced differential temperatures. In addition to this, observations at power station discharges in Lake Michigan at Gary, IN, and Waukegan, IL, have shown that the wave action and shore currents are very effective in breaking up any tendency to pronounced stratification and isolation of the warm water. It is expected that this action, together with the jet momentum entrainment of colder water, will cause all temperature effects to be indiscernible within less than 1 mile from the point of discharge. The same conditions will prevent the establishment of a distinct pronounced plume of heated water which would transport released fission products directly to any potable water intake structure. (PBN 2019a, Section 2.5.3)

3.6.2 Groundwater Resources

3.6.2.1 Groundwater Aquifers

The shallow aquifer system in eastern Wisconsin consists of a sand and gravel aquifer underlain by the Silurian dolomite aquifer. The underlying Maquoketa Formation, where present, is the lower limit of the shallow aquifer system. The Maquoketa Formation confining unit retards water flow between the shallow aquifer system and the deep sandstone aquifer. (USGS 1995)

The Silurian dolomite aquifer, present only in eastern Wisconsin along Lake Michigan, is predominantly Silurian-age dolomite, but contains minor amounts of calcite and gypsum crystals, pyrite, and beds of shale and limestone. The aquifer includes a small area of dolomite and shale of Devonian age that extends from Milwaukee to Sheboygan along Lake Michigan. (USGS 1995)This aquifer is thickest along the Lake Michigan shoreline and thins to the west. The aquifer lies above a fine-grained layer of shale. (WGNHS 2020) This shale, called the Maquoketa confining unit, includes the Maquoketa formation. This shale aquitard restricts vertical groundwater flow between the Silurian dolomite aquifer and the underlying sandstone aquifer. The sandstone aquifer consists of hydraulically connected sandstones and dolomites of Cambrian and Ordovician age. The oldest and the most extensive units are Cambrian sandstones that underlie 60 percent of the state. (USGS 1995)

The subsurface water table at PBN has a definite slope eastward toward the lake. The gradient indicated by test drilling on the site is approximately 30 feet per mile. It is, therefore, extremely unlikely that any accidental release of radioactivity on the site could spread inland. Furthermore, the rate of subsurface flow is small due to the relatively impervious nature of the soil and will not promote the spread of accidental releases. In addition to the groundwater table, an upper aquifer composed of glacial drifts and recent deposits exists at depths ranging from 31 to -33 feet in respect to the plant elevation zero. A lower (bedrock) aquifer (Silurian dolomite aquifer) can be found at -81 to -38 feet (USGS 2020c). The bedrock aquifer in the general site region is known to produce saline water; hence, that aquifer is usually not used for potable water supplies. Such supplies are taken from the upper aquifer or from the lake. (PBN 2019a, Section 2.5.1)

3.6.2.2 Hydraulic Properties

The subsurface water table at the site has a definite slope eastward toward the lake. The gradient indicated by test drilling on the site is approximately 30 feet per mile. It is therefore extremely unlikely that any accidental release of radioactivity on the site could spread inland. Furthermore, the rate of subsurface flow is small due to the relatively impervious nature of the soil and will not promote the spread of accidental releases. (PBN 2019a, Section 2.5.1) In general, surface water flow and groundwater flow are both to the east. Soils with horizontal hydraulic conductivity between 10-4 cm/s and 10-6 cm/s limit groundwater flow velocity to between 0.12 and 62 feet per year. (PBN 2017b)

There are no rivers or large streams on or near the site. The surface water on the site flows directly to Lake Michigan either through the storm sewer system or through two small creeks which drain the site. Natural drainage and site topography have proven adequate to remove water from precipitation flooding sources. The bank at PBN is graded so that it slopes down on a 6 percent slope from elevation 23.5 feet at points approximately 300 feet north and south of the intake structure to elevation 7.0 feet (the lowest elevation) at the intake structure. The topography of the site results in adequate natural drainage to remove the maximum amount of precipitation and snowmelt and limit ponding depth to prevent adversely affecting safety-related equipment. (PBN 2019a, Section 2.5.2)

The water level in Lake Michigan is dependent on rainfall and does not vary greatly. Other than the circulating water pumphouse, the lowest plant elevation having drain connections to the lake is 6.3 feet above the highest level recorded to date. The existing natural drainage system now draining the site is adequate to prevent flooding of the site due to rainfall and snowmelt. Thus, there is no danger of inundating equipment due to rainfall, snowmelt, or longtime variation in lake levels. (PBN 2019a, Section 2.10)

3.6.2.3 Potentiometric Surfaces

The Quaternary deposits and Silurian formations are identified as the upper aquifer relative to the confining unit of the Ordovician shales. Regional groundwater flow in the area is generally east, toward Lake Michigan. The subsurface water table at the site has a definite slope eastward toward the lake. (PBN 2019a, Section 2.5.1)

A potentiometric map of the shallow groundwater based on water level data collected in 2016 (as part of the Nuclear Energy Institute's [NEI's] groundwater protection initiative [GPI] program) is provided as Figure 3.6-7. Groundwater generally flows from west to east.

3.6.2.4 Groundwater Protection Program

In May 2006, the NEI implemented the GPI, an industry-wide voluntary effort to enhance nuclear power plant operators' management of groundwater protection (NEI 2007).

Industry implementation of the GPI identifies actions to improve licensee management and response to instances where the inadvertent release of radioactive substances may result in detectable levels of plant-related materials in subsurface soils and water, and also describes communication of those instances to external stakeholders. Aspects addressed by the initiative include site hydrology and geology, site risk assessment, onsite groundwater monitoring, and remediation. In August 2007, NEI published updated guidance on implementing the GPI as NEI 07-07, Industry Ground Water Protection Initiative-Final Guidance Document (NEI 2007). The purpose of NEI 07-07 is to improve the management of situations involving inadvertent radiological releases that get into groundwater and to improve communications with external stakeholders to enhance trust and confidence in the nuclear industry's commitment to a high standard of public radiation safety and protection of the environment.

NEPB implemented an NEI 0707 GPI program in 2008. The 2019 groundwater protection program included 15 wells and three creek sampling locations. This initiative was developed to ensure timely and effective management of situations involving inadvertent releases of licensed material to groundwater. As part of this GPI program, NEPB monitored 14 wells in 2019. One additional well was monitored in 2019 as part of the Radiological Environmental Monitoring Program (REMP). Groundwater samples collected from all 15 wells were analyzed for radionuclides. During 2019, the sampling program consisted of beach drains, intermittent stream and bog locations, drinking water wells, facade wells, yard electrical manholes, groundwater monitoring wells, and the subsurface drainage system sump located in the Unit 2 facade. (PBN 2020a, AMR Part D) Tritium has been detected in groundwater monitoring wells in the vicinity of the power block, as discussed in Sections 3.6.4.2 and 4.5.5.4, but all current measurements are well below the safe drinking water standard. (PBN 2016a; PBN 2017a; PBN 2018b; PBN 2019b; PBN 2020a)

In conjunction with the GPI and the NRC's Decommissioning Planning Rule, 10 CFR 20.1501, PBN performs groundwater monitoring from a total of 44 onsite locations to monitor for potential radioactive releases to groundwater, environmental conditions, and groundwater elevation in accordance with site procedures. Figure 3.6-6 shows locations of the groundwater monitoring wells with construction details presented in Table 3.6-3.

3.6.2.5 Sole Source Aquifers

A sole source aquifer (SSA), as defined by the EPA, is an aquifer which supplies at least 50 percent of the drinking water consumed by the area overlying the aquifer, and there is no reasonably available alternative drinking water source should the aquifer become contaminated. The SSA program was created by the U.S. Congress as part of the Safe Drinking Water Act and allows for the protection of these resources. (EPA 2020c)

PBN is located in EPA Region 5, which has oversight responsibilities for the public water supply in Michigan, Illinois, Indiana, Minnesota, Ohio, Wisconsin, and 35 tribal nations (EPA 2020c). The EPA has designated five aquifers in Region 5 as SSAs, none of which are located in the states of Wisconsin or Michigan. The closest SSA is the St. Joseph aquifer in northern Indiana, approximately 184 miles from PBN and 17 miles southeast of Lake Michigan. Therefore, PBN's property is not situated over any of these designated SSAs. (EPA 2020c)

3.6.3 Water Use

3.6.3.1 Surface Water Use

Lake Michigan is the source of water for cooling and auxiliary water systems at PBN. PBN uses a once-through condenser cooling system with a submerged offshore intake and a surface shoreline discharge. The withdrawal rate from the lake through each condenser (two per unit) is approximately 540 MGD (375,000 gpm) in the summer and 348 MGD (242,000 gpm) in the winter (see Figure 2.2-1). Water is then returned to the lake with minimal net loss. (NRC 2005, Section 2.2.2) The cooling water is discharged back into Lake Michigan through two flumes consisting of well-braced steel sheet piling driven 40 feet into the lakebed and protected by riprap. (PBN 2019a, Section 2.5.2)

Water from Lake Michigan is extensively used for municipal and domestic water supplies (PBN 2019a, Section 2.5.3). Lake Michigan is used as the source of potable water supplies in the vicinity of the site for the cities of Two Rivers (12 miles south), Manitowoc (13 miles south-southwest), Sheboygan (40 miles south), Green Bay (intake at Rostok, 1 mile north of Kewaunee, 13 miles north) and the Central Brown County Water Authority (supplied from Manitowoc). No other potable water uses are recorded within 50 miles of the site along the lakeshore. All public water supplies drawn from Lake Michigan are treated in purification plants. The nearest surface waters used for drinking other than Lake Michigan are the Fox River, 30 miles northwest, and Lake Winnebago, 40 miles west of the site. (PBN 2019a, Section 2.5.1)

Lake Michigan provides safe drinking water for 10 million people, wildlife habitat, food production and processing, an active sport and sustenance fishery, and other valuable commercial and recreational activities (NRC 2005, Section 2.2.3).

The drainage basin for lakes Michigan and Huron comprises 115,700 square miles and has an average annual rainfall of about 31 inches. (PBN 2019a, Section 2.5.2) Lakes Michigan and Huron have been above their monthly average levels since at least November 2015, with their mean level in December 2019 a full 65 inches higher than their record low in 2012. The water level of the two lakes has been above average every month since November 2014, a streak of 62 consecutive months. Unlike all of the other lakes, Michigan and Huron did not meet or exceed any record high levels in 2019, although the lakes came within an inch of their record high monthly levels in June, July, and December. The two lakes peaked in July at a monthly mean level of 581.92 feet. This level was the second-highest July level since 1918, the sixth-highest overall monthly level since 1918, and the highest monthly level since November 1986. (USACE 2020b) Table 3.6-1 presents monthly water levels for 2019 along with long-term mean, maximum, and minimum for 1918 through 2019.

The PBN intake system withdraws once-through cooling water from a submerged intake crib located 1,750 feet from the western shore in Lake Michigan. Water is drawn from the intake crib through two 14-foot diameter pipes buried below the lakebed. (PBN 2019a, Section 2.5.2) The average surface water withdrawal rate by PBN in 2019 was reported as 914.94 MGD and averaged 925.06 MGD between 2015 and 2019 (Table 3.6-4a). A summary of monthly surface water withdrawals reported by PBN between 2015 and 2019 is included as Table 3.6-4b. In 2013, the WDNR approved an increased withdrawal flow restriction of 1,252,823,000 gpd (1,252.823 MGD) from all combined sources with a withdrawal loss per day of 12,537,480 gpd (12.53748 MGD). (WDNR 2013)

In 2015, total surface water withdrawals in Manitowoc County were reported as 1,006.54 MGD, of which 986.87 MGD was used for power generation. The total surface water withdrawals in Kewaunee County along the western shore to the north were reported as 2.32 MGD, of which 1.63 MGD was withdrawn for industrial, self-supplied use, with no reported power generation or public supply uses. Excluding power generation, surface water use for Manitowoc County in 2015 was reported as 19.67 MGD. (USGS 2020d) A summary of surface water use in Manitowoc County is presented in Table 3.6-5.

3.6.3.2 Groundwater Use

Groundwater wells for private use are in existence throughout the region (PBN 2019a, Section 2.5.1).

Groundwater supplies in the vicinity of PBN are obtained primarily from the Silurian aquifer. This aquifer is in the uppermost bedrock, which consists of Silurian-age Niagara dolomite. It lies below approximately 33 meters (110 feet) of unconsolidated glacial material primarily consisting of clay with some sand, silt, and gravel. Underlying the Silurian-age deposits are relatively uniform layers of Ordovician-age formations composed of shale, dolomite, and limestone. Domestic-quality water for drinking and sanitary purposes is withdrawn from groundwater by five active domestic supply wells at PBN. The main well (Site Well No. 001) at PBN is drilled to a depth of 78 meters (257 feet). The normal water level in this well is at 3.5 meters (12 feet) below grade, which indicates an artesian condition in the Silurian aquifer. PBN is not connected to a municipal water system. (NRC 2005, Section 2.2.2) The five onsite domestic water supply wells include:

- E-10 well (Site Well No. 001; DNR High Cap Well # 52824, total depth [TD] 257 feet), which supplies the site with potable water.
- Energy Information Center (EIC) well (Site Well No. 005; DNR High Cap Well # 68865, TD 262 feet), which supplies the EIC with potable water.
- Site Boundary Control Center (SBCC) well (Site Well No. 003; DNR High Cap Well # 52826, TD 300 feet), which supplies the gym with shower and drinking water.
- Warehouse 6 well (Site Well No. 004; DNR High Cap Well # 01176, TD 480 feet), which supplies Warehouse 6 with potable water.
- Warehouse 7 well (Site Well No. 006, DNR High Cap Well # 71777, TD 640 feet), which supplies Warehouse 7 with sanitary (sink and toilet) and fire suppression water (water is not used for drinking).

These five onsite water supply wells are permitted through the WDNR with approved maximum withdrawal rates ranging from 2,000 gpd (1.4 gpm; SBCC Well) to 100,000 gpd (69.4 gpm; Warehouse 7 Well) (WDNR 2011a). The locations of these wells are shown on Figure 3.6-6. There are currently no discharges to groundwater from PBN requiring permits by regulatory agencies.

In 2015, groundwater withdrawals in Manitowoc County were reported as 5.61 MGD with no withdrawal for power generation. Livestock withdrawals were reported as the largest consumption of groundwater, reported at 2.34 MGD in Manitowoc County and 2.00 MGD in Kewaunee County. Public water supply was the next largest groundwater consumer, reporting withdrawals of 1.36 MGD in Manitowoc County and 0.87 MGD in Kewaunee County. (USGS 2020d) A summary of groundwater use in Manitowoc County is presented in Table 3.6-6.

A list of 62 offsite registered groundwater wells within a 2-mile radius from the PBN center point (Figure 3.6-8) is presented in Table 3.6-7. These wells withdraw groundwater from the Silurian aquifer and are used primarily for domestic purposes. (WDNR 2020b; WDNR 2020c)

As a condition of the well permits, NEPB is required to submit an annual report of water withdrawals for the previous year to the WDNR by January 31st of every year. As shown in Table 3.6-8a, the average groundwater withdrawal rate by PBN in 2019 was reported as 10,205.34 gpd and averaged 12,542.09 gpd between 2015 and 2019. Table 3.6-8b shows the monthly withdrawal quantities reported between 2015 and 2019.

3.6.4 Water Quality

3.6.4.1 Surface Water Quality

Lake Michigan and several tributaries to Lake Michigan within Manitowoc and Kewaunee counties appear on the WDNR's 2018 303(d) list of impaired waters (WDNR 2020d). This list includes:

- Ahnapee River, Kewaunee Co.– Polychlorinated biphenyls (PCBs) in fish tissue, total phosphorus, degraded biological community.
- East Twin River, Manitowoc Co. – PCBs and mercury in fish tissue, total phosphorus impairment unknown.
- Fisher Park Beaches, Lake Michigan, Manitowoc Co. – *E. coli* recreational restrictions; pathogens.
- Hika Park Bay Beach, Lake Michigan, Manitowoc Co. – *E. coli* recreational restrictions; pathogens.
- Kewaunee Inner Harbor, Kewaunee River, Kewaunee Co. – unspecified metals; chronic aquatic toxicity, PCBs in fish tissue.
- Kewaunee River, Kewaunee Co. – PCBs in fish tissue.
- Kewaunee River and Marsh, Kewaunee Co. – PCBs in fish tissue, total phosphorus impairment unknown.
- Krok Creek, Kewaunee Co. – total phosphorus degraded biological community.
- Lake Michigan, Great Lakes Shoreline, Kewaunee Co. and Manitowoc Co. – PCBs and mercury in fish tissue.
- Manitowoc River, Manitowoc Co. – PCBs in fish tissue and sediment, total phosphorus, degraded biological community.
- Red Arrow Park Beach, Lake Michigan, Manitowoc Co. – *E. coli*, recreational restrictions; pathogens.
- Selner Park Beach, Lake Michigan, Kewaunee Co. – *E. coli*, recreational restrictions; pathogens.
- Stoney Creek, Kewaunee Co. – Sediment/total suspended solids, degraded habitat.
- Two Rivers Harbor, Manitowoc Co. – Unknown pollutant, chronic aquatic toxicity.
- Warm Water Beach, Lake Michigan, Manitowoc Co. – E. coli, recreational restrictions – pathogens
- West Twin River, Manitowoc Co. – Total phosphorus, PCBs in fish tissue, unknown pollutant; elevated water temperature total phosphorus, low DO.
- YMCA Beach, Lake Michigan, Manitowoc Co. – E. coli, recreational restrictions; pathogens.
- Calvin Creek, Manitowoc Co. – total phosphorus, degraded biological community.
- Molash Creek, Manitowoc River – Total phosphorus, impairment unknown.

The known permitted discharges to Lake Michigan are limited to those from the existing units. These sources and permitted discharge limits are described in the WPDES permit. (PBN 2016a)

PBN is in compliance with its WPDES permit as discussed in Section 3.6.1.2.1, and does not contribute to these impairments.

3.6.4.2 Groundwater Quality

PBN monitors groundwater for tritium as part of its groundwater protection program. From 2015 to 2019, the sampling program consisted of beach drains, intermittent stream and bog locations, drinking water wells, façade wells, yard electrical manholes, groundwater monitoring wells, and the subsurface drainage system sump located in the Unit 2 façade. (PBN 2016a; PBN 2017a; PBN 2018b; PBN 2019b; PBN 2020a)

In the late 1970s, the beach drains entering Lake Michigan were found to contain tritium. The beach drains are the discharge points for the yard drainage system, which carries stormwater runoff, and are known to be infiltrated by groundwater as observed by discharges even when no rain has occurred. In the 1980s, the source of tritium for this pathway was postulated to be spent fuel pool leakage into the groundwater under the plant. Based on this observation, modifications were made to the pool, and the tritium concentrations decreased below the effluent lower limits of detection (LLDs). Beach drain effluents continue to be monitored and are accounted for in the monthly effluent quantification process. Because the beach drains are susceptible to groundwater in-leakage from other sources such as the area around the former retention pond, which is known to contain tritium, the beach drains are monitored as part of the PBN NEI 0707 GPI program. (PBN 2016a; PBN 2017a; PBN 2018b; PBN 2019b; PBN 2020a) For 2019, tritium concentrations detected in the beach drain samples ranged from 186 ± 79 picocuries per liter (pCi/L) to 631 ± 103 pCi/L, far below the EPA drinking water standard of 20,000 pCi/L (PBN 2020a). In addition to tritium, groundwater beach drain samples also are gamma scanned for the same suite of radionuclides as lake water using the lake water LLDs. (PBN 2016a; PBN 2017a; PBN 2018b; PBN 2019b; PBN 2020a). Tritium was the only PBN radionuclide detected above their respective minimum detectable concentration (MDC). (PBN 2020a)

Three intermittent stream locations and the EIC well were added to the groundwater monitoring program in the late 1990s when it was discovered that tritium diffusion from the then operable, earthen retention pond was observable in the intermittent streams which transverse the site in a northwest to southeast direction. A fourth stream location closer to the plant was added in 2008. These streams pass on the eastern and western sides of the former retention pond and empty into Lake Michigan about half a mile south of the plant near the meteorological tower. The intermittent stream samples track tritium in the surface groundwater. (PBN 2016a; PBN 2017a; PBN 2018b; PBN 2019b; PBN 2020a) For the most part, the creek results are barely above the detection level and less than the MDC. The highest averages are for the East Creek and the sewage treatment plant, which are in the groundwater flow path from the retention pond area to Lake Michigan. The analyses of these surface water samples in 2019 show low concentrations of tritium ranging from non-detectable to 238 ± 85 pCi/L. (PBN 2020a)

As part of the PBN NEI 0707 GPI program, groundwater samples are collected from selected onsite monitoring wells and analyzed for radionuclides to detect potential impacts to groundwater from inadvertent leaks or spills. Wells are typically sampled quarterly, semi-annually, or annually.

Groundwater monitoring indicates that low levels of tritium continue to occur in the upper soil layer but not in the deep drinking water aquifer. These results also indicate that the low levels of tritium are restricted to a small, well defined area close to the plant. Results from precipitation analysis show that airborne tritium concentrations are higher close to the plant as compared to results at the site boundaries. The observed tritium concentrations (ranging from 97 ± 78 to 311 ± 89 pCi/L in 2019) in the yard manholes can be explained by the higher tritium in precipitation close to the plant. In addition to tritium captured by precipitation, the beach drains also receive the tritium captured in the AC condensate because the condensate drainage is connected to the yard drain system. Tritium continues in the soil below the plant foundation as evidenced by results from the subsurface drainage system (ranging from 808 ± 110 to 10877 ± 318 pCi/L in 2019) and from the facade wells (ranging from non-detectable to 254 ± 89 pCi/L in 2019). (PBN 2020a)

In conclusion, the groundwater tritium concentrations observed at PBN are below the EPA drinking water standards (maximum contaminant level of 20,000 pCi/L) prior to emptying into Lake Michigan, where they will undergo further dilution. All analyses to date indicate that the drinking water contains no tritium. None of the tritium in the upper soil layer is migrating offsite toward the surrounding population. This is based on the known west-to-east groundwater flow toward Lake Michigan and the results from the two monitoring wells west of the plant [MW-6 (GW-12) and MW-2 (GW-13)]. Additionally, because no tritium is detected in either of the four onsite drinking water wells close to the power block or from the drinking water well at the site boundary, none of the tritium observed in the upper soil layer has penetrated into the drinking water aquifer to impact either onsite or offsite personnel. (PBN 2020a)

Procedures and plans are in place to protect the water quality at PBN. Industrial practices at PBN that involve the use of chemicals are those activities typically associated with painting, cleaning of parts/equipment, refueling of onsite vehicles/generators, fuel oil and gasoline storage, and the storage and use of water treatment additives. The use and storage of chemicals at PBN are controlled in accordance with NEPB procedures and site-specific spill prevention plans. In addition, as presented in Section 2.2.7, nonradioactive waste is managed in accordance with PBN's waste management procedure, which contains preparedness and prevention control measures.

3.6.4.2.1 History of Radioactive Releases

No unplanned radioactive liquid or gaseous releases were reported between 2015 and 2019. (PBN 2016a; PBN 2017a; PBN 2018b; PBN 2019b; PBN 2020a)

3.6.4.2.2 History of Nonradioactive Releases

Based on the review of site records from the 5 years from 2015–2019, there has been one inadvertent nonradioactive release that would be classified as an incidental spill.

On December 20, 2018, NEPB notified the WDNR of contaminated soil which was found during site excavation activities conducted on December 7, 2018. As part of cathodic protection installation, 10 boreholes were excavated between the circulating water pumphouse and the turbine building. One of the 10 boreholes had evidence of soil contamination. A sample was obtained from 3-4 feet below land surface and sent to a lab for diesel range organics (DRO), gasoline range organics (GRO), and metals analysis. Results from the lab analysis (DRO 171 mg/kg and GRO 44.9 mg/kg) confirmed diesel and gas organics in the soil sample. Approximately 600 pounds of soil were removed from the contaminated excavation hole and disposed at Waste Management's Ridgeview landfill. A confirmation soil sample was collected on February 25, 2019, and analyzed for volatile organic compounds (VOCs). No VOCs were detected above the laboratory's detection limit. The impacted soil from the excavation was disposed at Waste Management's Ridgeway landfill. (PBN 2019d)

There was no indication of any active leakage. This information, combined with the location of the excavation, supports that this discovery is related to a minor historical leak or spill. The WDNR issued a "No Further Action" letter on March 20, 2019. (WDNR 2019a)

Table 3.6-1 Lakes Michigan-Huron Water Levels, 1918–2019

Month	Jan	Feb	March	April	May	June	July	Aug	Sept	Oct	Nov	Dec	Annual
2019	580.09	580.15	580.25	580.58	580.27	578.76	581.92	581.76	581.59	581.66	581.56	581.53	581.17
MEAN	578.41	578.38	578.44	578.71	579.04	579.27	579.36	579.30	579.13	578.90	578.71	578.58	578.84
MAX	581.30	581.07	581.10	581.46	581.63	581.79	581.99	581.99	581.96	582.35	581.96	581.56	--
	1987	1986	1986	1986	1986	1986	1986	1986	1986	1986	1986	1986	--
MIN	576.02	576.08	576.05	576.15	676.57	676.647	676.71	676.67	676.64	676.44	676.28	676.15	--
	2013	1964	1964	1964	1964	1964	1964	1964	1964	1964	1964	2012	--

(WC 2020)

Elevations are referenced to the International Great Lake Datum of 1985.

Table 3.6-2 WPDES Water Quality Monitoring Program (Sheet 1 of 3)

Outfall	Description	Parameter	Permit Requirement	Frequency
001	Unit 1 condenser cooling water discharge to Lake Michigan	Flow Rate	No limit, monitor and report total daily in MGD	1/daily
		Temperature Maximum	No limit, monitor continuously and report daily in °F	daily
		pH	6.0–9.0 standard units (SU)	weekly
		Temperature Maximum	Calculated in degrees °F	hourly
		Temperature Average	Calculated in degrees °F	hourly
		Halogen, Total Residual as C12	38 ug/L limit, daily grab	daily
		Acute Whole Effluent Toxicity (WET)	24-hour flow prop comp. in TUa	2017, 3rd quarter, 2019, 2nd quarter, 2021, 1st quarter
		Chronic WET	24-hour flow prop comp. in rTUc	2017, 3rd quarter, 2019, 2nd quarter, 2021, 1st quarter
		Additive -Water Treatment - Specify	0.071 mg/L limit, daily grab	daily
		Phosphorous, Total	No limit, monitor and report in mg/L, monthly grab	monthly
		Heat	8,273 MBtu/hour, calculate and report weekly average	daily
002	Unit 2 condenser cooling water discharge to Lake Michigan	Flow Rate	No limit, monitor and report total daily in MGD	daily
		pH	6.0–9.0 SU	weekly
		Temperature Maximum	Calculated in degrees °F	daily
		Temperature Average	Calculated in degrees °F	daily
		Halogen, Total Residual as C12	38 ug/L, daily grab.	daily

Table 3.6-2 WPDES Water Quality Monitoring Program (Sheet 2 of 3)

Outfall	Description	Parameter	Permit Requirement	Frequency
002 (cont.)	Unit 2 condenser cooling water discharge to Lake Michigan (cont.)	Acute WET	24-hour flow prop comp. in TUa	2017-3rd quarter, 2019 2nd quarter, 2021-1st quarter
		Chronic WET	24-hour flow prop comp. in rTUc	2017-3rd quarter, 2019 2nd quarter, 2021-1st quarter
		Additive - Water Treatment - Specify	0.071 mg/L limit, daily grab	daily
		Phosphorous, Total	No limit, monitor and report in mg/L, monthly grab	monthly
		Heat	8,273 MBtu/hour, calculate and report weekly average	daily
004	Intake De-Icing	Flow Rate	No limit, monitor and report total per occurrence in MGD	1/occurrence
101 102 103 106 107	Demineralizer Regeneration Neutralization Tank Discharge Unit 1 Steam Generation Blowdown Unit 2 Steam Generation Blowdown Plant Process Water Reverse Osmosis Reject Wastewater Microfiltration Unit Backwash (from PBN's make-up water treatment system)	Flow Rate	No limit, monitor and report total daily in MGD	monthly
		Suspended Solids, Total	100 mg/L limit, daily max grab	monthly
		Suspended Solids, Total	30 mg/L limit, monthly average grab	monthly
		Oil and Grease (Hexane)	20 mg/L limit, daily max grab reported on an annual basis	annual
		Oil and Grease (Hexane)	15 mg/L limit, monthly average grab	annual

Table 3.6-2 WPDES Water Quality Monitoring Program (Sheet 3 of 3)

Outfall	Description	Parameter	Permit Requirement	Frequency
104	Sewage Treatment Plant Effluent	Flow Rate	No limit, monitor and report total daily in MGD	weekly
		BOD5, Total	30 mg/L limit, monthly average of a 24-hour composite	weekly
		BOD5, Total	45 mg/L limit, weekly average of a 24-hour composite	weekly
		Suspended Solids, Total	30 mg/L limit, monthly average of a 24-hour composite	weekly
		Suspended Solids, Total	45 mg/L limit, weekly average of a 24-hour composite	weekly
		pH Field	No limit, monitor, grab and report in SU	weekly
105	Low Volume Wastewater Effluent (discharge of sanitary wastewater effluent, turbine hall sumps and floor drains, facade sumps, water treatment plant backwash, heating steam condensate, and potable water treatment system filter backwash and reverse osmosis reject wastewater)	Flow Rate	No limit, monitor and report total daily in MGD	weekly
		Suspended Solids, Total	100 mg/L limit, daily max of a 24-hour composite	weekly
		Suspended Solids, Total	30 mg/L limit, monthly average of a 24-hour composite	weekly
		Oil and Grease (Hexane)	20 mg/L limit, daily max grab reported on an annual basis	monthly
		Oil and Grease (Hexane)	15 mg/L limit, monthly average grab	monthly
		pH Field	No limit, monitor, grab and report in SU	weekly

(PBN 2016a)

mg/L = milligram per liter

Table 3.6-3 PBN Groundwater Monitor Well Details

Well	Well Diameter[a]	Elevations (feet mean sea level)					Well Construction Material
		Top of Casing	Top of Filter[b]	Top of Screen[b]	Bottom of Screen[b]	Bottom of Filter[b]	
MW-1 (GW-11)	2	602.21	595.9	595.17	580.17	579.7	PVC
MW-2 (GW-12)	2	615.84	607.8	605.81	590.81	588.8	PVC
MW-3 (GW-16)	2	610.54	604.3	601.51	586.51	585.5	PVC
MW-4 (GW-15)	2	625.11	616.3	613.27	598.27	598.3	PVC
MW-5 (GW-14)	2	601.01	595.3	594.31	581.31	581.3	PVC
MW-6 (GW-13)	2	621.67	615.9	615.69	600.69	600.7	PVC
EIC (GW-04, Site Well #5)	6	—	—	—	—	—	Steel
SBCC (GW-05, Site Well #3)	6	—	—	—	—	—	Steel
Main (E10, Site Well #1)	6	—	—	—	—	—	Steel
Warehouse 6 (GW-06, Site Well #4)	6	—	—	—	—	—	Steel
Warehouse 7 (GW-18, Site Well #6)	6	—	—	—	—	—	Steel
1Z-361A (GW-09A, Unit 1 Façade Well A)	2	—	—	—	—	—	PVC
1Z-361B (GW-09B, Unit 1 Façade Well B)	2	—	—	—	—	—	PVC
2Z-361A (GW-10A, Unit 2 Façade Well A)	2	—	—	—	—	—	PVC
2Z-361B (GW-10B, Unit 2 Façade Well B)	2	—	—	—	—	—	PVC

(PBN 2017b; PBN 2020a)

a. Measured in inches. b. Approximate measurement. — = No data reported.

Table 3.6-4a PBN Yearly Surface Water Withdrawal Summary

Year		2015	2016	2017	2018	2019	2015–2019
Monthly Maximum	MGM	33,814.80	33,814.80	34,124.80	34,124.80	34,124.80	34,124.80
	gpm_a	757,500	757,500	764,444	764,444	764,444	764,444
Monthly Average	MGM	29,024.06	28,779.99	27,557.74	27,573.54	27,829.36	28,152.94
	gpm_a	662,208	655,236	628,782	627,646	634,463	641,667
Monthly Minimum	MGM	20,059.20	15,380.10	17,291.00	19,415.20	16,019.50	15,380.10
	gpm_a	463,555	344,536	387,343	464,923	370,821	344,536
Yearly Total	MGY	348,288.70	345,359.90	330,692.90	330,882.50	333,952.30	337,835.26
	MGD	954.22	943.61	906.01	906.53	914.94	925.06

(PBN 2016b; PBN 2017c; PBN 2018c; PBN 2019c; PBN 2020b)

MGY = millions of gallons per year; MGD = millions of gallons per day; MGM = millions of gallons per month

gpm_a = average gallons per minute (for the month)

Table 3.6-4b PBN Monthly Surface Water Withdrawal Summary (Sheet 1 of 2)

Month	CW Intake (MGM)	Total (gpm)
January-2015	22,208.40	497,500.00
February-2015	20,059.20	497,500.00
March-2015	22,208.40	497,500.00
April-2015	31,803.80	736,199.07
May-2015	33,814.80	757,500.00
June-2015	32,724.00	757,500.00
July-2015	33,814.80	757,500.00
August-2015	33,814.80	757,500.00
September-2015	32,724.00	757,500.00
October-2015[a]	20,693.10	463,555.11
November-2015	31,558.20	730,513.89
December-2015	32,865.20	736,227.60
January-2016	21,495.40	481,527.78
February-2016	20,108.60	481,527.78
March-2016	15,380.10	344,536.29
April-2016	30,446.60	704,782.41
May-2016	32,204.20	721,420.25
June-2016	32,405.10	750,118.06
July-2016	33,814.80	757,500.00
August-2016	33,814.80	757,500.00
September-2016	32,724.00	757,500.00
October-2016	33,720.40	755,385.30
November-2016	31,930.60	739,134.26
December-2016	27,315.30	611,901.88
January-2017	21,495.40	481,527.78
February-2017	19,415.20	481,527.78
March-2017	17,291.00	387,343.19
April-2017	23,231.20	537,759.26
May-2017	33,814.80	757,500.00
June-2017	32,784.70	758,905.09
July-2017	34,124.80	764,444.44
August-2017	34,124.80	764,444.44

Table 3.6-4b PBN Monthly Surface Water Withdrawal Summary (Sheet 2 of 2)

Month	CW Intake (MGM)	Total (gpm)
September-2017	33,024.00	764,444.44
October-2017	22,427.30	502,403.67
November-2017	32,542.50	753,298.61
December-2017	26,417.20	591,783.15
January-2018	21,495.40	481,527.78
February-2018	19,415.20	464,923.37
March-2018	21,495.40	481,527.78
April-2018	20,802.00	481,527.78
May-2018	33,515.80	750,801.97
June-2018	33,024.00	764,444.44
July-2018	34,124.80	764,444.44
August-2018	34,124.80	764,444.44
September-2018	33,024.00	764,444.44
October-2018	24,505.90	548,967.29
November-2018	33,024.00	764,444.44
December-2018	22,331.20	500,250.90
January-2019	21,495.40	481,527.78
February-2019	19,415.20	481,527.78
March-2019	18,887.90	423,116.04
April-2019	16,109.50	370,821.76
May-2019	33,365.30	747,430.56
June-2019	33,024.00	764,444.44
July-2019	34,124.80	764,444.44
August-2019	34,124.80	764,444.44
September-2019	33,024.00	764,444.44
October-2019	34,124.80	764,444.44
November-2019	33,024.00	764,444.44
December-2019	23,322.60	522,459.68

(PBN 2016b; PBN 2017c; PBN 2018c; PBN 2019c; PBN 2020b)

a. Unit 2 refueling outage during October 2015, March 11-April 8th 2016: Unit 1, March 18-April 13th 2017: Unit 2, October 7-28th 2017: Unit 1, October 6-30th 2018: Unit 2, March 23rd-April 20th 2019: Unit 1.

MG = millions of gallons; MGM = millions of gallons per month

Table 3.6-5 Surface Water Usage Summary in MGD, 2015

Category	Manitowoc County	Kewaunee County
Public Supply	14.32	0.00
Domestic, self-supplied	0.00	0.00
Industrial, self-supplied	0.18	1.63
Irrigation	0.01	0.00
Livestock	0.26	0.22
Aquaculture	0.00	0.47
Mining	4.90	0.00
Power Generation (thermoelectric)	986.87	0.00
Total	**1,006.54**	**2.32**

(USGS 2020d)

Table 3.6-6 Groundwater Usage Summary in MGD, 2015

Category	Manitowoc County	Kewaunee County
Public Supply	1.36	0.87
Domestic, self-supplied	1.20	0.46
Industrial, self-supplied	0.33	0.54
Irrigation	0.28	0.22
Livestock	2.34	2.00
Aquaculture	0.10	0.02
Mining	0.00	0.00
Power Generation (thermoelectric)	0.00	0.00
Total	**5.61**	**4.11**

(USGS 2020d)

Table 3.6-7 Registered Offsite Groundwater Wells, 2-Miles from NEPB, LLC Center Point (Sheet 1 of 2)

Map ID	WDNR Unique ID	Distance[a] (miles)	Well Depth (feet)	Use Description	Aquifer Name
1	MG210[b]	1.0	142	Private, potable	Silurian dolomite
2	DO403	1.1	201	Private, potable	Silurian dolomite
3	HW166	1.2	181	Private, potable	Silurian dolomite
4	8IY253	1.2	182	Non-community public well	Silurian dolomite
5	8MI241	1.2	125	Agricultural barn use[d]	Silurian dolomite
6	NB216 [b]	1.3	103	Private, potable	Silurian dolomite
7	WG352	1.3	250	Private, potable	Silurian dolomite
8	AE110	1.3	182	Private, potable	Silurian dolomite
9	ZS159	1.3	200	Private, potable	Silurian dolomite
10	8JA921	1.3	119	Potable domestic[d]	Silurian dolomite
11	8JA922	1.3	110	Potable domestic[d]	Silurian dolomite
12	SC696	1.4	282	Private, potable	Silurian dolomite
13	EJ290	1.4	167	Private, potable	Silurian dolomite
14	FL385	1.4	160	Private, potable	Silurian dolomite
15	HT707	1.4	200	Private, potable	Silurian dolomite
16	8IY264	1.4	160	Potable domestic[d]	Silurian dolomite
17	8JA920	1.4	161	Potable domestic[d]	Sand and gravel
18	IY190	1.5	263	Non-community public well	Silurian dolomite
19	DB117	1.5	123	Private, potable	Silurian dolomite
20	ZS701	1.5	125	Private, potable	Silurian dolomite
21	UL414	1.5	202	Private, potable	Silurian dolomite
22	WO574	1.5	260	Private, potable	Silurian dolomite
23	ZU351	1.5	158	Private, potable	Silurian dolomite
24	8JA923	1.5	170	Unknown potable domestic	Silurian dolomite
25	CY815	1.6	123	Private, potable	Silurian dolomite
26	8JA919	1.6	168	Potable domestic[d]	Sand and gravel
27	ML746	1.7	180	Private, potable	Silurian dolomite
28	GH542	1.7	163	Private, potable	Silurian dolomite
29	TQ628	1.7	142	Private, potable	Silurian dolomite
30	WG653	1.7	260	Private, potable	Silurian dolomite
31	MB069	1.7	200	Private, potable	Silurian dolomite
32	QS857	1.7	202	Private, potable	Silurian dolomite
33	8IY252	1.7	143	Unknown potable public (camping area)	Silurian dolomite

Table 3.6-7 Registered Offsite Groundwater Wells, 2-Miles from NEPB, LLC Center Point (Sheet 2 of 2)

Map ID	WDNR Unique ID	Distance[a] (miles)	Well Depth (feet)	Use Description	Aquifer Name
34	8JA908	1.7	127	Unknown potable municipal park	Silurian dolomite
35	8MI004	1.7	59	Unknown potable domestic	Silurian dolomite
36	QQ877 [c]	1.8	153	Non-community public well	Silurian dolomite
37	AE100	1.8	123	Private, potable	Silurian dolomite
38	FI360	1.8	227	Private, potable	Silurian dolomite
39	IJ553	1.8	204	Private, potable	Silurian dolomite
40	FN543	1.8	222	Private, potable	Silurian dolomite
41	UG750	1.8	198	Private, potable	Silurian dolomite
42	WU446	1.8	122	Private, potable	Silurian dolomite
43	8IY276	1.8	118	Potable domestic[d]	Silurian dolomite
44	8JA960	1.8	110	Potable domestic[d]	Sand and gravel
45	HL797	1.9	122	Private, potable	Silurian dolomite
46	WW821	1.9	105	Private, potable	Silurian dolomite
47	KL695	1.9	115	Private, potable	Silurian dolomite
48	OL580	1.9	220	Private, potable	Silurian dolomite
49	LH222 [c]	1.9	103	Non-community public well	Silurian dolomite
50	RN013	1.9	162	Non-community public well	Silurian dolomite
51	QQ376 (replacement for LH222)	1.9	102	Private, potable	Silurian dolomite
52	8IY254	1.9	143	Unknown	Silurian dolomite
53	8JA909	1.9	120	Potable domestic[d]	Silurian dolomite
54	8JA955	1.9	152	Potable domestic and agriculture[d]	Silurian dolomite
55	8MI002	1.9	78	Unknown	Silurian dolomite
56	DS874	2.0	103	Private, potable	Silurian dolomite
57	MW111	2.0	290	Private, potable	Silurian dolomite
58	LV895	2.0	201	Private, potable	Silurian dolomite
59	HB020	2.0	110	Private, potable	Silurian dolomite
60	LJ195	2.0	220	Private, potable	Silurian dolomite
61	ZB485	2.0	181	Private, potable	Silurian dolomite
62	8JA907	2.0	75	Potable domestic[d]	Silurian dolomite

(WDNR 2020b, WDNR 2020c)

a. Distance is from the PBN center point and rounded to the nearest tenth of a mile. Wells listed are limited to those within a 2-mile radius.

b. Well is listed as permanently abandoned.

c. Well is listed as inactive.

d. Use shown as "unknown" by WDNR electronic file, use in table was taken from driller's well log

Table 3.6-8a PBN Yearly Groundwater Withdrawal Summary

Year		2015	2016	2017	2018	2019	2015–2019
Monthly Maximum	gals	569,610	570,564	549,573	536,530	389,423	570,564
	gpm_a	12.76	12.78	12.31	12.02	9.01	12.78
Monthly Average	gals	402,217	423,722	447,294	324,955	310,412	381,720
	gpm_a	9.19	9.66	10.22	7.43	7.10	8.72
Monthly Minimum	gals	260,349	281,431	349,365	219,038	200,707	200,707
	gpm_a	5.83	6.30	8.09	4.91	4.50	4.50
Yearly Total	gals/yr	4,826,609	5,084,668	5,367,530	3,899,456	3,724,949	4,580,642
	gpd_a	13.223.59	13,892.54	14,705.56	10,683.44	10,205.34	12,542.09

(PBN 2016b; PBN 2017c; PBN 2018c; PBN 2019b; PBN 2020b)

gpd_a = average gallons per day (for the month)

gpm_a = average gallons per minute (for the month)

Table 3.6-8b PBN Monthly Groundwater Withdrawal Summary (Sheet 1 of 3)

Month	EIC Well (gals)	Main Well (gals)	Site Boundary Control Center Well (gals)	Warehouse 6 Well (gals)	Warehouse 7 Well (gals)	Total (gals)	Total (gpm_a)
January-2015	5,191	239,250	4,008	9,400	2,500	260,349	5.83
February-2015	7,316	381,165	6,882	8,100	700	404,163	10.02
March-2015	5,326	294,915	5,610	11,400	200	317,451	7.11
April-2015	14,308	317,408	4,751	6,400	2,200	345,067	7.99
May-2015	7,357	385,623	5,087	7,000	3,400	408,467	9.15
June-2015	6,643	371,089	7,019	6,300	1,500	392,551	9.09
July-2015	6,196	379,317	6,316	6,900	110,300	509,029	11.40
August-2015	9,397	394,883	4,709	4,300	60,700	473,989	10.62
September-2015	12,282	378,992	5,581	7,150	17,200	421,205	9.75
October-2015	7,897	534,474	4,869	8,470	13,900	569,610	12.76
November-2015	10,475	397,384	8,243	5,480	19,000	440,582	10.20
December-2015	5,199	270,570	4,677	3,400	300	284,146	6.37
January-2016	7,489	417,679	8,163	6,970	2,600	442,901	9.92
February-2016	5,984	388,400	7,603	6,070	1,000	409,057	9.80
March-2016	4,881	412,695	7,107	4,960	3,700	433,343	9.71
April-2016	8,088	441,205	8,213	5,900	6,100	469,506	10.87
May-2016	4,447	295,031	5,119	4,000	2,100	310,697	6.96
June-2016	6,065	471,388	8,036	5,300	32,500	523,289	12.11
July-2016	6,108	482,529	6,125	9,440	2,300	506,502	11.35
August-2016	4,032	307,630	3,925	2,560	300	318,447	7.13

Table 3.6-8b PBN Monthly Groundwater Withdrawal Summary (Sheet 2 of 3)

Month	EIC Well (gals)	Main Well (gals)	Site Boundary Control Center Well (gals)	Warehouse 6 Well (gals)	Warehouse 7 Well (gals)	Total (gals)	Total (gpm[a])
September-2016	6,092	455,353	6,425	4,800	400	473,070	10.95
October-2016	7,040	537,919	6,155	6,050	13,400	570,564	12.78
November-2016	4,263	330,294	4,544	3,060	3,700	345,861	8.01
December-2016	4,365	269,456	4,620	2,290	700	281,431	6.30
January-2017	6,700	458,168	7,846	5,200	2,300	480,214	10.76
February-2017	5,673	464,902	7,858	5,900	2,100	486,433	12.06
March-2017	6,427	530,145	6,321	5,980	700	549,573	12.31
April-2017	4,400	346,185	5,623	4,770	5,700	366,678	8.49
May-2017	3,960	404,746	5,502	4,580	1,500	420,288	9.42
June-2017	2,540	406,654	4,863	3,670	36,700	454,427	10.52
July-2017	2,500	401,300	4,683	3,230	900	412,613	9.24
August-2017	4,500	432,258	5,588	3,670	3,000	449,016	10.06
September-2017	3,172	502,742	5,419	6,560	11,100	528,993	12.25
October-2017	3,028	422,700	4,318	5,540	600	436,186	9.77
November-2017	2,800	331,072	8,293	4,900	2,300	349,365	8.09
December-2017	2,300	424,716	3,828	2,200	700	433,744	9.72
January-2018	3,000	345,666	6,014	3,600	400	358,680	8.03
February-2018	1,342	341,546	4,958	3,400	9,900	361,146	8.96
March-2018	3,212	231,600	5,675	4,100	0	244,587	5.48
April-2018	2,646	238,900	5,915	4,300	7,700	259,461	6.01

Table 3.6-8b PBN Monthly Groundwater Withdrawal Summary (Sheet 3 of 3)

Month	EIC Well (gals)	Main Well (gals)	Site Boundary Control Center Well (gals)	Warehouse 6 Well (gals)	Warehouse 7 Well (gals)	Total (gals)	Total (gpm_a)
May-2018	2,800	251,440	5,906	4,100	6,700	270,946	6.07
June-2018	2,100	316,360	7,828	7,000	31,800	365,088	8.45
July-2018	1,600	210,400	3,038	1,900	2,100	219,038	4.91
August-2018	2,019	312,499	8,008	4,440	600	327,566	7.34
September-2018	1,927	325,401	14,293	4,460	900	346,981	8.03
October-2018	2,405	444,178	78,317	11,230	400	536,530	12.02
November-2018	2,106	230,178	79,517	4,870	400	317,071	7.34
December-2018	1,343	256,134	31,285	3,200	400	292,362	6.55
January-2019	2,300	304,834	6,043	4,700	500	318,377	7.13
February-2019	2,900	292,176	5,017	5,110	400	305,603	7.58
March-2019	1,100	283,564	2,268	3,090	500	290,522	6.51
April-2019	2,532	363,976	4,378	8,200	1,300	380,386	8.81
May-2019	708	269,792	4,574	3,800	500	279,374	6.26
June-2019	1,132	276,992	5,106	11,000	9,700	303,930	7.04
July-2019	1,028	368,446	4,622	4,700	1,300	380,096	8.51
August-2019	780	288,016	2,980	4,430	2,300	298,506	6.69
September-2019	549	377,678	4,426	4,170	2,600	389,423	9.01
October-2019	413	190,736	7,168	1,990	400	200,707	4.50
November-2019	934	309,000	5,560	5,240	2,100	322,834	7.47
December-2019	664	246,669	4,388	2,970	500	255,191	5.72

(PBN 2016b; PBN 2017c; PBN 2018c; PBN 2019c; PBN 2020b)

gpm_a = average gallons per minute (for the month)

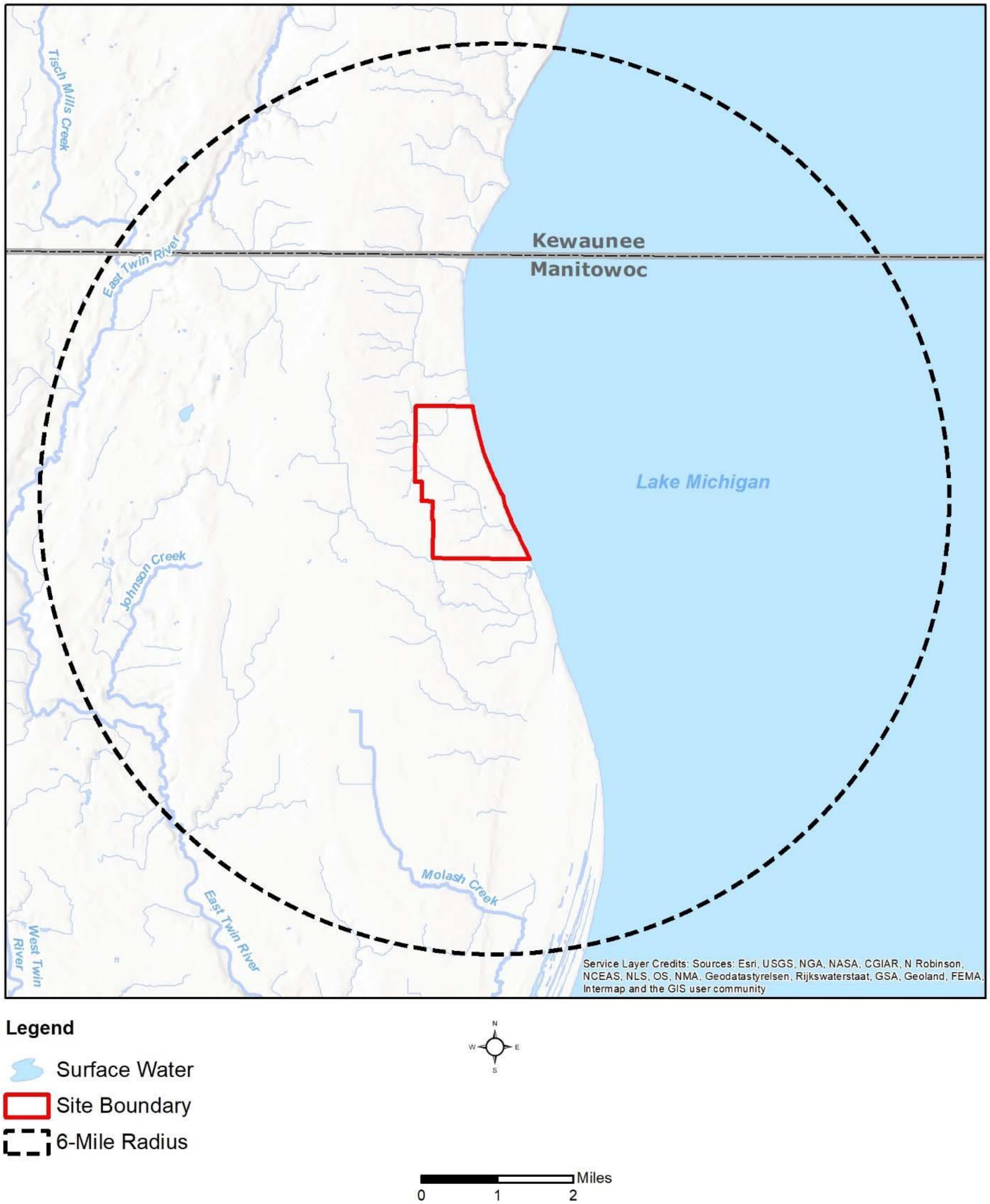


Figure 3.6-1 Vicinity Hydrological Features

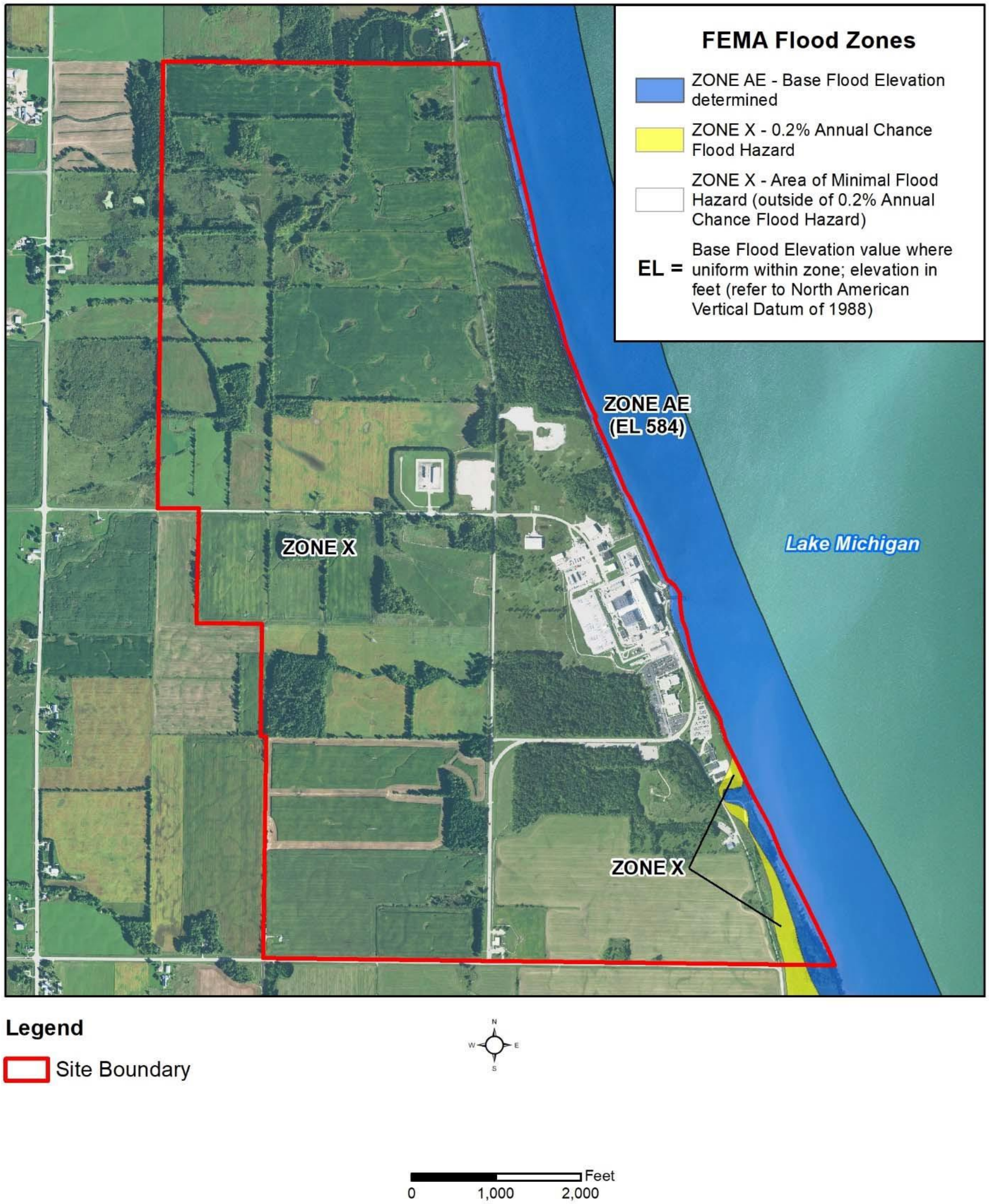


Figure 3.6-2 FEMA Floodplain Zones at PBN

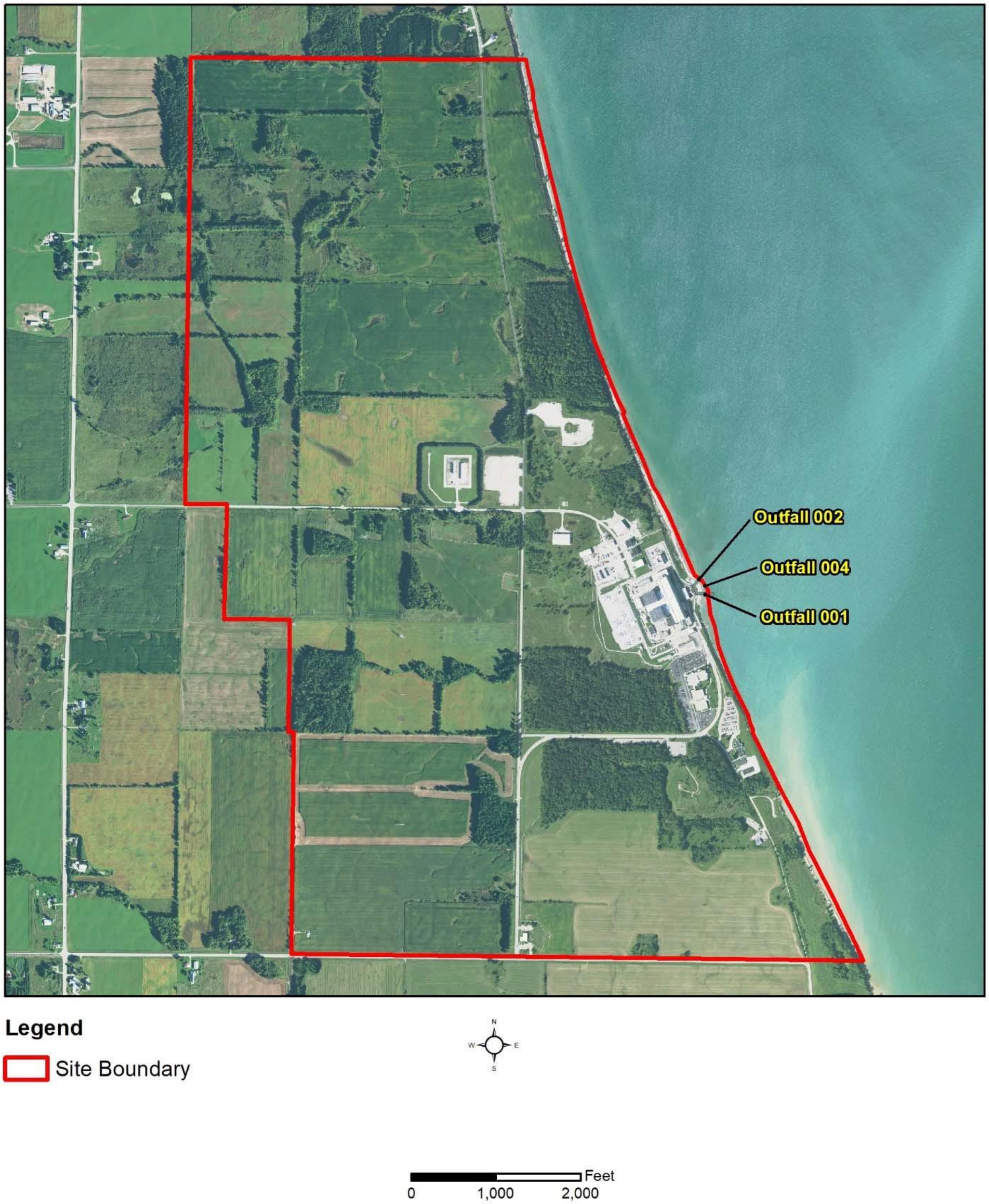


Figure 3.6-3 WPDES Outfalls

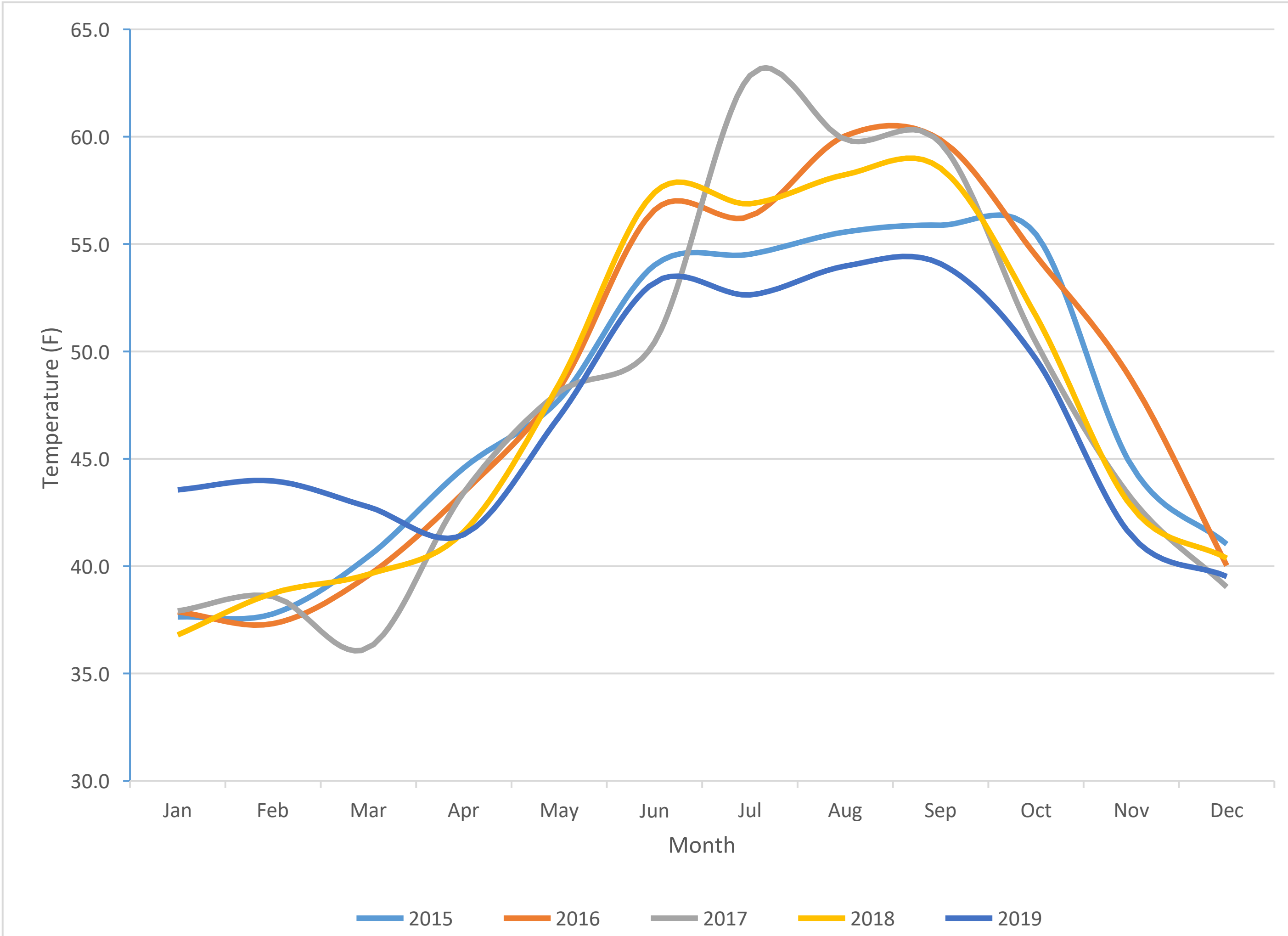


Figure 3.6-4 Average Condenser Intake Temperature

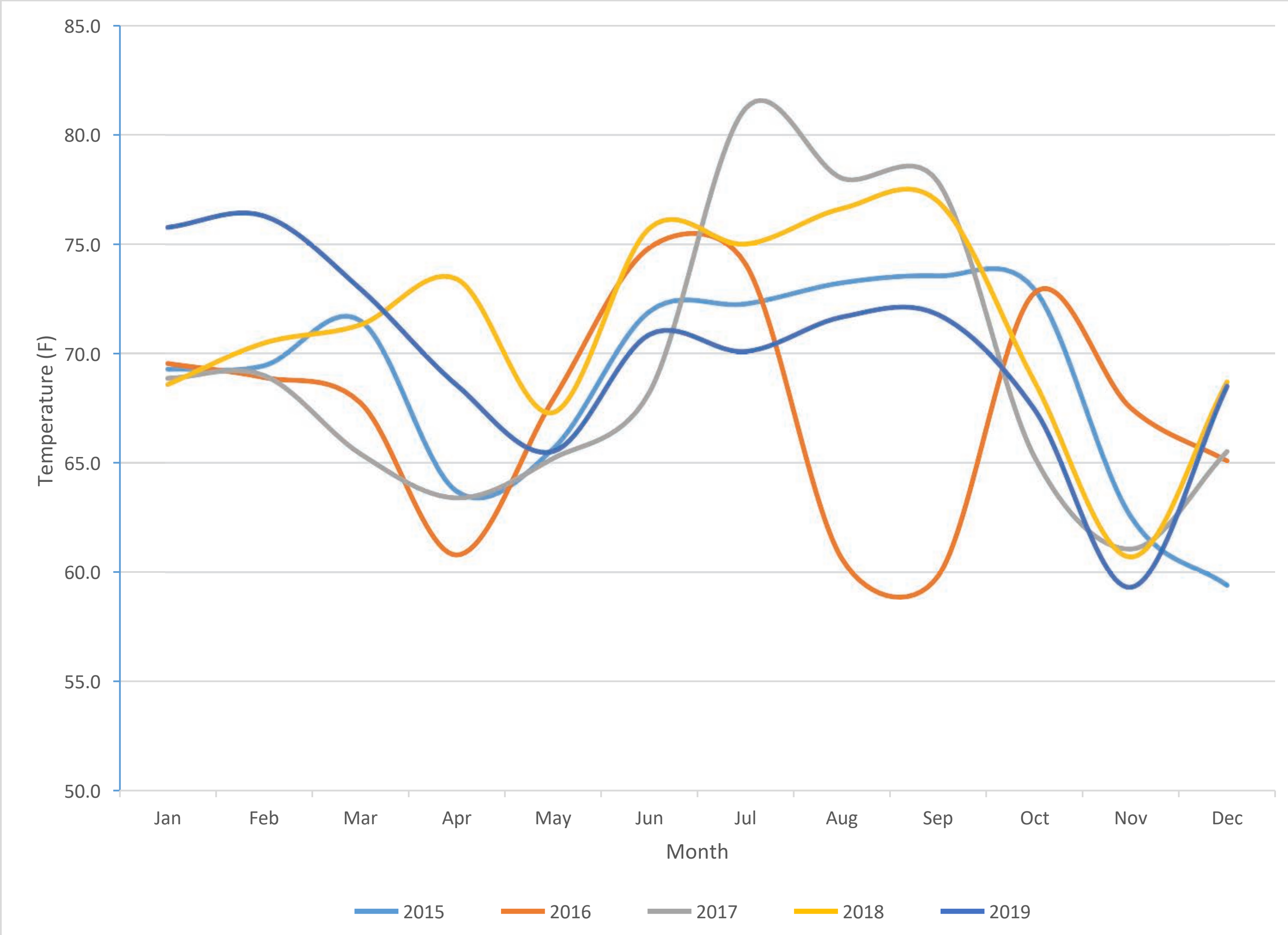


Figure 3.6-5 Average Condenser Discharge Temperature

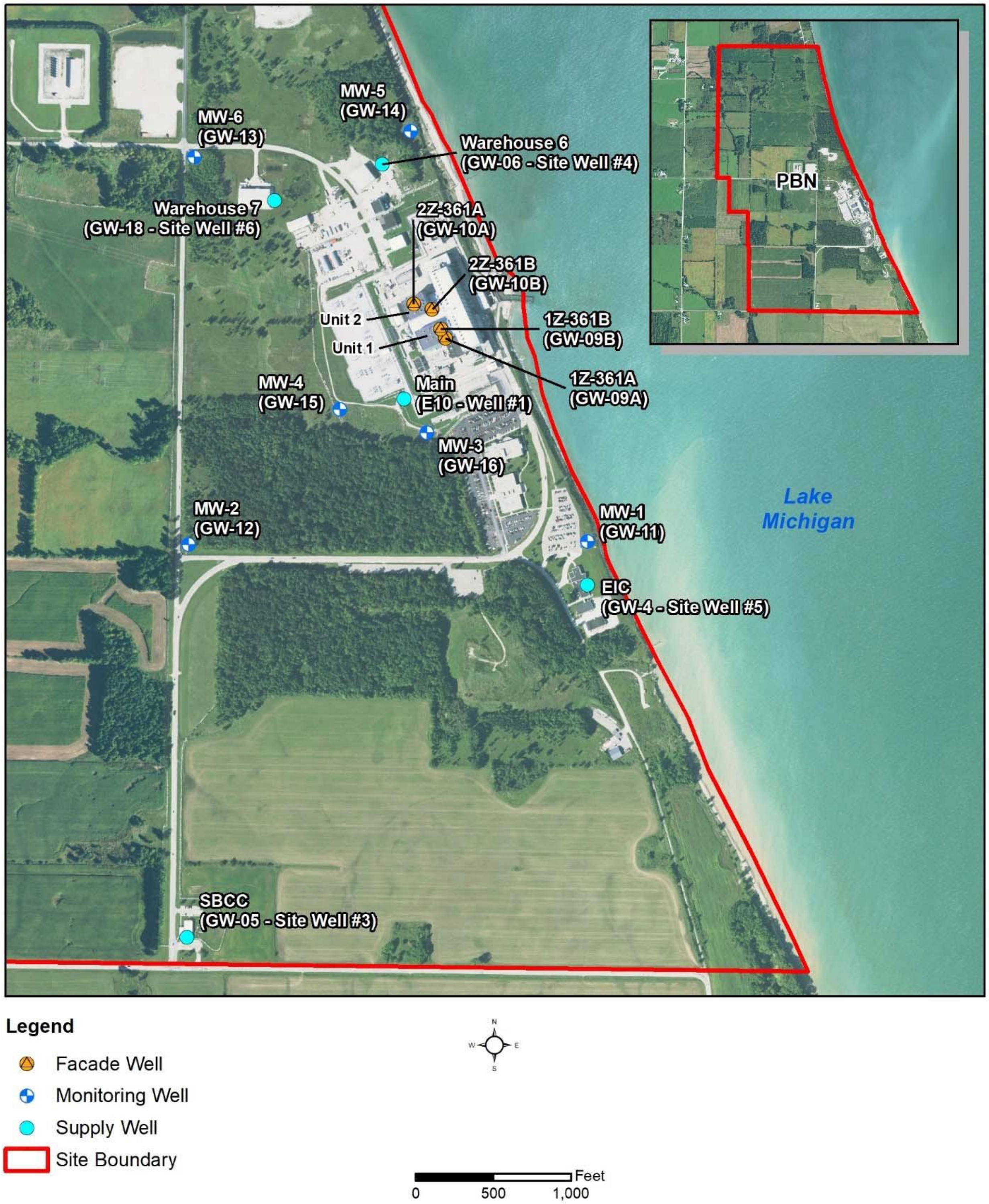


Figure 3.6-6 Well Locations Onsite

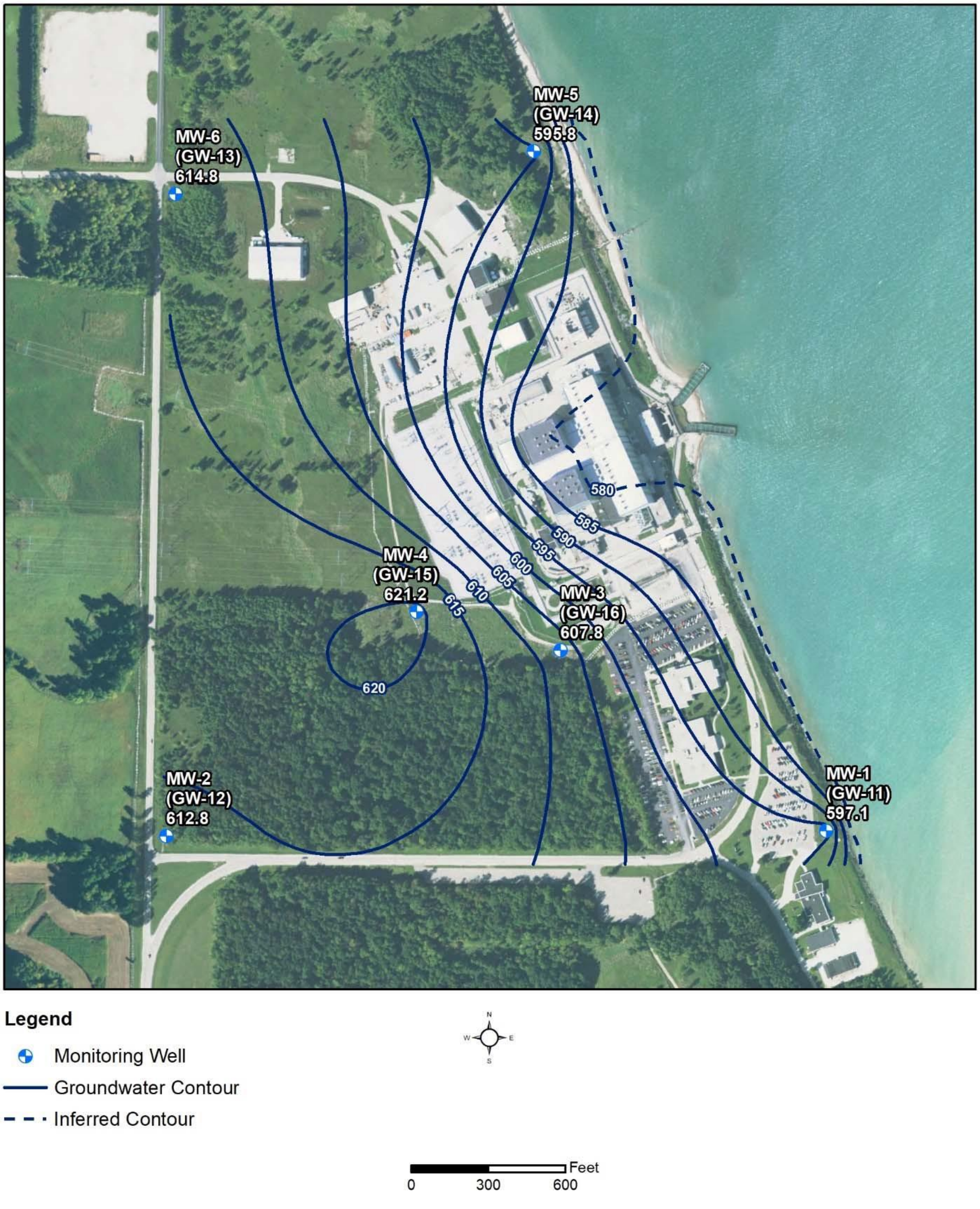


Figure 3.6-7 Potentiometric Surface Map, January 15, 2016

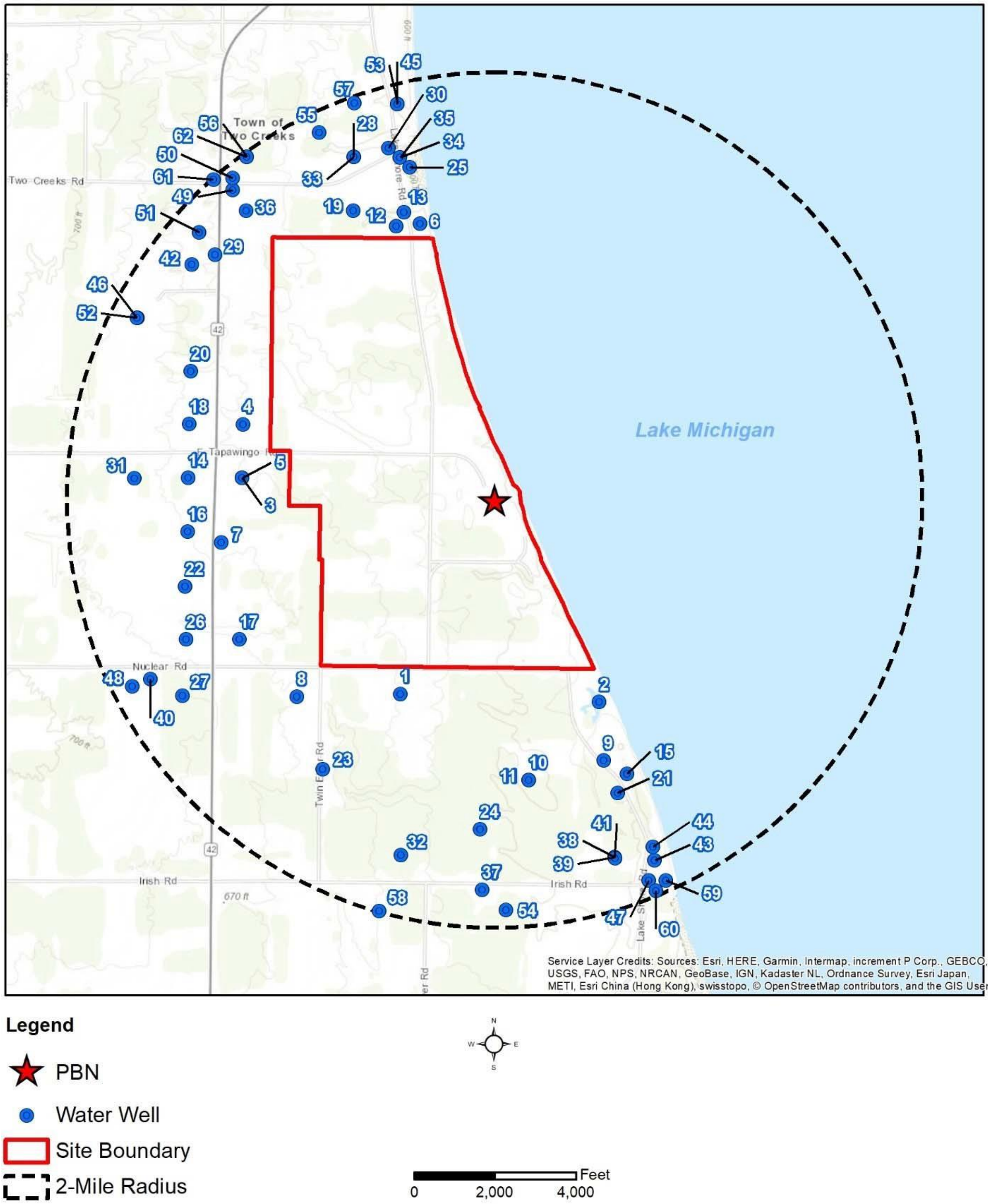


Figure 3.6-8 Offsite Registered Water Wells within 2 Miles

3.7 Ecological Resources

Regional ecology is greatly influenced by the geomorphic and physiographic characteristics of the region. Soils determine the basic fertility of the region, which in turn determines the types of plants that may grow there. The plants that are present greatly influence the types and number of animals that reside in the region. Soil types also greatly influence the basic fertility of aquatic ecosystems and the species present. Climatological factors such as temperature, day length, and precipitation, further refine the plants and animals that may live in a locale.

3.7.1 Aquatic Communities

This section describes the aquatic environment and biota near the PBN site and other areas potentially affected by the continued operation of PBN. It includes a description of the aquatic ecosystems at or near the site, a description of representative important species that are present or are expected to occur, and the location of state parks, critical habitats, or other areas carrying special designations.

The aquatic environment near the PBN site is associated with Lake Michigan. Lake Michigan serves as the cooling water source for PBN. Lake Michigan is the second largest in volume of the Great Lakes, covering 22,300 square miles with 1,638 miles of shoreline. The lake drains a land area of 45,600 square miles. It is the only Great Lake entirely within the boundaries of the United States. Water from Lake Michigan flows to Lake Huron through the Straits of Mackinac. Lake Michigan is also among the most urbanized of the Great Lakes because it includes the Chicago, Milwaukee, and Green Bay metropolitan areas. (EPA 1995; EPA 2019)

3.7.1.1 Lake Michigan

Lake Michigan is the fifth largest lake in the world in surface area and supports a diverse assemblage of fish species and aquatic organisms. Fish can move between Lake Huron and Lake Michigan, creating an international aspect of the fisheries present. Lake Michigan can be divided into two sections: a southern basin with a maximum depth of 558 feet, and a northern basin with a maximum depth of 922 feet (INDNR 2020). Over the years, increased industrialization has degraded the water quality of Lake Michigan. Large cities such as Milwaukee, Chicago, and Green Bay contribute pollution, as does runoff from agricultural areas and industries such as papermills. The lake also has been degraded due to atmospheric inputs of PCBs and mercury (NMC 2004a). As of 2008, the levels of PCBs and mercury were above acceptable levels; however, there was an improvement in the contaminants found in sport fish. (EPA 2008; Rasmussen et al. 2014)

The surface water temperature ranges from an average of 35°F to 70°F depending on year and season. The water in the lake generally circulates in a counterclockwise motion, and currents tend to be stronger in the winter and the summer. This can cause upwelling to occur when wind pushes warmer water to the middle of the lake and cold water replaces it, resulting in drastic temperature changes. Between 1918 and 2017, the lake-wide water level average was 176.4

feet. Variations around the mean lake water levels likely have not affected the fish populations around the PBN site. (NEE 2018a)

The lake historically supported a large population of lake trout; however, after the introduction of sea lampreys, the population declined rapidly. Alewife were introduced to the lake and had a similar effect on native species populations. The lake began to be stocked with game fish, such as coho salmon, chinook salmon, brown trout, and steelhead trout during the 1960s to help reduce the number of alewife, and the species adapted well and now support several populations of game fish in the lake. (INDNR 2020; NMC 2004a) Lake Michigan has also suffered under invasions of quagga and zebra mussels. These species have altered the ecosystem by reducing the amount of phytoplankton and zooplankton available to native shellfish and fish, which can alter the food web structure of Lake Michigan (Benson et al. 2020b). Table 3.7-1 shows the species of phytoplankton and zooplankton commonly found in Lake Michigan, while Table 3.7-2 shows the common fish species.

Between 1973–2016, the USGS conducted yearly trawls of the fish community in Lake Michigan. Trawls were conducted at depths of 9 to 110 meters. The location of PBN fell between two of the trawl transects, Sturgeon Bay to the north and Port Washington to the south. Results of the trawls indicated that species such as deepwater sculpin, ninespine stickleback, slimy sculpin, yellow perch, alewife, and rainbow smelt decreased in abundance, while round goby increased. PBN conducted aquatic studies near the site in 2006 and 2017. The results from both studies indicate similar trends. (NEE 2018a)

3.7.1.2 Door-Kewaunee Watershed

The Door-Kewaunee watershed encompasses Door County in its entirety, most of Kewaunee County, and the northeastern corner of Brown County. Within the watershed, all surface water drains to Lake Michigan. The largest drainages in the area include the Ahnapee River and the Kewaunee River, which enters Lake Michigan at Kewaunee. The area is known for its recreational opportunities due to an extensive scenic shoreline. Other land uses include dairy farms and agricultural areas planted in corn, soybeans, and alfalfa. Small towns can be found interspersed with farms throughout the watershed. The watershed is comprised mostly of well-drained soils, and the majority of the watershed is considered prime farmland. Both the Kewaunee and Ahnapee rivers are designated as impaired waters under Section 303(d) of the CWA due to high levels of PCBs. This has led to chronic aquatic toxicity, contaminated fish tissue, and degraded biological communities. Excessive nutrients and pathogens in the groundwater are the largest resource concerns in the watershed. However, within the watershed, Little Scarboro Creek, Keyes Creek, and the Mink River are considered either exceptional or outstanding resource waters and are protected by the state. (NRCS 2008a; WDNR 2018b)

3.7.1.3 Manitowoc-Sheboygan Watershed

The Manitowoc-Sheboygan watershed encompasses all of Manitowoc County, and portions of Kewaunee, Brown, Calumet, Sheboygan, Fond du Lac, and Ozaukee counties. This large watershed covers over one million acres and has 15 waterbodies (streams, creeks, rivers) that empty into Lake Michigan. Two large cities, Sheboygan and Manitowoc, are found within the watershed. Smaller towns can be found throughout the rest of the area. More than three-fourths of the watershed is considered agricultural. The major agricultural enterprises include dairy, grain, beef, hog, sheep, and poultry farms, while primary crops include soybeans, oats, and wheat. Outside of agriculture, other economic activities in the area include tourism, commercial fishing, outdoor recreation, and manufacturing. Soils in the watershed are predominantly well-drained, and the majority of the watershed is considered prime farmland or farmland of statewide importance. There are several waterbodies designated as impaired waters under Section 303(d) of the CWA. The East and West Twin rivers and the Manitowoc River fall under this designation. They are considered impaired for a variety of reasons, including high levels of PCBs and polycyclic aromatic hydrocarbons, phosphorus, and mercury. This impairment causes biologically degraded environments as well as contaminated fish tissue and sediment, low dissolved oxygen, and elevated water temperatures. However, the watershed does have several waterbodies considered to be either outstanding or exceptional resource waters. These include Ben Nutt, Dotyville, Feldners, Krok, La Budde, Millhome, and Schuett creeks. These creeks provide unique ecological or geographic features and are not significantly impacted by human activities. (NRCS 2008b; WDNR 2018b)

3.7.1.4 Kewaunee River and Kewaunee River Watershed

The Kewaunee River is a low gradient river with fair to good water quality along portions of the river. The major tributaries to the river are Casco, School, Scarboro, and Little Scarboro creeks. Because the river has fair to good water quality, it can support warm-water sport fisheries. Along the lower portion of the Kewaunee River, WDNR constructed a fish hatchery for trout and salmon. The lower portion of the river is surrounded by wetlands, creating essential habitat for fish and protecting the river. However, there are several issues facing the river. The area is mostly agricultural, which contributes to high levels of runoff from non-point sources of pollution, and the City of Kewaunee has a wastewater treatment plant that discharges directly into the river. The Kewaunee River has been listed as impaired under section 303(d) of the CWA due to contaminated fish tissue from PCBs. (WDNR 2011b; WDNR 2018b)

The Kewaunee River watershed is located in Kewaunee County and extends into the eastern edge of Brown County. The watershed is composed of 295 miles of streams and rivers. Within the watershed, three-quarters of the land use is agricultural, which contributes to high levels of runoff of sediment, pesticides, and herbicides into the various waterbodies. The remaining largest land covers are wetlands, open space, suburban areas, open water, and forests. Historically, the landscape was mostly mesic forest which covered the dolomite Niagara escarpment bedrock. The dolomite cliffs within this area provide important habitat for endemic and rare plants, snails, and bats. Waters in the upper area of the watershed have low flow and warmer water, but the remainder have conditions that support warm-water sport fisheries. For example, perennial streams support salmon spawning. Rogers Creek and Casco Creek are considered exceptional resource waters for the state. However, Kewaunee Harbor and Kewaunee marsh are listed as impaired due to high levels of PCBs and arsenic (WDNR 2011b).

3.7.1.5 East Twin River and East Twin River Watershed

The East Twin River runs for 34.5 miles and is considered a low gradient river with fair to good water quality. It flows southeastward from west-central Kewaunee County through Manitowoc County until it empties into Lake Michigan. The East Twin River falls within the East Twin River watershed, which is approximately 117,493 acres between Manitowoc and Kewaunee counties. Within the watershed, there are 314 miles of streams and rivers, 12,446 acres of lakes, and 14,181 acres of wetlands. However, the dominant land use in the area is agricultural. The area was historically covered in mesic hardwood forests. The terrain is rolling and composed of soils that range from poorly drained organic soils to clay to loam soils that overlay the dolomite Niagara escarpment bedrock. The dolomite cliffs within this area provide critical habitat for endemic and rare plants, snails, and bats. There are no direct industrial discharges to the East Twin River. The lack of point source pollution has helped maintain habitat for many native fish and gamefish. However, large amounts of non-point source pollution from agricultural runoff and construction are degrading the available habitat. The East Twin River is considered impaired under Section 303(d) of the CWA due to excessive amounts of total phosphorous, mercury, and PCBs. This has led to contaminated fish tissue and degraded biological environments on portions of the river (WDNR 2018b). Many of the smaller creeks are buffered by forested habitat or wetlands and provide better habitats for small fish and aquatic organisms (WDNR 2000; WDNR 2012b).

3.7.1.6 West Twin River and West Twin River Watershed

The West Twin River begins in Brown County as the Neshota River and flows to the southeast. When it enters Manitowoc County and joins Black Creek, it becomes the West Twin River, and continues to flow south until it joins with the East Twin River before draining into Lake Michigan. Combined, the Neshoto and West Twin River are 36 miles long. The West Twin River is divided into upper and lower sections. Six miles upstream of Lake Michigan is the Shoto Dam, which creates the divide. Above the Shoto Dam, the habitat and biotic index are good; however, the water quality has suffered in recent years. The area of river above Shoto Dam still maintains a diverse warm-water fish community, which supports species such as smallmouth bass and northern pike. The lower section of the West Twin River below Shoto Dam is influenced directly by Lake Michigan. Therefore, many fish species, including chinook and coho salmon, return to this section of the river to spawn. The water quality in this section is fair to poor due to turbid water and degraded habitat. The river runs through agricultural areas, which contribute to runoff from farms. This causes increased ammonia and suspended solids in the water, which degrade water quality. The water is also becoming more turbid and bank erosion is increasing, adding more sediment to the water (WDNR 2010).

The West Twin River watershed is located in north-central Manitowoc County and southeastern Brown County. A small section of the watershed extends into southwestern Kewaunee County. Encompassing 176 square miles, this is a smaller watershed falling within the larger Manitowoc-Sheboygan watershed. Twenty-nine rivers and streams cover 130 miles, with 19 miles of stream classified as trout waters, 23 miles classified as warm-water sport fisheries, and another 23 miles are designated as warm-water forage fisheries. There are also five lakes larger than 10 acres and various wetlands. Small towns are found throughout the area, but the major land use in the watershed is agricultural, which has caused significant pollution from runoff into the water sources. There has been a reduction in forested and emergent wetlands similar to most of the United States, resulting in a watershed that is inadequately equipped to handle increased water infiltration and retention. Instead, flashy runoff scours the land, increasing sedimentation and agricultural runoff to water sources. Underneath the land surface, the major bedrock feature is the dolomite Niagara escarpment. The topography is gently rolling hills. Important ecological communities in this watershed include clay bluffs, beach and dune complexes, and ridge and swale systems associated with the shorelines of Lake Michigan. There are also a series of cliffs within this watershed that provide unique habitat for rare species. Within the West Twin River watershed, there are two state natural areas: Cherney Maribel Caves State Natural Area and the Woodland Dunes Nature Preserve. Priority issues within the watershed include decreasing agricultural runoff, decreasing urban stormwater runoff, restoring wetlands, and preventing invasive species. Point-source pollution from several locations is also a problem for the watershed (WDNR 2010).

3.7.2 Terrestrial and Wetland Communities

The PBN site consists of generation and maintenance facilities, laydown areas, parking lots, roads, and mowed grass. A large portion of the site also consists of cultivated crops and pasture/hay. Intermixed with the agricultural areas, the site also consists of patches of mixed deciduous forest and forested wetlands. This section identifies terrestrial and wetland ecological resources and describes species composition and other structural and functional attributes of terrestrial biotic assemblages that could be affected by the continued operation and maintenance of the facilities.

3.7.2.1 Physiographic Province

PBN is located within the central lowland physiographic province of the United States. This province is the largest in the United States and covers 585,000 square miles. It covers all of Iowa and Michigan, and the majority of Oklahoma, Illinois, Indiana, Ohio, Wisconsin, and Minnesota. It stretches into the northern portion of Missouri and the eastern sections of North Dakota, South Dakota, Nebraska, and Kansas. The Great Lakes region of the central lowland physiographic province is the result of repeated glacial scouring and the shape of the lakes is a result of pre-glacial streams bordering rocks that influenced the direction of the advancing ice (NPS 2018).

3.7.2.2 Ecoregion

PBN is situated within the Lake Michigan lacustrine clay plain ecoregion, which falls within the larger southeastern Wisconsin till plains ecoregion. The Lake Michigan lacustrine clay plain ecoregion is flatter than the surrounding ecoregions and the soil is characterized by red calcareous clay that is generally silty and loamy. This region also has more fertile soils and longer growing seasons than surrounding areas, leading to agriculture with a mix of crops.

Natural vegetation in forested areas consists of beech, sugar maples, basswood, red oaks, and white oaks (Omernik et al. 2000).

A brief description of regional ecosystems, including state-listed natural communities, is provided below.

3.7.2.2.1 Clay Seepage Bluffs

Clay seepage bluffs are characteristic sites along the shores of Lake Michigan and Lake Superior. These bluffs were created and are maintained by erosion and action from waves and ice. They typically occur in small linear patches associated with glacio-lacustrine clays. Although site differences occur because of changes in microclimate, plants associated with clay seepage bluffs are adapted to cool, moist, calcareous environments, with clay substrates and periodic disturbances from waves and ice from the lakes. Vegetation communities on the bluffs can range from dense forests to bare slopes. Common shrubs include russet buffalo-berry (*Shepherdia canadensis*), common snowberry (*Symphoricarpos albus*), green alder (*Alnus viridis*), gray alder (*Alnus incana*), red-osier dogwood (*Cornus sericea* ssp. *sericea*), common ninebark (*Physocarpus opulifolius*), and northern bush honeysuckle (*Diervilla lonicera*). Common herbs include Canada goldenrod (*Solidago canadensis*), daisy fleabane (*Erigeron strigosus*), white panicle aster (*Symphyotrichum lanceolatum*), and pearly everlasting (*Anaphalis margaritacea*). Some of the bluffs are characterized by the discharge of groundwater as seeps or runs, and these bluffs often support habitat for rare plant species. Areas with seepage provide a water source for butterfly species and a source of mud for nesting cliff and barn swallows.

Clay seepage bluffs are threatened for several reasons. The first is that very little data about this habitat type exists. Second is residential development, and third is the potential changes in the water levels of the Great Lakes. Additional potential threats include over-browsing of sensitive vegetation by white-tailed deer and the encroachment of invasive species (Epstein 2017).

3.7.2.2.2 Great Lakes Beaches

Great Lakes beaches are dynamic habitats that change and evolve based on periodic water level changes, currents, ice scour, and storms on Lake Michigan. The beaches are usually comprised of sand, but can also consist of bedrock, gravel, or cobble, or even be covered in piles of driftwood. The amount of beach exposed depends on the conditions of the lakes and water levels. Lake Michigan has experienced water fluctuations over two meters for the last one hundred years. Also depending on the water levels and amount of beach exposed, active dune habitats such as interdunal wetlands may become established for long periods of time. Because of the fluctuating habitat conditions, the plant species present are highly adapted endemic species or weedy generalists (Epstein 2017).

The beaches are characterized by three distinct zones: the lower beach, which is closest to the water; an upper beach that is farthest from the edge of the water; and a middle beach. The lower beach is mostly unvegetated due to continuous wave action that prevents permanent vegetation from establishing. The middle beach can be affected by water levels, but can also remain dry and stable for long periods of time. Common native species that inhabit the middle beach area on Lake Michigan include silverweed cinquefoil (*Potentilla anserina* ssp. *anserina*), arctic rush (*Juncus arcticus*), green sedge (*Carex viridula*), American bugseed (*Corispermum americanum*), seaside spurge (*Euphoriba polygonifolia*), and American searocket (*Cakile edentula* var. *lacustris*). The upper beach zone remains dry most of the time except when inundated by large waves and storms. Many common dune species can be found in this habitat type, including American beachgrass (*Ammophila breviligulata*), beach pea (*Lathyrus japonicus*), and streambank wheatgrass (*Elymus lanceolatus* ssp. *psammophilus*); on Lake Michigan, Pitcher's thistle (*Cirsium pitcheri*) and dwarf lake iris (*Iris lacustris*) are found. The beaches provide nesting habitat for many shorebirds, gulls, terns, and waterfowl. The threatened piping plover uses this habitat as breeding grounds. Other species that breed on the beaches include common terns (*Sterna hirundo*), Caspian terns (*Hydroprogne caspia*), double-crested cormorants, (*Phalacrocorax auritus*), and American white pelicans (*Pelecanus erythrorhynchos*). This habitat is also highly beneficial for migrating birds, providing stopover areas for snow buntings (*Plectrophenax nivalis*), American pipits (*Anthus rubescens*), and horned larks (*Eremophila alpestris*), among others. Several species follow the beaches during migration, including the common green darner (*Anax junius*) and variegated meadowhawk (*Sympetrum corruptum*) dragonflies, and hawks such as peregrine falcons (*Falco peregrinus*) and American kestrels (*Falco sparverius*). The Great Lakes beach habitats are threatened by the encroachment of invasive species, overgrowth of algae from agricultural runoff, and untreated sewage. Human use of the beaches also disrupts natural dynamics and can disturb nesting birds or crush eggs and nests (Epstein 2017).

3.7.2.2.3 Great Lakes Dunes

Great Lakes dunes are a rare habitat type found along the shores of the Great Lakes. The dunes are created and continually maintained by a combination of wind, water currents, geographic position, composition of the substrate, and lake water levels. The dunes on the Wisconsin side of Lake Michigan are rarer because the east and northeast winds that maintain the dunes are not as prevalent as the west and southwest winds that help create the dunes on the Michigan side of Lake Michigan. In Wisconsin, the dunes along Lake Michigan provide a more diverse plant community, with many native species adapted to the dynamic conditions as compared to the less dynamic conditions along Lake Superior. The species present are also able to tolerate substrate with low nutrient values. The dunes along Lake Michigan can exist in patches among a mosaic of landscape types and can be bordered by forests, wetlands, or even developed areas. Plants commonly encountered on the dunes include American beachgrass, beach pea, lyrate rockcress (*Arabidopsis lyrata* ssp. *lyrata*), field sagewort (*Artemisia campestris*), American bugseed, hairy bugseed (*Corispermum villosum*), Canada wildrye (*Elymus canadensis*), crinkled hair grass (*Avenella flexuosa*), and starry false Solomon's seal (*Maianthemum stellatum*). Shrub species can also become established and species likely to be encountered include common juniper (*Juniperus communis*), sand cherry (*Prunus pumila*), bearberry (*Arctostaphylos uva-ursi*), Missouri willow (*Salix eriocephala*), bayberry willow (*Salix myricoides*), shining willow (*Salix lucida*), and autumn willow (*Salix serissima*). Plant species particularly adapted to the continually changing dune habitat include sand-heather (*Hudsonia tomentosa*) and coastal jointweed (*Polygonella articulata*), along with common weedy species such as slender wheatgrass (*Elymus trachycaulus*), common cocklebur (*Xanthium strumarium*), and winged pigweed (*Cycloloma atriplicifolium*). Dunes along the Great Lakes also provide the environment for rare, and in some cases threatened and endangered, plant species. Of particular note are Pitcher's thistle, Rand's goldenrod (*Solidago simplex* var. *gillmanii*), Lake Huron tansy (*Tanacetum bipinnatum*), dwarf lake iris, prairie dunewort (*Botrychium campestre*), prairie sandreed (*Calamovilfa longifolia* var. *magna*), heartleaf willow (*Salix cordata*), and clustered broomrape (*Orobanche fasciculata*). Some dunes that are located farther from the direct effects of waves and wind can become more stabilized and provide a habitat that supports shrubs and trees (Epstein 2017).

Along with rare plant species endemic to the dune habitat, there are several bird and insect species that rely on this unique ecological community. Piping plovers (*Charadrius melodus*), Caspian terns, and common terns all use the dunes. Invertebrate species include the Lake Huron locust (*Trimerotropis huroniana*), seaside grasshopper (*Trimerotropis maritima*), hairy-necked tiger beetle (*Cicindela hirticollis hirticollis*), and a moth found only at Lake Michigan sand dunes, *Copablepharon michiganensis*. Large numbers of dragonflies gather along the dunes before migrating, which in turn attracts many migratory birds that feed on the insects and replenish their stores during their migration. The Great Lakes dune ecological community is a rare habitat type that is at risk from anthropogenic sources. Continued development and recreational use are damaging and destroying the dunes. There have also been efforts to stabilize the dunes, which can destroy them as they are meant to be dynamic. Recreational uses of beaches destroy sensitive vegetation and can introduce invasive species, which further endangers native species (Epstein 2017).

3.7.2.2.4 Interdunal Wetlands

Interdunal wetlands are a rare habitat type dependent on Great Lakes dunes. They are restricted to a few areas along the coasts of the Great Lakes where hollows between the dunes intersect the water table. Along Lake Michigan only a few locations of interdunal wetlands can be found and they are located at small parts of coastal ridge and swale systems. Most interdunal wetlands are less than ten acres in size. Although small, they provide essential habitat for migratory shorebirds. The rarity of this habitat is associated with similarly rare plant species that are adapted to this unique and dynamic ecological condition. Shrub species are not often associated with interdunal wetlands, but they can occasionally be present. Species that are adapted to the conditions associated with interdunal wetlands are: Kalm's St. Johnswort (*Hypericum kalmianum*), shrubby cinquefoil (*Dasiphora fruticosa*), common ninebark, and willows (*Salix* spp.). Common plants include arctic rush, smooth sawgrass (*Cladium mariscoides*), green sedge, sevenangle pipewort (*Eriocaulon aquaticum*), water horsetail (*Equisetum fluviatile*), horned bladderwort (*Utricularia cornuta*), watershield (*Brasenia schreberi*), and silverweed cinquefoil. Rare species that can be found in this habitat type are marsh grass of Parnassus (*Parnassia palustris*), marsh arrowgrass (*Triglochin palustris*), Robbin's spikerush (*Eloecharis robbinsii*), and northeastern bladderwort (*Utricularia resupinata*).

Many activities threaten the existence of interdunal wetlands and include direct destruction of the dunes, sand mining, dune stabilization, residential development, recreation, and construction of seawalls. Invasive species also threaten many of the rare native plants that exist in this habitat type (Epstein 2017).

3.7.2.2.5 Northern Wet-Mesic Forests

Northern wet-mesic forests are minerotrophic forested wetlands characterized by coniferous tree species. The soils are primarily woody peats or mucks, and roots of trees are often connected to groundwater sources. The dominant tree species associated with this ecological community is the northern white cedar (*Thuja occidentalis*), which grows only 40–60 feet tall in this habitat. There is a rich understory and the ground is often covered in various mosses. Other common tree species are tamarack (*Larix laricina*), black spruce (*Picea mariana*), Canadian spruce (*Picea glauca*), balsam fir (*Abies balsamea*), Canada hemlock (*Tsuga canadensis*), paper birch (*Betula papyrifera*), and white pine (*Pinus strobus*). The understory shrub layer can be diverse and include species such as mountain maple (*Acer spicatum*), catberry (*Ilex mucronata*), northern mountain-ash (*Sorbus decora*), European cranberrybush (*Viburnum opulus*), velvetleaf blueberry (*Vaccinium myrtilloides*), bog labrador tea (*Rhododendron groenlandicum*) and alder-leaf buckthorn (*Rhamnus alnifolia*). Herbaceous species found along the ground layer are threeleaf goldthread (*Coptis trifolia*), bluebead (*Clintonia borealis*), gaywings (*Polygala paucifolia*), twistedstalk (*Streptopus lanceolatus*), crested woodfern (*Dryopteris cristata*), western oakfern (*Gymnocarpium dryopteris*), and narrow beech fern (*Phegopteris connectilis*). Graminoid species associated with this habitat are soft-leaf sedge (*Carex disperma*), greater bladder sedge (*Carex intumescens*), and bristlestalked sedge (*Carex leptalea*). Many rare plants are found in northern-wet mesic forests, including fairy-slipper orchid (*Calypso bulbosa*), ram's head lady's slipper (*Cypripedium arietinum*), showy lady's slipper (*Cypripedium reginae*), roundleaf orchid (*Galearis rotundifolia*), marsh valerian (*Valeriana sitchensis* var*. uliginosa*), western polemonium (*Polemonium occidentale* ssp*. lacustre*), black currant (*Ribes hudsonianum*), limestone oakfern (*Gymnocarpium robertianum*), bog sedge (*Carex gynocrates*), northern mountain cranberry (*Vaccinium vitis-idaea*) and Lapland buttercup (*Ranunculus lapponicus*). Because groundwater is the driving hydrological factor, many streams and seeps are also found within the forests (Epstein 2017).

The northern wet-mesic forest provides habitat to many animal species such as summer habitat for neotropical migratory songbirds, nesting habitat for northern goshawks (*Accipiter gentilis*), northern saw-whet owls (*Aegolius acadicus*), and long-eared owls (*Asio otus*). Areas near larger bodies of water provide habitat for bald eagles (*Haliaeetus leucocephalus*) and osprey (*Pandion haliaetus*). Rare four-toed salamanders (*Hemidactylium scutatum*) can be found in wet mesic forests that have ephemeral ponds and woody debris. Mammals common in this habitat include bobcat (*Lynx rufus*), northern flying squirrel (*Glaucomys sabrinus*), and water shrews (*Sorex palustris*). Pervasive threats to this ecosystem include alterations to hydrology, logging, over-browsing by white-tailed deer, and the encroachment of invasive species (Epstein 2017).

3.7.2.2.6 Northern Sedge Meadows

Northern sedge meadows are minerotrophic wetland communities characterized by graminoid species. They can be found as part of the natural mosaic of wetlands near the Great Lakes and they can also be found along rivers and streams. Sedge meadows are typically located in intermediate zones between wet and slightly drier forested areas. This habitat type requires groundwater or surface water and can be seasonally flooded or permanently saturated. Fire may have played a role in maintaining sedge meadows historically. The soils can be organic or mineral, but sedge meadows are typically found on glaciated terrain. Peat accumulation can occur in these wetlands. Southern sedge meadows and northern sedge meadows can be distinguished by the plant species present. Southern sedge meadows have species affiliated with prairie and calcareous fens. The hydrology, soil, and disturbances such as fire directly influence the species present. Graminoid species from the genus *Carex* (sedges) are the most common. The dominant species in sedge meadows can further divide them into additional types. For example, narrow-leaved sedges can define one sedge meadow, while broad-leaved sedges can define another. Species found in various types of sedge meadows include woolly-fruit sedge (*Carex lasiocarpa*), fewseed sedge (*Carex oligosperma*), Northwest Territory sedge (*Carex utriculata*), upright sedge (*Carex stricta*), lakebank sedge (*Carex lacustris*), water sedge (*Carex aquatilis*), longhair sedge (*Carex comosa*), and blister sedge (*Carex vesicaria*). Other graminoid species besides sedges include bluejoint reedgrass (*Calamagrostis canadensis*), green bulrush (*Scirpus atrovirens*), woolgrass (*Scirpus cyperinus*), fowl bluegrass (*Poa palustris*), rattlesnake mannagrass (*Glyceria canadensis*), common spikerush (*Eleocharis palustris*), and marsh muhly (*Muhlenbergia glomerata*). Other herbaceous plants that are common are white panicle aster, marsh fern (*Thelypteris palustris*), purplestem aster (*Symphyotrichum puniceum*), purple marshlocks (*Comarum palustre*), swamp milkweed (*Asclepia incarnata*), northern water-horehound (*Lycopus uniflorus*), water horsetail, and arrowleaf tearthumb (*Persicaria sagittata*). Woody plants are typically not dominant in sedge meadows, but several shrubs can be found, such as white meadowsweet (*Spiraea alba*), steeplebush (*Spiraea tomentosa*), gray alder, swamp birch (*Betula pumila*), and common ninebark. Rare plants that can be found in northern sedge meadows are smooth black sedge (*Carex nigra*), quill spikerush (*Eleocharis nitida*), Torrey's bulrush (*Schoenoplectus torreyi*), downy willowherb (*Epilobium strictum*), northern bur-reed (*Sparganium glomeratum*), and lesser yellow water buttercup (*Ranunculus gmelinii*) (Epstein 2017).

Northern sedge meadows provide essential habitat for a variety of animals species. Many bird species of conservation concern utilize this habitat. For example, whooping cranes (*Grus americana*), sandhill cranes (*Grus canadensis*), American bitterns (*Botaurus lentiginosus*), yellow rails (*Coturnicops noveboracensis*), Henslow's sparrow (*Ammodramus henslowii*), Le Conte's sparrow (*Ammodramus leconteii*), and Nelson's sparrow (*Ammodramus nelsoni*) rely on the habitat provided. Blanding's turtles (*Emydoidea blandingii*), boreal chorus frogs (*Pseudacris maculata*), and mink frogs (*Lithobates septentrionalis*) also rely on the specific habitat of northern sedge meadows. Additionally, bat species such the northern long-eared bat (*Myotis septentrionalis*), the eastern red bat, and the hoary bat (*Lasiurus cinereus*) will forage for prey above the water and wetlands during the summer months. The biggest threats to northern sedge meadows are from influences that disrupt their hydrologic functioning. This can include groundwater withdrawals and ditching. Invasive species and excessive sedimentation from runoff from agricultural areas degrade the habitat as well (Epstein 2017).

3.7.2.2.7 Northern Hardwood Swamps

Hardwood swamps are minerotrophic forested wetlands characterized by deciduous, broad-leaved tree species. This ecological community can be found where there is input from nutrient rich groundwater, such as near lakes or streams. Soils in the hardwood swamps tend to be mucky peats or sands, or mineral in nature, but can also contain clays, silts, or bedrock. One of the defining characteristics of northern hardwood swamps, and what helps give it its species diversity, is micro-topography. These wetlands are often seasonally inundated or saturated, and the micro-topography can create small pools of water that keep the soils moist. Water drainage in the hardwood swamps tends to be slow. Plant species found in northern hardwood swamps have adapted to periodic flooding. The dominant tree species found in this habitat include black ash (*Fraxinus nigra*), red maple (*Acer rubrum*), yellow birch (*Betula alleghaniensis*), American elm (*Ulmus americana*), and balsam poplar (*Populus balsamifera*). Coniferous species such as eastern white cedar and tamarack can be present, but are often not found in large numbers. The understory directly below the canopy of deciduous trees is often composed of tall shrubs such as gray alder, common winterberry (*Ilex verticillata*), nannyberry (*Viburnum lentago*), swamp fly honeysuckle (*Lonicera oblongifolia*), and American black currant (*Ribes americanum*). The composition of the herbaceous ground layer is highly dependent on location and micro-topography. Plants associated with the ground layer in northern hardwood swamps include jack-in-the-pulpit (*Arisaema triphyllum*), smallspike false nettle (*Boehmeria cylindrica*), yellow marsh marigold (*Caltha palustris*), Pennsylvania bittercress (*Cardamine pensylvanica*), small enchanter's nightshade (*Circaea alpina*), Canada woodnettle (*Laportea canadensis*), small white violet (*Viola macloskeyi*), Canada clearweed (*Pilea pumila*) and ferns such as (*Matteuccia struthiopteris*), cinnamon fern (*Osmundastrum cinnamomeum*), and royal fern (*Osmunda regalis*). Grasses and sedges associated with this ecological community can be fowl mannagrass (*Glyceria striata*), drooping woodreed (*Cinna latifolia*), brome-like sedge (*Carex bromoides*), fringed sedge (*Carex crinita*), and graceful sedge (*Carex gracillima*) (Epstein 2017).

The micro-topography also creates niches that many species of wildlife rely on. The ephemeral ponds formed in the depressions provide essential breeding habitat for many frogs and salamanders, particularly because they lack fish species that prey on eggs and young. Many mammal species can be found in northern hardwood swamps and these can include American black bear (*Ursus americanus*), fisher (*Pekania pennanti*), northern flying squirrel, eastern red bat (*Lasiurus borealis*), and woodland jumping mouse (*Napaeozapus insignis*). It is also important habitat for bird species, particularly for songbirds when the swamps are located near the Great Lakes. Bird species that use this habitat include red-shouldered hawk (*Buteo lineatus*), ruffed grouse (*Bonasa umbellus*), veery (*Catharus fuscescens*), Canada warbler (*Cardellina canadensis*), and least flycatcher (*Empidonax minimus*). Any change to the hydrology of northern hardwood swamps can cause entire forested areas to die off. Logging has been detrimental as well. Additional threats to this ecosystem include invasive species such as the emerald ash borer (*Agrilus planipennis*) and Dutch elm disease (Epstein 2017).

3.7.2.2.8 Shrub-Carr

Shrub-carr are minerotrophic wetland communities characterized by tall deciduous shrubs. This habitat typically occurs between wet forests and wet prairies. They can be permanently saturated or seasonally inundated with water. It can also exist as patches within emergent marshes or sedge meadows. Shrub-carr usually occurs on soils classified as calcareous mucks or azonal peats. The canopy height of the shrubs can be 3 to 9 feet tall. Common tall shrub species that characterize this habitat type include red-osier dogwood, silky dogwood (*Cornus amomum*), nannyberry, gray willow (*Salix bebbiana*), pussy willow (*Salix discolor*), and meadow willow (*Salix petiolaris*). Shorter shrub species in this community include white meadowsweet, common ninebark, elderberry (*Sambucus nigra* ssp. *canadensis*), and swamp rose (*Rosa palustris*). Below the canopy of shrubs, species such as bluejoint reedgrass, giant goldenrod (*Solidago gigantea*), jewelweed (*Impatiens capensis*), marsh blue violet (*Viola cucullata*), marsh fern, purple meadowrue (*Thalictrum dasycarpum*), American waterhorehound (*Lycopus americanus*), and sensitive fern (*Onoclea sensibilis*) can be found. This habitat type often has springs running through it or seeps formed within it. If seeps or springs provide more permanent sources of water, additional species like American water plantain (*Alisma subcordatum*), purplestem angelica (*Angelica atropurpurea*), cutleaf water-parsnip (*Berula erecta*), American golden saxifrage (*Chrysosplenium americanum*), and marsh saxifrage (*Micranthes pensylvanica*) can be present. This ecological community provides habitat for many songbirds, including willow flycatchers and yellow warblers. It can also be habitat for the state endangered queen snake as well as home to many frogs and other amphibians. As with other rare habitat types, invasive species are a threat to native vegetation. Other threats to shrub-carr communities include hydrological alteration from deposits of agricultural sediment and excessive nutrient inputs from agriculture (Epstein 2017).

3.7.2.3 <u>Wetlands</u>

Wetlands are defined as areas inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (USACE 1999).

Thirteen functions and values typically considered by regulatory and conservation agencies when evaluating wetlands are used as part of the New England method. These include groundwater recharge/discharge; floodflow alteration; fish and shellfish habitat; sediment, toxicant, and pathogen retention; nutrient removal, retention, and transformation; production export (nutrient); sediment and shoreline stabilization; wildlife habitat; recreation (consumptive and non-consumptive); educational and scientific value; uniqueness, heritage, visual quality, and aesthetics; and threatened or endangered species habitat. (USACE 1999)

The U.S. Fish and Wildlife Service (USFWS) maintains the National Wetlands Inventory (NWI), which integrates digital map data along with other resource information to produce current information on the status, extent, characteristics, and functions of wetland, riparian, and deepwater habitats in the United States.

Based on a review of USFWS NWI maps of the site (USFWS 2019f), there are approximately 36,464 acres of wetlands within a 6-mile radius of PBN, composed of the following types (Figure 3.7-1):

- Freshwater emergent wetlands covering approximately 256 acres (0.7 percent of total wetland habitat)
- Freshwater forested/shrub wetlands covering approximately 3,502 acres (9.6 percent of total wetland habitat)
- Freshwater ponds covering approximately 56 acres (0.15 percent of total wetland habitat)
- Lakes covering approximately 32,413 acres (88.89 percent of total wetland habitat)
- Riverine waters covering approximately 229 acres (0.63 percent of total wetland habitat)

The PBN property is roughly rectangular in shape and is bound by Lake Michigan on the eastern boundary. Based on the NWI data (USFWS 2019f), a total of 49.1 acres of wetlands, lakes, ponds, and riverine waters are located on the PBN site (Figure 3.7-2). Several mapped drainages transverse the PBN site flowing southeast to wetlands or Lake Michigan. Several freshwater emergent and forested/shrub wetlands are mapped as occurring along these drainages.

Based on the NWI data, the following wetland water types are located on the PBN site:

- Freshwater emergent wetlands covering approximately 10 acres (21.01 percent of total wetland habitat)
- Freshwater forested/shrub wetlands covering approximately 25 acres (51.89 percent of total wetland habitat)
- Freshwater ponds covering approximately 1 acre (2.04 percent of total wetland habitat)
- Lakes covering approximately 3 acres (5.58 percent of total wetland habitat)
- Riverine waters covering approximately 10 acres (19.48 percent of total wetland habitat)

3.7.2.4 Terrestrial Animal Communities

The terrestrial community at PBN consists of wooded wetlands interspersed with agricultural fields and developed areas. Wildlife species found primarily in the wooded wetlands and agricultural areas are those typically found in the central Lake Michigan ecological landscape. Terrestrial species that are federally and/or state-listed as endangered or threatened and known to occur in the vicinity of PBN are discussed in detail in Section 3.7.8. Suitable habitat likely exists within the vicinity of PBN for red-shouldered hawks (*Buteo lineatus*), bald eagles (*Haliaeetus leucocephalus*), streambank wheatgrass (*Elymus lanceolatus ssp. psammophilus*), sand reedgrass (*Calamovilfa longifolia* var. *magna*), Pitcher's thistle (*Cirsium pitcheri*), tri-colored bats (*Perimyotis subflavus subflavus*), northern long-eared bats (*Myotis septentrionalis*), big brown (*Eptesicus fuscus*) and little brown bats (*Myotis lucifugus*). Table 3.7-3 includes terrestrial species that are likely to be observed in Manitowoc and Kewaunee counties.

Mammals commonly seen on and in the vicinity of PBN or animals suited to the habitat surrounding the site include white-tailed deer (*Odocoileus virginianus*), Virginia opossums (*Didelphis virginiana*), raccoons (*Procyon lotor*), and eastern cottontail rabbits (*Sylvilagus floridanus*). None of the mammal species observed or reported at the site are unusual for the region. According to the Wisconsin Natural Heritage Inventory (WHNI), there is a known bat hibernaculum in Manitowoc County (WDNR 2019n).

Reptiles and amphibians likely to inhabit the PBN site and its surrounding areas include American bullfrog (*Lithobates catesbeianus*), American toad (*Anaxyrus americanus*), northern leopard frog (*Lithobates pipiens*), common garter snake (*Thamnophis sirtalis*), northern water snake (*Nerodia sipedon)*, and painted turtle (*Chrysemys picta*). Reptiles and amphibian populations are likely representative of what would be found in the region (Table 3.7-3).

Bird populations on the PBN site include year-round residents, seasonal residents, and transients (birds stopping briefly during migration). Year-round residents include Canada geese (*Branta canadensis*), mallards (*Anas platyrhynchos*), sharp-shinned hawks (*Accipiter striatus*), mourning doves (*Zenaida macroura*), downy woodpeckers (*Picoides pubescens*), black-capped chickadees (*Poecile atricapillus*), tufted titmice (*Baeolophus bicolor*), and northern cardinals (*Cardinalis cardinalis*). Bird populations on the site are representative of those found in the region.

While there are resident bird populations, the region also serves as a pass-through area for semi-annual migrations of neotropical birds that may range between South America and Canada, as well as seasonal migrations of waterfowl. The PBN site is located within the Mississippi flyway, a major migratory route for birds during the spring and fall. The Mississippi flyway extends from the Arctic Circle down to the Gulf Coast of Louisiana, Mississippi, and Alabama. Migrating birds often fly these routes at night and land to rest early in the morning. Before dawn they seek out suitable habitat, called stopovers, in which to feed and avoid predators. Large natural barriers such as mountains and deserts, or large bodies of water create especially crowded stopovers. These stopovers are very important because the flight over the barrier will mean a long stretch without any opportunity to stop for food, rest, or cover. Along the Mississippi flyway, the Hudson Bay and the Great Lakes are major barriers. There is a known migratory bird stopover concentration site at Point Beach State Park in Manitowoc County, which lies in the vicinity of PBN. This area is known for hosting over 200 species as they feed and rest during migration (Kreitinger et al. 2019). Common migrants that pass through the area include: tundra swan (*Cygnus columbianus*), snow goose (*Chen caerulescens*), black scoter (*Melanitta nigra*), common loon (*Gavia immer*), American golden plover (*Pluvialis dominica*), solitary sandpiper (*Tringa solitaria*), pectoral sandpiper (*Calidris melanotos*), gray-cheeked thrush (*Catharus minimus*), American pipit, and orange-crowned warbler (*Leiothlypis celata*).

Many bird species use the central Lake Michigan ecoregion during the breeding season. There is at least one known bird rookery in Manitowoc County. This is an area where more than one pair of birds nest together and can contain many different species and up to several hundred nests. Species that can be found breeding in a rookery in the region include great blue herons (*Ardea herodias*), black-crowned night herons (*Nycticorax nycticorax*), and cattle egrets (*Bubulcus ibis*).

3.7.2.5 Transmission Lines

Physical features (e.g., length, width, route) of each of the in-scope transmission lines are described in Section 2.2.5.1. The transmission corridors are situated within the central lowlands physiographic province. All in-scope transmission lines are located completely within the PBN EAB, as shown in Figure 2.2-4.

Although critical habitat for the piping plover is located south of the PBN site, potential habitat for this federally threatened species exists within approximately 70 yards of the in-scope transmission lines (USFWS 2020b). The risk of collision with in-scope transmission lines poses a potential threat to piping plovers. Surveys for piping plover nests on the beaches adjacent to PBN are conducted annually. The in-scope transmission corridors do not cross any state or federal parks. While significant vegetation growth is unlikely due to the industrialized location of the in-scope transmission corridors, the corridors are monitored for vegetation annually, with no more than 18 months between inspections. Appropriate control measures are applied to discourage vegetation that is incompatible with the in-scope transmission lines. Control methods are based on environmental impact and anticipated effectiveness, along with site characteristics, security, economics, current land use, and other factors. These methods include, but are not limited to pruning, removal, herbicide application, and mowing. All vegetation-related work will comply with the following industry standards: ANSI Z133.1-2012 safety requirements for arboricultural operations; OSHA 1910.269 electric power generation, transmission and distribution; ANSI A300 (Part 1) 2012 pruning for tree care operations–tree, shrub, and other woody plant maintenance–standard practices; and ANSI A300 (Part 7) 2012 IVM tree, shrub, and other woody plant maintenance standard practices (integrated vegetation management approach for electric utility rights-of-way). Data regarding herbicide use and brush control are provided to corridor maintenance contractors so adverse impacts on rare and sensitive species and habitats can be avoided.

3.7.3 Potentially Affected Water Bodies

The major water resource in the vicinity of PBN is Lake Michigan. Water from the lake is used for once-through cooling water. The PBN site contains several surface water features, including two creeks and four intermittent streams.(PBN 2019a; PBN 2020a) Lake Michigan is the second largest in volume of the Great Lakes and is the only one that exists entirely within the boundaries of the United States. The lake covers 22,300 square miles and drains a land area of

45,600 square miles (EPA 1995; EPA 2019). The PBN site lies within the central Lake Michigan coastal ecological landscape. Elevation ranges from 580 to 1,020 feet in the central Lake Michigan coastal ecological landscape, with the lowest elevation occurring along the coast of Lake Michigan. The topography is predominantly undulating, rolling plains, which are underlain by the Silurian Niagara dolomite bedrock. Most of the soils overlaying the bedrock are well drained and loamy or clayey with a silt loam surface. Areas underlain by karst bedrock are more susceptible to groundwater contamination (WDNR 2015c).

PBN uses a once-through cooling systems for both Units 1 and 2. Water is drawn from and discharges into Lake Michigan. Water enters the forebay through two 14-foot diameter pipes buried beneath the lakebed. The water then enters the intake structure, a cylinder filled with limestone blocks, which is located 1,750 from the lakeshore. The design intake flow of the cooling water pumps is 1,248 MGD. Vertical bar racks (3/8 inch by 4 inches, with 2¼ spacing in the center) are located in the inshore forebay. To protect aquatic organisms, eight traveling screens (3/8 square inch mesh, 11 feet wide) are used. An 80 psi wash is used to clean the traveling screens, which discharges to the lake. The intake velocities are typically between 0.5-1 feet/second (NEE 2018a). The water is returned via two flumes at a speed that creates a sufficient mixing of the discharge water with the lake water (NMC 2004a).

PBN cannot operate without the intake and discharge of cooling water, which directly impacts Lake Michigan. The NRC is responsible for authorizing the operation of nuclear facilities, as well as approving any extension of an initial operating license through the license renewal process. Intake and discharge of water through the cooling water system would not occur but for the operation of the facility pursuant to a renewed license. The effects of the proposed federal action—the continued operation of PBN, which necessarily involves the removal and discharge of water from Lake Michigan—are therefore shaped by the NPDES permit issued to the plant. The current WPDES permit was effective as of July 1, 2016, with an expiration date of June 30, 2021 (Attachment B).

3.7.4 Places and Entities of Special Ecological Interest

3.7.4.1 Two Creeks Buried Forest

Two Creeks Buried Forest was designated as a state natural area in 1967 and is owned by the WDNR. Two Creeks Buried Forest is a unit of the Ice Age National Scientific Reserve. Approximately 16 acres, this area provides a record of the glacial advances and retreats that occurred during the Wisconsin glaciation. This forest became established between the Cary and Valders glacial substages. As the Cary glacier retreated, the forest became more boreal-like with species such as hemlocks, pines, and white spruce, with mosses inhabiting the forest floor. When the Valders glacier moved and blocked the drainageway of Lake Michigan, lake waters rose and flooded the forest and covered the ground with clay. When the glacier retreated it flattened the forest and left the forest covered in more clay. Scientists have radiocarbon-dated unearthed wood and determined the age to be 11,850 years before present. This has given an exact date on the glacial sequences from the Lake Michigan basin. Today, the buried forest, including needles, mosses, and snails, is visible between the clay layers on a bluff along the lakeshore where erosion has exposed the area (WDNR 2020e).

3.7.4.2 Point Beach State Forest

Point Beach State Forest is approximately 2.5 miles south of PBN. It is comprised of 3,000 acres of beach and forested area along the Lake Michigan shore. The area is predominantly covered in woody wetlands where 20 percent or more of the vegetation is shrubland or forest and the area is periodically saturated with water. This provides habitat for numerous amphibians, reptiles, mammals, waterfowl, and birds, particularly providing suitable breeding habitat for the federally endangered piping plover. It also provides camping and outdoor recreation opportunities for the public such as fishing, boating, camping, hiking, and picnicking (NRC 2005; WDNR 2019f).

3.7.4.3 Michigan Islands National Wildlife Refuge

Michigan Islands National Wildlife Refuge is run by the USFWS and is composed of eight islands in Lake Michigan and Lake Huron. It was originally established for the protection of migratory birds and as refuge for breeding birds. In 1947, Shoe Island, Pismire Island, and Scarecrow Island, totaling ten acres, were acquired, and in 1970 were designated as federal wilderness. During the 1960s Gull Island was acquired from the U.S. Coast Guard and Hat Island was acquired from the Nature Conservancy in 1994. Big and Little Charity Islands were acquired from General Motors Corporation. Sugar Island, the most recent addition, was acquired from the Nature Conservancy in 2010, adding more than 284 additional acres to the refuge. Some of the islands were used for historic purposes. For example, Hat Island was bombed for target practice during World War II, covering parts of the island in tar, while Big and Little Charity Islands were used as stopping points for French explorers during the 1600s and as a refuge for sailors trapped during storms on Lake Huron. The largest islands have flat sandy beaches or steep rocky faces along the outer edges, while the inner portions of the island often consist of large deciduous and evergreen tree species including paper birch, red maple, sugar maple, northern white cedar, balsam firs, white spruce, and trembling aspens. Pitcher's thistles, a federally threatened plant, can be found on the sand dunes on these islands. Many of the smaller islands consist of sparsely vegetated cobblestone and sandy pits that provide breeding habitat for the colonial water birds that nest there. Over 150 species of birds have used these islands, particularly numerous colonial nesting water birds including ring-billed gulls (*Larus delawarensis*), herring gulls (*Larus argentatus*), great blue herons, great egrets (*Ardea alba*), black-crowned night herons, double-crested cormorants, Caspian terns, and common terns. Additional bird species that use these islands to breed include spotted sandpipers (*Actitis macularius*), killdeer (*Charadrius vociferous*), American bitterns, bald eagles, northern harriers (*Circus cyaneus*), American woodcocks (*Scolopax minor*), and endangered piping plovers as well as other waterfowl, raptors, and songbirds. The Michigan Island National Wildlife Refuge provides essential habitat for colonial water birds and the Audubon Society has proposed Gull, Scarecrow, and Hat islands as important bird areas (USFWS 2013; USFWS 2018c).

3.7.4.4 Leopold Wetland Management District

The Leopold Wetland Management District is part of a complex that includes Fox River National Wildlife Refuge, Green Bay National Wildlife Refuge, Gravel Island National Wildlife Refuge, and Horicon National Wildlife Refuge. The district was established in 1993 and manages almost 13,500 acres of waterfowl production areas within the refuges that span seventeen Wisconsin counties. It also administers 45 conservation easements in 21 Wisconsin counties. Waterfowl production areas are wetland habitats that are surrounded either by forested areas or grasslands. They provide essential habitat not only for waterfowl, but for other wetland dependent wildlife such as shorebirds, wading birds, and muskrats (USFWS 2019e).

3.7.5 Invasive Species

This section contains the occurrences of aquatic and terrestrial invasive species in the PBN vicinity, and management activities undertaken by the plant to control such species. The WDNR maintains an inventory of invasive species known to have significant economic impacts on agricultural systems, public infrastructure, or natural resources, or are recognized by ecologists to degrade natural ecosystems, negatively affect native species, or have the potential to have deleterious effects on human health (WDNR 2015b). NEPB maintains guidance documents with policies and procedures for invasive species management.

3.7.5.1 Aquatic Plants

3.7.5.1.1 Eurasian Watermilfoil (Myriophyllum spicatum)

Eurasian watermilfoil is an aquatic plant that has feather-like leaves and can grow between 1 to 3 meters long. Stems of the plant can vary in color between green, brown, or pinkish white. Eurasian watermilfoil can easily be confused with native species with similar appearance. However, it can be distinguished from native species by having more than 14 leaflet pairs per leaf and by the fact that it does not produce buds during the winter. The plant typically flowers twice a year, with yellow flowers that rise 5–10 centimeters above the water surface. Plants automatically break into fragments post-flowering. New roots are produced at nodes along the stem and then the plant fragments at these nodes, allowing the plant to disperse. This species can produce seeds, but typically spreads via vegetative roots and fragments. Although the plant will die back before winter, the roots are capable of surviving until the following spring when it regrows when the water reaches approximately 60°F (Pfingsten et al. 2020).

Eurasian watermilfoil likely spread and became invasive due to the aquarium and aquatic nursery trade. However, this species is largely spread through transport on boating equipment. Ecologically, this species outcompetes native species and reduces the presence of other species. It often grows before other species can germinate and creates dense canopies that reduce light penetration and kill native species below. Eurasian watermilfoil grows in high densities and reduces invertebrate abundance and therefore reduces food resources for fish. The density of the species and the mats it can produce when it dies reduces oxygen levels in the water. Economically, it can clog water intakes, foul beaches, and disrupt the fishing and boating industry (Pfingsten et al. 2020).

3.7.5.1.2 Curly-leaf pondweed (Potamogeton crispus)

Curly-leaved pondweed grows entirely as a submersed aquatic plant with no floating leaves. This species can survive and grow at very low light levels (less than 1 percent of the surface irradiance) and low water temperatures (34-39°F). As such, the plant thrives in polluted waters with low light penetration. Curly-leaved pondweed is often found growing in the deepest vascular plant zone and, in waters with higher light penetration, can be found in 16-23 foot depth contours. This species is capable of surviving under the ice throughout winter. When springtime temperatures rise above 50°F, it exhibits a growth rate of 3–4 inches per day, which allows curly-leaf pondweed to exploit the warming waters before other aquatic plants begin to grow (Thayer et al. 2020).

The species has spread across much of the United States, presumably by migrating waterfowl, intentional planting for waterfowl and wildlife habitat, and possibly even as a contaminant in water used to transport fish and fish eggs to hatcheries. Curly-leaved pondweed can also be spread by plant fragments attached to boats and equipment that are not properly cleaned. Large infestations of curly-leaf pondweed can impede water flow and cause stagnant water conditions. A large amount of phosphorus is released during decomposition after the plant dies and breaks down, which can lead to eutrophication and algal blooms, causing oxygen levels in the water to drop significantly, thus impacting fish (Thayer et al. 2020).

3.7.5.2 Aquatic Animals

3.7.5.2.1 Asian Clam (Corbicula fluminea)

Asian clams were first introduced to the United States in 1938 via the Columbia River in Washington State (Foster et al. 2020). Asian clams are small, lightly yellow-green to light-brown bivalves that average 25 mm in length, but can be as large as 65 mm long. This species both reproduces and reaches sexual maturity very rapidly. Individuals can be capable of reproduction within several months. They are also capable of reproducing by self-fertilization. The average life span of individual clams is between 2 and 4 years, but they can live up to 7 years. Asian clams can be found in various water sources such as lakes and streams, but prefer habitats with high levels of dissolved oxygen and substrate consisting of sand or clay where they can be found on or buried just below the sediment (USFWS 2015b).

The main threat to PBN from Asian clams stems from damage to pipes from clogging, where clams accumulate to such an extent that discharge from or intake into pipes is blocked. Asian clams can easily outcompete native species for food resources and habitat, as well as alter substrate (Foster et al. 2020; USFWS 2015b).

3.7.5.2.2 Zebra Mussel (Dreissena polymorpha)

Zebra mussels were first introduced into the United States from the Black Sea to the Great Lakes. They are native to seas and rivers between eastern Europe and western Asia. Zebra mussels are small bivalves that are no larger than 50 mm long and named for the pattern on their shells; however, colors of the shell can vary, having only light or dark shells with no markings. Reproduction usually occurs during the spring or summer. Females produce approximately 40,000 eggs which are released into the water column and fertilized by males. Up to one million eggs can be produced per female during the spawning season. Larva emerge after 3 to 5 days and remain free floating in the water currents until they develop enough to settle to the bottom and begin searching for a substrate to attach to. Adults are sexually mature when they reach 8–9 mm in length. Individuals typically live between three and nine years. Zebra mussels prefer habitat conditions with optimal temperatures between 68–77°F, although they can tolerate a range of conditions and have shown growth in temperatures as low as 43°F. They feed on algae by efficiently filtering as much as 1 liter of water per day per individual (Benson et al. 2020a).

Zebra mussels have spread to many waterways due to their free floating larval form. Larval mussels then mature and attach to boats by threads and are easily transported to other waterways. They cause significant damage and problems because of their biofouling capabilities. They colonize rapidly and have been known to attach to surfaces in high densities, such as in pipes, reducing water flow and intake capabilities in many nuclear and hydroelectric plants. They also disrupt the natural ecosystems they invade. They reduce the amount of food available and therefore outcompete many native mussel species, which also reverberates up the food chain as it removes food sources from other species including fish. Zebra mussels also affect native mussels species by directly attaching to them and restricting their ability to survive (Benson et al. 2020a).

3.7.5.2.3 Quagga Mussel (Dreissena bugensis)

Quagga mussels were introduced to the United States from Ukraine through the Great Lakes via ballast water from transoceanic vessels. They are small bivalves that are slightly larger than zebra mussels, reaching lengths of four centimeters. Color patterns on the shells can vary from black to white to cream bands that have dark concentric rings. Reproduction is similar to that of the zebra mussel (Benson et al. 2020b). Females produce eggs which are released into the water column and fertilized by males. Larva emerge after 4 to 5 days and remain free-floating in the water currents until they develop enough to settle to the bottom and begin searching for a substrate to attach to. Females are typically sexually mature in their second year. Ordinarily, individuals live between 4 to 5 years (Ianniello 2013). These mussels prefer freshwater with very low salinity levels and temperatures below 82°F. Quagga mussels can attach to both hard and soft substrates, but are generally not found near shorelines due to too much wave motion. They can be found at various depths down to 13 meters depending on water temperature. Phytoplankton are their primary food source, which they obtain by filtering water (Benson et al. 2020b).

Quagga mussels have similar economic and ecological impacts as zebra mussels. However, they have largely displaced zebra mussels in offshore areas of Lake Michigan and they now have a more extensive distribution and abundance in the Great Lakes than the zebra mussel. They reduce the amount of food available and therefore outcompete many native mussel species, which also reverberates up the food chain as it removes food sources from other species, including fish. By removing phytoplankton and filtering the water, they change the clarity of the water, increasing light penetration. This alters the ecosystem by encouraging the growth of vegetation. Quagga mussels also produce waste that as it is broken down and decomposes, reduces available oxygen. They colonize rapidly and have been known to attach in high densities in pipes and on intake screens, reducing water flow and intake capabilities in many nuclear and hydroelectric plants (Benson et al. 2020b).

3.7.5.2.4 Alewife (Alosa pseudoharengus)

Alewife are a small herring species that can grow up to 35 centimeters in length. They are typically bluish to greenish with a dark back and light sides that have horizontal dark stripes (Fuller et al. 2020a). Alewife reach sexual maturity when they are approximately 11 cm long. This species overwinters in deep water and returns to shallower lake waters in the spring to spawn. Alewife in Lake Michigan have been documented spawning at temperatures between 60 and 82°F. Juveniles prefer waters near 90°F, which are found at shallower depths. Juveniles tend to move farther from the shore as they age. After spawning, adults return to open waters away from the shore, but avoid the deeper cold waters and remain in the mid to upper depths of the lake. The temperature tolerance limits of alewife are a minimum low temperature of 37°F and a maximum high temperature of 93°F. Alewife feed on zooplankton and can often be found schooling diurnally (USFWS 2019d).

Alewife populations were dominant in Lake Michigan during the 1950s and 1960s. Large die-offs occurred during this time, fouling beaches and posing health hazards. Large populations of alewife disproportionately consumed prey in the Great Lakes and altered the zooplankton and phytoplankton populations, further affecting native fish populations. Alewife has contributed to the disappearance of lake whitefish (*Coregonus clupeaformis*) and bloaters (*Coregonus hoyi*) and to the decline of chub species in the Great Lakes. Alewife predation of native fish larvae has contributed to the decline of yellow perch (*Perca flavescens*), deepwater sculpin (*Myoxocephalus thompsonii*), emerald shiners (*Notropis atherinoides*), and lake trout (*Salvelinus namaycush*). Alewife contain high levels of an enzyme that can cause thiamine deficiency and early mortality in species that prey on it. Pacific salmon species were recently introduced into the Great Lakes and have helped to control the alewife population (Fuller et al. 2020a).

3.7.5.2.5 Common Carp (Cyprinus carpio)

The common carp is native to Eurasia and was first introduced in the United States in the 1800s. Adult fish can be as long as 25 inches and weigh between 20–60 pounds. Carp coloring can vary from olive, gold, reddish brown, to a blackish-red on top and from silver to yellowish-white below. Tail fins often have red coloring. Age of sexual maturity of the individuals depends on water temperature, with most fish becoming mature between two and five years of age. Common carp spawn from April through August, commencing when water temperatures reach 62°F. Females release eggs into shallow areas which are then fertilized by males. The eggs stick to underwater surfaces such as logs or plants and then hatch within 3 to 16 days. Common carp have a wide range of habitat tolerances and can live in waters that have a range of oxygen, salinity, and turbidity level, but preferred habitats include shallow water with lots of vegetation and little current. When carp inhabit lakes, they will use warmer, shallower water with plenty of vegetation near the edges of the lake. However, during the winter can inhabit areas four to twenty-one feet below the surface of the water. Common carp are omnivorous and feed on a variety of items including invertebrates, plankton, detritus, and vegetation (NatureServe 2019d; Nico et al. 2020).

Common carp can negatively affect the habitat where they exist by destroying vegetation and increasing the turbidity of the water. This reduces spawning habitat and water clarity, thereby reducing habitat for species that require clean water and aquatic vegetation. They have also been known to feed on the eggs of other fish, reducing populations of native species (Nico et al. 2020).

3.7.5.2.6 Round Goby (Neogobius melanostormus)

The round goby is native to the Black and Caspian seas and was introduced to the Great Lakes via ballast water from transatlantic vessels. They are mottled with brown and black blotches, have a white to greenish dorsal fin, and can grow up to ten inches in length. One identifying characteristic is a black spot at the base of the dorsal fin. A second identifying characteristic that helps distinguish them from native sculpins are their fused pelvic fins. The fused pelvic fins form a suction disk that helps the fish anchor themselves to substrate when they are in fast moving waters. Round gobies prefer habitat with rocky substrate near the shore, but can migrate and survive to deeper waters (50-60m) during the winter. However, they are capable of surviving in degraded water conditions. Females reach sexual maturity when they are 1-2 years old and males reach sexual maturity when they are 3-4 years old. The spawning season is long and lasts from April through September. Females are capable of producing between 300 to 5,000 eggs. The eggs are laid in nests that are guarded by the males. Round gobies are able to use a food resource that many other species in the Great Lakes cannot eat. They can feed on zebra mussels, with individuals capable of eating up to 78 mussels a day. They will also prey on small fish, eggs, and aquatic insects. This provides them an abundant food source. They also have a well-developed sensory system that allows them to feed in the dark by detecting water movement. This provides them with a significant advantage over native species (Fuller et al. 2020b; MNSG 2017).

The round goby is known to outcompete native species, particularly the mottled sculpin, for spawning sites and food resources. They have also had a negative impact on lake trout populations in the Great Lakes as they prey on both eggs and young trout. There is also a concern that because round gobies consume zebra mussels, they will transfer contaminants to sport fish that prey on them. Also, birds preying on round gobies are more likely to be infected with avian botulism (Fuller et al. 2020b; MNSG 2017).

3.7.5.2.7 Sea Lamprey (Petromyzon marinus)

The sea lamprey is native to the Atlantic Ocean. They may been native to Lake Ontario because of access through the St. Lawrence River which connects to and drains to the Atlantic Ocean. There is speculation that sea lampreys entered the other Great Lakes through the Welland Canal. Niagara Falls was once a deterrent for the movement of the lamprey, but when the Welland Canal opened for ships to avoid Niagara Falls, it likely opened the pathway for the sea lampreys to inhabit the Great Lakes. It is believed they did not use this pathway until improvements were made to the canal in 1919. Sea lamprey were detected in Lake Erie in 1921 and were abundant in Lake Michigan by the 1930s. Sea lampreys are eel-like in appearance, but are primitive jawless fish that grow between 12 to 20 inches long. They are a grayish blue-black color with metallic violet along their sides and a silvery-white color on the bottom. Sea lampreys are anadromous; they live in marine waters, but return to freshwater sources to breed (Fuller et al. 2020c; MNSG 2016).

Sea lampreys are parasites with a funnel-like mouth with sharp curved teeth that attach to fish and bore into their skins to feed on blood and body fluid. A single lamprey can destroy 40 pounds of fish during its lifetime. They either kill their hosts outright, or the fish succumb to infections of the wound left by the lamprey. Sea lampreys have had a dramatic negative impact on commercial fisheries, having reduced the catch in Lake Michigan from a high of 5.5 million pounds in 1946 to 402 pounds in 1953. Common prey/host species for sea lamprey in the Great Lakes include large native fish species such as lake trout and walleye, but they are also known to prey on burbot, yellow perch, and white sucker, among other species. In addition to reducing populations of commercial species, the sea lamprey invasion contributed to the extinction of three native species: the longjaw cisco (*Coregonus alpenae*), the deepwater cisco (*C. johannae*), and the blackfin cisco (*C. nigripinnis*). The reduction in large predatory species preyed upon by the sea lamprey led to the invasion of alewife, another problematic invasive species in the Great Lakes. Lampricide use began during the 1950s to combat the invasion of sea lampreys. It has helped reduce the sea lamprey population, but requires continual application to keep the population under control. Unfortunately, it has negative effects on native fish and non-parasitic lamprey species. There is also a significant economic cost to purchasing and applying the lampricides (Fuller et al. 2020c; MNSG 2016).

3.7.5.2.8 Spiny Water Flea (Bythotrephes longimanus)

The spiny water flea is a tiny crustacean native to northern Europe and Asia. It is believed to have been introduced into the Great Lakes through ship ballast water and from sediment in ballast tanks. Spiny water fleas range in length from 0.25–0.6 inches long. They have a long tail that is twice as long as their bodies, with one to three pairs of barbs. The tail has a kink in the middle if the flea was produced asexually, while fleas without the kink are produced sexually. They also have a distinctive black eyespot. One of the characteristics that make spiny water fleas successful invaders is their ability to reproduce rapidly. The form of reproduction depends on the season and water temperature, as they can reproduce both sexually and asexually. Asexual reproduction takes place during the spring and summer. Sexual reproduction occurs in the fall when fertilized eggs that are resistant to drying and freezing are released, which then hatch during the spring. The spiny water flea is typically found in the upper water column of temperate lakes, where they are most abundant during the summer and fall. Their preferred conditions are water temperatures between 50-75°F with salinity levels between 0.04-0.4 parts per thousand. However, they can tolerate temperature ranges between 39-86°F and salinity levels between 0.04-8.0 parts per thousand (Liebig et al. 2020; MNDNR 2020).

Spiny water fleas are voracious predators, eating up to 75 percent of their body weight each day by preying on zooplankton. The spiny water flea can disrupt the zooplankton community structure in lakes. They prey on native zooplankton and cause the decline or elimination of zooplankton species. They directly compete with larval fish who also rely on zooplankton. Spiny water fleas provide a food source for some fish, but native species are often unable to eat them because of their long tails and spines. Fishermen often encounter them because they foul fishing gear by getting hooked on fishing lines. They can be observed on fishing line in clumps that resemble a gelatinous blob (Liebig et al. 2020; MNDNR 2020).

3.7.5.3 Terrestrial Plants

3.7.5.3.1 Hairy Willow Herb (Epilobium hirsutum)

Hairy willow herb is an herbaceous perennial semi-aquatic plant native to Eurasia and North Africa. It was likely introduced to the United States through ornamental cultivation. Individual plants can grow up to 6 feet tall. The plant has opposite leaves that are 2-5 inches long and 0.5-1 inch wide. Pink flowers 0.75 inches wide with four petals are produced in July or August. This species can reproduce both through seeds and rhizomes. Each plant can produce up to 70,000 seeds that are dispersed by wind. It is believed that the seeds can remain viable for several years in the soil before germinating. Hairy willow herb is tolerant of flooding as it can often be found in water-logged soils and it is tolerant of semi-shaded areas. The hairy willow herb is an aggressive plant and can easily spread into a variety of different habitats including wetlands and meadows where, once it becomes established, it can form large monotypic stands. Invasion of this species can alter hydrologic regimes, displace native plant species, and degrade wildlife habitat (CDA 2015; PADCNR 2020).

3.7.5.3.2 Reed Canary Grass (Phalaris arundinacea)

Reed canary grass is a cool season grass that is considered to be a 'native invasive' in the Great Lakes region. It is likely a native species with genes from introduced populations or a hybrid of native and non-native varieties. Non-native varieties have been introduced into the United States because reed canary grass has been used agriculturally as forage for livestock. It was also planted for erosion control and shoreline stabilization in many locations. Individual plants can grow between 2 and 9 feet tall. Preferred habitat is fertile and moist clay/loam soil. This species is tolerant of both flooding and mildly saline water. Reed canary grass is difficult to control because it spreads easily through seeds, rhizomes, and stem fragments (Sturtevant et al. 2020; USFWS 2018b).

Reed canary grass is a threat in many habitat types, but particularly in wetlands, wet meadows, wet prairies, marshes, and fens. It can form a thick layer of rhizomes on the subsurface of the soil, impeding the growth of other species. Reed canary grass can alter the hydrology of an area, particularly affecting the edges of ponds, lakes, streams, and ditches. It is also a threat to native wetland plant communities because it outcompetes native plants for nutrients and light. Communities with abundant reed canary grass often have overall lower numbers of plant species and lower soil insect diversity (Sturtevant et al. 2020; USFWS 2018b).

3.7.5.3.3 Narrowleaf Cattail (Typha angustifolia)

Narrowleaf cattail is a perennial species native to Eurasia, temperate Asia, and northern Africa. It has been dispersed throughout the United States through canals and on railroads and highways. It is often difficult to distinguish from the native common cattail (*Typha latifolia*). The native and non-native species often hybridize (*Typha x glauca*), making distinction even more difficult. The easiest time to tell the difference between the native and invasive cattails is after the flower has fully formed in late summer. Narrowleaf cattail prefers wet habitats in full sun. Individual plants can grow up to 7 feet tall. This species can be found in a range of habitats from ditches to wetlands, lakes, and streams. Plants can tolerate inundation to depths of 3 to 6 feet and excessive silt and nutrients, and can survive seasonal drawdowns in water levels (Cao et al. 2020).

Each female plant can produce between 20,000-700,000 seeds that are wind dispersed. These seeds can remain viable for up to 70-100 years if the soil conditions are ideal. In addition to seed dispersal, they also produce rhizomes and can easily spread through this method in addition to seed germination. The narrowleaf cattail often forms monotypic stands that reduce native plants and reduce overall plant species diversity. Dead cattails can remain standing for up to 2 years before falling and decomposing. They can tolerate a wide range of conditions and often outcompete native species when the environment changes (Cao et al. 2020).

3.7.5.4 <u>Terrestrial Animals</u>

3.7.5.4.1 Emerald Ash Borer

The emerald ash borer is native to Asia and is believed to have been brought to the United States in wood packing materials as early as the 1990s. The first beetle was discovered in the United States near Detroit, Michigan, in 2002. Since 2002, it has spread to 23 states and killed over 25 million ash trees. Much of the spread throughout the United States is from people moving firewood cut from infested trees. Adult emerald ash borers are a metallic emerald green and are approximately 7.5-15mm long. The beetles will feed on leaves of the ash tree, but the main damage to the trees is the done by larvae feeding on the inner bark. All native ash trees in the United States have been found to be susceptible to emerald ash borer infestations. Adults are active from May to the beginning of September and are most active on sunny days when temperatures are above 77°F. Males live for an average of 7 weeks, while females live on average for 9 weeks. Females prefer to lay eggs on ash trees that are in open areas or on the edges of forests and will slowly move to more interior trees as the outer trees die from the infestation. Eggs are laid in cracks and crevices in the bark of the trunk, branches, and exposed roots. Once the larvae hatch after 7 to 10 days, they chew a path into the inner bark and outer sapwood. This is where tree nutrients are supported. Larvae will overwinter in the ash trees and emerge the following spring or early summer. They chew their way out and widen the tunnels they made moving to the interior of the tree. The adults emerge from a "D"-shaped hole, and once emerged they subsist on the ash leaves. Once trees become infested with emerald ash borers, they die within 1 to 3 years (Chamorro et al. 2015; USDA 2020d).

3.7.5.4.2 Gypsy Moth (Lymantria dispar)

The gypsy moth was introduced to the United States from western Europe in 1869. Adult male moths are a light brownish-yellow and are diurnal. Female moths are white with wavy black markings and cannot fly. Caterpillars are approximately 2 inches long with yellow and black heads. They are hairy and have five pairs of blue spots followed by six pairs of red spots on their back. Masses of 400-600 eggs are laid on various substrates such as trees and stones. The eggs overwinter and hatch in early spring. The larvae that hatch from the eggs can be dispersed by wind. Larvae will eat the leaves of trees all day and night until they are half grown and they then become nocturnal. The preferred host trees for gypsy moths include alder, aspen, gray birch, white birch, hawthorn, larch, linden, mountain ash, oaks, willow, and witch-hazel. Tree mortality is often due to defoliation multiple years in a row (PSU 2020).

3.7.6 Procedures and Protocols

NEPB relies on administrative controls and other regulatory programs to ensure habitats and wildlife are protected as a result of a change in plant operations (i.e., water withdrawal increase, new NPDES discharge point, wastewater discharge increase, air emissions increase), or prior to ground-disturbing activities. The administrative controls, as presented in Section 9.5, involve reviewing the change, identifying effects, if any, on the environmental resource area (i.e., habitat and wildlife), establishing BMPs, modifying existing permits, or acquiring new permits as needed to minimize impacts. Existing regulatory programs that the site is subject to, as presented in Chapter 9, also ensure that habitats and wildlife are protected. These are related to programs such as the following: stormwater management for controlling the runoff of pollution sources such as sediment, metals, or chemicals; spill prevention to ensure that BMPs and structural controls are in place to minimize the potential for a chemical release to the environment; USACE permitting programs to minimize dredging impacts; and management of herbicide applications to ensure that the intended use will not adversely affect the environment.

3.7.7 Studies and Monitoring

3.7.7.1 Entrainment and Impingement Monitoring

In accordance with the statutory guidelines set forth in the WPDES permit issued to NEPB for PBN, and to maintain compliance under Section 316(b) of the CWA, periodic monitoring of entrainment and impingement of fish and aquatic species is conducted to verify that PBN is utilizing the best technologies available to reduce entrainment and impingement.

3.7.7.1.1 Entrainment Monitoring

Entrainment monitoring took place at PBN during three time periods: 1975, 2006, and 2017. Entrainment data were collected from mid-April through the end of October 1975. During the 1975 study, data were collected for 24 hours every fourth day. Submersible pumps were placed at 20 percent and 80 percent of water depth in front of the second traveling screen. Water was pushed through plankton nets made of 333 micron mesh. Entrainment data were collected at PBN from mid-April through September 2006, and for the same time period in 2017 as part of a series of studies conducted to meet the requirements of the §316(b) Phase II Rule. Samples were collected bi-weekly and every 6 hours during the sampling event to address diel patterns. Samples were collected by pumping water from the intake forebay, which is a sampling approach that represents intake sampling that results in low potential for damage or loss to entrained organisms. Samples were only collected at one depth under the assumption that the intake water was well mixed due to the forebay turbulence. Offshore ambient sampling for fish eggs and larvae, and shellfish, occurred at three depth contours to represent conditions near the plant intake. These samples were collected outside the zone of the thermal plume at depths of 6-8 feet, 18 feet, and 30 feet (EA Engineering 2007; NEE 2018a).

Results from the 1975 entrainment study estimated that during the monitoring period, 2,082,525 fish larvae were entrained, composed of 20 percent alewife, 61 percent smelt, and 17 percent sculpin. Of the 4,661,410 fish eggs estimated to be entrained, all were expected to be alewife. A total of 37,975 "shellfish" and 127 ichthyoplankton specimens were collected during the 2006 study. Results from the 2006 study found that the most common "shellfish" (WDNR considered amphipods as shellfish for the purpose of the study) was *Gammarus* (almost 100 percent of the shellfish sample), with few *Mysis* and no *Diporeia* collected. The lack of *Diporeia* and *Mysis* may have indicated a population decline in Lake Michigan for these species. Rainbow smelt at all life stages accounted for 62.2 percent of the entrained species and was most common in the 30-foot depth. At the 6- to 8-foot depth, rainbow smelt composed 2.2 percent of the sample and was 21.0 percent of the sample at 18 feet. The second most common species was alewife, composing 21.1 percent of the total sample; they were 73.7 percent of the 6-8 foot depth sample, 3.7 percent of the 18-foot, and were not present in the 30-foot depth sample. Other species (at various life stages) entrained included stickleback (2.4 percent of all samples), Coregoninae species (1.6 percent of all entrainment samples), common carp (0.8 percent of all samples), and burbot (0.8 percent of all samples). The results of the 1975 and 2006 study were similar, except that alewife eggs were more abundant than larval alewife in the 2006 study, and the 2006 study had more taxa reported (EA Engineering 2007).

The 2017 study resulted in a total of 32,477 organisms collected that represented five shellfish taxa and five ichthyoplankton taxa. Of the shellfish species, *Gammarus* spp. and *Echinogammarus ischnus* accounted for more than 99 percent of entrained shellfish. Only one native opossum shrimp, *Mysis diluviana*, was collected. The most abundant ichthyoplankton species were rainbow smelt (41.6 percent of total), burbot (26.3 percent), alewife (11.1 percent), and round goby (8.3 percent). The results of the 2006 and 2017 sampling indicate that the relative abundance of alewife and rainbow smelt were similar. Compared to the 2006 study, the 2017 study had a larger proportion of burbot and a smaller proportion of alewife. Larvae, post yolk-sac larvae, and yolk-sac larvae were the life stages most commonly entrained (83 percent). Between the 2006 and 2017 studies, both alewife and rainbow smelt remained the dominant entrained taxa. One difference was that during the 2006 study, juveniles and eggs were the life stages more likely to be entrained, while in the 2017 study it was larvae, yolk-sac, and post-yolk sac larvae. Alewife entrainment also decreased by 67 percent compared to the 2006 study, which mirrors the population decline throughout Lake Michigan for this species (NEE 2018a).

3.7.7.1.2 Impingement Monitoring

Impingement monitoring occurred at PBN between 1975–1976 and 2005–2006. During the 1975–1976 study, impingement monitoring occurred for 24 hours every fourth day from March 1975 through February 1976. During the 1975–1976 study, impinged fish were collected by washing the traveling screens and fish were collected in mesh baskets below the screens. All fish from the wastewater were collected. Determinations were made about sex and sexual state, as well as information regarding length and weight for each specimen. The 1975–1976 study resulted in 313,151 impinged fish, representing more than 25 species. Of the fish collected, 84.79 percent were alewife, 13.81 percent were smelt, 1.4 percent were forage species such as slimy sculpin and ninespine stickleback, and 0.03 percent were trout and salmon. Seasonality influenced species collected. Alewife were not present in the impingement collection from December through April, but became a significant part of the collected samples in late May through early July. For rainbow smelt, most of the individuals collected were taken in October. The estimated total impingement for PBN during the first study was 1,056,724 individual fish weighing 96,904 pounds. Alewife composed 83.9 percent of the projected catch by number of individuals and 95.3 percent by weight. Smelt were estimated to be 15.3 percent by individuals, and 2.2 percent by weight. It was estimated that a large proportion of the impinged alewife were dead prior to being impinged due to a yearly die-off.

When analyzing the impacts of impingement on fish, the speed of juvenile (i.e., smaller) fish is used to help determine a safe intake velocity. The speeds of specific fish species must be maintainable for the fish for 30 seconds or more, which would permit the individual to escape impingement. However, fish are capable of burst speeds that can be up to 50 percent faster than their sustained speeds. The most important factors that can determine the ability of fish to sustain speeds is the size of the fish and water temperature, although other variables such as oxygen concentration and pollutants can have an effect. The intake velocity of 0.5–1.0 feet per second (fps) at PBN appears satisfactory to protect even the smallest impingeable fish.

During the 2005–2006 study, sampling occurred weekly from early December 2005 through mid-May 2006, and twice weekly from mid-May through November 2006. For each sampling period, fish and shellfish were washed from the upstream side of the traveling water screens into a trough and collected in a 3/8-inch square mesh basket placed where the screen wash discharges to a 24-inch pipe leading to the Unit 2 discharge flume. Individuals were determined to be either alive or dead and then were identified to the lowest possible taxonomic level. Species determined to have died 24 hours or more prior to impingement were tallied but not processed further. Results from the study included 40 fish species and one crayfish. Of the 40 fish species, 30 native and 10 non-native species were collected. The introduced species included alewife, four salmon/trout species, rainbow smelt, common carp, white perch, threespine stickleback, and round goby. The only shellfish collected was the Great Lakes crayfish. Throughout the study period, 1.6 million fish and crayfish were collected, weighing approximately 6,134 kilograms. In this study, similar to the one that occurred from 1975–1976, alewife accounted for the majority, 99.1 percent, of the total impingement and almost 93 percent of the biomass. Rainbow smelt accounted for 0.6 percent of the impingement, while the third most common was spottail shiner, composing 0.1 percent. White sucker, after alewife, accounted for the second highest biomass, composing 3.3 percent of the total, which was followed by rainbow smelt at 0.8 percent of the total biomass. High occurrence of few species occurred during both studies. The majority of the species in the second study were small fish or juveniles of large species. The majority of impingement for the Great Lakes crayfish occurred from late April through early August. Similar to the first study, the majority of alewife, the most abundant fish in the impingement samples, were impinged from June onward, and none were impinged between December and early April. Rainbow smelt were more likely to be impinged in October, and less likely from June through September due to higher water temperature. The increase in impinged species from 1975–1976 through 2005–2006 can be attributed to the increase in alewife. PBN had installed an acoustic deterrent system designed to deter alewife, but this malfunctioned for a majority of the 2005–2006 study. The impingement of rainbow smelt was 76 percent less than the 1975–1976 study. PBN uses an offshore intake system and historical impingement data from Lake Michigan power plants indicate that offshore intakes impinge fewer fish (EA Engineering 2007).

3.7.7.1.3 Avian Monitoring

Annual surveys are conducted for nesting piping plovers on the beaches adjacent to the PBN site. If a piping plover is sighted, it is reported immediately to the WDNR and the USFWS. Follow-up surveys are conducted if a plover is observed. However, no breeding pairs or nests were identified on the beaches associated with the PBN site from 2015–2019. NEPB monitors sites for eagle nests prior to any project initiation. Eagles are known to nest in the vicinity of the PBN site. NEPB reports information regarding banded birds found at the facility to the proper federal agency. The intake structure is monitored and any incident where a banded or migratory bird has entered the structure is reported. Studies and monitoring at PBN occur as needed to comply with federal, state, and local regulatory requirements as directed by the agencies and generally prior to new projects.

3.7.7.1.4 As-Needed Monitoring

Studies and monitoring at PBN occur as needed to comply with federal, state, and local regulatory requirements, as directed by the agencies, generally prior to new projects. Any monitoring that occurs is consistent with agency policies and procedures and performed under the guidance of the agency under which coordination is occurring.

3.7.8 Threatened, Endangered, and Protected Species, and Essential Fish Habitat

The USFWS maintains current lists of threatened or endangered species on its website (USFWS 2020a). The WDNR also maintains a list of state protected species on its website (WDNR 2015a). The USFWS federal endangered and threatened species listing and the WDNR state endangered and threatened species listings were reviewed. Species located onsite or potentially occurring near the PBN site, or within counties occurring within a 6-mile radius of the site, that are listed as threatened or endangered by these agencies are described below. Consultation letters with state and federal agencies are included in Attachment C.

3.7.8.1 Federally Listed Species

A total of seven species in Manitowoc and Kewaunee Counties are federally protected under the BGEPA and the ESA. The rufa red knot (*Calidris canutus rufa*), piping plover, rusty patched bumble bee (*Bombus affinis*), and Pitcher's thistle occur in Manitowoc County. The Hine's emerald dragonfly (*Somatochlora hineana*) is known to occur in Kewaunee County, while the northern long-eared bat and the bald eagle are known to occur in both Kewaunee and Manitowoc counties. The ecological requirements for these species are summarized below. With the exception of the bald eagle, no other federally and/or state-listed endangered, threatened, candidate, or delisted terrestrial animals are known to exist at the PBN site or along the transmission line ROWs (WNHI 2020a; WNHI 2020b).

Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to any special status and protected species.

3.7.8.1.1 Bald Eagle

Effective in August 2007, the bald eagle was removed from the federal list of threatened and endangered species. However, the bald eagle is still afforded special protection under the Bald and Golden Eagle Protection Act (BGEPA) and the Migratory Bird Treaty Act (MBTA). The bald eagle is currently globally secure, with current estimates at approximately 9,700 nesting pairs in the contiguous United States (USFWS 2019a).

Bald eagles are large, majestic birds distinguished by a white head and white tail feathers. Bald eagles do not get their characteristic white head and tail until about 5 years of age, remaining mostly brown until then. This can cause identification confusion with golden eagles. However, golden eagles have feathers on the legs all the way down, while bald eagles only have feathers on the tops of the legs. Both males and females are large birds with females weighing up to 14 pounds with an 8-foot wingspan, while males are slightly smaller, averaging 10 pounds with a 6-foot wingspan. Eagles mate for life (USFWS 2019a).

The staple food of bald eagles is fish, but they will feed on waterfowl and small mammals such as rabbits. Eagles are found near rivers, lakes, marshes, estuaries, and seacoasts. They can be found in tall trees used for perching, roosting, and nesting. Nests are built in the tops of trees and eagles will re-use and add to the same nest year after year. Nests can be up to 10 feet across and weigh up to a half ton. If trees are not available, eagles will nest on cliffs or on the ground. Eagles typically breed once a year and lay 1 to 3 eggs that hatch after an incubation period of approximately 35 days. Young eagles can fly 3 months after hatching and will leave the nest about a month after that. Causes of eaglet death include human interference, disease, and lack of food. However, research indicates about 70 percent of eaglets survive the first year of life (USFWS 2019c). Several compounding factors led to the bald eagle's decline. Decline started in the late 1800s with the demise of many waterfowl and shorebird species that were overhunted for their plumage, leading to a loss of prey. Eagles often succumbed to lead poisoning after consuming carrion that had been killed with lead shot. The threat that led to the most significant decline was the pesticide dichlorodiphenyltrichloroethane (DDT), which was popular as a means to kill insects after World War II. DDT residues ended up in waterways, where it was ingested by aquatic organisms and fish. Through a process of biomagnification, eagles were ingesting fish that had high levels of the pesticide in their bodies. DDT caused eggshells to be thin, with most either cracking during incubation or never hatching. By 1963, only 487 nesting pairs of eagles remained. DDT was eventually outlawed and the bald eagle was placed on the endangered species list. Recovery efforts included protecting nest sites, captive breeding programs, reintroduction efforts, and law enforcement of prohibited harassment and take of eagles. In July of 2007 the bald eagle was removed from the endangered species list, with the ruling becoming effective in August of 2007 (USFWS 2019a).

Activities on the PBN site are evaluated to ensure compliance under the BGEPA and MBTA. When necessary, consultation with responsible agencies is conducted to maintain compliance with existing regulations. There are currently no MBTA or BGEPA permitting requirements associated with PBN site operations or in-scope transmission lines that are under the scope of the PBN SLRA. If any work is conducted that could potentially affect bald eagles, the appropriate agencies would be consulted and work would remain farther than 660' from a known nest, and/or any required permits would be obtained. Compliance with all regulatory requirements associated with this species will continue to be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to bald eagles.

3.7.8.1.2 Rufa Red Knot

The red knot is listed as federally threatened. The red knot migrates annually between its breeding grounds in the Canadian Arctic to overwintering regions, which range from the southeastern United States, the northwest Gulf of Mexico, northern Brazil, to Tierra del Fuego at the southern tip of South America. During both the northbound (spring) and southbound (fall) migrations, groups of a few individuals to thousands of red knots can be found anywhere along the coastal and inland United States migration corridors from Argentina to Canada. In the spring, well-known staging and stopover areas include Patagonia, Argentina; eastern and northern Brazil; the southeastern United States; the Virginia barrier islands; and Delaware Bay. In the fall, well-known migration stopovers include Hudson Bay, James Bay, St. Lawrence River, Mingan Archipelago, and the Bay of Fundy in Canada; the Massachusetts and New Jersey coasts; the Altamaha River in Georgia; the Caribbean; and the northern coast of South America from Brazil to Guyana. Throughout the range, red knots occur primarily along the coasts, but also migrate across areas of open ocean as well as over land (USFWS 2014).

In the United States, red knots use both coastal and interior routes during migration, including the central, Mississippi, and Atlantic flyways. Most records in the interior states show small numbers, fewer than 100 red knots, but there are multiple records in every inland state. Although several thousand red knots migrate through inland areas each year, scientists are just beginning to discover where these birds are stopping to rest and feed along the way. For example, geolocator information shows red knots using stopovers in North Dakota and in Montana, and there are clusters of sighting records along tributaries to the Mississippi River and along the Great Lakes (USFWS 2014).

Threats to food resources from climate change and other causes occur throughout the red knot's range. Data suggest reduced horseshoe crab populations in Delaware Bay due to commercial harvesting is an important factor in red knot population declines. The birds rely on horseshoe crab eggs as a major source of nutrition during migration. Since 2000, the Atlantic States Marine Fisheries Commission has restricted harvest of horseshoe crabs, and in 2012 it implemented an adaptive management framework that explicitly ties crab harvest levels to red knot populations. Though crab numbers have not completely rebounded, the full implementation and monitoring of this framework should lead to increased crab populations and help red knot recovery. Outside Delaware Bay, the red knot feeds mainly on small clams and mussels, except in its arctic breeding grounds, where it feeds mainly on insects. Climate change has begun affecting both types of prey. Oceans are more acidic as carbon dioxide emitted into the atmosphere dissolves in the ocean; this interferes with the ability of clams and mussels to form shells. Clams and mussels are also sensitive to warming water temperatures, and changes in their geographic distribution or timing of spawning are likely to affect red knot food supplies during important stopover periods. For example, the range of blue mussels, the young of which are an important prey species for red knots, has already shrunk due to warming ocean temperatures and the mussel may soon be unavailable as a resource for migrating red knots. On the arctic breeding grounds, insects are hatching earlier in the spring due to warming temperatures. This change in timing could cause red knot chicks to miss the peak window for feeding and rapid growth before their long southward migration. Additionally, sand placement projects and off-road vehicle use are known to bury or crush animals that the red knots eat (USFWS 2014). A review of the WNHI species observation data yielded no observation of this species within 6 miles of the PBN site (WNHI 2019). Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to this species.

3.7.8.1.3 Northern Long-Eared Bat

The northern long-eared bat is federally and state listed as threatened. On Jan. 28, 2020, the U.S. District Court for the District of Columbia remanded the federal listing decision to the USFWS to make a new decision whether the northern long-eared bat should be listed as endangered. *Center for Biological Diversity v. Everson*, No. 15-477. However, the threatened listing currently remains in effect (DDC 2020). The northern long-eared bat is 3–3.7 inches long with a wingspan of 9 to 10 inches. It is distinguished by its long ears, which are larger than other species in the genus *Myotis*. Fur color ranges from medium to dark brown on its back and tawny to pale brown on its front. During the summer, northern long-eared bats use cavities under bark on both dead and live trees as well as mines and caves to roost. Females will roost in small colonies of 30 to 60 bats and on average give birth to one pup per female. During the winter bats hibernate in small crevices and cracks in caves and mines that have constant temperatures, high humidity, and no air currents. Changes to any wintering site microclimates can make that habitat unsuitable for the bats. Threats to this species include white-nose syndrome, impacts to roost sites, loss of habitat, and wind farm operations (USFWS 2015a). Due to the sensitive nature of this species to collection and disturbance, known locations are not available below the county level (WNHI 2017). Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to northern long-eared bats.

3.7.8.1.4 Rusty Patched Bumble Bee

The rusty patched bumble bee is federally listed as endangered. It is considered a species of concern in Wisconsin, but is not listed as threatened or endangered by the state. Rusty-patched bumble bees have a black head, a yellow upper thorax with a black spot between the wings, and a black lower thorax. Queens, workers, and males all have slightly different characteristics that distinguish them from one another. Queens can be distinguished by their larger size, and the upper thorax is yellow as are the two first abdominal sections, while the rest of the segments are black. On workers and males, the first abdominal section is yellow, while the second has a patch of rusty hairs on the back. Workers can be seen from late June through September, while males are present late summer to fall. The queens can be seen from mid-March through May and again from late summer through fall (USFWS 2017b; USFWS 2019b). Rusty patched bumble bees live in colonies that have an annual cycle. Queens emerge from hibernation in the spring and find new nest sites. She then lays eggs that were fertilized the previous fall. Worker bees hatch from the eggs and start forming the colony, while the queen continues to lay eggs. New queens are also hatched at this time. Later in the fall males leave the colony to mate with queens. All workers, males, and queens die. The new queens hibernate over the winter and start new colonies the following spring (USFWS 2017b).

Rusty patched bumble bees are an important part of the ecosystem as they pollinate a diversity of plants. They rely on the pollen and nectar from these plants from April through September. This species is imperiled because of several threats. The first is habitat loss and degradation. Historically, rusty patched bumble bees could be found in prairies and grasslands, but most of these areas have been converted to either urban areas or for agriculture. Second, the changes in agricultural practices have also impacted this species. Decreases in plant diversity has led to limited food sources. Third, pesticides harm the bees by either being absorbed through their exoskeleton from contaminated nectar and pollen or by pesticides that have remained in the soil where they hibernate and nest (USFWS 2017b). A review of the WNHI species observation data yielded no observation of this species within 6 miles of the PBN site (WNHI 2019). Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to this species.

3.7.8.1.5 Hine's Emerald Dragonfly

Hine's emerald dragonflies are federally and state listed as endangered. Hine's emerald dragonflies are sometimes locally known as the Ohio emerald dragonfly or Hine's bog skimmer. They are 2.5 inches long, with an average wingspan of 3.3 inches. They can be distinguished by their emerald green eyes. They have dark brown bodies, with yellow stripes on the thorax. During the breeding season, males develop small territories that they defend from other males, but when a female enters, they attempt to mate with her. Females lay eggs by dipping the tips of their bodies into the water. Nymphs hatch and live under the water for 2 to 4 years before emerging from the water. They shed their exoskeletons multiple times, remaining underwater until they shed their skin for the last time and emerge as an adult dragonfly. Adult dragonflies typically only live for 4 to 5 weeks. This species can be found in Illinois, Michigan, Missouri, and Wisconsin. They prefer wetland habitats with high levels of calcium carbonate, typically inhabiting spring-fed marshes and sedge meadows overlaying dolomite rock (USFWS 2019c).

Threats facing Hine's emerald dragonflies include habitat loss and degradation, particularly as wetland habitat is lost to development. Pollution and pesticides can contaminate the wetland habitat that the dragonflies rely on. Changes to groundwater affects the condition of wetlands, thus affecting the dragonflies' ability to use the habitat for reproduction and survival (USFWS 2019c). A review of the WNHI species observation data yielded no observation of this species within 6 miles of the PBN site (WNHI 2019). Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to this species.

3.7.8.1.6 Pitcher's Thistle

Pitcher's thistle is federally and state listed as threatened. Named after Dr. Zina Pitcher, who discovered the plant in 1820, this thistle is smaller than other species found in the area. It is endemic to the Great Lakes region and has a long life cycle. Pitcher's thistles exist as a basal rosette of leaves between 5 to 8 years before maturing. They then produce a stem, flower, seed, and senesce shortly after. When flowering, the plant can be 3 to 4 feet tall. Whitish to light pink flowers bloom between June and September. The leaves are woolly, silvery green in color, deeply toothed, and have spines on the tips. The taproot can grow up to 6 feet long, providing the plant access to water. Pitcher's thistles prefer open habitat with exposed sand and are therefore found on dunes, beaches, and secondary dunes along the Great Lakes (Harwood 2019; NPS 2015).

Human activity is a threat to this species. Among the threats caused by humans are residential and commercial development along the shores of the Great Lakes. Because beaches and dunes are used for recreation, foot traffic can trample the plants, particularly in the immature stage. Fragmented populations also create pollination problems. The seeds of thistles provide a good food source for many birds and small mammals, but many of the seeds are consumed before being able to germinate (Harwood 2019; NPS 2015).

Based on a review of WNHI species observation data, Pitcher's thistles have been documented at least once in township 20N range 25E, which is partially within a 6-mile radius of PBN (WNHI 2019). Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to this species.

3.7.8.1.7 Piping Plover

Piping plovers are federally listed as threatened. Piping plovers are small shorebirds that are approximately 7 inches long and weigh between 43-63 grams. During the breeding season, adult birds are sandy gray above, with a white collar and underparts. They have a black band that stretches across the forehead between the eyes and a black band also develops around the neck. Legs are orange, and the bill is orange with a black tip. During the non-breeding season, the feathers on the back are paler and the black bands on the forehead and neck are not present. The bill becomes all black. Piping plovers breed from the northern Great Plains through North Dakota and South Dakota and southward along major rivers to northern Kansas. They can be found breeding on the beaches of Lake Superior, Lake Michigan, and Lake Huron in Michigan and Wisconsin. The Atlantic population breeds along the coast of New England from Novia Scotia through the mid-Atlantic coast down to North Carolina. Little is known about their overwintering territory. The population of piping plovers that breeds in the Great Plains region spends the winter along the Gulf Coast, while the population that breeds along the

Atlantic coast spends the winters further down the Atlantic coast near Florida. They are also thought to overwinter in Mexico, the Bahamas, and Cuba. Fall migration peaks between August and September, but can occur from July through November. Spring migration peaks by mid-April and most birds have left overwintering sites by mid-May (Elliott-Smith and Haig 2004).

Breeding begins in late April to early May and pairs typically raise only one brood per year. Nests are constructed in sand, shells, or gravel-covered ground near patches of grass, away from water, and near a large object such as a log. Nests are shallow depressions scratched into the ground 1 to 2 centimeters deep that may or may not be lined with pebbles or shells. Females typically lay four eggs, which are incubated for approximately 20-30 days by both the males and females. Both parents also brood the young birds after hatching. Chicks forage near their parents and remain with family groups through fledging, which can occur between 21-35 days after hatching. Piping plovers prefer wide and sparsely vegetated beaches and have been documented breeding on alkali lakes, barrier islands, reservoirs, rivers, and on sand bars. Similar habitat on beaches, mudflats, and sandflats along the Gulf of Mexico and Atlantic coasts are preferred during the winter months. Threats to this species include habitat degradation and loss, particularly from development and beach stabilization projects (Elliott-Smith and Haig 2004). Critical habitat for the piping plover is located along the beach of Lake Michigan approximately 3 miles south of the PBN site (USFWS 2020b). Annual surveys are conducted for nesting piping plovers on the beaches adjacent to the PBN site. Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to this species.

3.7.8.2 State-Listed Species

A total of 37 state-listed species are listed as potentially occurring in Kewaunee and Manitowoc counties. These species are: peregrine falcon, red-shouldered hawk, black tern (*Chlidonias niger*), Caspian tern, upland sandpiper (*Bartramia longicauda*), Acadian flycatcher (*Empidonax virescens*), Henslow's sparrow, cerulean warbler (*Setophaga cerulea*), hooded warbler (*Setophaga citrina*), northern long-eared bat, tri-colored bat (*Perimyotis subflavus subflavus*), big brown bat (*Eptesicus fuscus*), little brown bat (*Myotis lucifugus*), Blanchard's cricket frog (*Acris blanchardi*), redfin shiner (*Lythrurus umbratilis*), longear sunfish (*Lepomis megalotis*), pugnose shiner (*Notropis anogenus*), slippershell mussel (*Alasmidonta viridis*), monkeyface mussel (*Theliderma metanevra*), ellipse mussel (*Venustaconcha ellipsiformis*), Hine's emerald dragonfly, rusty patched bumble bee, hairy-necked tiger beetle, Hubricht's vertigo (*Vertigo hubrichti*), cherrystone drop (*Hendersonia occulta*), Pitcher's thistle, prairie sandreed, fairyslipper orchid, shore sedge (*Carex lenticularis*), streambank wheatgrass, clustered broomrape, shore buttercup (*Ranunculus cymbalaria*), heartleaf willow, sticky tofieldia (*Triantha glutinosa*), snow trillium (*Trillium nivale*), harbinger of spring (*Erigenia bulbosa*), and forked aster (*Eurybia furcata*) (WNHI 2020a; WNHI 2020b).

Ecological descriptions and requirements for these species are summarized below. Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practice by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations should prevent potentially negative impacts to any special status and protected species.

3.7.8.2.1 Peregrine Falcon

The peregrine falcon was federally delisted in 1999 and is classified by the USFWS as in recovery, but is considered endangered in Wisconsin (WDNR 2015a). Peregrine falcons are approximately 15 to 21 inches long and have a wingspan of about 40 inches. The species is sexually dimorphic, with females larger than males. They have slate blue/gray wings, black bars across the back, and pale white or buff undersides with brown stripes/spots. They also have white faces with black stripes on each cheek, as well as dark eyes. Birds will mature to breeding age around 2 years. Falcons lay an average of four eggs in nests that are often on cliff edges or on edges of man-made structures. Peregrines are known for their diving speed, which they use to strike prey in mid-air. Prey often consists of other bird species including songbirds, shorebirds, ducks, pigeons, and starlings (USFWS 2006).

The peregrine falcon used to be widespread across the United States, but the population was never very abundant. The population crashed by the mid-1960s with the extirpation of the east coast populations. The primary element of the most significant decline was DDT, the pesticide which was a popular means to kill insects after World War II. DDT residues were on seeds and insects that small birds ate, and through a process of biomagnification the peregrine falcons were ingesting smaller birds that had high levels of the pesticide in their bodies. DDT caused eggshells to thin, with most either cracking during incubation or never hatching. DDT was eventually outlawed and the American peregrine falcon was placed on the endangered species list. Recovery efforts included releasing up to 6,000 captive-reared birds through an intensive reintroduction program (USFWS 2006).

Based on a review of WNHI species observation data, peregrine falcons have been documented at least once in township 22N range 24E, which is partially within a 6-mile radius of PBN (WNHI 2019). Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to this species.

3.7.8.2.2 Red-Shouldered Hawk

Red-shouldered hawks are listed as threatened in Wisconsin (WDNR 2015a). Males range in size from 17-22 inches and weigh on average 1.2 pounds, while females range from 19-24 inches long and weigh approximately 1.5 pounds. Adult males and females have a similar appearance, although slight differences in size occur regionally with hawks being slightly smaller in the west and south. Adults are rusty to reddish brown underneath and have red shoulder patches. Wings are black and white barred above and similar, but less contrasting, below. Tails are barred with alternating dark and white bands and a white tail tip. Juveniles are brown above, with various dark and medium brown feathers with light brown edges. Underneath, they are a cream to pale yellowish brown color. Adults have black bills, yellow legs and feet, black talons, and dark brown eyes. Red-shouldered hawks are largely non-migratory except for the northern population. Birds that inhabit the United States year-round can be grouped into an eastern and western population. The eastern population ranges from southern Canada down to the Gulf Coast and from the Atlantic to the eastern edge of the Great Plains. The western population ranges from Oregon south to Baja California and east into Arizona. Birds that do migrate generally do not travel far. Northern birds will fly south, with fall migration peaking late October through early November. Spring migration peaks from late February through early April. Most migrants will follow river corridors and shorelines such as the Great Lakes (Dykstra et al. 2008).

Breeding habitat is found primarily in deciduous forests and occasionally in mixed deciduous-coniferous forests. Hawks generally select nest trees that are larger and taller than what is found in surrounding areas. Nest trees also tend to be located within the vicinity of a water source. However, some hawks will nest in suburban areas. Nests are constructed by both males and females and consist primarily of dead and live twigs with various other resources included such as evergreen sprigs, leaves, bark, songbird nests, and plants. The nest building, or refurbishing in cases where nests are used from previous years, takes approximately 4 to 5 weeks. Females lay eggs several days apart and incubate each egg for approximately 33 days. Males occasionally help incubate the eggs. Once hatched, adults feed the young on small mammals, reptiles, and amphibians. Young birds fledge the nest when they are about 6 weeks old (Dykstra et al. 2008).

Outside of the breeding habitat, red-shouldered hawks are associated with lowland areas near water. They will also use open habitat such as fields, but require areas to perch. Hawks perch on items such as telephone poles and tree branches, where they wait and drop down on prey when hunting. They also occasionally hunt from the ground or fly just above ground level. Major threats to this species stem from a loss of forested habitat. The loss or degradation of large forested tracts has reduced available breeding and overwintering habitat. It has also created habitat that is more favorable to great horned owls and red-tailed hawks, which outcompete red-shouldered hawks for habitat and resources (Dykstra et al. 2008).

Based on a review of WNHI species observation data, red-shouldered hawks have been documented at least once in townships T20 (R24,25E), T21 (R23,24,25E), and T22 (R24, 25E), which are wholly or partially within a 6-mile radius of PBN (WNHI 2019). Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to this species.

3.7.8.2.3 Black Tern

Black terns are listed as endangered in Wisconsin (WDNR 2015a). Black terns are small terns that are 9 to 10 inches long and weigh between 50 and 60 grams. During the breeding season, they are easily recognized by their black head and underbody. Back, wings, and tail are black, with white feathers underneath the tail. The legs are black with a slight pinkish tinge, and the bill is also black. The eyes are a deep brown. Juveniles and adults in the non-breeding season have a different appearance compared to breeding season plumage. The head and underbody are white, the tail, top of the head, and wings are gray. The legs are gray with black toenails. The terns breed in the northern United States and Canada and overwinter along the coasts of Central America and northern South America. Fall migration begins in mid to late August and during the spring. By mid-May, terns have returned to their breeding grounds (Heath et al. 2009).

Black terns nest semi-colonially in freshwater wetlands. Nests are constructed of dead vegetation on floating substrate in shallow water and typically consist of a small mound with a shallow depression in the middle. Females typically lay three eggs, which are then incubated by both sexes for approximately 20–21 days. The eggs are adapted to the moist environment. Adults brood the chicks for approximately 6 to 10 days. Chicks may fledge the nest before taking their first flight. First flights for chicks can be 18–24 days after hatching. Black terns rely on insects, primarily damselflies and dragonflies, and small fish during the summer. During the winter, they will eat small marine fish, plankton, and water striders. During the breeding season and migration, black terns rely heavily on freshwater wetland complexes and during the winter, they tend to use marine and coastal habitats. When overwintering, most birds can be found in marine areas within 20 miles of land. Habitat selection during the breeding season is related to landscape structure, as terns prefer wetland habitats in complexes larger than 50 acres. They also predominantly select wetlands that had corresponding upland habitat that was not in agricultural development or forested. When choosing nesting sites within wetlands, the water tends to be still and 25–75 percent covered with vegetation, and floating dead vegetation is also present. Nest sites also tend to be closer to open water than the shore. Water in the wetlands are usually between 0.5–4 feet (Heath et al. 2009).

The largest threat to the black tern is loss and degradation of wetland habitat in both the breeding and migratory range. Because they prefer larger wetland complexes within the landscape, habitat fragmentation is likely also a major problem. Another concern for the species is overfishing, which depletes their food source along coastal marine areas (Heath et al. 2009). A review of the WNHI species observation data yielded no observations of this species within 6 miles of the PBN site (WNHI 2019).

3.7.8.2.4 Caspian Tern

Caspian terns are listed as endangered in Wisconsin (WDNR 2015a). The Caspian tern is a large tern that is 18–21 inches long and weighs between 530–782 grams. During the breeding season adults are light gray on their back and wings, and their underparts and tail are white. There is a distinctive black cap on their head that extends just below the eye. Feet are black and legs can be mottled or vary from orange-red to yellow. Breeding adults have a bright red bill with yellow tip. Juveniles and non-breeding adult bills are more orange with a black tip. Juveniles have a blackish cap and on their backs some feathers may have black or brown V-shaped marks on them, while their underparts are white. They also have a narrow white eye ring. Non-breeding adult crowns are mottled black with brown or white. Caspian terns breed in North America and spend the winters along the lower Atlantic and Gulf Coasts of North America, and along the Atlantic coasts of Mexico through northern South America. The terns breed in six regions of North America. They can be found along the Pacific Coast near Alaska and there are breeding territories in eastern Washington and Oregon, western Nevada, California, and into Mexico. There are also breeding areas in central Canada, southern Idaho, and northwest Wyoming, along the Gulf Coast of Texas to Florida, Newfoundland, along barrier islands in North Carolina and Virginia, and along the Great Lakes (Cuthbert and Wires 1999).

Caspian terns breed in colonies near other bird species. Breeding begins shortly after arriving on the summer territories. Nests are created in vegetation free areas by digging depressions in the ground, which may then be lined with vegetation or small shells or pebbles. The substrate is usually sand, gravel, or limestone. Terns will breed in a wide variety of habitats ranging from coastal estuaries to freshwater islands. Birds that nest along the Great Lakes start laying eggs the beginning of May. Females lay one to three eggs which are incubated by both males and females. Chicks hatch after 25–27 days. Both sexes will brood the chicks until the chicks fledge the nest around 37 days after hatching. However, the adults will continue to feed juvenile birds for several months. Caspian terns almost exclusively rely on fish for their diet. They catch the fish by diving below the surface, where they typically feed on alewife and rainbow smelt in Lake Michigan. During the winter months, terns can be found using a variety of habitats. For example, on the U.S. Atlantic coast they have been documented on barrier islands and beaches, while in Louisiana and California they use marshes and other sources of fresh or brackish water habitats. Preferred breeding habitat is open area consisting of sand or gravel that is sparsely vegetated. During migration, terns will use coastlines of large rivers and freshwater lakes as stopover sites to rest and refuel (Cuthbert and Wires 1999).

There are several threats to the Caspian tern population. They are sensitive to human disturbance, which can cause them to abandon nests. When terns are disturbed, they will also flush from the nest, which provides greater opportunities for their eggs to be preyed upon. Another threat is the accumulation of toxic contaminants through fish, which lowers reproductive success and can lead to increased mortality of chicks and adults during migration (Cuthbert and Wires 1999). A review of the WNHI species observation data yielded no observations of this species within 6 miles of the PBN site (WNHI 2019).

3.7.8.2.5 Upland Sandpiper

Upland sandpipers are listed as threatened in Wisconsin (WDNR 2015a). Upland sandpipers are considered medium-sized shorebirds, although they are not associated with coasts or wetlands, but rather grasslands. The birds are typically 11–12.5 inches long and females weigh between 121–246 grams, while males weight between 112–179 grams. Both sexes have a similar appearance during the winter and breeding seasons. They have small heads, long legs, and a long neck. Birds are dull olive to brown with strong patterns of dark brown and buff on their backs which helps camouflage them in grassland habitats. They typically have a dark crown on their heads. Their undersides are pale yellow to whitish with brown barring on the breast and sides. Their bills are slender with a slight curve downward at the end and are typically yellow with a black tip. Their legs and feet are grayish yellow with brown-black claws. Juveniles have a similar appearance to adults, except they lack the dark crown on their head (Houston et al. 2011).

Upland sandpipers breed in the north-central United States and Canada. Their breeding range in the coterminous United States extends from Montana eastward to western New York and Maine, and south into Nebraska and Ohio, though it is largely absent from southern Michigan and northeastern Indiana. There are a few isolated populations that breed in eastern and central Alaska. This species spends relatively little time on the breeding ground, typically only 4 months, and spend as much as 8 months in their overwintering territory. The birds spend the winter in South America east of the Andes Mountains, southward to Brazil, Paraguay, Uruguay, northeast Argentina and eastern Bolivia. Upland sandpipers migrate nocturnally through the Great Plains. Spring migration typically begins in February through March and April, while fall migration occurs from mid-July to late August. Birds start building nests approximately 2 weeks after they arrive on the breeding grounds. Nests are constructed in un-grazed upland habitats with dense vegetation 4–25 inches tall to provide cover. Nests are scrapes in the ground that slowly have vegetation added as a liner. Birds will also pull overhanging grasses to create a canopy over the nest. Females typically only lay one brood per season, which usually consists of four eggs. The eggs are incubated by both males and females for 21–29 days. Males provide most of the care for the chicks. Young birds are active at a week and begin searching for their own food. The broods of birds will move to more open habitat away from the nest site after hatching. Young birds begin to fly 27–29 days after hatching and when they are older than 30 days and capable of flight they are not cared for by parents (Houston et al. 2011).

The presence of upland sandpipers indicates the health of native prairies. During the breeding season they prefer dry grassland habitats with low forb and low woody cover, and moderate cover of grass and litter. While migrating, sandpipers will use pastures and cultivated fields. Little is known about their habitat preferences during the winter months, but it is assumed they prefer similar grassland habitats. Upland sandpipers were once hunted extensively. Today, the threat to this species lies in degradation and loss of habitat, particularly conversion to agriculture or development. When birds nest on pasture, cows pose a threat because they trample eggs and young (Houston et al. 2011).

Based on a review of WNHI species observation data, upland sandpipers have been documented at least once in townships T20 (R24,25E), T21 (R23,24,25E), and T22 (R24, 25E), which are wholly or partially within a 6-mile radius of PBN (WNHI 2019). Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to this species.

3.7.8.2.6 Acadian Flycatcher

Acadian flycatchers are listed as threatened in Wisconsin (WDNR 2015a). Acadian flycatchers are large flycatchers that weigh about 13.1 grams. During the breeding season, adults have upperparts that are olive green, with pale underparts. The lower face is pale green, the throats are grayish white, and there is a faint-olive breast band and the underparts are pale yellow. They have a distinct white eye ring and wings are dark with contrasting buff colored bars. During the winter season, the wing bars become white to buff, they become whiteish gray below, and the eye ring becomes indistinct. Juveniles are similar in appearance to winter adults. Legs and feet are grey, the upper mandible of the bill is dark, and the bottom is pinkish to yellow. Eyes are dark brown. Acadian flycatchers breed in the central and eastern United States from eastern Texas northward to Wisconsin, eastward to Pennsylvania and south to northern Florida. They overwinter in Central America from Nicaragua and Panama through Costa Rica and southward to Columbia, Venezuela, and Ecuador. They migrate along the eastern coast of Mexico and Central America. Spring migration occurs from mid-March through mid-May, and the return to overwintering grounds occurs from late August through October (Allen et al. 2017).

Females begin creating nests within a week of arriving on breeding grounds. They choose branches with a fork in them to create the nest on. They never build a nest against the trunk of the tree. Nesting sites are often associated with water and therefore are usually along a stream or forested swamp. Depending on the location, some common trees chosen for nesting include witch hazel, white oak, beech, and hemlock. Nests are not usually protected by surrounding vegetation. Vegetation is absent below the nest because that is how the adults approach. The nests are constructed with fine bark, grape tendrils, oak and hickory catkins, grasses, and spider silk. Nests consist typically of three eggs, which are incubated for 13-15 days by females. Once the eggs hatch, females continue to brood the young, however, both sexes feed the chicks. The food includes caterpillars, moths, flies, and small butterflies. Young birds fledge the nest 12-18 days after hatching. Most females lay single broods, but sometimes lay a second (Allen et al. 2017).

Throughout the breeding range, Acadian flycatchers require large areas of undisturbed mature forest. Depending on location, they can be found in deciduous riparian forests and in swampy woodlands. In the northwest region, they nest preferentially in hemlock stands. The birds are more likely to be found in primary or second growth forests that can be dry or wet during the winter and migration. They also utilize shade-grown coffee plantations, which may provide habitat in fragmented and modified areas. Because this species requires large patches of mature forest, habitat loss and fragmentation are potential threats to the population. Deforestation on its wintering habitat is also a problem. Also, throughout the breeding range, their preferred hemlock trees are succumbing to the invasive hemlock woolly adelgid (Allen et al. 2017).

Based on a review of WNHI species observation data, Acadian flycatchers have been documented at least once in townships T20 (R24,25E), T21 (R23,24,25E), and T22 (R24, 25E), which are wholly or partially within a 6-mile radius of PBN (WNHI 2019). Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to this species.

3.7.8.2.7 Henslow's Sparrow

Henslow's sparrows are listed as threatened in Wisconsin (WDNR 2015a). Henslow's sparrows are small grassland birds that are 5 inches long and weigh between 7-15 grams. Both sexes are similar in appearance, although males may be slightly longer than females. They have whitish underparts with blackish streaks across the breast and legs. The upper back and wings are reddish brown with dark patterns. Heads are olive-green to brownish-olive with distinctive dark lines on the throat and crown. Their bills are brown-gray on the top and pinkish brown on the bottom. Legs and feet range in color from light brown to white, to pinkish-brown to gray. Juveniles have a similar appearance, except that markings are duller. Henslow's sparrows breed in the upper Midwest of the United States from Wisconsin east through Pennsylvania and New York, south through parts of Iowa, Kentucky, and northwest West Virginia. They overwinter throughout the southeastern United States and along the coast from eastern Texas and Louisiana and the lower/coastal portions of Alabama, Georgia, South Carolina, North Carolina, and Texas. Populations are local and variable within these areas. Little is known about their migratory behavior. Spring migration likely begins in March and lasts through May, with most migration occurring in April. Fall migrants likely return to overwintering sites between September and October (Herkert et al. 2018).

Breeding occurs between late April and August. Females construct nests approximately 6-8 centimeters off the ground with the bottom of the nest about 1 centimeter from the ground in thick litter, in thick clumps of grass, or occasionally attached to stems of forbs and grasses. Nests are constructed from grasses loosely woven together. Two to five eggs are laid and females incubate the eggs until hatching. Once hatched, both adults will feed the chicks until they fledge the nest around 9-10 days later. During the breeding season, Henslow's sparrows prefer habitat consisting of large fields with dense grasses, a well-developed litter layer, little to no trees, and areas with less than 7 percent slope. The density and depth of litter as well as vegetation height and density play important roles in breeding habitat selection. On overwintering sites, the sparrows prefer similar habitats to those selected during the breeding season. They have been documented in areas of low moisture, open pine flats, and burned habitats with a fire return frequency of 3 to 5 years. The biggest threat to Henslow's sparrows is habitat loss and degradation. Loss of habitat has been due to succession of vegetation because of fire suppression, agricultural conversion, urbanization, cattle grazing, or management such as mowing (Herkert et al. 2018).

Based on a review of WNHI species observation data, Henslow's sparrows have been documented at least once in townships T20 (R24,25E), T21 (R23,24,25E), and T22 (R24, 25E), which are wholly or partially within a 6-mile radius of PBN (WNHI 2019). Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to this species.

3.7.8.2.8 Cerulean Warbler

Cerulean warblers, a small songbird, are listed as threatened in Wisconsin (WDNR 2015a). Adult males are blue above and white underneath, while adult females are bluish green above, while the underparts are white with a wash of yellow. Both sexes have two white wing bars and white tail spots. Legs and feet are dark, either black or slate with blue-gray soles. Bills of adult males are black with varying amounts of blue-gray on the lower bill, while adult females have dark bills with varying amounts of brown on the lower bill. Juveniles have an appearance similar to adult females. Cerulean warblers breed between late April and late July. Distribution of breeding habitat is from central Minnesota and northern Wisconsin, eastward to Connecticut and Rhode Island, south to the mountains of West Virginia and North Carolina. Usually only one brood is produced per breeding season. Nests are constructed predominantly by females, who weave nests from fine plant fibers, fine grass stems, hair, spider silk, and lichens. Females incubate two to five eggs and once hatched, both parents feed the young until fledging (Buehler et al. 2013).

Cerulean warblers overwinter in the mountains of northern South America, including Colombia, Venezuela, Ecuador, Peru, and Bolivia. Spring migration from South America to breeding grounds in North America occurs from late March through mid-May, with migration peaking April-May. Fall migrants begin to leave the breeding grounds as early as late July and continue through early October. This species is associated with forested habitats during both its breeding and overwintering range. They prefer areas with canopy gaps in deciduous forests on north- and east-facing slopes and in riparian bottomlands. Preferred tree species for nesting, foraging, and perching include white oak (*Quercus alba*) and bitternut hickories (*Carya cordiformis*), while avoidance of red oak (*Quercus rubra*) and red maple is common. During the winter, habitat preferences are similar (Buehler et al. 2013).

Major threats to this species are habitat loss and degradation. Forests have been fragmented or cleared, leading to loss of both breeding and overwintering habitat. This is particularly relevant in areas where mature riparian forests are lost and where oaks, sycamores, elms, and American chestnuts are lost (Buehler et al. 2013). A review of the WNHI species observation data yielded no observations of this species within 6 miles of the PBN site (WNHI 2019).

3.7.8.2.9 Hooded Warbler

Hooded warblers are listed as threatened in Wisconsin (WDNR 2015a). Hooded warblers are average sized warblers that are approximately 5 inches long and weigh about 11 grams. Males and females have a slightly different appearance. Males are very distinctive with an olive green back, yellow underparts, yellow forehead and cheeks with a black hood and throat. Juvenile males have more yellow on the throat and more olive on the crown. First and second year females have little to no black on crown or throat. Older females may develop a black throat and hood, but it is never as extensive as the males. Legs are a light flesh color and feet are just slightly darker. Eyes are dark brown and bills are black or brownish. Hooded warblers are found along the east coast of the United States east to Wisconsin and Nebraska and south to Texas through Florida during the breeding season. They can be found during the winter along the southeastern coast of Mexico and the Yucatan Peninsula. They typically migrate during the fall from the middle of July through October. Spring migration begins when birds leave wintering grounds in early March, and ends by early May when most have reached the breeding grounds (Chiver et al. 2011).

As the breeding season starts, females choose the nest site and build the nest. Females prefer nesting habitat in shrubs along forest edges. Nests are typically constructed on blackberries, black cherries, or prickly gooseberries at approximately 0.3-1.4 meters above the ground. They will also use trees such as white ash, black kohash, switchcane, and red bay. Nests are constructed of soft bark and fine grasses which are woven into a cup. It is camouflaged by the dead leaves placed around the outside. Females lay clutches of approximately four eggs, which are then solely incubated by the females for about 12 days. Young birds leave the nest 8 or 9 days after hatching and can fly 2 to 3 days later. Once fledged, the young are split into two groups, with each group cared for by one of the parents. The young are completely independent 4 to 5 weeks after they fledge the nest (Chiver et al. 2011).

During the breeding season, hooded warblers prefer forested habitats with open gaps in the canopy and a shrub understory for nesting. The forests are typically composed of maples, beech, oak, sweetgum, water oak, sweet bay or hemlock with understory species of cherry, blackberry, common spicebush, and switchcane. They primarily use coastal woodlands when migrating. On the overwintering range, they can be found in wet forests, brushy fields, second growth, and mature deciduous forests. Females and males prefer different habitat during the winter, with males preferring more mature forests than females. Threats to this species include habitat degradation and fragmentation from agriculture and urbanization. Deforestation has affected the habitat available during the wintering range, which leads to increased overwinter mortality. During the breeding season, nest parasitism by brown headed cowbirds can cause additional mortality (Chiver et al. 2011).

Based on a review of WNHI species observation data, hooded warblers have been documented at least once in townships T20 (R24,25E), T21 (R23,24,25E), and T22 (R24, 25E), which are wholly or partially within a 6-mile radius of PBN (WNHI 2019). Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to this species.

3.7.8.2.10 Tri-colored Bat

Tri-colored bats are listed as threatened in Wisconsin (WDNR 2015a). Formerly known as eastern pipistrelles, these are very tiny bats weighing between 4-8 grams with a wingspan of 8-10 inches. The bats can be identified by the tri-coloring of their fur, which is dark at the base, yellowish-brown in the middle, and dark at the tips. Their face and ears have a pink tinge and their radius bone is also pink. The feet of this species are an identifying feature because they are large compared to its body size. When hibernating they can be identified by their orange forearm that is between 31-35mm long. They have short round ears and a straight tragus. Tricolored bats are associated with forested landscapes and open woods, near water. This is one of the first species to emerge at dusk to forage for 2 hours after dusk and then for an additional 2 hours after midnight. This species is capable of increasing its body mass up to 25 percent in a half-hour when foraging on insects such as flies, flying ants, and small moths (TPWD 2019a; USFWS 2017a).

Mating occurs before hibernation in the fall. Females store sperm and give birth from May to July to a set of twin pups. Pups are capable of flight at approximately 3 weeks and are completely weaned by 4 weeks (TPWD 2019a). Tricolored bats are solitary except for forming small nursery groups in the spring. Small nursery groups consist of approximately 35 bats or less, located in buildings, tree cavities, or rock crevices. Males remain solitary during the summer. Hibernacula are important habitats for tricolored bats. They will spend 6-9 months hibernating in mines or caves that maintain ambient temperature between 46-55°F and have very little airflow. The bats will enter hibernation in September or October and emerge in late April or early May. They are known to swarm cave entrances before entering hibernation. Tricolored bats will migrate short distances between winter and summer sites. They will also return to the same caves to hibernate each year (TPWD 2019a).

Threats to tricolored bats include white nose syndrome, destruction of hibernacula, disturbance during hibernation, wind turbines, habitat loss, and pesticide poisoning (USFWS 2017a).

Due to the sensitive nature of this species to collection and disturbance, known locations are not available below the county level (WNHI 2017). Tricolored bats are known to occur in Manitowoc County but not Kewaunee County. Compliance with all regulatory requirements associated with protected species will be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to this species.

3.7.8.2.11 Big Brown Bat

Big brown bats are listed as threatened in Wisconsin (WDNR 2015a). These bats weigh between 12-30 grams and have a wingspan of 13-16 inches. They have forearms that can be longer than 1.5 inches, which helps distinguish them from other species. The fur on their muzzle, ears, and wing membranes is black, while other fur ranges from light to dark brown. They have a broad snout and mouth and their tail membrane lacks fur. Big brown bats exist in a variety of habitats, but prefer deciduous forests. They emerge after sundown and feed most extensively during the first 2 hours after sundown, but can feed throughout the night. Their preferred prey are small beetles, but this can vary during season and by location (NPS 2017; TPWD 2019c).

Mating occurs before hibernation in the fall. Big brown bats among the last species to enter hibernation in November/December. They return to the same hibernacula and summer roost sites. Hibernacula can be in buildings, but in caves, bats choose crevices near cold areas (32-41°F) near entrances. Bats can hibernate solitarily or in small groups. They emerge from hibernation in March. Big brown bats can migrate for hundreds of miles between hibernacula and summer roost sites. During the summer, females form maternity colonies where they give birth from May to July. Preferred maternity roost sites include under loose bark and in small cavities of pine, oak, beech, and bald cypress trees. They may also use buildings, barns, bridges, and bat houses. Pups learn to fly between 18 and 35 days after birth (NPS 2017; TPWD 2019c).

Threats to big brown bats include white nose syndrome, loss of roosting snags, disruption of hibernation, and inappropriate nuisance control measures (NPS 2017; TPWD 2019c).

Due to the sensitive nature of this species to collection and disturbance, known locations are not available below the county level (WNHI 2017). Big brown bats are known to occur in Manitowoc County, but not Kewaunee County. Compliance with all regulatory requirements associated with protected species will be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to this species.

3.7.8.2.12 Little Brown Bat

Little brown bats are listed as threatened in Wisconsin (WDNR 2015a). Little brown bats belong to the genus *Myotis*, meaning "mouse eared." They weigh between 7-10 grams and have a wingspan of 8-10 inches. Their fur is golden to olive brown. One distinguishing feature is that they have long hairs on the hind foot that extends just beyond the claws and another is that when their ears are pressed forward, they extend less than 2mm beyond the nose. The diet of little brown bats consists of midge flies, stone flies, and mayflies, as they often forage over water. They will forage between 1 and 5 hours and can consume up to 600 insects in one hour (SUNY 2019).

Mating occurs before hibernation in the fall. Little brown bats begin hibernating in September and October and remain through April to June. Hibernacula are often found far back in caves and abandoned mines where they hibernate in clusters. Hibernacula temperatures are cold, but not freezing, and humidity remains high. Once emerged from hibernation, females form maternity colonies where they give birth to one pup. Pups are weaned and capable of flight 21-28 days after birth. During the summer, males roost alone or in small groups. Little brown bats migrate up to several hundred miles between summer roost sites and winter hibernacula (SUNY 2019). Threats to little brown bats include white nose syndrome and disturbance during hibernation, as well as loss of roosting sites and hibernacula.

Due to the sensitive nature of this species to collection and disturbance, known locations are not available below the county level (WNHI 2017). Little brown bats are known to occur in Manitowoc County, but not Kewaunee County. Compliance with all regulatory requirements associated with protected species will be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to this species.

3.7.8.2.13 Blanchard's Cricket Frog

Formerly known as northern cricket frogs, Blanchard's cricket frogs are listed as endangered in Wisconsin (WDNR 2015a). Blanchard's cricket frogs are small (0.5-1.5 inches) tree frogs whose coloring is highly variable. The main skin color is brown, green gray, or reddish tan and is bumpy. A dorsal stripe in green or rust and a dark triangle between the eyes may be present. Their call sounds like two marbles being rubbed/clicked together increasing in frequency which then tapers off (WDNR 2017).

Cricket frogs forage on crustaceans, insects, mollusks, and segmented worms. They spend most of their time in shallow water, but can migrate up to 1 mile seasonally. Cricket frogs hibernate during the winter. This species prefers open-canopy habitat and uses both semi-permanent and permanent water sources. Preference is also for water sources with emergent vegetation with adjacent areas with open canopies. Cricket frogs can be found in ponds, lakes, streams, rivers, and wetlands with gently sloping muddy banks. They have also been observed on banks and in cracks and crevices in upland areas in Wisconsin (WDNR 2017).

Causes of the rapid decline of Blanchard's cricket frogs is still unknown, but threats include agricultural runoff, intensive grazing leading to shoreline disturbance and increased water turbidity, habitat alteration, and invasive species. They also have a short lifespan (4-16 months), which can increase local population extinctions (WDNR 2017).

Based on a review of WNHI species observation data, Blanchard's cricket frogs have been documented at least once in townships T20 (R24,25E), T21 (R23,24,25E), and T22 (R24, 25E), which are wholly or partially within a 6-mile radius of PBN (WNHI 2019). Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to this species.

3.7.8.2.14 Redfin Shiner

Redfin shiner are listed as threatened in Wisconsin (WDNR 2015a). The redfin shiner is a freshwater minnow species that reaches approximately 3.5 inches in length. Individual coloration varies from light olive to bluish gray on the back and upper sides and silvery white to white along the lower sides, with red pigment developing in the fins of breeding males. A distinguishing feature is a small dark spot at the base of the dorsal fin. Spawning occurs from late spring through summer. Redfin shiners spawn over sunfish nests because they provide a silt-free substrate for egg development and the male sunfish will guard the nests and protect the eggs from predation. They feed on zooplankton, small invertebrates, and plant matter near the surface of the water (TSU 2019).

Redfin shiners are often associated with flowing waters in small to medium-sized streams. However, they avoid strong currents, preferring deep pools where they school near the surface of the water. They can tolerate a range of water clarity from clear to turbid (TSU 2019). A review of the WNHI species observation data yielded no observations of this species within 6 miles of the PBN site (WNHI 2019).

3.7.8.2.15 Longear Sunfish

Longear sunfish are listed as threatened in Wisconsin (WDNR 2015a). Longear sunfish are a freshwater species found from southern Quebec and Minnesota to north-central Mexico and New Mexico. They often do not reach more than 9 inches in length. This species can be easily identified by a black bony flap that is outlined in white and covers the gills. This species is also known for being colorful. Adults are bright red on the back and the underside is orange with blue spots and marbling. Juvenile fish have a different appearance; their upper back is olive, their undersides are white, and their sides are speckled with yellow. Longear sunfish can be found in small streams and creeks. However, this species has also been documented in reservoirs and medium-sized rivers. They prefer slow-moving water and therefore can be found with vegetation in pools and inlets away from strong currents. They prefer clear, shallow water with rocky and sandy bottoms. They feed primarily on invertebrates, fish eggs, and occasionally algae. This species spawns in small colonies from late spring and into early summer. Females lay eggs on nests created by the males, which are often located near other longear sunfish nests. Males will then guard the nests until after all the eggs have hatched and the juvenile fish have dispersed. Young fish do not become sexually mature for 2 to 3 years (NatureServe 2019c; TPWD 2019b). A review of the WNHI species observation data yielded no observations of this species within 6 miles of the PBN site (WNHI 2019).

3.7.8.2.16 Pugnose Shiner

Pugnose shiners are listed as threatened in Wisconsin (WDNR 2015a). Pugnose shiners are small straw-colored minnows that grow to only 2 inches in length. The back of this species is pale yellow, while the undersides are white. Sides are silver and a black stripe runs from mouth to tail fin. It can be distinguished by the darkly outlined scales on the upper back; however, the most distinguishing feature of this species is its upturned mouth that is nearly vertical. This species prefers clear, slow-moving water with vegetation. It can be found in large streams and lakes, but is restricted to the Great Lakes drainage basin. The primary threat to this species is increased turbidity leading to loss of suitable habitat (NYDEC 2020). A review of the WNHI species observation data yielded no observations of this species within 6 miles of the PBN site (WNHI 2019).

3.7.8.2.17 Slippershell Mussel

Slippershell mussels are listed as threatened in Wisconsin (WDNR 2015a). It is a small mussel that grows to approximately 1.5 inches long. The posterior end of the shell is square while the anterior end is rounded. The shell is smooth, yellow-brown, and marked with fine green rays. Inside the shell, the nacre is iridescent. Slippershell mussels can be found in creeks, headwaters of rivers, larger rivers, and lakes with clear, clean water. They prefer sand or gravel substrate, but can occur in mud (Carman 2002).

The slippershell mussel requires a host fish to complete its life cycle. Males release sperm into the water, which is taken up by females. Larvae, called glochidia, are released into the water where they must attach to a host fish. Host fish for slippershells include Johnny darters (*Etheostoma nigrum*) and mottled sculpins (*Cottus bairdi*). Glochidia remain on the host fish as they transform into their adult stage, and then they fall off. Adult mussels obtain nutrition by filtering algae, zooplankton, and debris (Carman 2002).

Threats to the slippershell mussel are increased siltation, poor water quality, pollution, loss of host fish populations, and invasive species (Carman 2002). A review of the WNHI species observation data yielded no observations of this species within 6 miles of the PBN site (WNHI 2019).

3.7.8.2.18 Monkeyface Mussel

Monkeyface mussels are listed as threatened in Wisconsin (WDNR 2015a). This freshwater mussel species has a thick, rounded shell with knobs on the posterior ridge and an indentation on the posterior margin that appears like a profile of a chimpanzee, giving the monkeyface mussel its name. It can reach a length of 4 inches. The shell is green or light brown and has distinctive yellow zig-zag/chevron markings. In older mussels, the shells may be darker and the zig-zag markings may be missing. The nacre of the shell is a pearly iridescent white on the posterior side (NatureServe 2019a). The monkeyface mussel requires a host fish to complete its life cycle. Males release sperm into the water, which is taken up by females between March and July. Larvae, called glochidia, are released into the water where they must attach to a host fish. Confirmed host fish for monkeyface mussels include spotfin shiner (*Cyprinella spiloptera*), eastern blacknose dace (*Rhinichthys atratulus*), and creek chub (*Semotilus atromaculatus*), while reported hosts include bluegill (*Lepomis macrochirus*), green sunfish (*Lepomis cyanellus*), and sauger (*Sander canadensis*). Glochidia remain on the host fish as they transform into their adult stage, and then they fall off (NatureServe 2019a; WDNR 2019b).

Monkeyface mussels can be found in medium and large rivers with clean water. They prefer substrate comprised of gravel or mixed sand and gravel and have been documented in the Manitowoc-Sheboygan watershed. Threats facing this species include pollution, habitat destruction, and competition with zebra mussels (NatureServe 2019a; WDNR 2019b). A review of the WNHI species observation data yielded no observations of this species within 6 miles of the PBN site (WNHI 2019).

3.7.8.2.19 Ellipse Mussel

Ellipse mussels are listed as threatened in Wisconsin (WDNR 2015a). This is a freshwater mussel species with an oval shape and a smooth shell without ridges. The shells range from yellow to dark tan and reach a maximum length of 3 inches. The shells also have green rays present that become thin and wavy towards the outer edge of the shell. The nacre is an iridescent white posteriorly and it will occasionally have an orange tint under the beak. The ellipse mussel requires a host fish to complete its life cycle. Males release sperm into the water, which is taken up by females. Larvae, called glochidia, are released into the water where they must attach to a host fish where they continue to develop into the adult form and then drops off the host. Host fish for ellipse mussels include greenside darter (*Etheostoma blennioides*), rainbow darter (*Etheostoma caeruleum*), orangethroat darter (*Etheostoma spectabile*), redfin darter (*Etheostoma whipplei*), and banded sculpin (*Cottus carolinae*) (Badra 2007).

Ellipse mussels can be found in small to medium-sized streams. They prefer a substrate of firm sand or gravel. Threats to this species include habitat alteration, degradation, and loss. Additionally, pollution, zebra mussels, and Asian clams pose hurdles to the recovery of ellipse mussels (Badra 2007). A review of the WNHI species observation data yielded no observations of this species within 6 miles of the PBN site (WNHI 2019).

3.7.8.2.20 Hairy-Necked Tiger Beetle

Hairy-necked tiger beetles are listed as endangered in Wisconsin (WDNR 2015a). This species is a ground beetle that is approximately half an inch long. It is distinguishable by hair along the thorax and white maculations on the wing covers along the main portion of the body. The head and eyes are larger than the thorax. They have large sickle-shaped mouth parts and antennae with 11 segments. Hairy-necked tiger beetles are diurnal and active on warm, sunny days. Eggs are laid in burrows under the sand where larva eventually develop. Hairy necked beetles prey on other insect species (NYNHP 2020).

This species of beetle is associated with sandy beaches on large lakes. They can be found on stable Great Lakes dunes, which are sandy areas densely populated by grasses and shrubs. Threats to this species are beach-related activities including vehicle traffic, beach grooming, and stabilization as these activities can crush both adult beetles and larvae (NYNHP 2020).

Based on a review of WNHI species observation data, hairy-necked tiger beetles have been documented at least once in townships T20 (R24,25E), T21 (R23,24,25E), and T22 (R24, 25E), which are wholly or partially within a 6-mile radius of PBN (WNHI 2019). Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to this species.

3.7.8.2.21 Midwest Pleistocene Vertigo

Midwest Pleistocene vertigos (also known as Hubricht's vertigo) are listed as endangered in Wisconsin (WDNR 2015a). This is a very small species of land snail, with the shell only 2.1 mm long. The shells vary in color from brown to tan to orange with six whorls and they have an indentation on the outer lip and distinctive folds within the aperture. The primary habitat is on soil and fern-covered ledges of limestone cliffs along the upper Great Lakes. Populations of this species often occupy patches no larger than 0.25 square feet on cold forested algific sites. While fern and moss dominate the surface in this habitat, this species avoids completely moss and fern-covered areas. It can be found in small pockets of litter that provide a cool microclimate during the summer, particularly thriving in lime rich soil. These pockets are often associated with decaying deciduous tree leaves of paper birch and mountain maple. Threats to this species include trampling, trail development, and alteration to water and airflow in their habitat (NatureServe 2019b; WDNR 2019c). A review of the WNHI species observation data yielded no observations of this species within 6 miles of the PBN site (WNHI 2019).

3.7.8.2.22 Cherrystone Drop Snail

Cherrystone drop snails are listed as threatened in Wisconsin (WDNR 2015a). This is a very small species of land snail, reaching only 5-8 mm in diameter and height. The shell is a low, three-dimensional spiral with a flattened spire and whorls that regularly increase in diameter; curved ribs mark the surface. The shell varies in color and can be red, reddish brown, purple, pink, tan, orange, or pale yellow. The opening of the shell is crescent shaped with a projected ridge around the edge. Cherrystone drop snails are unisexual and reproduce by laying eggs under leaf litter or logs. This species feeds on vegetative material by scraping surfaces with their tongues which are covered with hard teeth (Lee 2001).

Cherrystone drop snails are associated with cool, well-shaded, humid and/or wet conditions near streams. Habitats are often associated with limestone bedrock, areas rich in calcium, slopes, and moist alluvial soil with a layer of humus. This species has been documented on Lake Michigan shorelines in forested habitat dominated by sugar maple (*Acer saccharum*) and has low rock outcrops less than 13 feet tall. Within these habitats, cherrystone drops can be found under leaf litter and logs and in humus-filled crevices in bedrock. In drier conditions, snails remain under leaf litter and logs within a moist microclimate, but can be found crawling on top of these locations after a rain event.

Threats to this species are related to its specific habitat requirements and small isolated populations. Habitat alteration, disturbance, loss, and trampling are the major threats facing this species (Lee 2001). A review of the WNHI species observation data yielded no observations of this species within 6 miles of the PBN site (WNHI 2019).

3.7.8.2.23 Prairie Sandreed

Prairie sandreed, also known as sand reedgrass, is listed as threatened in Wisconsin (WDNR 2015a). It is a perennial grass species that can be found on Lake Michigan sand dunes. The leaf blades can be up to 60 cm long and 12 mm wide. The base of the leaf sheath wraps around the stem for 15 cm and the sheath is covered in small hairs. Prairie sandreed blooms from July through September. The flower is a floral spike that is broad and spreading, which is a distinguishing characteristic of this species. The spikelets produced are cream colored with a brownish cast. Roots are rhizomatous and adapted to sandy soil. Prairie sandreed is found on sand dunes and the root structure is ideal for stabilizing the dunes (Thieret 1960; WDNR 2019d).

Based on a review of WNHI species observation data, prairie sandreed has been documented at least once in townships T20 (R24,25E), T21 (R23,24,25E), and T22 (R24, 25E), which are wholly or partially within a 6-mile radius of PBN (WNHI 2019). Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to this species.

3.7.8.2.24 Fairy Slipper Orchid

Fairy slipper orchids, also called calypso orchids, are listed as threatened in Wisconsin (WDNR 2015a). These orchids are referred to as fairy slipper orchids due to the appearance of the flower. Fairy slipper orchids are a species native to circumboreal North America, with a range from Labrador west to Alaska, and south to Maine and the Rocky Mountains and over to California and down to Arizona. The plants are small and only reach between 3 to 6 inches in height. A solitary plant emerges from a single blue-green plantain-like leaf that withers shortly after blooming. The upper petals are lavender while the lower petal is dotted with red or magenta spots. This species can be found growing during the fall and spring. Overwintering leaves emerge during September and the plant blooms during May to late June, and then disappears. They can produce thousands of seeds, but it is likely that they spread through rhizomatous roots. This species can be difficult to detect as it can go dormant for several years at a time. Fairy slipper orchids are typically found in mature cedar swamps in areas with little other herbaceous competition. Therefore, it can often be found on slopes, ridges, or on decaying logs. It is intolerant of soils above 59°F and habitat with less than 60 percent canopy cover. Therefore, logging has contributed to the decline of this species. Habitat loss is another significant threat, as is over-browsing of the plants by white-tailed deer (NatureServe 2019e). A review of the WNHI species observation data yielded no observations of this species within 6 miles of the PBN site (WNHI 2019).

3.7.8.2.25 Shore Sedge

Shore sedge is listed as threatened in Wisconsin (WDNR 2015a). Shore sedge is a relatively small perennial sedge species, with leaves growing between 4 and 24 inches long, and 1-2 mm wide. Typically, 3 to 4 female spikes are produced, while only one male spike is present. Reproduction is usually accomplished through rhizomatous roots. The plants produce fruit from late June through late August. This species can be found on wet, rocky, or sandy soil around streams, ponds, and wetlands. In Wisconsin it is typically found in rock splash pools and inland on lake beaches along the Great Lakes. Due to the locations this species grows, they are likely to be susceptible to trampling. Changes in hydrology and overuse of pesticides can also negatively affect this species (MTGOV 2020; WDNR 2019j).

Based on a review of WNHI species observation data, shore sedge has been documented at least once in townships T20 (R24,25E), T21 (R23,24,25E), and T22 (R24, 25E), which are wholly or partially within a 6-mile radius of PBN (WNHI 2019). Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to this species.

3.7.8.2.26 Streambank Wheatgrass

Streambank wheatgrass, also called thickspike, is listed as threatened in Wisconsin (WDNR 2015a). It is an endemic species that is found on the sand dunes and beaches of Lake Michigan. This species is a native, long-lived cool season grass. It can grow up to 50 inches tall. It spreads primarily through rhizomatous roots. The root systems are well developed and create a thick mat in the top 8 inches of preferably sandy soil. Although rare, it can tolerate slightly acidic to slightly saline conditions; it is also tolerant to cold, grazing, and fire. Blooming typically occurs in June, with fruiting occurring July through August. Threats to this species include loss of habitat through bank and dune stabilization projects or public recreation. Invasive species also pose a threat (Scher 2002; WDNR 2019g).

Based on a review of WNHI species observation data, streambank wheatgrass has been documented at least once in townships T20 (R24,25E), T21 (R23,24,25E), and T22 (R24, 25E), which are wholly or partially within a 6-mile radius of PBN (WNHI 2019). Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to this species.

3.7.8.2.27 Clustered Broomrape

Clustered broomrape is listed as threatened in Wisconsin (WDNR 2015a). Clustered broomrape is a parasitic plant that attaches to the roots of other plants. It can be found from the Great Lakes region westward to British Columbia, and south to California, Arizona, and northern Mexico. In Wisconsin and Michigan, the host plant for this species is field sagewort. This species obtains needed nutrients from the host plant's roots to which its own roots are attached. This plant produces a stem that grows mostly below ground and leads to several flowering stalks that bloom in June and July. Three to ten pink to white tubular flowers with bright yellow spots within the tube are produced. The entire aboveground portion of the plant grows between 2 to 6 inches tall. The plant and stem lack chlorophyll, giving it a brown or yellowed appearance. Fruiting capsules with seeds are produced.

Clustered broomrape is found along sand dunes of Lake Michigan. It can be found on sand dune habitats where other rare species are likely to be found, including prairie sandreed, heartleaf willow, and Pitcher's thistle. Threats to this species include habitat disturbance and development. Most habitat disturbance results from recreational use of sand dunes (MINFI 2004).

Based on a review of WNHI species observation data, clustered broomrape has been documented at least once in townships T20 (R24,25E), T21 (R23,24,25E), and T22 (R24, 25E), which are wholly or partially within a 6-mile radius of PBN (WNHI 2019). Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to this species.

3.7.8.2.28 Shore Buttercup

Shore buttercup, also known as seaside crowfoot, is listed as threatened in Wisconsin (WDNR 2015a). It is a perennial forb species that grows low to the ground in a prostrate form. The leaves are mostly basal, heart-shaped, and grouped near the soil. The species blooms from early June through late August. A few flowers are produced and they have five yellow petals that are 3 to 5 mm long. Shore buttercup prefers wet sandy and calcareous soils. It can be found along muddy shores and marshes, particularly in harbors and ditches along Lake Michigan. Threats to this species include habitat loss and degradation. It is particularly sensitive to changes in hydrology and soil disturbance (MINFI 2020a; WDNR 2019k). A review of the WNHI species observation data yielded no observations of this species within 6 miles of the PBN site (WNHI 2019).

3.7.8.2.29 Heartleaf Willow

Heartleaf willows, also known as sand dune willows, are listed as endangered in Wisconsin (WDNR 2015a). This species grows as a perennial shrub that can grow between 3 and 12 feet tall, but it does not often grow over 6 feet tall. Young twigs are covered with whitish hairs that eventually fall off and leave a smooth dark red bark. The leaves are similar in that they are covered with fine white hairs, but as they mature, they become more lustrous. The lance-shaped leaves grow to 3-4 inches long. Blooming occurs in May. They prefer sandy and alluvial soils. This species is found only on dunes, particularly on the dunes of Lake Michigan. Threats to this species include damage and trampling from off-road vehicles and dune de-stabilization (NYNHP 2009; WDNR 2019m).

Based on a review of WNHI species observation data, sand dune willows have been documented at least once in townships T20 (R24,25E), T21 (R23,24,25E), and T22 (R24, 25E), which are wholly or partially within a 6-mile radius of PBN (WNHI 2019). Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to this species.

3.7.8.2.30 Sticky Tofieldia

Sticky tofieldia is listed as threatened in Wisconsin (WDNR 2015a). It is also known as false asphodel. This species is a perennial forb with basal leaves that are 3 to 8 inches long and 1/3-inch wide. When the plant blooms between June and August, two to three white flowers bloom at each node. This species prefers habitats with high levels of calcium and magnesium carbonates, therefore usually composed of clay and crumbled shells. It can be found on shorelines, in seeps, or in fens. Threats to false asphodels include changes to water quality, such as eutrophication (WDNR 2019h). A review of the WNHI species observation data yielded no observations of this species within 6 miles of the PBN site (WNHI 2019).

3.7.8.2.31 Snow Trillium

Snow trillium is listed as threatened in Wisconsin (WDNR 2015a). It is a perennial forb species that grows up to 6 inches tall. A single flower is produced from a single stem which rises from a short root. Flowers have three white petals that are occasionally pinkish at the tips and range from 2.5 – 4 cm. Blooming occurs from late March through late April. Snow trillium have a single whorl of three leaves that are 3-5 cm long. This species is found in hardwood forests near rivers and streams with fertile soil that is high in limestone. Threats to snow trillium include habitat destruction and loss (PNHP 2019; WDNR 2019e).

Based on a review of WNHI species observation data, snow trillium has been documented at least once in townships T20 (R24,25E), T21 (R23,24,25E), and T22 (R24, 25E), which are wholly or partially within a 6-mile radius of PBN (WNHI 2019). Compliance with all regulatory requirements associated with protected species will continue to be an administrative control practiced by NEPB for the licensed life of the PBN facility. Adherence to these controls, as well as compliance with applicable laws and regulations, should prevent potentially negative impacts to this species.

3.7.8.2.32 Harbinger-of-Spring

Harbinger-of-spring is listed as endangered in Wisconsin (WDNR 2015a). Harbinger-of-spring is a perennial wildflower that emerges in early spring and grows between 3 and 10 inches tall. Several light green to reddish-brown stems sprawl across the ground and support leaves that are up to 5 inches long and 3 inches wide. Each flower is about 0.25 inch long and can be found blooming for approximately one month during early spring. This species provides a good source of pollen for pollinators that emerge early in spring. Blooming typically occurs from late April through early May in Wisconsin. This species is typically found in deciduous forests with moist to mesic conditions and rich loamy soil with organic matter. Some sunlight is required, but they can generally tolerate shade. Threats to this species include habitat loss and habitat degradation. Changes to the forest canopy from logging could change the habitat requirements and cause this species to become extinct in a particular area. Changes in hydrology and trampling are also threats to its survival (Hilty 2019; WDNR 2019i). A review of the WNHI species observation data yielded no observations of this species within 6 miles of the PBN site (WNHI 2019).

3.7.8.2.33 Forked Aster

Forked asters are listed as threatened in Wisconsin (WDNR 2015a). Forked asters are perennial herbs that grow between 12 and 31 inches tall. The plants are distinguishable by the heart-shaped bases of lower leaves and the rough surface on the upper part of the leaf. Leaves are typically 2-5 inches long and 1-3 inches wide. Flowers are white and petals are 8-15 mm long. The plants typically bloom from August through early October and reproduce through rhizomatous roots. The habitat where this species can be found is typically in dry-mesic to mesic hardwood forests along lakes or streams or in floodplain forests. It prefers moist, calcareous soils. Threats to this species include disturbance, hydrological alteration, and habitat loss and degradation (MINFI 2020b; WDNR 2019l). A review of the WNHI species observation data yielded no observations of this species within 6 miles of the PBN site (WNHI 2019).

3.7.8.3 Species Protected Under the Bald and Golden Eagle Protection Act

Bald eagles are protected under the BGEPA. Bald eagles have nested in the region and suitable nesting habitat is present within a 6-mile radius of PBN. Current and future bald eagle nests located on the PBN site would be subject to all protections under the BGEPA.

The BGEPA was originally enacted in 1940 (16 USC 668-668c) and it prohibits anyone without a permit issued by the Secretary of the Interior from "taking" bald eagles, including their parts, nests, eggs, or feathers. The BGEPA provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle…[or any golden eagle], alive or dead, or any part, nest, or egg thereof." The BGEPA defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb."

"Disturb" means: "to agitate or bother a bald or golden eagle to a degree that causes, or is likely to cause, based on the best scientific information available, 1) injury to an eagle; 2) a decrease in its productivity by substantially interfering with normal breeding, feeding, or sheltering behavior; or 3) nest abandonment, by substantially interfering with normal breeding, feeding, or sheltering behavior." In addition to immediate impacts, this definition also covers impacts resulting from human-induced alterations initiated around a previously used nest site during a time when eagles are not present, if, upon the eagle's return, such alterations agitate or bother an eagle to a degree that interferes with or interrupts normal breeding, feeding, or sheltering habits, and causes injury, death or nest abandonment (USFWS 2018a).

There are currently no BGEPA permitting requirements associated with PBN site operations or in-scope transmission lines. NEPB recommends that if an eagles nest is within the site, any human activity should be further than 660 feet from an active nest between January 15 through July 30.

3.7.8.4 Species Protected Under the Migratory Bird Treaty Act

In addition to species protected under federal and state endangered species acts, there are numerous bird species protected under the MBTA that may visit PBN. The MBTA makes it illegal for anyone to take, possess, import, export, transport, sell, purchase, barter or offer for sale, or purchase or barter, any migratory bird, or the parts, nests, or eggs of such a bird except under the terms of a valid permit issued pursuant to federal regulations. Birds of conservation concern in particular conservation regions in the continental United States that may occur in Manitowoc and Kewaunee counties include the following species: American bittern, dunlin (*Calidris alpine*), ruddy turnstone (*Arenaria interpres*), willow flycatcher (*Empidonax traillii*), and least bittern (*Ixobrychus exilis*). The following species are considered birds of conservation concern throughout their range in the continental United States and Alaska: American golden plover (*Pluvialis dominica*), black-billed cuckoo (*Coccyzus erythropthalmus*), bobolink (*Dolichonyx oryzivorus*), buff-breasted sandpiper (*Tryngites subruficollis*), eastern whip-poor-will (*Antrostomus vociferous*), golden-winged warbler (*Vermivora chrysoptera*), king rail (*Rallus elegans*), lesser yellowlegs (*Tringa flavipes*), long-eared owl, red-headed woodpecker (*Melanerpes erythrocephalus*), rusty blackbird (*Euphagus carolinus*), semipalmated sandpiper (*Calidris pusilla*), short-billed dowitcher (*Limnodromus griseus*), and wood thrush (*Hylocichla mustelina*).

Several migratory birds that are species of concern have the potential to use the PBN site. Least bitterns and king rails are likely to be rare visitors due to the lack of suitable habitat. Several of the species of concern are likely to use the PBN site as stopover habitat. Semipalmated sandpipers, short-billed dowitchers, and ruddy turnstones may use the shoreline habitat of Lake Michigan to feed and roost during migration. American golden plovers are likely to use both the shoreline and nearby agricultural fields. Buff-breasted sandpipers and dunlins will also use the agricultural fields during migration, although dunlins may also use shallow wetlands. The two remaining migratory species, lesser yellowlegs and rusty blackbirds, will use vegetated wetlands and wet woodlands, respectively (Cornell University 2020).

The remaining species are likely to use the PBN site during the breeding season if enough suitable habitat exists on site. Although the long-eared owl is a year-round resident, they, along with eastern whip-poor-wills, wood thrushes, black-billed cuckoos, and red-headed woodpeckers, breed in forested areas located near open landscapes. American bitterns will use woody wetlands to nest, while willow flycatchers use shrubby areas near water, and bobolinks use open hayfields or meadows (Cornell University 2020).

If a banded migratory bird is found, PBN reports the band information to the appropriate federal authority. Yearly surveys for piping plovers are conducted during the breeding season.

3.7.8.5 Essential Fish Habitat

A review of NOAA's essential fish habitat (EFH) was conducted to determine the location of EFH within 6 miles of PBN. NOAA only provides EFH for federally managed fish and invertebrates. EFH does not apply to enclosed freshwater habitats, including the Great Lakes;

subsequently, no EFH is located in the vicinity of PBN; nor were any EFH areas protected from fishing. As habitat areas of particular concern (HAPC) are derived from EFH, there were also no HAPCs located within the 6-mile vicinity of PBN. (NOAA 2020c).

Table 3.7-1 Phytoplankton and Zooplankton Taxa in Lake Michigan (Sheet 1 of 2)

Phytoplankton Scientific Name	Zooplankton Scientific Name
Asterionella Formosa	*Bosmina longirostris*
Aulacoseira ambigua	*Bythotrephes cederstroemi*
Aulacoseira distans	*Conochilus unicornis*
Aulacoseira granulate	*Kellicottia longispina*
Aulacoseira islandica	*Keratella cochlearis*
Aulacoseira italica	*Keratella crassa*
Crucigenia quadrata	*Polyartha remata*
Cryptomonas erosa	*Polyartha vulgaris*
Cryptomonas pyrenoidifera	
Cryptomonas reflexa	
Crytomonas rostratiformis	
Cyclotella atomus	
Cyclotella comensis	
Cyclotella comta	
Cyclotella ocellate	
Cyclotella operculate	
Cymatopleura solea	
Diatoma tenue var. *elongatum*	
Diatoma vulgare	
Fragilaria crotonensis	
Fragilaria pinnata	
Gymnodinium helveticum	
Gyrosigma nodiferum	
Navicula tripunctata	
Nitzchia acicularis	
Nitzschia lauenburgiana	
Oocystis borgei	
Oscillatoria limnetica	
Oscillatoria minima	
Rhodomonas lens	
Rhodomonas minuta	
Stephanodiscus alpinus	
Stephanodiscus binderanus	
Stephanodiscus hantzchii	

Table 3.7-1 Phytoplankton and Zooplankton Taxa in Lake Michigan (Sheet 2 of 2)

Phytoplankton Scientific Name	Zooplankton Scientific Name
Stephanodiscus niagarae	
Stephanodiscus parvus	
Stepahnodiscus subtransylvanicus	
Surirella ovata	
Synedra delicatissima	
Synedra filiformis	
Synedra ostenfeldii	
Synedra radians	
Synedra ulna var. *biceps*	
Synedra ulna var. *chaseana*	
Tabellaria flocculosa	
Ankistrodesmus falcatus var. *mirabilis*	

(Gannon et al. 1982; KPS 2007; Reavie et al. 2014; Vanderploeg et al. 2012)

Table 3.7-2 Common Fish Species in Lake Michigan in the Vicinity of PBN (Sheet 1 of 2)

Common Name	Scientific Name
Alewife	*Alosa pseudoharengus*
Atlantic Salmon	*Salmo salar*
Black Bullhead	*Ameiurus melas*
Black Crappie	*Pomoxis nigromaculatus*
Bloater	*Coregonus hoyi*
Bluegill	*Lepomis macrochirus*
Brook Stickleback	*Culaea inconstans*
Brook Trout	*Salvelinus fontinalis*
Brown Trout	*Salmo trutta*
Burbot	*Lota lota*
Central Mudminnow	*Umbra limi*
Channel Catfish	*Ictalurus punctatus*
Cherry Salmon	*Oncorhynchus masou*
Chinook Salmon	*Oncorhynchus tshawytscha*
Chum Salmon	*Oncorhynchus keta*
Coho Salmon	*Oncorhynchus kisutch*
Common Carp	*Cyprinus carpio*
Common Shiner	*Luxilus cornutus*
Deepwater Sculpin	*Myoxocephalus thompsonii*
Emerald Shiner	*Notropis atherinoides*
Fathead Minnow	*Pimephales promelas*
Freshwater Drum	*Aplodinotus grunniens*
Gizzard Shad	*Dorosoma cepedianum*
Golden shiner	*Notemigonus crysoleucas*
Green Sunfish	*Lepomis cyanellus*
Lake Chub	*Couesius plumbeus*
Lake Herring	*Coregonus artedi*
Lake Sturgeon	*Acipenser fulvescens*
Lake Trout	*Salvelinus namaycush*
Lake Whitefish	*Coregonus clupeaformis*
Largemouth Bass	*Micropterus salmoides*
Longnose Dace	*Rhinichthys cataractae*
Longnose Sucker	*Catostomus catostomus*

Table 3.7-2 Common Fish Species in Lake Michigan in the Vicinity of PBN (Sheet 2 of 2)

Common Name	Scientific Name
Mottled Sculpin	*Cottus bairdii*
Ninespine Stickleback	*Pungitius pungitius*
Northern Pike	*Esox Lucius*
Pumpkinseed	*Lepomis gibbosus*
Pink Salmon	*Oncorhynchus gorbuscha*
Rainbow Smelt	*Osmerus mordax*
Rainbow Trout	*Oncorhynchus mykiss*
Round Goby	*Neogobius melanostomus*
Round Whitefish	*Prosopium cylindraceum*
Slimy Sculpin	*Cottus cognatus*
Smallmouth Bass	*Micropterus dolomieu*
Sockeye Salmon	*Oncorhynchus nerka*
Spottail Shiner	*Notropis hudsonius*
Threespine Stickleback	*Gasterosteus aculeatus*
Trout Perch	*Percopsis omiscomaycus*
White Perch	*Morone americana*
White Sucker	*Catostomus commersonii*
Yellow Perch	*Perca flavescens*

(EA Engineering 2007; NEE 2018a; NRC 2005)

Table 3.7-3 Terrestrial Species Likely to be Observed in Kewaunee and Manitowoc Counties (Sheet 1 of 12)

Common Name	Scientific Name
Amphibians	
American Toad	*Anaxyrus americanus*
Blanchard's Cricket Frog	*Acris blanchardi*
Blue-Spotted Salamander	*Ambystoma laterale*
Boreal Chorus Frog	*Pseudacris maculata*
Bullfrog	*Lithobates catesbeianus*
Central Newt	*Notophthalmus viridescens louisianensis*
Common Mudpuppy	*Necturus maculosus*
Cope's Gray Treefrog	*Dryophytes chrysoscelis*
Eastern Newt	*Notophthalmus viridescens*
Eastern Red-Backed Salamander	*Plethodon cinereus*
Eastern Tiger Salamander	*Ambystoma tigrinum*
Four-Toed Salamander	*Hemidactylium scutatum*
Gray Treefrog	*Dryophytes versicolor*
Northern Green Frog	*Lithobates clamitans*
Northern Leopard Frog	*Lithobates pipiens*
Spotted Salamander	*Ambystoma maculatum*
Spring Peeper	*Pseudacris crucifer*
Western Chorus Frog	*Pseudacris triseriata*
Wood Frog	*Lithobates sylvaticus*
Birds	
Acadian Flycatcher	*Empidonax virescens*
Alder Flycatcher	*Empidonax alnorum*
American Avocet	*Recurvirostra americana*
American Bittern	*Botaurus lentiginosus*
American Black Duck	*Anas rubripes*
American Coot	*Fulica americana*
American Crow	*Corvus brachyrhynchos*
American Golden Plover	*Pluvialis dominica*
American Goldfinch	*Spinus tristis*
American Kestrel	*Falco sparverius*
American Pipit	*Anthus rubescens*
American Redstart	*Setophaga ruticilla*
American Robin	*Turdus migratorius*

Table 3.7-3 Terrestrial Species Likely to be Observed in Kewaunee and Manitowoc Counties (Sheet 2 of 12)

Common Name	Scientific Name
American Tree Sparrow	*Spizelloides arborea*
American White Pelican	*Pelecanus erythrorhynchos*
American Wigeon	*Anas americana*
American Woodcock	*Scolopax minor*
Ancient Murrelet	*Synthliboramphus antiquus*
Arctic Tern	*Sterna paradisaea*
Baird's Sandpiper	*Calidris bairdii*
Bald Eagle	*Haliaeetus leucocephalus*
Baltimore Oriole	*Icterus galbula*
Bank Swallow	*Riparia riparia*
Barn Swallow	*Hirundo rustica*
Barred Owl	*Strix varia*
Bay-Breasted Warbler	*Setophaga castanea*
Belted Kingfisher	*Megaceryle alcyon*
Black and White Warbler	*Mniotilta varia*
Black-Bellied Plover	*Pluvialis squatarola*
Black-Billed Cuckoo	*Coccyzus erythropthalmus*
Black-Capped Chickadee	*Poecile atricapillus*
Black-Headed Gull	*Chroicocephalus ridibundus*
Black-Legged Kittiwake	*Rissa tridactyla*
Black Scoter	*Melanitta nigra*
Black-Tailed Gull	*Larus crassirostris*
Black Tern	*Chlidonias niger*
Black Turnstone	*Arenaria melanocephala*
Black-Crowned Night Heron	*Nycticorax nycticorax*
Black-Throated Blue Warbler	*Setophaga caerulescen*
Black-Throated Green Warbler	*Setophaga virens*
Blackburnian Warbler	*Setophaga fusca*
Blackpoll Warbler	*Setophaga striata*
Blue-Gray Gnatcatcher	*Polioptila caerulea*
Blue-Headed Vireo	*Vireo solitarius*
Blue-Winged Teal	*Anas discors*
Blue-Winged Warbler	*Vermivora cyanoptera*
Blue Jay	*Cyanocitta cristata*

Table 3.7-3 Terrestrial Species Likely to be Observed in Kewaunee and Manitowoc Counties (Sheet 3 of 12)

Common Name	Scientific Name
Bobolink	*Dolichonyx oryzivorus*
Bonaparte's Gull	*Chroicocephalus philadelphia*
Brant	*Branta bernicla*
Broad-Winged Hawk	*Buteo platypterus*
Brown-Headed Cowbird	*Molothrus ater*
Brown Creeper	*Certhia americana*
Brown Pelican	*Pelecanus occidentalis*
Brown Thrasher	*Toxostoma rufum*
Buff-Breasted Sandpiper	*Tryngites subruficollis*
Bufflehead	*Bucephala albeola*
Cackling Goose	*Branta hutchinsii*
California Gull	*Larus californicus*
Canada Goose	*Branta canadensis*
Canada Warbler	*Cardellina canadensis*
Canvasback	*Aythya valisineria*
Cape May Warbler	*Setophaga tigrina*
Caspian Tern	*Hydroprogne caspia*
Cedar Waxwing	*Bombycilla cedrorum*
Cerulean Warbler	*Setophaga cerulea*
Chestnut-Sided Warbler	*Setophaga pensylvanica*
Chimney Swift	*Chaetura pelagica*
Chipping Sparrow	*Spizella passerina*
Clark's Nutcracker	*Nucifraga columbiana*
Clay-Colored Sparrow	*Spizella pallida*
Cliff Swallow	*Petrochelidon pyrrhonota*
Common Eider	*Somateria mollissima*
Common Goldeneye	*Bucephala clangula*
Common Grackle	*Quiscalus quiscula*
Common Loon	*Gavia immer*
Common Merganser	*Mergus merganser*
Common Nighthawk	*Chordeiles minor*
Common Raven	*Corvus corax*
Common Redpoll	*Acanthis flammea*
Common Tern	*Sterna hirundo*

Table 3.7-3 Terrestrial Species Likely to be Observed in Kewaunee and Manitowoc Counties (Sheet 4 of 12)

Common Name	Scientific Name
Common Yellowthroat	*Geothlypis trichas*
Cooper's Hawk	*Accipiter cooperii*
Curlew Sandpiper	*Calidris ferruginea*
Dark-Eyed Junco	*Junco hyemalis*
Dickcissel	*Spiza americana*
Double-Crested Cormorant	*Phalacrocorax auritus*
Downey Woodpecker	*Picoides pubescens*
Dunlin	*Calidris alpina*
Eared Grebe	*Podiceps nigricollis*
Eastern Bluebird	*Sialia sialis*
Eastern Kingbird	*Tyrannus tyrannus*
Eastern Phoebe	*Sayornis phoebe*
Eastern Towhee	*Pipilo erythrophthalmus*
Eastern Whip-Poor-Will	*Antrostomus vociferus*
Eastern Wood-Pewee	*Contopus virens*
European Starling	*Sturnus vulgaris*
Evening Grosbeak	*Hesperiphona vespertina*
Field Sparrow	*Spizella pusilla*
Forster's Tern	*Sterna forsteri*
Fox Sparrow	*Passerella iliaca*
Franklin's Gull	*Leucophaeus pipixcan*
Gadwall	*Anas strepera*
Glaucous Gull	*Larus hyperboreus*
Golden-Crowned Kinglet	*Regulus satrapa*
Golden-Winged Warbler	*Vermivora chrysoptera*
Gray Catbird	*Dumetella carolinensis*
Gray-Cheeked Thrush	*Catharus minimus*
Great Black-Backed Gull	*Larus marinus*
Great Blue Heron	*Ardea herodias*
Great Crested Flycatcher	*Myiarchus crinitus*
Great Horned Owl	*Bubo virginianus*
Greater Scaup	*Aythya marila*
Greater White-Fronted Goose	*Anser albifrons*
Greater Yellowlegs	*Tringa melanoleuca*

Table 3.7-3 Terrestrial Species Likely to be Observed in Kewaunee and Manitowoc Counties (Sheet 5 of 12)

Common Name	Scientific Name
Green Heron	*Butorides virescens*
Green Winged Teal	*Anas crecca*
Gyrfalcon	*Falco rusticolus*
Hairy Woodpecker	*Picoides villosus*
Henslow's Sparrow	*Ammodramus henslowii*
Hermit Thrush	*Catharus guttatus*
Herring Gull	*Larus argentatus*
Hooded Merganser	*Lophodytes cucullatus*
Hooded Warbler	*Setophaga citrina*
Horned Grebe	*Podiceps auritus*
Horned Lark	*Eremophila alpestris*
House Finch	*Haemorhous mexicanus*
House Sparrow	*Passer domesticus*
House Wren	*Troglodytes aedon*
Hudsonian Godwit	*Limosa haemastica*
Iceland Gull	*Larus glaucoides*
Indigo Bunting	*Passerina cyanea*
Ivory Gull	*Pagophila eburnea*
Killdeer	*Charadrius vociferus*
King Rail	*Rallus elegans*
Lapland Longspur	*Calcarius lapponicus*
Least Bittern	*Ixobrychus exilis*
Least Flycatcher	*Empidonax minimus*
Least Sandpiper	*Calidris minutilla*
Least Tern	*Sternula antillarum*
Lesser Black-Backed Gull	*Larus fuscus*
Lesser Yellowlegs	*Tringa flavipe*
Lesser Scaup	*Aythya affinis*
Little Gull	*Hydrocoloeus minutus*
Lincoln's Sparrow	*Melospiza lincolnii*
Long-Billed Curlew	*Numenius americanus*
Long-Billed Dowitcher	*Limnodromus scolopaceus*
Long-Eared Owl	*Asio otus*
Long-Tailed Duck	*Clangula hyemalis*

Table 3.7-3 Terrestrial Species Likely to be Observed in Kewaunee and Manitowoc Counties (Sheet 6 of 12)

Common Name	Scientific Name
Long-Tailed Jaeger	*Stercorarius longicaudus*
Magnolia Warbler	*Setophaga magnolia*
Mallard	*Anas platyrhynchos*
Marbled Godwit	*Limosa fedoa*
Marsh Wren	*Cistothorus palustris*
Merlin	*Falco columbarius*
Mew Gull	*Larus canus*
Mountain Bluebird	*Sialia currucoides*
Mourning Dove	*Zenaida macroura*
Mourning Warbler	*Geothlypis philadelphia*
Mute Swan	*Cygnus olor*
Nashville Warbler	*Leiothlypis ruficapilla*
Northern Cardinal	*Cardinalis cardinalis*
Northern Flicker	*Colaptes auratus*
Northern Harrier	*Circus cyaneus*
Northern Parula	*Setophaga americana*
Northern Pintail	*Anas acuta*
Northern Rough-Winged Swallow	*Stelgidopteryx serripennis*
Northern Shoveler	*Anas clypeata*
Northern Waterthrush	*Parkesia noveboracensis*
Olive-sided Flycatcher	*Contopus cooperi*
Orange-Crowned Warbler	*Leiothlypis celata*
Osprey	*Pandion haliaetus*
Ovenbird	*Seiurus aurocapilla*
Pacific Loon	*Gavia pacifica*
Palm Warbler	*Setophaga palmarum*
Parasitic Jaeger	*Stercorarius parasiticus*
Pectoral Sandpiper	*Calidris melanotos*
Peregrine Falcon	*Falco peregrinus*
Philadelphia Vireo	*Vireo philadelphicus*
Pied-Billed Grebe	*Podilymbus podiceps*
Pileated Woodpecker	*Dryocopus pileatus*
Pine Grosbeak	*Pinicola enucleator*
Pine Siskin	*Spinus pinus*

Table 3.7-3 Terrestrial Species Likely to be Observed in Kewaunee and Manitowoc Counties (Sheet 7 of 12)

Common Name	Scientific Name
Pine Warbler	*Setophaga pinus*
Piping Plover	*Charadrius melodus*
Pomarine Jaeger	*Stercorarius pomarinus*
Purple Finch	*Haemorhous purpureus*
Purple Martin	*Progne subis*
Purple Sandpiper	*Calidris maritima*
Red-Bellied Woodpecker	*Melanerpes carolinus*
Red-Breasted Merganser	*Mergus serrator*
Red-Breasted Nuthatch	*Sitta canadensis*
Red Crossbill	*Loxia curvirostra*
Red-Eyed Vireo	*Vireo olivaceus*
Red-Headed Woodpecker	*Melanerpes erythrocephalus*
Red Knot	*Calidris canutus*
Red-Necked Phalarope	*Phalaropus lobatus*
Red Shouldered Hawk	*Buteo lineatus*
Red-Tailed Hawk	*Buteo jamaicensis*
Red-Throated Loon	*Gavia stellata*
Red-Winged Blackbird	*Agelaius phoeniceus*
Redhead	*Aythya americana*
Ring-Billed Gull	*Larus delawarensis*
Ring-Necked Duck	*Aythya collaris*
Rock Pigeon	*Columba livia*
Rose-Breasted Grosbeak	*Pheucticus ludovicianus*
Ross's Goose	*Chen rossii*
Rough-Legged Hawk	*Buteo lagopus*
Royal Tern	*Thalasseus maximus*
Ruby-Crowned Kinglet	*Regulus calendula*
Ruby-Throated Hummingbird	*Archilochus colubris*
Ruddy Duck	*Oxyura jamaicensis*
Ruddy Turnstone	*Arenaria interpres*
Ruffed Grouse	*Bonasa umbellus*
Rusty Blackbird	*Euphagus carolinus*
Sanderling	*Calidris alba*
Sandhill Crane	*Grus canadensis*

Table 3.7-3 Terrestrial Species Likely to be Observed in Kewaunee and Manitowoc Counties (Sheet 8 of 12)

Common Name	Scientific Name
Savannah Sparrow	*Passerculus sandwichensis*
Scarlet Tanager	*Piranga olivacea*
Sedge Wren	*Cistothorus platensis*
Semipalmated Plover	*Charadrius semipalmatus*
Semipalmated Sandpiper	*Calidris pusilla*
Sharp-Shinned Hawk	*Accipiter striatus*
Short-Billed Dowitcher	*Limnodromus griseus*
Solitary Sandpiper	*Tringa solitaria*
Song Sparrow	*Melospiza melodia*
Snow Bunting	*Plectrophenax nivalis*
Snow Goose	*Chen caerulescens*
Snowy Owl	*Bubo scandiacus*
Snowy Plover	*Charadrius nivosus*
Sooty Tern	*Onychoprion fuscatus*
Spotted Sandpiper	*Actitis macularius*
Stilt Sandpiper	*Calidris himantopus*
Surf Scoter	*Melanitta perspicillata*
Swainson's Thrush	*Catharus ustulatus*
Swamp Sparrow	*Melospiza georgiana*
Tennessee Warbler	*Leiothlypis peregrina*
Thayer's Gull	*Larus thayeri*
Tree Swallow	*Tachycineta bicolor*
Trumpeter Swan	*Cygnus buccinator*
Tundra Swan	*Cygnus columbianus*
Turkey Vulture	*Cathartes aura*
Upland Sandpiper	*Bartramia longicauda*
Veery	*Catharus fuscescens*
Warbling Vireo	*Vireo gilvus*
Western Grebe	*Aechmophorus occidentalis*
Western Sandpiper	*Calidris mauri*
Whimbrel	*Numenius phaeopus*
White-Breasted Nuthatch	*Sitta carolinensis*
White-Rumped Sandpiper	*Calidris fuscicollis*
White-Throated Sparrow	*Zonotrichia albicollis*

Table 3.7-3 Terrestrial Species Likely to be Observed in Kewaunee and Manitowoc Counties (Sheet 9 of 12)

Common Name	Scientific Name
White-Winged Scoter	*Melanitta fusca*
White-Winged Tern	*Chlidonias leucopterus*
Willet	*Tringa semipalmata*
Willow Flycatcher	*Empidonax traillii*
Wilson's Phalarope	*Phalaropus tricolor*
Wilson's Snipe	*Gallinago delicata*
Wilson's Warbler	*Cardellina pusilla*
Winter Wren	*Troglodytes troglodytes*
Western Meadowlark	*Sturnella neglecta*
White-Crowned Sparrow	*Zonotrichia leucophrys*
White-Winged Crossbill	*Loxia leucoptera*
White-Winged Scoter	*Melanitta fusca*
Wild Turkey	*Meleagris gallopavo*
Willet	*Tringa semipalmata*
Wood Duck	*Aix sponsa*
Wood Thrush	*Hylocichla mustelina*
Yellow-Bellied Flycatcher	*Empidonax flaviventris*
Yellow-Bellied Sapsucker	*Sphyrapicus varius*
Yellow-Billed Cuckoo	*Coccyzus americanus*
Yellow-Headed Blackbird	*Xanthocephalus xanthocephalus*
Yellow-Rumped Warbler	*Setophaga coronata*
Yellow-Throated Vireo	*Vireo flavifrons*
Yellow Warbler	*Setophaga petechia*
Invertebrates	
American Lady	*Vanessa virginiensis*
Appalachian Brown	*Lethe appalachia*
Arctic Skipper	*Carterocephalus palaemon*
Black Striate	*Striatura ferrea*
Black Swallowtail	*Papilio polyxenes*
Bronze Copper	*Lycaena hyllus*
Cabbage White	*Pieris rapae*
Cherrystone Drop	*Hendersonia occulta*
Clouded Sulphur	*Colias philodice*
Common Wood Nymph	*Cercyonis pegala*

Table 3.7-3 Terrestrial Species Likely to be Observed in Kewaunee and Manitowoc Counties (Sheet 10 of 12)

Common Name	Scientific Name
Coral Hairstreak	*Satyrium titus*
Deep-Throat Vertigo	*Vertigo nylanderi*
Dentate Supercoil	*Paravitrea multidentata*
Dun Skipper	*Euphyes vestris*
Eastern Comma	*Polygonia comma*
Eastern Glass-Snail	*Vitrina angelicae*
Eastern Tailed Blue	*Everes comyntas*
Eastern Tiger Swallowtail	*Papilio glaucus*
European Skipper	*Thymelicus lineola*
Eyed Brown	*Lethe eurydice*
Fiery Skipper	*Hylephila phyleus*
Gorgone Checkerspot	*Chlosyne gorgone*
Gray Hairstreak	*Strymon melinus*
Great Spangled Fritillary	*Speyeria cybele*
Hine's Emerald Dragonfly	*Somatochlora hineana*
Hobomok Skipper	*Poanes hobomok*
Hubricht's Vertigo	*Vertigo hubrichti*
Hydroporus Diving Beetle	*Heterosternuta wickhami*
Least Skipper	*Ancyloxypha numitor*
Little Wood-Satyr	*Megisto cymela*
Long Dash	*Polites mystic*
Meadow Fritillary	*Boloria bellona*
Monarch	*Danaus plexippus*
Mourning Cloak	*Nymphalis antiopa*
Northern Crescent	*Phyciodes cocyta selenis*
Northern Pearly-Eye	*Lethe anthedon anthedon*
Painted Lady	*Vanessa cardui*
Phyllira Tiger Moth	*Grammia phyllira*
Question Mark	*Polygonia interrogationis*
Red Admiral	*Vanessa atalanta*
Rhode's Tiger Beetle	*Cicindela hirticollis rhodensis*
Ribbed Striate	*Grammia phyllira*
Rusty Patched Bumble Bee	*Bombus affinis*
Sachem	*Atalopedes campestris*

Table 3.7-3 Terrestrial Species Likely to be Observed in Kewaunee and Manitowoc Counties (Sheet 11 of 12)

Common Name	Scientific Name
Silver-Spotted Skipper	*Epargyreus clarus*
Mammals	
American Beaver	*Castor canadensis*
Big Brown Bat	*Eptesicus fuscus*
Bobcat	*Lynx rufus*
Coyote	*Canis latrans*
Deer Mouse	*Peromyscus maniculatus*
Eastern Chipmunk	*Tamias striatus*
Eastern Cottontail	*Sylvilagus floridanus*
Eastern Fox Squirrel	*Sciurus niger*
Eastern Gray Squirrel	*Sciurus carolinensis*
Eastern Pipistrelle	*Perimyotis subflavus subflavus*
Eastern Spotted Skunk	*Spilogale putorius*
Gray Fox	*Urocyon cinereoargenteus*
Little Brown Bat	*Myotis lucifugus*
Muskrat	*Ondatra zibethicus*
North American Porcupine	*Erethizon dorsatus*
Northern Long-Eared Bat	*Myotis septentrionalis*
Norway Rat	*Rattus norvegicus*
Red Fox	*Vulpes vulpes*
Red Squirrel	*Tamiasciurus hudsonicus*
Stiped Skunk	*Mephitis mephitis*
Virginia Opossum	*Didelphis virginiana*
White-Footed Mouse	*Peromyscus leucopus*
White-Tailed Deer	*Odocoileus virginianus*
Woodchuck	*Marmota monax*
Reptiles	
Blanding's Turtle	*Emydoidea blandingii*
Common Garter Snake	*Thamnophis sirtalis*
DeKay's Brown Snake	*Storeria dekayi*
Eastern Fox Snake	*Pantherophis vulpinus*
Eastern Milk Snake	*Lampropeltis triangulum*
Northern Redbelly Snake	*Storeria occipitomaculata occipitomaculata*
Ornate Box Turtle	*Terrapene ornata*

Table 3.7-3 Terrestrial Species Likely to be Observed in Kewaunee and Manitowoc Counties (Sheet 12 of 12)

Common Name	Scientific Name
Painted Turtle	*Chrysemys picta*
Red-Bellied Snake	*Storeria occipitomaculata*
Snapping Turtle	*Chelydra serpentina*

(eBird 2020; USFWS 2020c; USFWS 2020d; UWM 2020; WB 2020; WDNR 2019o; Watermolen and Murrell 2001)

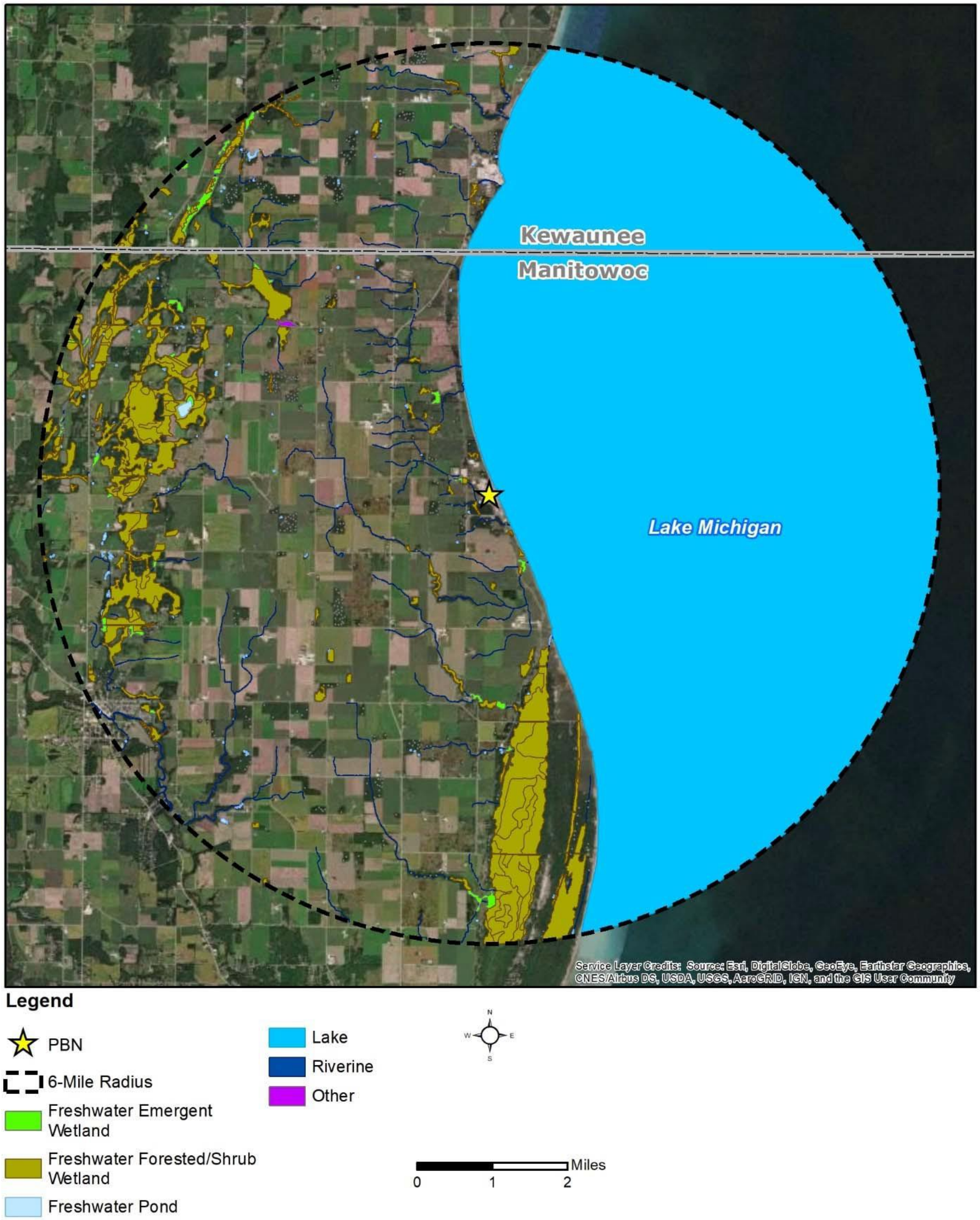


Figure 3.7-1 NWI Wetlands within a 6-mile Radius of PBN

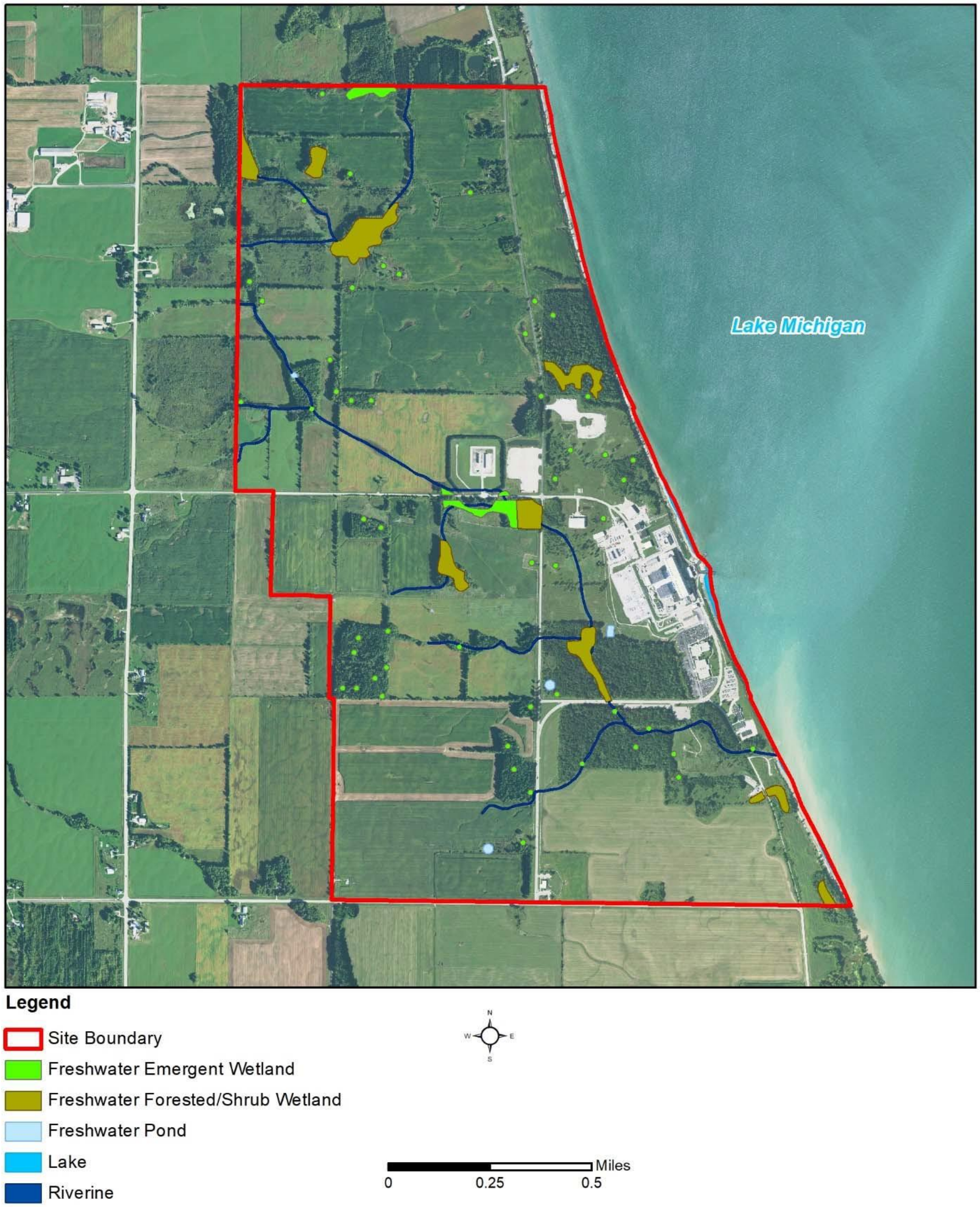


Figure 3.7-2 NWI Wetlands on the PBN Site

3.8 Historic and Cultural Resources

Cultural resources include prehistoric era and historic era archaeological sites and objects, architectural properties and districts, and traditional cultural properties, which are defined as significant objects or places important to Native American tribes for maintaining their culture (USDOI 1998). Of particular concern are those cultural resources that may be considered eligible for listing on the National Register of Historic Places (NRHP). Any cultural resources listed on or eligible for the NRHP are considered historic properties under the National Historic Preservation Act (NHPA) [Public Law 89-665; 54 U.S.C. 300101 et seq].

Prior to taking any action to implement an undertaking, Section 106 of the NHPA requires the NRC as a federal agency to do the following:

- Take into account the effects of an undertaking (including issuance of a license) on historic properties, including any district, site, building, structure, or object included in or eligible for inclusion in the NRHP.
- Afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on such undertaking.

To provide early consultation for the Section 106 process, NEPB contacted the Wisconsin Historical Society (WHS) for informal consultation concerning the proposed PBN SLR and potential effects on cultural resources within the approximately 1,260-acre site and on historic properties within a 6-mile radius of PBN. Native American groups recognized as potential stakeholders were also consulted by NEPB with the opportunity for comment. NEPB correspondence is included in Attachment D.

This ER identifies all known archaeological sites within a 6-mile radius of PBN, as well as properties listed on the NRHP within that same radius. The approximately 1,260-acre NEPB PBN property is described in Section 3.2. For the purpose of SLR, the aboveground area or area of potential effect (APE) is defined as the entire PBN property and everything within a 6-mile radius of PBN. The aboveground APE considers the visual integrity of historical properties in relation to continued PBN operation. The archaeological APE is considered bounded by the approximately 1,260 acres, where ground disturbance, though unanticipated during the proposed SLR operating term, might compromise the physical integrity of archaeological data.

There are no refurbishment activities or other construction activities currently planned to support SLR operations, and therefore no identified ground disturbances associated with SLR. As such, the SLR consists of an administrative action relative to historic and cultural resources. Although construction of the existing PBN facility itself would have impacted any archaeological resources that may have been located within its footprint, much of the surrounding area remains largely undisturbed. There have been five previous cultural resources surveys within the 1,260-acre PBN property (Table 3.8-1). These surveys have covered approximately 972 acres of the of the PBN property. Approximately 88 acres of the property's surface and subsurface is inaccessible for survey due to structures or roads. In an environmental assessment of the plant in 1985, records were reviewed to determine what, if any, impact on historic or archaeological sites resulted from the initial licensing of PBN. (NRC 1987) At that time, the closest NRHP site was listed as approximately 27 miles away and the Wisconsin state historic preservation officer (SHPO) concurred that the operation of the plant would not interact with any known historic sites. (NRC 1987) During the 1985 application for license amendments, the Wisconsin SHPO was consulted to determine if additional properties had been added to the NRHP in the vicinity of the PBN plant since the initial licensing. (NRC 1987) The SHPO stated that three additional properties had been added, but he did not believe the proposed license extension would have any effect on the new properties. (NRC 1987)

The SLR literature review of previously recorded archaeological sites included the area within a 6-mile radius of PBN. The purpose of the literature review was to help develop an understanding of the local context by conducting an inventory of all previously and newly recorded archaeological sites on the 1,260-acre PBN property and within a 6-mile radius of PBN, regardless of NRHP status. While there are 14 entries, either isolated finds or sites, on the Wisconsin archaeological sites inventory (ASI), there are no NRHP-eligible cultural resources confirmed within the 1,260-acre PBN property (Table 3.8-2). (WHS 2020a) Additionally, PBN has already committed to avoiding four previously identified sites which have not been recommended ineligible for the NRHP within the 1,260-acre property. (AVD 2004)

The results of the literature review showed 50 archaeological resources and 24 architectural resources previously recorded within 6 miles of PBN (WHS 2020a; NOAA 2020a). There are three resources either recommended eligible for the NRHP or have the equivalent eligibility or potential eligibility under national heritage or legacy commission designations (Tables 3.8-2, 3.8-3, and 3.8-4). There is one NRHP-listed structure, the Rawley Point Light Station, within the 6-mile radius of PBN that is not listed on the Wisconsin Historic Preservation Database (WHPD).

3.8.1 Land Use History

The land use history for PBN and the surrounding region was developed as part of a Phase 1A literature review and archaeological sensitivity assessment of the PBN property and is summarized here. Section 3.8.2 provides a more detailed discussion of historical land use as part of the cultural history. Early maps provide information on how the area was used in the past. (DRHMC 2020) An 1835 map shows a dearth of early historic development within and immediately surrounding the PBN property (Figure 3.8-1). At that time there were no structures, roads, fences, camps, or agricultural fields recorded. A historic map from 1845 depicts the location of three different Native American tribes that had been removed to Wisconsin in the 1830s: the Oneida, Stockbridge, and Brothertown tribes (Figure 3.8-2). An 1878 map of Manitowoc County shows the increasing development in the county and several railroads serving the region (Figure 3.8-3). A 1927 road map of Wisconsin shows the extensive road and highway system throughout the state by that time (Figure 3.8-4). The 1978 USGS topographic map shows the PBN facility, power lines, roads, and structures both on and off the PBN property (Figure 3.1-2).

Photographs taken in the years during and after the construction of the PBN facility are useful in showing the environmental context during that time period. At the time of construction, the PBN facility consisted of undeveloped forests, small towns, and agricultural fields (Figure 3.8-5). By 1969, there is evidence of substantial subsurface disturbance, particularly along the Lake Michigan shoreline, but the neighboring forests were still intact (Figure 3.8-6). Additional aerial views depict the completed facility, stands of woods, and agricultural fields (Figures 3.8-7 and 3.8-8).

The PBN property and the surrounding region hold evidence of both prehistoric and historic occupation by Native Americans and Euro-Americans. Archaeological records suggest that the PBN property and the surrounding area were occupied by Native American populations during the Archaic Period (ca. 8000 to 500 BCE) and the Woodland Period (ca. 500 BCE to 1700 AD).

NEPB's consultations with Native American groups are included in Attachment D.

3.8.2 Cultural History

3.8.2.1 Paleoindian Period (Prior to 8000 BC)

The glaciers from the last ice age retreated from the Wisconsin landscape around 13,000 years ago, leaving the state bordered by the Mississippi River on the west, Lake Michigan on the east, and Lake Superior on the north (WHS 2020b). As the ice sheets retreated northward, animals, followed by people, moved into the area starting the Paleoindian period (MVAC 2020). This period is the earliest substantiated cultural adaptation in Wisconsin (WHS 2020b). Very little was left behind by those people who lived in this area ca. 12,000 years ago. Most of the artifacts that have been recovered are made of stone or occasionally of bone. The temperature was colder than today. It was very similar to present-day Alaska or northern Canada. Glaciers were still present in northern Wisconsin. Southwestern Wisconsin was without glaciers and is known today as the "Driftless Area." (MVAC 2020) Paleoindian peoples tended to live in small bands which traveled seasonally within set territories for food sources that included hunting megafauna such as mammoths and mastodons as well as caribou and elk. (MVAC 2020) While archaeological evidence is not as well preserved, these people used the limited plants that they found such as berries, seeds, and nuts. Many of these bands likely lived along large rivers for access to more highly concentrated resource areas. These same resource areas commonly have lithic resources suitable for tool manufacture. (MVAC 2020) The material culture is characterized by large, fluted points such as the Clovis and Folsom spear points. Toolkits also included utilitarian tools made from stone such as scrapers and modified flakes for dressing hides, knives for cutting, gravers for engraving or incising, and hammerstones used for making stone tools. They probably also used some bone and wooden tools. (MVAC 2020) Paleo people traded and/or traveled long distances to obtain different kinds of stones for their tools. They got some materials from hundreds of miles away. One important place where they found the stones they needed was Silver Mound, in Jackson County, Wisconsin. (MVAC 2020) As the glaciers left Wisconsin, the climate warmed and megafauna such as mammoths and mastodons became extinct. (MVAC 2020) Subsistence strategies adapted accordingly.

3.8.2.2 Archaic (8000 BC to 500 BC)

The Archaic Period was the longest of any periods in Wisconsin. It first appears in the southern part of the state and later in the northern, probably because the glaciers had retreated from southern Wisconsin long before they melted in the north. People in each area adapted to their environment as it changed. (MVAC 2020) This period is characterized by the exploitation of a larger variety of plant and animal resources with an overall greater diversity in material culture. The transition to the Archaic Period is inferred to include a less mobile and more localized lifestyle than the preceding Paleoindian Period. Projectile points no longer exemplified the intricate work characteristic of Paleoindian tools and expanded to include atlatls for hunting with notched and stemmed points as well as mortars and pestles for food processing. Textiles and basketry originated during this time. (MVAC 2020) The first use of copper seems to take place during this time period. Items made from copper appear to be useful items rather than objects for adornment. While Archaic people across Wisconsin were involved in similar lifeways, archaeologists find that copper artifacts are mainly found in the eastern and northern part of the state. (MVAC 2020) Evidence of domesticated dogs is first found at some Archaic sites. Dogs would have helped in hunting, guarded the camps, and might have served as a source of food in hard times. (MVAC 2020) The first formal cemeteries are found at the end of the Archaic period. The use of cemeteries, as well as the establishment of trade networks, were both further developed during the later Woodland tradition. (MVAC 2020)

3.8.2.3 Woodland (500 BCE to CE 1200 in the south, 1700 in the north)

The Woodland Period is characterized by increasing horticultural expertise, widespread adoption of ceramic technology, increasing sedentism and social complexity, and the construction of earthen mounds. (WHS 2020b) The Effigy Mound culture constructed distinctive burial mounds in shapes resembling birds, mammals, or people across the southern two-thirds of Wisconsin. (WHS 2020b) During this time the population increased, which put additional demand on resources. This resulted in increasing tension among people. These things make Woodland people unique from past people. (MVAC 2020)

People in this period were primarily hunters and gatherers. Deer were an important food source as were small animals such as beaver, raccoon, muskrats, squirrels, fish, turtles, freshwater mussels, waterfowl and birds. (MVAC 2020) While not to the level of full-scale farming, people began to cultivate plants such as squash, gourds, sunflowers, and towards the end of the period, corn, in small gardens. Tobacco, pipes, and pottery are first dated to the Woodland Period. (MVAC 2020) While the people in most of the state followed the Woodland tradition, during the middle of the period some people adapted ideas of the people in Ohio and Illinois. The resulting culture is called Hopewell. The Hopewell culture has its roots in the trade systems and social complexity of the Red Ocher people. (MVAC 2020) Toward the end of the period, the climatic and environmental differences between northern (pine forest) and southern (deciduous forest) Wisconsin gave rise to different lifeways in northern and southern Wisconsin. People in the northern part of the state continued to follow the Woodland hunting, gathering, and gardening traditions until the arrival of Europeans, while in the south, two new lifeways (Mississippian and Oneota) arose. While both of these traditions were still involved in hunting and gathering, they also became full-scale farming cultures that persisted until the arrival of the Europeans. (MVAC 2020)

3.8.2.4 Mississippian and Oneota Traditions (CE 1000 to 1650)

The Mississippian Period is characterized by the practice of maize, beans, and squash agriculture, complex chiefdoms, populous villages and zones of dispersed housing, and constructed earthen mounds in some of the villages, usually along the floodplains of major rivers. (MVAC 2020) The mounds were built in stages with temples and the houses of the high-ranking individuals often erected on the summits of these truncated pyramids. The mound centers were supported by outlying villages, also typically built along major rivers, smaller hamlets and farmsteads to provide food, tribute, services, and labor to the chief in return for protection and inclusion in the sociopolitical system. (MVAC 2020) Trade networks were extensive throughout the Mississippi Valley, and the exchanged resources included marine shell, copper, and exotic lithic materials. These items, in turn, could be fashioned into jewelry or other items of status for the elites of the society. (WHS 2020b) They also built fortified towns consisting of an open plaza surrounded by platforms and enclosed within wooden palisades. The most notable is Aztalan, located in Jefferson County. (WHS 2020b)

An Oneota manifestation was found in the southern part of Wisconsin. The Oneota culture is considered the local version of the Mississippian culture found in Illinois to the south. (MVAC 2020) Both traditions had large villages involved in farming. The Mississippians left Wisconsin about CE 1200, succeeded by or transitioned into the Oneota culture by about 1200 CE. By the end of the Oneota culture, the villages had suffered substantial population decline through the introduction of European disease. (WHS 2020b; MVAC 2020) Villages were stockaded, suggesting the need for defense. (MVAC 2020) The Menominee, Ho-Chunk (Winnebago), and Dakota (Eastern Sioux) appear to be descendants of the Oneota. (WHS 2020b)

3.8.2.5 Fur Trade and Territorial Era (CE 1650 to 1850)

In the early 1600s, explorers from France began arriving in Wisconsin, followed by fur traders and missionaries (WHS 2020c). Local Native Americans traded beaver pelts to the French in exchange for knives, beads, blankets and other goods (WHS 2020c). French explorers first heard the name "Wisconsin" in a 1673 conversation with one of the Indian tribes. While there has been academic debate over the meaning, the most authoritative study of the name concluded that it probably meant "River of Red Stone." (WHS 2020c) As the fur trade economy flourished, the British moved in to replace the French. Change and conflict were the result of the competing interests of the various native populations, the French, and the British. (WHS 2020c) But by 1830, over-hunting had nearly exterminated fur-bearing mammals in Wisconsin. The trade began to shift farther west and north. (WHS 2020c) When the War of 1812 broke out, many Wisconsin residents sided with the British rather than the Americans, though many struggled to remain neutral. (WHS 2020d) The war ended in 1814 with Americans victorious, and resulted in the British retreat from Wisconsin by 1815. With the decline of British influence after the War of 1812, the population of the Great Lakes region increased dramatically. (WHS 2020d)

In August of 1825, thousands of Indians from Wisconsin tribes gathered in Prairie du Chien, and federal officials engineered a general treaty of peace. More than 70 treaties were negotiated with Wisconsin Indians between 1804 and 1854, transferring nearly all of Wisconsin to U.S. ownership. (WHS 2020d). Native populations were coerced into moving west of the Mississippi River or confined on reservations. Land was surveyed and divided for settlement by farmers and immigrants, and canals, roads, and other "public improvements" were built. (WHS 2020d) By 1840, most of Wisconsin belonged to the United States. The Menominee had previously relinquished much of their territory to the Oneida, Munsee, Brothertown, and Stockbridge nations, which had relocated to Wisconsin from their homelands back east. (WHS 2020d) In 1854, the Lake Superior Ojibwe bands ceded ownership of the northern forests (but retained rights to hunt and fish in them forever). U.S. control over Wisconsin was complete. Wisconsin became the 30th state on May 29, 1848. (WHS 2020d)

3.8.2.6 Historic Period (CE 1850 to present)

In 1779, Samuel Robertson became the first European to explore Manitowoc when he traveled from Milwaukee to meet a friend at a place called "Twin Rivers" (WHS 2020e). Lumbermen and mills moved into the region, setting up industrial towns along the rivers. The area's population fluctuated greatly over the early decades. When the railroad came, many settlers moved further west. A huge influx of Bohemians, Germans, and Poles in the 1870s helped Manitowoc's population rebound. (WHS 2020e) Shipbuilding took root in the mid-19th century, mostly of various lake schooners and clippers. The establishment of the Manitowoc Dry Dock Company in 1902 led to the building of steel vessels and its famed submarine industry during World War II. (WHS 2020e)

3.8.3 Onsite Cultural Resources

Onsite cultural resources are those located within the 1,260-acre PBN property. That property includes the entirety of the archaeological APE, which is also the onsite portion of the aboveground APE.

While there are 14 entries, either isolated finds or sites, on the ASI, there are no NRHP-eligible cultural resources confirmed within the 1,260-acre PBN property (Table 3.8-2). (WHS 2020a) Additionally, PBN has already committed to avoiding four previously identified sites which have not been recommended ineligible for the NRHP within the 1,260-acre property. (AVD 2004) The PBN power plant is the only structure within the PBN property listed in the Architecture and History Inventory (AHI). It is listed as an "astylistic utilitarian building," but has not been considered for NRHP status. (WHS 2020a) Inclusion in the AHI conveys no special status such as NRHP designation, nor any rights or benefits for owners of these properties. (WHS 2020f)

3.8.4 Offsite Cultural Resources

Offsite cultural resources are those outside the 1,260-acre PBN property boundary. There are 36 offsite resources within 6 miles of the PBN. Lists of known archaeological sites within a 6-mile radius of PBN are presented in Table 3.8-3. There is only one NRHP-eligible site within 6 miles, MN-0397 Pathfinder (1869), which is located approximately 2.5 miles from PBN. There are 24 structures listed on the AHI within a 6-mile radius of the PBN property (Table 3.8-4). (WHS 2020a)

There is conflicting information about NRHP structures near PBN. There are only two potentially NRHP-eligible structures listed on the WHPD within 6 miles of the PBN property. The closest of the two, historically called the Mishicot School, currently the Mishicot Museum and Research Center (AHI # 233465), is located approximately 5.66 miles away. (WHS 2020a) AHI # 65985, currently called Frank Rose's Century Inn, is located approximately 5.79 miles from the PBN property. (WHS 2020a) The Rawley Point Light Station, located approximately 5.09 miles from PBN, is not listed on the WHPD. It was built in 1853 on the western shore of Lake Michigan in an area that is presently the Point Beach State Forest. (NMC 2004b) The 1.5-story wooden structure (reference #84003706) has a national listing date of July 19, 1984, and a state listing date of January 1, 1989 (WHS 2020g). There should be no adverse effects to the NRHP eligible, or the NRHP-listed properties mentioned above as a result of continued operation of PBN during the proposed PBN operating term.

3.8.5 Cultural Resource Surveys

There have been five previous cultural resources surveys within the 1,260-acre PBN property (Table 3.8-1). There is no documentation of a cultural resources survey of the property conducted prior to the construction of PBN; however, the five recorded surveys were done at various stages of expansion and licensing between 1993 through 2018. (NMC 2004b; WHS 2020a) An additional 23 cultural resources surveys have been documented outside of the 1,260-acre property, but within the 6-mile radius of the PBN property. (WHS 2020a)

3.8.6 Procedures and Integrated Cultural Resources Management Plan

Protection of cultural resources on the PBN site is dictated by the PBN procedures manual "Archaeological, Cultural, & Historic Resources" (PBN 2010), which is specifically applicable to PBN. This guidance document ensures that cultural resource remains are not damaged and are protected from unauthorized removal, and that in the event disturbance is required in these areas, remains will be appropriately protected for their cultural resource information value. When implemented, the guidance protects known cultural resources, as well as unknown cultural resources, by establishing a process for all activities that require a federal permit or use federal funding or have the potential to impact historic resources.

Table 3.8-1 Previous Cultural Resource Surveys within the PBN Property

WHPD Survey ID	Survey Company	Date	Description	Findings
4990	Great Lakes Archeological Research Center, Inc.	August 1993	Phase I survey of a 40-acre parcel of agricultural land northwest of the power plant for a proposed storage site	No cultural resources identified
N/A	AVD Archaeological Services, Inc.	December 2002 & January 2003	Survey and Historical Assessment of the Alois Biel Fisherman's Shed	Not NRHP eligible
53831	AVD Archaeological Services, Inc.	June 2004	Phase I Survey of cultivated fields as part of the PBN LR process.	15 isolates 1 prehistoric site 3 historic sites
55456	Phase One Archaeological Services	November 2017 & May-June 2018	Phase I Survey for a proposed Two Creeks Solar Energy project	No cultural resources identified on PBN site
55959	Commonwealth Heritage Group, Inc.	November 2018	Phase I Survey for proposed solar energy project. Survey limited to areas with high potential for archaeological resources & which had not been previously surveyed	1 isolate

(NMC 2004b; WHS 2020a)

Table 3.8-2 Archaeological Sites Inventory Entries within the PBN Property

Code #	Name	Site Type	Cultural Affiliation
47-MN-0267	Krase Farm	Campsite/village	Unknown Prehistoric
47-MN-0437	MN1 Isolate	Isolated finds	Unknown Prehistoric
47-MN-0438	MN2 Isolate	Isolated finds	Middle Woodland
47-MN-0439	MN3 Isolate	Isolated finds	Archaic
47-MN-0440	MN4 Isolate	Isolated finds	Unknown Prehistoric
47-MN-0441	MN5 Isolate	Isolated finds	Unknown Prehistoric
47-MN-0443	MN7 Isolate	Isolated finds	Unknown Prehistoric
47-MN-0444	MN8 Isolate	Isolated finds	Unknown Prehistoric
47-MN-0445	MN9 Isolate	Isolated finds	Unknown Prehistoric
47-MN-0451	MN15-Ace Status	Isolated finds	Early Archaic
47-MN-0455	MN19	Isolated finds	Unknown Prehistoric
47-MN-0442	MN6 CZ-75 Site	Lithic scatter	Unknown Prehistoric
47-MN-0452	N. McMillan Farm	Isolated finds	Archaic
47-MN-0454	MN18	HCM concentration	Historic Euro-American

(WHS 2020a)

Table 3.8-3 Archaeological Sites Inventory Entries within a 6-Mile Radius of PBN (Sheet 1 of 2)

Code #	Name	Site Type	Cultural Affiliation
47-KE-0086	Chas. Olson	Campsite/village	Middle Archaic
47-MN-0397	Pathfinder (1869)[(a)]	Shipwreck	Historic Euro-American
47-MN-0063	O'Neil 1	Campsite/village	Unknown Prehistoric
47-MN-0234	School Forest 4	Campsite/village	Unknown Prehistoric
47-MN-0233	School Forest 3	Campsite/village	Unknown Prehistoric
47-MN-0065	School Forest 2	Campsite/village	Unknown Prehistoric
47-MN-0064	School Forest 1	Campsite/village	Unknown Prehistoric
47-MN-0213	Stephen Elliott Farm	Campsite/village	Unknown Prehistoric
47-MN-0069	West Shore Sportmen's Club	Campsite/village	Unknown Prehistoric
47-MN-0068	Schmidt I	Campsite/village	Unknown Prehistoric
47-MN-0214	Henry Short Farm	Campsite/village	Unknown Prehistoric
47-MN-0212	Charles Leclair	Campsite/village	Unknown Prehistoric
47-MN-0410	Continental (1882)	Shipwreck	Historic Euro-American
47-KE-0010	Prucha	Campsite/village	Unknown Prehistoric
47-MN-0415	Murray	Lithic scatter	Unknown Prehistoric
47-MN-0185	William Schroeder Farm	Isolated finds	Unknown Prehistoric
47-MN-0266	Jean Vieau's Landing Place	Trading/fur post	Historic Euro-American
47-MN-0168	V. Hallada Farm	Campsite/village	Unknown Prehistoric
47-MN-0170	Jonathan Paarman Farm	Campsite/village	Middle Archaic
47-MN-0186	N. McMillan Farm	Isolated finds	Archaic
47-MN-0268	Frasch-Schroeder Farm	Campsite/village	Unknown Prehistoric
47-MN-0114	Thomas Zahorik Farm	Campsite/village	Late Archaic; Middle Archaic
47-MN-0169	Louis Abbet Farm	Campsite/village	Archaic
47-MN-0292	Joseph Strauf Farm	Campsite/village	Unknown
47-MN-0446	MN10 Isolate	Isolated finds	Unknown Prehistoric
47-MN-0447	MN11 Isolate	Isolated finds	Unknown Prehistoric
47-MN-0448	MN12 Isolate	Isolated finds	Unknown Prehistoric
47-MN-0449	MN13 Isolate	Isolated finds	Unknown Prehistoric
47-MN-0450	MN14 Isolate	Isolated finds	Unknown Prehistoric

Table 3.8-3 Archaeological Sites Inventory Entries within a 6-Mile Radius of PBN (Sheet 2 of 2)

Code #	Name	Site Type	Cultural Affiliation
47-MN-0453	MN17	HCM concentration	Historic Euro-American
47-KE-0098	K74	Isolated finds	Late Archaic; Middle Woodland
47-KE-0100	K78	Isolated finds	Late Archaic; Middle Woodland
47-MN-0460	Manitowoc School Forest	Isolated finds	Unknown Prehistoric
47-MN-0038	Chandelle's Village	Campsite/village; cemetery/burial; corn hills/garden beds	Historic Indian
47-MN-0486	Two Creeks Pier	Cemetery/burial	Unknown Prehistoric
47-MN-0500	Frank Biface	Isolated finds	Unknown Prehistoric

(WHS 2020a)

a. NRHP eligible.

Table 3.8-4 Architecture and History Inventory Entries within a 6-Mile Radius of PBN

AHI #	Historical Name	Historical Use	Style
65260	Point Beach Nuclear Power Plant	power plant	Astylistic utilitarian building
65242	N/A	barn	N/A (unknown or not a building)
65248	N/A	pony truss bridge	Side gabled
65256	N/A	Agricultural – outbuilding	N/A
65257	N/A	barn	N/A
65258	N/A	barn	Gabled ell
65259	N/A	house	Other vernacular
65971	Twin Elder School; School District No. 2	elementary, middle, junior high, or high	Other vernacular
65972	N/A	house	Astylistic utilitarian building
65384	N/A	mill	Italianate
65385	N/A	retail building	Gothic revival
65386	N/A	church	Queen Anne
65984	N/A	house	Front gabled
65990	N/A	retail building	Commercial vernacular
26259	W R Forst Hotel	retail building	Boomtown
26260	N/A	retail building	Italianate
26261	N/A	house	Astylistic utilitarian building
26262	Edward Albertson Octagonal Barn	centric barn	Boomtown
32874	N/A	retail building	Cross gabled
32876	N/A	house	Other vernacular
65987	N/A	barn	Boomtown
65985	N/A[b]	retail building	Neogothic revival
65387	St. Peter's Evangelical Lutheran Church	church	N/A
230040	Mishicot School[b]	elementary, middle, junior high, or high	Romanesque revival
233465	Mishicot Graded School	elementary, middle, junior high, or high	N/A (unknown or not a building)

(WHS 2020a)

a. Distances are approximate and based on the PBN center point and AHI location data.

b. Potentially NRHP eligible.

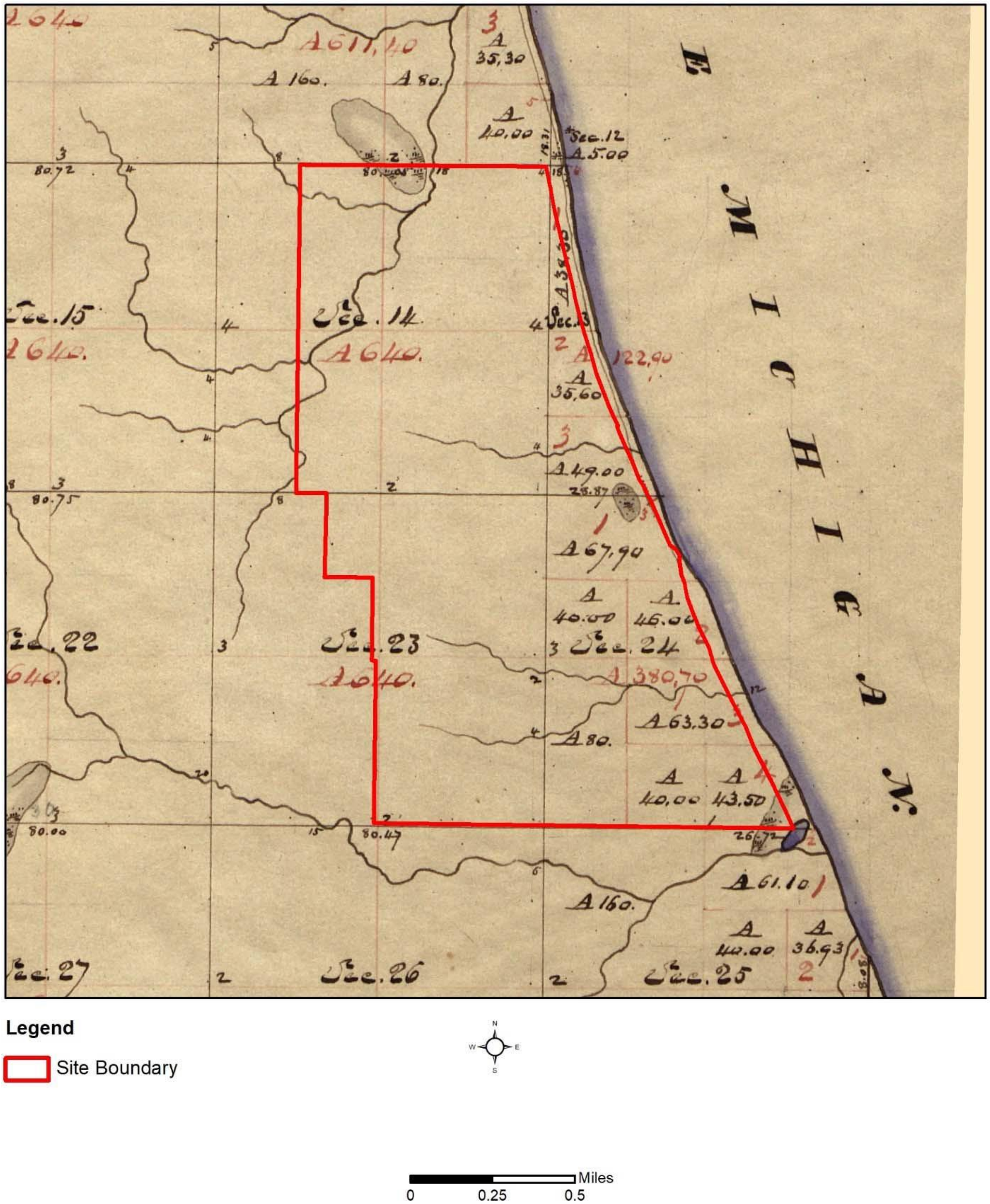
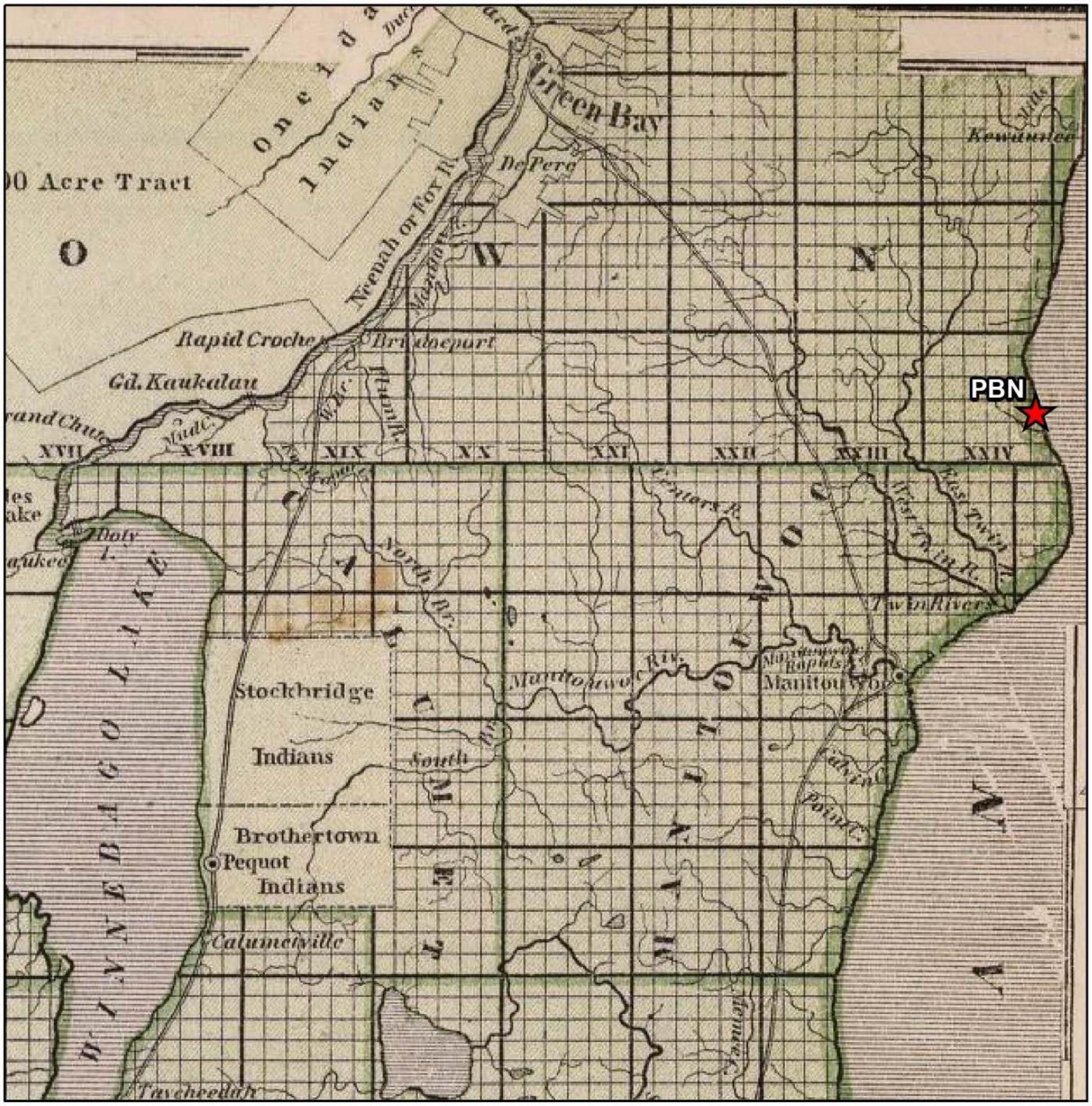


Figure 3.8-1 Government Land Office Survey Map, 1835



Legend

★ PBN

Figure 3.8-2 Historic Map of Wisconsin, 1845

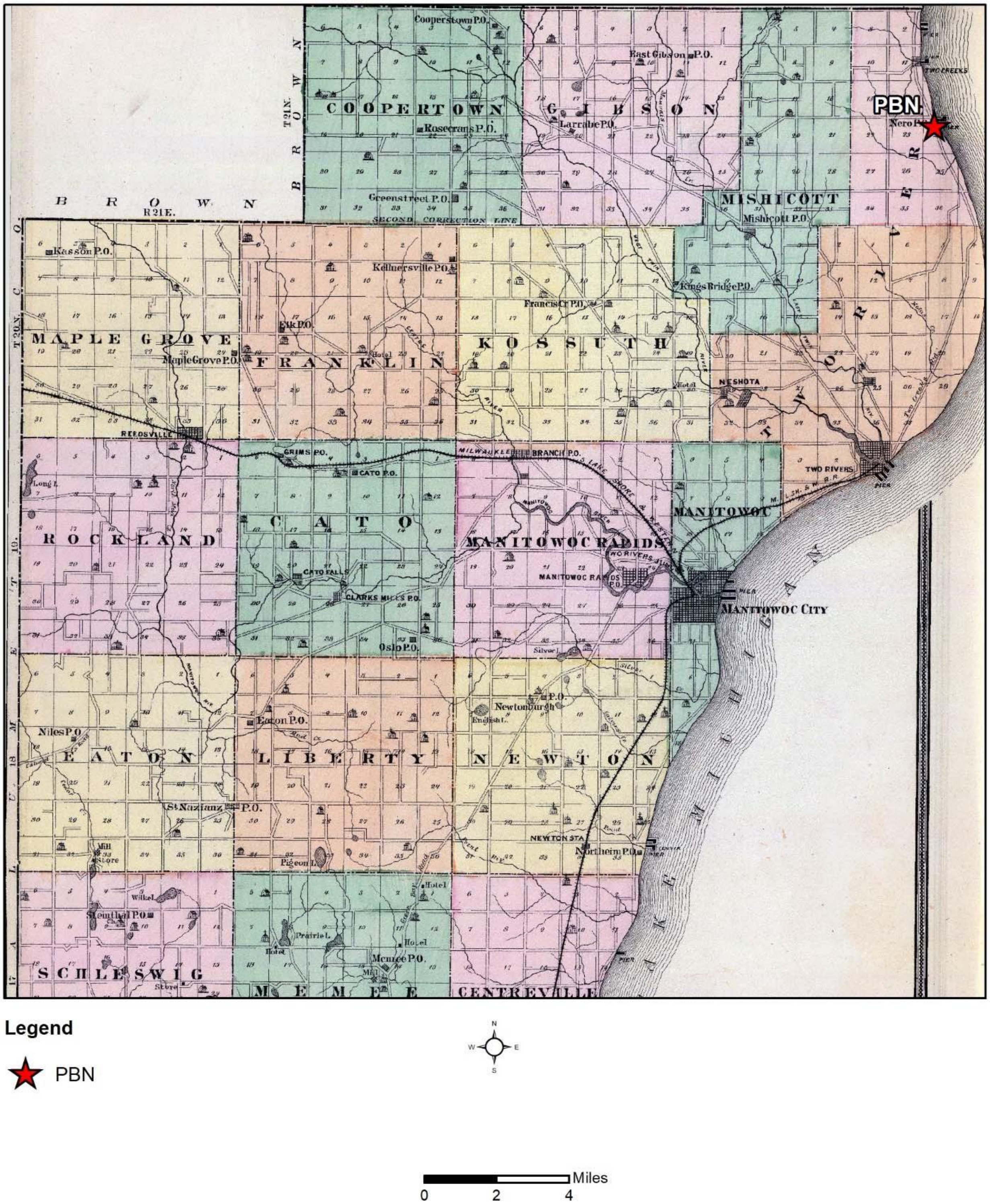


Figure 3.8-3 Manitowoc County, Wisconsin, 1878

Legend

PBN

Figure 3.8-4 Auto Road Map of Wisconsin, 1927

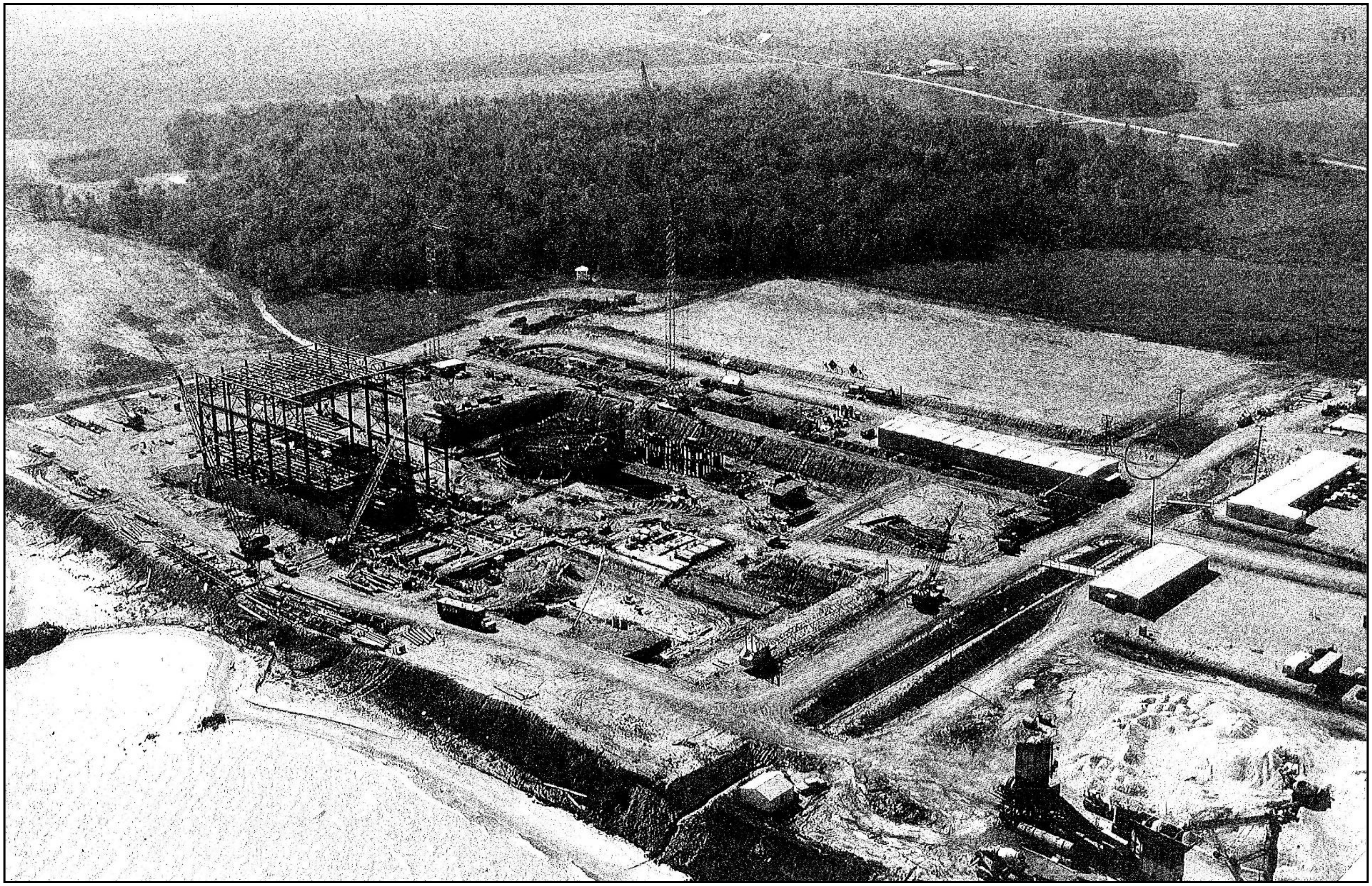


Figure 3.8-5 Early Construction of PBN Site, 1967

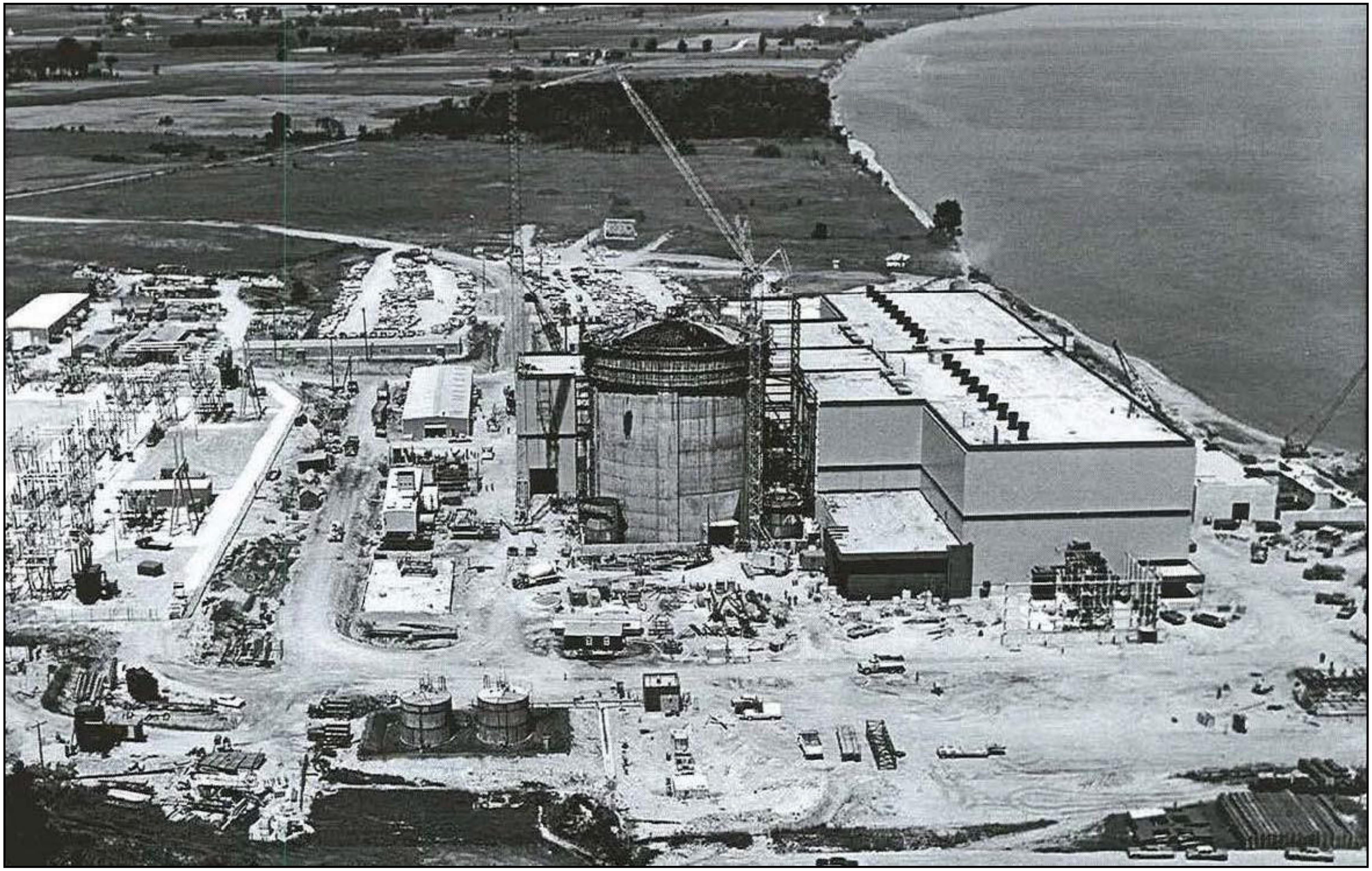


Figure 3.8-6 Construction Photograph of the PBN Site, August 1969

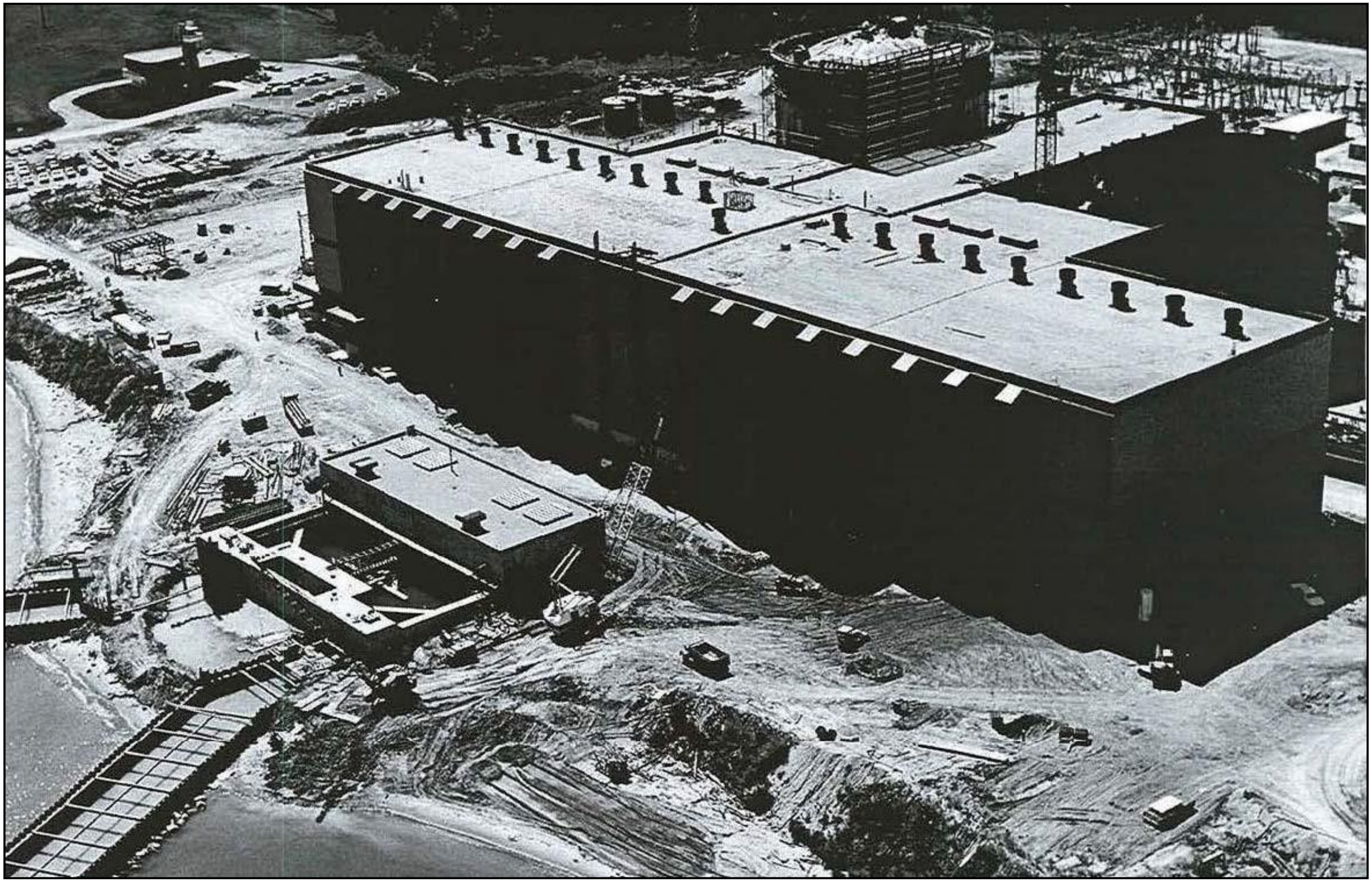


Figure 3.8-7 Construction Photograph of PBN, August 1969

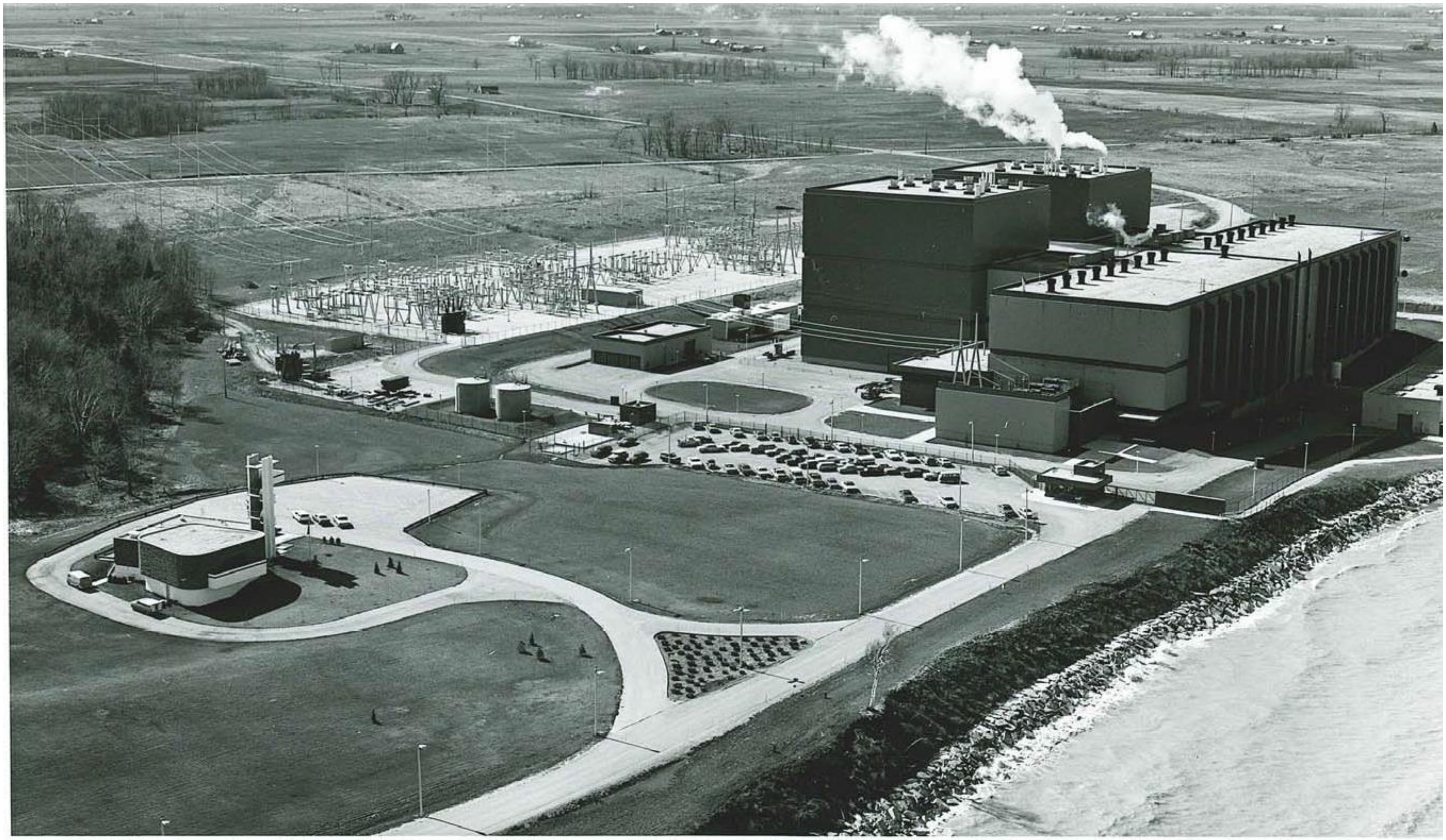


Figure 3.8-8 Post-Construction Photograph of PBN, 1973

3.9 Socioeconomics

Socioeconomic descriptions are focused on Manitowoc County and Brown County, WI, because approximately 81 percent of the PBN workforce are located in the two counties, while the remaining workforce is dispersed throughout the region (see Table 2.5-1).

As described in Section 2.5, refueling and maintenance outages for the two PBN units are on an 18-month cycle, with one unit's outage scheduled for the spring and the other for the fall. There are typically an additional 800 contract employees onsite during an outage. As seen in Figure 3.1-4, within the 50-mile radius of PBN there are several nearby Wisconsin communities, including Mishicot, Two Rivers, Manitowoc, and Green Bay. There are also numerous motels, campgrounds, and food service conveniences available for contract workers who provide temporary services during site outages. Transportation corridors such as I-43 and local roads provide commuter access to PBN.

3.9.1 Employment and Income

The two geographic areas most influenced by PBN operations are Brown and Manitowoc counties. NEPB pays an annual gross-receipts license fee on electricity sales in lieu of property taxes to the state of Wisconsin, with disbursement to Manitowoc County and local municipalities (PBN 2009b, Appendix D, Section 5.0). As discussed in Section 3.11, Brown County's population has shown continued growth since 2000, while Manitowoc County's population has been in decline. Low-income populations and poverty thresholds for the counties are described in Section 3.11.2.

Brown County is a medium-sized (population) county in the Green Bay, WI, metropolitan area (NACo 2020). The estimated employed population in Brown County was 197,631 persons in 2018. The leading reported occupational sector was manufacturing, with approximately 14.0 percent, or 27,573 persons employed; followed by health care and social assistance with 12.3 percent, or 24,213 persons employed; and government and government enterprises with 10.1 percent, or 19,908 persons employed. The annual personal income in Brown County was approximately $13.9 billion in 2018, and average wage per job was $51,382. In 2018, per capita income was $52,821. (BEA 2020) The annual average unemployment rate in Brown County has dropped steadily over the years from a reported recent high of 7.9 in 2010 to 2.7 in 2018 (BLS 2020). The average annual unemployment rate for 2019 has not been released. Brown County's largest employer is the Oneida Tribe of Indians of Wisconsin (Brown County 2020b).

Manitowoc County is a medium-sized (population) county located in the Manitowoc, WI, micropolitan area (NACo 2020). The estimated employed population in Manitowoc County was 44,172 persons in 2018. The leading reported occupational sector was retail trade, with approximately 10.8 percent, or 4,775 persons employed; followed by health care and social assistance, with approximately 10.5 percent or 4,633 persons employed, and government and government enterprises with 9.7 percent, or 4,292 persons employed. The annual personal income in Manitowoc County was approximately $3.8 billion in 2018, and average wage per job was $45,057. In 2018, per capita income was $47,675. (BEA 2020) The annual average unemployment rate in Manitowoc County has been in a continuous decline from its most recent high in 2010 (9.9). In 2018 the annual average unemployment rate in Manitowoc County was 3.1. (BLS 2020) The largest employer in Manitowoc County is Lakeside Foods Inc. (PL 2020).

3.9.2 Housing

Between 2010 and 2018, the population in Brown County is estimated to have increased by approximately 6.2 percent (see Table 3.11-2). As seen in Table 3.9-1, total available housing within Brown County grew by 15.7 percent between 2000 and 2010; and increased by 4.3 percent between 2010 and 2018. In 2010, the overall vacancy rate was at 5.7 percent and was an estimated 4.4 percent in 2018. With the vacancy rate showing only minimal decline in housing availability over the years, this would indicate that adequate housing was available to keep up with the Brown County population increase. The median home values in Brown County increased by 37.1 percent between 2000 and 2010, but housing values increased by only 4.9 percent between 2010 and 2018. The median rent for the county increased 27.3 percent between 2000 and 2010, and 16.6 percent between 2010 and 2018. (USCB 2020f; USCB 2020g)

As seen in Table 3.11-2, the population in Manitowoc County was estimated to decrease by approximately 3.0 percent from 2010 to 2018. From 2000 to 2010, the total available housing grew by 7.3 percent, but housing growth slowed down significantly between 2010 and 2018 with total available housing increasing by only 0.6 percent overall (Table 3.9-1). In turn, the resulting vacancy rate declined slightly from 2010 (8.5 percent) to 2018 (7.9 percent). The reported vacancy rate would still indicate enough housing availability for the current estimated county population. After median housing values increased by 37.1 percent between 2000 and 2010, there was a minimal 2.1 percent increase in median housing values between 2010 and 2018. The median rent for the county increased by 23.1 percent between 2000 and 2010, and by 22.0 percent between 2010 and 2018. (USCB 2020f; USCB 2020g)

3.9.3 Water Supply and Wastewater

While potable water in the vicinity of PBN is drawn primarily from Lake Michigan, groundwater does provide potable water for smaller towns and rural residences in the plant region (NRC 2011a)

In Brown County, groundwater has long been the source of drinking water, except for the city of Green Bay, which obtains its water by pipeline from Lake Michigan. There are 17 public municipal community water systems in Brown County, four listed as other than municipal community systems (e.g. subdivision, apartment complex, etc.), 13 non-transient non-community systems (e.g. school, daycare, factory, etc.), and 115 transient non-community systems (e.g. gas station, golf course, etc.). There are approximately 6,640 documented wells in Brown County. Most private wells in Brown County obtain water from two shallow aquifers, while most public wells obtain water from the deeper St. Peter sandstone aquifer. Because of depletion of groundwater in the Green Bay metropolitan area, recommendations have been to move to obtain Lake Michigan water for the area's long-term potable water needs. (Brown County 2020a)

Regarding sanitary sewer service, Brown County has both offsite service, which is typically located with urban and urbanizing areas; and onsite service, generally located in the rural portions of the county as septic systems. Offsite wastewater collection, treatment, and disposal are provided to all or portions of county cities, all nine villages, and nine of 13 towns in Brown County. Also, the cities and villages typically provide sewer service to their entire community, while towns provide this service to only a portion of their populace. Many towns in Brown County have developed town-wide sanitary districts or districts that serve a portion of their communities. There are eight sewage treatment plants within Brown County, and county population is expected to grow in the coming years (see Table 3.11-2). Local Brown County communities, sanitary districts, and sewage districts regularly review the condition of their sewage systems to determine if maintenance, upgrades, or replacement of components are necessary. Brown County envisioned that these practices will continue to be adequate for the foreseeable future. (Brown County 2020a)

Rural septic systems (onsite sewage disposal) are used in areas not served by municipal systems and sanitary districts. In 2001, the Wisconsin Department of Commerce recognized new technologies and standards for private sewage disposal, providing more options to owners on improving treatment. Data gathered by the Brown County Zoning Department indicate that the use of onsite sewage disposal has remained steady over the years. Within Brown County, joint planning between affected local units of government and agencies has been recommended for extension of the sewer infrastructure, utilities, and services; the use of onsite sewage disposal systems; and potential introduction of decentralized sewer systems (small community collection and treatment systems). (Brown County 2020a)

Municipal water systems serve the majority of residential, commercial, and industrial users in 11 communities within Manitowoc County. Nine of the public water systems are supplied from groundwater through community wells. The cities of Manitowoc and Two Rivers utilize Lake Michigan for their public water supply needs. Each community's water system should be sufficient to meet the everyday demands of the customer in addition to demands for higher volumes, as would be the case for fire protection. Future expansion needs for each community's public water service areas will be dependent on storage capacity and density of homes that could be accommodated using the existing community systems. The Village of Francis Creek and 18 towns within the county not serviced by public systems have individual or shared wells that are owned and maintained by the property owner(s). (Manitowoc County 2020b) See Section 3.6 for a description of groundwater wells located within 2 miles of PBN.

Wastewater in the urbanized and developed rural areas of Manitowoc County is treated by municipal wastewater treatment facilities. There are 12 communities in the county that utilize municipal wastewater treatment systems to dispose of sewage discharged from residences, office buildings, factories, and other buildings. Manitowoc County also has sanitary districts that service communities, including Clark Mills, Kossuth, Liberty, and Rockland. Several areas in the county have established sanitary districts but have yet to install the infrastructure to make them operational. A number of communities also utilize private onsite wastewater treatment systems, also known as septic systems. (Manitowoc County 2020b) The town of Two Creeks utilizes a variety of septic system types for wastewater disposal (Two Creeks 2019).

As discussed in Section 3.6.3.2, PBN is not connected to a municipal water system and accesses potable water from onsite groundwater wells. Sanitary wastes from the plant and administration building are treated in an onsite package extended aeration, activated sludge plant before disposal at the PBN cooling water discharge location. A local licensed septage hauler periodically removes the remnant sludge offsite for disposal; see Section 3.6.1.2.3.

3.9.4 Community Services and Education

As of the 2018–2019 school year, Brown County has 10 public school districts (PSD), with 44,585 total students and 83 schools (grades pre-kindergarten to 12). The Green Bay area PSD is the largest in Brown County with 20,391 students and 42 schools. The Green Bay area PSD student/teacher ratio was 13.56. Brown County has 23 private schools with a total of 5,640 students (2017–2018 school year). (NESC 2020).

During the same time period, Manitowoc County has six PSDs, with 10,364 total students and 29 schools (grades pre-kindergarten to 12). Manitowoc school district is the largest PSD in Manitowoc County, with 4,961 students and 11 schools. The Manitowoc school district student/teacher ratio was 14.75. Manitowoc County has 16 private schools with a total of 1,831 students. (NESC 2020)

Within approximately 50 miles of the town of Two Creeks (municipality where PBN is located), there are 17 two-year and four-year higher educational institutions (both public and private), with nine schools offering bachelor and advanced degrees. The nearest higher educational institution to PBN is located in Manitowoc County. (NESC 2020)

For Brown County emergency services, primary law enforcement is provided through the Brown County sheriff's office, and community departments of public safety or police departments in Ashwaubenon, De Pere, Denmark, Green Bay, Oneida, Pulaski, and Suamico (USACOPS 2020). Brown County residents are served by a combination of community and rural fire departments with both active career firefighters and volunteers. There are 18 fire departments and 33 fire stations in Brown County, manned by 317 active career firefighters and 216 active volunteer firefighters, with 317 firefighters paid per call. (USFA 2020) A wide range of medical facilities and treatment centers are available in Brown County. The full-service hospitals are located in the city of Green Bay and include Aurora BayCare Medical Center (167-bed facility), Bellin Hospital (167-bed facility), St Mary's Hospital Medical Center (83-bed facility), and St. Vincent Hospital (255-bed facility). (WHA 2020)

Manitowoc County emergency services primary law enforcement is provided through the Manitowoc County Sheriff's office, and community police departments of Cleveland, Kiel, Manitowoc, Mishicot, Reedsville, Saint Nazianz, Two Rivers, and Valders (USACOPS 2020). There are 19 fire departments and 23 fire stations in Manitowoc County, manned by 73 active career firefighters, 448 active volunteer firefighters, with 56 firefighters paid per call (USFA 2020). There are two full-service hospitals in Manitowoc County. Holy Family Memorial is a 58-bed facility located in the city of Manitowoc. The Aurora Medical Center of Manitowoc County is a 62-bed facility located in the city of Two Rivers. (WHA 2020)

3.9.5 Local Government Revenues

In Wisconsin, public utilities are exempt from local property taxation and, instead, are taxed by the state. NEPB pays a gross-receipts license fee on PBN electricity sales instead of paying property taxes under Wisconsin Statute 76.28(9). The annual fee is equivalent to 1.59 percent of the plant gross revenues for the previous calendar year. These annual fees are paid to the Wisconsin Department of Revenue (WDR) and deposited in the state general fund. As seen in Table 3.9-2, NEPB annual license fee payments to WDR ranged from $7,279,882 in 2015 to $7,849,298 in 2018. In 2019, the license fee paid on behalf of PBN to WDR was $8,027,490. Upon receipt of revenue, the state distributes (Wisconsin Statute 79.04) the fee paid in lieu of property tax to the appropriate municipal and county taxing authorities through a shared revenue process. (PBN 2009b, Section 5.1; WDR 2020a; WSL 2020a; WSL 2020b)

Wisconsin has a long history of sharing state revenues with local governments. These funding mechanisms include the county and municipal aid payment, which provides unrestricted aid payments to municipalities and counties; the expenditure restraint program, which provides unrestricted aid to qualifying municipalities that limit growth in spending; and public utility aid, which helps counties and municipalities pay for services provided to tax exempt utility property. The utility aid payments are also viewed as partial compensation for potential air pollution, noise, traffic congestion, and land use limitations caused by the presence of a utility property. As of 2009, the shared revenue utility aid payment is recalculated each year by the state using the following components: ad valorem (net book value) payment, spent nuclear storage payment, minimum payment, megawatt payment, incentive payment, decommission payment, and the per capita limit. (WDR 2020b)

Manitowoc County and the town of Two Creeks are the county and municipality where PBN is physically located, and as established in Wisconsin statute 79.04, receive the largest share of public utility aid distribution in the county. (WSL 2020a) As presented in Table 3.9-2, the shared revenue utility aid payment attributable to PBN represented approximately 30 to 64 percent of the revenues of Two Creeks between 2015 to 2018. In 2018 (latest year of complete financial reporting) the shared revenue utility aid payment attributable to PBN represented approximately 64 percent of revenues. The largest program receiving Two Creeks funding was highway construction, followed by solid waste collection and disposal, fire, health and human services, and parks and recreation. (WDR 2017; WDR 2018; WDR 2019; WDR 2020b; WDR 2020c)

During the same 2015–2018 time period, the shared revenue utility payment attributable to PBN represented approximately 2 to 3 percent of the revenues of Manitowoc County. In 2018, the shared revenue utility aid payment attributable to PBN represented approximately 3 percent of revenues. These revenues support county programs such as health and human services, public safety, law enforcement, highway construction and maintenance, solid waste collection, parks and recreation, culture and education, and other municipal programs. (WDR 2017; WDR 2018; WDR 2019; WDR 2020b; WDR 2020c)

Overall, NEPB's payment of the gross-receipts license fee to the WDR have remained consistent between 2015 and 2019 (Table 3.9-2) and there were no adjustments to the payments caused by reassessments and other actions that resulted in notable increases or decreases. At this time, NEPB does not anticipate any future changes in tax laws, assessments, or any other adjustments that could result in notable future increase or decrease in license fees or other payments to Manitowoc County and the town of Two Creeks.

PBN staff is proactive in reaching out to community stakeholders in Manitowoc County and the region. In 2019, NEPB provided monetary support to a number of local schools and charitable programs, and contributes approximately $78,000 annually for a wide range of community services involving civic, educational, human health, business, and community development efforts in the area.

3.9.6 Transportation

As discussed in Section 3.1, transportation in the PBN region includes an extensive road network serving both rural and urban areas, rail and airports. The closest commercial port to PBN is the Port of Manitowoc, where the car ferry dock is also located, providing seasonal ferry service across Lake Michigan from Manitowoc to Ludington, MI. (WCPA 2020; Two Creeks 2019).

The primary road network in the area is shown in Figure 3.1-3 and Figure 3.1-4. The I-43 transportation corridor runs north and south across Wisconsin, providing access to the cities of Green Bay, Manitowoc, and Sheboygan. PBN staff and plant visitors arrive at the southern entrance of the plant by traveling east on Nuclear Road to Lake Shore Road. Nuclear Road intersects STH 42 approximately 1 mile west of the plant. The mainly north-south STH 42 connects the communities of Manitowoc, Two Rivers, Two Creeks, and Kewaunee, with CTH V providing access to STH 42 from the town of Mishicot. (USDOT 2020a).

The Wisconsin Department of Transportation (WDOT) average annual daily traffic (AADT) volumes available for state and local roads in the 6-mile vicinity that link to PBN are listed in Table 3.9-3. STH 42 is the main road in the PBN vicinity feeding commuter traffic to the plant. It is described as a two-lane, undivided highway classified as a major collector, with 12 to 13-foot-wide lanes, 2-foot-wide paved shoulders, and 5-foot-wide gravel shoulders. (PSC 2019b) Over the years, the traffic count on STH 42 shows a decrease in vehicle load. At WDOT station number (SN) 360124, located near the town of Two Creeks north of the Nuclear Road intersection with STH 42, the AADT count was 1,300 vehicles in 2017, declining from 1,800 vehicles in 2011. At WDOT SN 360867, located north of the city of Two Rivers and south of the Nuclear Road intersection with STH 42, the AADT count was 3,500 vehicles in 2011 and 2,100 vehicles in 2017. (WDOT 2020) The east-west commuter road providing access to the plant (via STH 42 and Nuclear Road) is local road CTH V. Described as a two-lane undivided highway with 11 to 12-foot-wide lanes and 2-foot-wide gravel shoulders, CTH V is classified as a major collector west of STH 42, providing access from the village of Mishicot, and a minor collector east of STH 42 supporting local traffic. (PSC 2019b) At SN 360209, CTH V, located east of STH 42, the 2011 AADT count was 400. At SN 360341 CTH V, east of Mishicot and west of the STH 42 intersection, the 2011 AADT count was 1,400. The 2011 AADT counts were the most recent reported for CTH V at the assigned station numbers. (WDOT 2020)

The U.S. Transportation Research Board has developed a commonly used indicator called level of service (LOS) to measure how well a highway accommodates traffic flow. LOS is a qualitative assessment of traffic flow and how much delay the average vehicle might encounter during peak hours. LOS categories are listed and defined in Table 3.9-4. (TRB 2010)

No WDOT or recent traffic studies with LOS analysis were available for PBN vicinity roads. To provide a current evaluation of LOS for STH 42 and CTH V, the known AADT traffic volumes were compared to the estimated capacity of a two-lane highway, as defined in the highway capacity manual. The manual notes that the capacity of a two-lane highway under base conditions is 1,700 passenger cars per hour (pc/h) in one direction, with a limit of 3,200 pc/h for the total of the two directions. Because of the interactions between directional flows, when a capacity of 1,700 pc/h is reached in one direction, the maximum opposing flow would be limited to 1,500 pc/h. (TRB 2010) Based on 2017 recorded volumes at SN 360124, STH 42 has a 2017 reported flow rate of 54 pc/h on average. At SN 360867, STH 42 has a reported 2017 flow rate of 88 pc/h on average. At SN 360209, CTH V has a reported 2011 flow rate of 17 pc/h on average. At SN 360341, CTH V has a reported 2011 flow rate of 58 pc/h on average. Because traffic flow has stayed consistent over the years, and the base condition capacities for a two-lane road are not exceeded by the current average traffic conditions, there should be ample traffic capacity on STH 42 in the road areas associated with plant access. Applying the LOS traffic conditions defined in Table 3.9-4, SH-42 and CTH V should fall within the LOS "A" to "C" range of conditions.

The PBN current workforce and places of residence are described in Section 2.5. As identified in Figure 3.1-3, the Point Beach and Two Creeks solar power generation facilities are located in proximity to PBN on neighboring property, and infrastructure will be located within the PBN site boundary. Both solar facilities are expected to be through the construction phase and operational by October 2021 (see Section 3.1). There are an estimated 300 workers anticipated to support construction of the solar facilities in the short term. Once construction is complete, the solar facilities will require approximately three full-time staff for operations and maintenance (PSC 2018). Planners for the solar facilities have had discussions with Manitowoc County and Two Creek Township road personnel regarding local road conditions and accessibility, and have noted any constraints for use in their project planning (PSC 2019b). With completion of construction, the day-to-day operation of the solar arrays will require little large or heavy traffic. Typical vehicles used during operations will be pick-up trucks or small vans for regular panel maintenance and site upkeep (e.g. mowing, etc.). (PSC 2019b)

According to the town of Two Creeks Comprehensive Plan, the Manitowoc County Highway Commission's tentative 5-year construction schedule for the years 2019–2023 includes no construction plans involving Two Creeks. (Two Creeks 2019)

3.9.7 Recreational Facilities

As seen in Figure 3.1-5 and Figure 3.1-6, there are a number of public lands and recreational activities located within the region and vicinity of PBN; Table 3.1-1 identifies public lands within the vicinity.

Thousands of visitors are drawn annually to Manitowoc County. Within the PBN vicinity, the Point Beach State Park is one of the largest recreational sites, featuring 3,000 acres of forest and 6 miles of Lake Michigan shoreline. Along with camping and cabin facilities for overnight visitation, the park contains day use picnic areas and playgrounds, and a number of recreational trails supporting wildlife viewing, bicycle, snowmobile, horseback riding, hiking, and backpack use. A popular feature within the park property is the Rawley Point Lighthouse, which has been operated by the U.S. Coast Guard since 1853. (MTR 2020) The lighthouse grounds and tower are closed to the public, but easily viewed from other areas of the park (USL 2020). According to the WDNR's park attendance records since 2001, annual visitation at Point Beach State Park (Point Beach State Forest) regularly exceeds 370,000 persons. In 2018, annual visitation totaled 374,300 persons, and each year the majority of park attendance takes place between April and November. (WDNR 2020f).

The Ice Age National Scenic Trail is a thousand-mile footpath entirely within the state of Wisconsin. The trail is managed by a partnership of the National Park Service, the WDNR, and the Ice Age Trail Alliance. Within the PBN vicinity, trail segments traverse Point Beach State Park, the town of Mishicot, and into Kewaunee County. Throughout the state of Wisconsin, more than one million people use the Ice Age Trail each year to hike, backpack, and snowshoe. No recreational trail use figures were available specific to Manitowoc County. (IATA 2020)

Within the Two Creeks Township are a number of federal and state natural areas and local parks, including the Two Creeks Buried Forest. Located near the border of Manitowoc and Kewaunee counties, the site is owned by WDNR and was designated a state natural area in 1967. Two Creeks Buried Forest is a unit of the Ice Age National Scientific Reserve and along with being open to the public, the buried forest has been a popular study site for North American geologists, botanists, glacial ecologists, and climatologists. No recreational use visitation estimates are available. (WDNR 2020f)

PBN does not have an onsite public visitor center. Rather, PBN reaches out to the local community through employees speaking on behalf of the plant, or via PBN educational campaigns sharing information with area stakeholders in Manitowoc County and the region.

Table 3.9-1 Housing Statistics, 2000–2018

Name	2000	2010	2000 to 2010 Change (%)	2018 Estimate	2010 to 2018 Change (%)
Brown County					
Total Housing Units	90,199	104,371	15.7	108,876	4.3
Occupied Units	87,295	98,383	12.7	104,133	5.8
Vacancy Units	2,904	5,988	106.2	4,743	-20.8
Vacancy Rates (%)	3.2	5.7	2.5	4.4	-1.4
Median House Value ($)	116,100	159,200	37.1	167,000	4.9
Median Rent ($/month)	520	662	27.3	772	16.6
Manitowoc County					
Total Housing Units	34,651	37,189	7.3	37,428	0.6
Occupied Units	32,721	34,013	3.9	34,463	1.3
Vacancy Units	1,930	3,176	64.6	2,965	-6.6
Vacancy Rates (%)	5.6	8.5	3.0	7.9	-0.6
Median House Value ($)	90,900	124,600	37.1	127,200	2.1
Median Rent ($/month)	433	533	23.1	650	22.0

(USCB 2020f; USCB 2020g)

Table 3.9-2 PBN Payment in Lieu of Property Taxes, 2015-2019

	2015	2016	2017	2018	2019
PBN – WDR Annual License Fee	$7,279,882	$7,771,244	$7,869,982	$7,849,298	$8,027,490
Manitowoc County					
Total WDR Shared Revenues	$4,410,996.97	$4,410,158.78	$4,422,916.03	$4,485,903.42	N/A
WDR Utility Aid Payment (on behalf of PBN)	$1,852,427.40	$1,851,589.21	$1,864,346.46	$1,927,333.85	N/A
Percent of Total Tax Revenues (utility)	3%	3%	2%	3%	—
Total Revenue & Other Financing Sources	$57,828,300.00	$62,250,200.00	$76,735,100.00	$63,130,100.00	N/A
Town of Two Creeks					
Total WDR Shared Revenues	$234,368.58	$233,518.58	$232,243.58	$236,493.58	N/A
WDR Utility Aid Payment (on behalf of PBN)	$231,475.00	$230,625.00	$229,350.00	$233,600.00	N/A
Percent of Total Tax Revenues (utility)	30%	57%	64%	64%	—
Total Revenue & Other Financing Sources	$769,600.00	$403,300.00	$357,000.00	$363,400.00	N/A

(WDR 2017; WDR 2018; WDR 2019; WDR 2020b; WDR 2020c)

N/A = Not available.

Table 3.9-3 Total Average Annual Daily Traffic Counts on Routes Near PBN

Count Location (Station Number)	Route	AADT Count Location	2011	2017
360124	STH 42	Between CTH BB and Zanders Road (north of Nuclear Road intersection)	1,800	1,300
360867	STH 42	North of CTH W (south of Nuclear Road intersection)	3,500	2,100
360209	CTH V	East of STH 42	400	NC
360341	CTH V	East of Mishicot (west of STH 42 intersection)	1,400	NC

(WDOT 2020)

NC = No count.

Table 3.9-4 Level of Service Definitions

Level of Service	Conditions
A	Free flow of the traffic stream; users are mostly unaffected by the presence of other vehicles.
B	Free flow of the traffic stream, although the presence of other vehicles becomes noticeable. Drivers have slightly less freedom to maneuver.
C	The influence of the traffic density on operations becomes marked and queues may be expected to form. The ability to maneuver with the traffic stream is clearly affected by other vehicles.
D	The ability to maneuver is severely restricted due to traffic congestion. Travel speed is reduced by the increasing volume. Only minor disruptions can be absorbed without extensive queues forming and the service deteriorating.
E	Operations at or near capacity, an unstable level. The densities vary, depending on the free-flow speed. Vehicles are operating with the minimum spacing (or gaps) for maintaining uniform flow. Disruptions cannot be dissipated readily, often causing queues to form and service to deteriorate to LOS F.
F	Forced or breakdown of flow. It occurs either when vehicles arrive at a rate greater than the rate at which they are discharged or when the forecast demand exceeds the computed capacity. Queues form behind these breakdowns. Operations within queues are highly unstable, with vehicles experiencing brief periods of movement followed by stoppages.

(TRB 2010)

3.10 Human Health

This section describes site conditions likely to contribute to the occurrence of pathogenic thermophilic microbiological organisms; methodology and procedures designed to meet the regulatory requirements and standards for limiting potential induced current hazards arising from energized in-scope transmission lines; and a description of the plant's radiological health environment and preventative measures necessary to reduce potential exposure levels to plant workers and visitors during plant operations.

3.10.1 Microbiological Hazards

In the GEIS, the NRC considered health impacts from thermophilic microorganisms posed to both the public and plant workers because ideal conditions for thermophilic microorganisms can result from nuclear facility operations and discharges. Microorganisms of particular concern include several types of bacteria (*Legionella* species, *Salmonella* species, *Shigella* species, and *Pseudomonas aeruginosa*) and the free-living amoeba *Naegleria fowleri*. The public can be exposed to the thermophilic microorganisms *Salmonella*, *Shigella*, *P. aeruginosa*, and *N. fowleri* during swimming, boating, or other recreational uses of freshwater. If a nuclear plant's thermal effluent enhances the growth of thermophilic microorganisms in waters open for recreational use, recreational users could experience an elevated risk of exposure when using waters near the plant's discharge. (NRC 2019a)

Legionella is a genus of common warm water bacteria that occurs in lakes, ponds, and other surface waters, as well as some groundwater sources and soils. *Legionella* optimally grow in stagnant surface waters with biofilms or slimes that range in temperature from 95 to 113°F, although the bacteria can persist in waters from 68 to 122°F. The bacteria are only pathogenic to humans when aerosolized and inhaled into the lungs. As such, human infection is often associated with complex water systems housed within buildings or structures, such as cooling towers. (NRC 2019a) The health risk is to workers exposed to discharged heated waters, rather than the public.

Naegleria fowleri is ubiquitous in nature and thrives in water bodies at temperatures ranging from 95-106°F or higher and is rarely found in water cooler than 95°F. Infection rarely occurs in water temperatures of 95°F or less (NRC 2013a, Section 3.9.3). Infections occur when *N. fowleri* penetrates the nasal tissue through direct contact with water in warm lakes, rivers, or hot springs and migrates to the brain tissues (NRC 2019a). There have been only 145 cases of primary amebic meningoencephalitis, the infection caused by *N. fowleri*, in the United States with no cases occurring in Wisconsin from 1962–2018 (CDC 2019). The exposure route of concern would be emersion (e.g., swimming) in water contaminated with a sufficient population of microorganism for human infection.

The other human pathogens mentioned above have infection routes of contact with infected persons or contaminated water, food, soil, or other contaminated material. The pathogens can grow at a range of temperatures, but as human pathogens, have an optimal growth temperature around the human body temperature. There were no reported cases of infection from waterborne *Salmonella* spp. in the United States in 2018 (CDC 2018). There were three infection cases from waterborne pathogens in untreated recreational water in Wisconsin in 2013-2014, which occurred from *Escherichia coli* in a reservoir setting (CDC 2014). The exposure route of concern would be contact with contaminated water—i.e., containing a population of microorganisms sufficient for human infection.

As discussed in Section 2.2.3, PBN utilizes a once-through cooling system for both units that draws water from and discharges to Lake Michigan. The intake structure is located 1,750 feet offshore in 22 feet of water. Cooling water exits the plant via two steel piling troughs extending in opposite directions (30-degree angle from the plant centerline) approximately 200 feet out into Lake Michigan. The momentum of the discharge velocity is sufficient to create a high degree of mixing with the lake surface water in the immediate vicinity. Lake Michigan along PBN is a security zone where entry is prohibited pursuant to U.S. Coast Guard/Homeland Security regulation (Navigation and Navigable Waters) 33 CFR 165.916(a)(2). The nearest public beach areas to PBN are Two Creeks County Park approximately 1 mile north and Point Beach Campground approximately 4 miles south.

The plant's WPDES permit limits waste heat rejected to Lake Michigan to a weekly average of 8,273 MBtu per hour. The permit requires reporting of intake and discharge temperatures to allow for the calculation of the heat rejection. (Attachment B)

EPUs were implemented at Units 1 and 2 in 2011. The EPUs were estimated to result in a 2°C (3.6°F) increase in discharge temperature. The month with the highest water temperatures at the plant's intake (November 2004 to May 2008) was August, with an average temperature of 19.3°C (66.74°F). The estimated average discharge temperature for August during this timeframe applying the uprate predictions was 32.3°C (90.14°F). The maximum temperature increase over intake temperature predicted for the uprate for 1,000 feet offshore (within the security zone) is 8.57°C (15.43°F) with an assumed along-shore current of 0.2 feet/second. (EA Engineering 2008) This increase added to the average temperature at the intake for the month of August by 19.3°C (66.74°F), resulting in an estimated average temperature of 27.9 (82.2°F) at the approximate end of the security zone. This temperature is below that which would optimize growth of the pathogens. The average August discharge temperatures for years 2014–2018 for Units 1 or 2 (whichever was higher) were 82.2, 75.6, 84.8, 87.7, and 84.0 (PBN 2015; PBN 2016a; PBN 2017a; PBN 2018b; PBN 2019b) and the highest average daily discharge temperature for August 2019 was 88.8°F. These discharge temperatures fall below the average discharge temperature for August estimated in the EPU study of 90.14°F. Furthermore, the discharge temperatures which occur within the restricted security zone also fall below the temperature range for optimum growth of the microorganisms of particular concern discussed above.

NEPB correspondence to the Wisconsin Department of Health Services (DHS) Division of Public Health (DPH), regarding the PBN thermal discharge is included in Attachment E.

3.10.2 Electric Shock Hazards

The electric field created by high-voltage lines can extend from the energized conductors on the lines to other conducting objects, such as the ground, vegetation, buildings, vehicles, and persons if appropriate clearances are not maintained, posing a shock hazard for the public and workers. To minimize the shock that could be experienced by someone touching an object that is capacitively charged, the clearance between the power lines and the object must limit the induced current to a low enough electrical charge. The National Electrical Safety Code (NESC) contains the basic provisions considered necessary for the safety of workers and the public.

The in-scope transmission lines (Figure 2.2-4) are located completely within the PBN property boundary. Thus, risk to the public is minimized due to restricted site access. Furthermore, the transmission lines span areas with additional layers of access restrictions. The spans of the transmission lines are wholly located within fenced areas, the protected area, and the switchyard. The switchyard is accessed through the protected area. Access to the protected area is through guarded entry points. The areas beneath the lines are under the control of PBN, tasks and equipment/structures use, and temporary or permanent placement are governed by PBN procedures. There are small vegetative areas beneath the spans and landscape maintenance activities within the protected area are conducted by PBN workers.

The in-scope transmission lines include a line from the Unit 1 turbine building to the switchyard and a line from the Unit 2 turbine building to the switchyard. NEPB maintains these lines in accordance with NESC clearance guidelines. A transmission line survey for clearance compliance under the scenario of extreme temperature conditions for the increased total current carried by the lines under EPU conditions was undertaken in 2010–2011. The survey involved a site walkdown and code compliance review by a third-party contractor and further site walkdowns, plant licensing documentation reviews, and a code compliance review by NEPB. The survey considered the transmission lines characteristics (e.g., design, voltages, capacity, configuration, clearances, etc.), human uses of the transmission corridor, applicable codes and guidelines, and PBN's licensing basis. As a result of the survey, the Unit 2 lines were considered in compliance with NESC clearances, and the Unit 1 transmission line span was to be re-tensioned to ensure the minimal clearance above the south service building was in compliance with NESC guidelines. Following the re-tensioning of the lines, the heights and clearances were re-assessed and documented. The Unit 1 line's origination and terminal points are approximately 47 and 48 feet high with the lowest elevation across the span being over 37 feet high, with clearance above the site structures exceeding the NESC guideline. The Unit 2 line is similarly high in elevation with terminal points previously documented at approximately 53 feet and 42 feet and the lowest elevation across the span being 40 feet high.

PBN's procedure manual for electrical safety sets approach boundaries for shock protection for qualified electrical workers and other personnel for being in the vicinity of exposed circuits for a range of voltages including 345kV. The manual also addresses electrical safety for location of conducive fences and trailers under or near electrical lines, calling for proper grounding. Work on the PBN site is governed by PBN's health and safety program.

3.10.3 Radiological Hazards

As required by NRC regulations at 10 CFR 20.1101, "Radiation protection programs," NEPB designed a radiation protection program to protect onsite personnel (including employees and contractor employees), visitors, and offsite members of the public from radiation and radioactive material at PBN. NRC regulations require that gaseous and liquid radioactive releases from nuclear power plants must meet radiation dose-based limits specified in 10 CFR Part 20, "Standards for Protection Against Radiation," and the ALARA criteria in 10 CFR Part 50, Appendix I, "Numerical Guides for Design Objectives and Limiting Conditions for Operation to Meet the Criterion 'As Low as is Reasonably Achievable' for Radioactive Material in Light-Water-Cooled Nuclear Power Reactor Effluents." Through these release limits, the NRC places regulatory limits on the radiation dose that members of the public can receive from a nuclear power plant's radioactive effluent. NEPB uses its ODCM, which contains the methods and parameters for calculating offsite doses resulting from liquid and gaseous radioactive effluents. These methods ensure that radioactive material discharges from PBN meet NRC and EPA regulatory dose standards.

PBN's annual radioactive effluent release reports contain a detailed presentation of the radioactive liquid and gaseous effluents released from PBN and the resultant calculated doses. Radioactive effluent release data from 2014 through 2019 showed that radiation doses to members of the public were controlled within the NRC's and EPA's radiation protection standards contained in Appendix I to 10 CFR Part 50, 10 CFR Part 20, and 40 CFR Part 190. (PBN 2015; PBN 2016a; PBN 2017a; PBN 2018b; PBN 2019b; PBN 2020a)

The following summarizes the calculated doses to an offsite member of the public from radioactive liquid and gaseous effluents released from PBN Units 1 and 2 during the most recent available year (2019) (PBN 2020a):

Liquid releases:

- Whole body dose 0.00173 millirem (mrem) (regulatory dose limit 6 mrem)
- Organ dose 0.00290 mrem (regulatory dose limit 20 mrem)

Gaseous releases:

- Particulate organ dose 0.00874 mrem (regulatory dose limit 30 mrem)
- Noble gas beta air dose 0.0000347 milliradiation absorbed dose (mrad; regulatory dose limit 40 mrad)
- Noble gas gamma ray air dose 0.0000986 mrad (regulatory dose limit 20 mrad)
- Noble gas dose to skin 0.000137 mrem (regulatory dose limit 30 mrem)
- Noble gas dose to whole body 0.0000934 mrem (regulatory dose limit 10 mrem)

The REMP measures the aquatic, terrestrial, and atmospheric environment for ambient radiation and radioactivity. Monitoring is conducted for the following: direct radiation, air, lake water, groundwater, soil, vegetation, milk, fish, and algae. The REMP also measures background radiation (i.e., cosmic sources, global fallout, and naturally occurring radioactive material, including radon). A review of the monitoring results from 2014 through 2019 showed that air monitoring did not reveal any effect from PBN effluents; terrestrial monitoring consisting of soil, vegetation, and milk found no influence from PBN; and samples from the aquatic environment, consisting of lake well water, fish, and algae (as available) revealed no buildup of PBN radionuclides released in liquid effluents. The ambient radiation was measured using thermoluminescent dosimetry (TLD) at various sampling locations. The average indicator TLD are not significantly different from TLD background location as has been case for previous years. The subset of the PBN TLD cards used to evaluate the environmental impact of the PBN ISFSI showed no environmental impact from its operation. The environmental monitoring conducted 2014 to 2019 confirmed that the effluent control program at PBN ensured a minimal impact on the environment. (PBN 2015; PBN 2016a; PBN 2017a; PBN 2018b; PBN 2019b; PBN 2020a)

In addition to the REMP, PBN has an onsite groundwater protection program designed to monitor the onsite plant environment. Groundwater monitoring indicates that low levels of tritium occur in the upper soil layer of a small, well-defined area close to the plant, but not in the deep drinking water aquifer. No tritium has been detected in the four onsite drinking water wells close to the power block or from the drinking water well at the site boundary, and analyses indicate that the tritium in the upper soil layer is not migrating offsite toward the surrounding population. The groundwater tritium concentrations observed at PBN are below the EPA drinking water standards prior to emptying into Lake Michigan, where they will undergo further dilution. (PBN 2020a, Section 15.0) Section 3.6.4.2 provides a summary of tritium detected in groundwater.

Occupational exposure at nuclear power plants is monitored by the NRC. The 3-year (2016-2018) average occupational dose per individual [total effective dose equivalent (TEDE)] was 0.105 rem for PBN. The annual TEDE limit is 5 roentgen equivalent man (rems) [10 CFR 20.1201(a)(1)]. For 2018, only one worker at PBN received an annual dose greater than 1.00 rem, which is much less than the NRC occupational dose limit of 5.0 rem. The average annual collective dose per reactor for pressurized water reactors (PWRs) was 34 person-rem. In comparison, PBN had a 3-year (2016–2018) TEDE collective dose per reactor of approximately 31 person-rem. (NRC 2020b)

3.11 Environmental Justice

This section characterizes the population and demographic characteristics, including the identification of minority and low-income individuals, within a 50-mile radius of PBN.

3.11.1 Regional Population

The GEIS presents a population characterization method based on two factors: "sparseness" and "proximity" (NRC 1996b, Section C.1.4). Sparseness measures population density and city size within 20 miles of a site and categorizes the demographic information as follows.

Demographic Categories Based on Sparseness

		Category
Most sparse	1.	Less than 40 persons per square mile and no community with 25,000 or more persons within 20 miles.
	2.	40 to 60 persons per square mile and no community with 25,000 or more persons within 20 miles.
	3.	60 to 120 persons per square mile or less than 60 persons per square mile with at least one community with 25,000 or more persons within 20 miles.
Least sparse	4.	Greater than or equal to 120 persons per square mile within 20 miles.

(NRC 1996b, Section C.1.4)

"Proximity" measures population density and city size within 50 miles and categorizes the demographic information as follows.

Demographic Categories Based on Proximity

		Category
Not close proximity	1.	No city with 100,000 or more persons and less than 50 persons per square mile within 50 miles.
	2.	No city with 100,000 or more persons and between 50 and 190 persons per square mile within 50 miles.
	3.	One or more cities with 100,000 or more persons and less than 190 persons per square mile within 50 miles.
Close proximity	4.	Greater than or equal to 190 persons per square mile within 50 miles.

(NRC 1996b, Section C.1.4)

The GEIS then uses the following matrix to rank the population in the region of the plant as low, medium, or high:

GEIS Sparseness and Proximity Matrix

		Proximity			
		1	**2**	**3**	**4**
Sparseness	**1**	1.1	1.2	1.3	1.4
	2	2.1	2.2	2.3	2.4
	3	3.1	3.2	3.3	3.4
	4	4.1	4.2	4.3	4.4

Low Population Area

Medium Population Area

High Population Area

(NRC 1996b, Figure C.1)

The 2010 census population and TIGER/line data from the USCB were used to determine demographic characteristics in the vicinity of the site (USCB 2020d). The data were processed at the state, county, and census block levels using ArcGIS (USCB 2020h; USCB 2020i; USCB 2020j; USCB 2020k). Census data include people living in group quarters such as institutionalized and non-institutionalized populations. Examples of institutional populations living in group quarters are correctional institutions (i.e., prisons, jails, and detention centers); nursing homes; mental (psychiatric) hospitals; hospitals or wards for the chronically ill; and juvenile institutions. Examples of non-institutional populations living in group quarters are group homes; college dormitories; military quarters; soup kitchens; shelters for abused women (shelters against domestic violence or family crisis centers); and shelters for children who are runaways, neglected, or without conventional housing. (USCB 2020l)

The 2010 census data indicate that approximately 81,843 people live within a 20-mile radius of the PBN site, which equates to a population density of 65 persons per square mile (USCB 2020k). Based on the GEIS sparseness index, the site is classified as Category 3, with 60 to 120 persons per square mile or less than 60 persons per square mile with at least one community with 25,000 or more persons within 20 miles.

The 2010 census data indicate that approximately 777,625 people live within a 50-mile radius of the PBN site, which equates to a population density of 99 persons per square mile (USCB 2020k). One city within a 50-mile radius has a population greater than 100,000 residents (Table 3.11-1). Based on the GEIS proximity index, the site is classified as Category 3: one or more cities with 100,000 or more persons and less than 190 persons per square mile within 50 miles.

As illustrated in the GEIS sparseness and proximity matrix, the combination of "sparseness" Category 3 and "proximity" Category 3 results in the conclusion that PBN is located in a "medium" population area.

The area within a 50-mile radius of the PBN site totally or partially includes 12 counties within Wisconsin (Table 3.11-2). A portion of the state of Michigan is also included in the 50-mile radius; however, this portion is located in Lake Michigan and the USCB does not record any permanent population for this area. According to the 2010 census, the permanent population (not including transient populations) of the entire 12 counties was 1,108,966 (Table 3.11-2). By 2053, the end of the proposed SLR operating term, the permanent population (not including transient populations) of the entire 12 counties is projected to be approximately 1,296,603. Based on 2010–2053 population projections, an annual growth rate of approximately 0.36% is anticipated for the permanent population in the 12 counties wholly or partially within a 50-mile radius (SWDA 2020).

As shown in Table 3.11-2, the total population (including transient populations) of the 12 counties, which are totally or partially included within a 50-mile radius, is projected to be approximately 1,363,031 in 2053. The total population (including transient populations) within the 50-mile radius is projected to be 973,630 in 2053. (SWDA 2020; USCB 2020i; USCB 2020k; WDT 2020)

The latest permanent population projections for Wisconsin were obtained from the State of Wisconsin Department of Administration (SWDA 2020). County-level permanent population values for the counties within a 50-mile radius are shown in Table 3.11-2. Transient data for the State of Wisconsin was obtained from Wisconsin Department of Tourism (WDT 2020).

PBN is located in Manitowoc County. As shown in Table 3.11-2, the population of Manitowoc County, WI, as reported in the 2010 census was 81,442. Based on Wisconsin's population projection data, Manitowoc County's projected permanent population for 2053 is expected to be 82,230. Estimated projected populations and average annual growth rates for Manitowoc County are shown in Table 3.11-3 (SWDA 2020).

Cities, towns, villages, and some census designated places (CDPs) with centers falling within a 50-mile radius of PBN are listed in Table 3.11-1. As seen in Figure 3.1-3, within the 6-mile vicinity of the plant the town nearest to PBN is Two Creeks, WI, in (approximately 2 miles northwest). Its 2018 estimated population was reported at 436 persons (USCB 2020m). Located approximately 6 miles west-southwest of PBN is the community of Mishicot, WI, in Manitowoc County (estimated 2018 population 1,388) (USCB 2020j).

As shown in Table 3.11-1, the largest community in Manitowoc County is the city of Manitowoc (2018 population 32,627), located approximately 15 miles south-southwest of PBN. The largest city in Brown County is Green Bay (2018 population 104,879), located approximately 29 miles northwest of PBN. Green Bay is the only community within a 50-mile radius of PBN that has a population greater than 100,000. A total of five additional communities (Appleton, De Pere, Manitowoc, Neenah, and Sheboygan, WI) within a 50-mile radius have a population greater than 25,000 as of 2018 (Table 3.11-1).

3.11.2 Minority and Low-Income Populations

3.11.2.1 Background

The NRC performs environmental justice analyses utilizing a 50-mile radius around the plant as the environmental "impact area." LIC-203 Revision 3 (NRC 2013d) defines a geographic area for comparison as a 50-mile radius (also referred to as "the region" in this discussion) centered on the nuclear plant. An alternative approach is also addressed that uses an individual state that encompasses the 50-mile radius individually for comparative analysis as the "geographic area." Both approaches were used to assess the minority and low-income population criteria for PBN.

LIC-203 guidance suggests using the most recent USCB decennial census data. However, low-income data are collected separately from the decennial census and are available in 5-year averages. The 2018 low-income and minority census population data and TIGER/Line data for Wisconsin were obtained from the USCB website and processed using ArcGIS software (USCB 2020k). Census population data were used to identify the minority and low-income populations within a 50-mile radius of PBN. Environmental justice evaluations for minority and low-income populations are based on the use of USCB block groups for minority and low-income populations.

3.11.2.2 Minority Populations

NRC procedural guidance defines a "minority" population as Black or African American, American Indian or Alaska Native, Asian, Native Hawaiian/other Pacific Islander, some other race, two or more races, the aggregate of all minority races, Hispanic or Latino ethnicity, and the aggregate of all minority races and Hispanic ethnicity (NRC 2013d). The guidance indicates that a minority population is considered present if either of the following two conditions exists:

1. The minority population in the census block group exceeds 50 percent; or
2. The minority population percentage is more than 20 percentage points greater in the census block group than the minority percentage of the geographic area chosen for the comparative analysis.

To establish minimum thresholds for each minority category, the non-white minority population total for each state was divided by the total population in the state. This process was repeated with a 50-mile radius total minority population and 50-mile radius total population. As described in the second criterion, 20 percentage points were added to the minority percentage values for each geographic area. The lower of the two NRC conditions for a minority population was selected as defining a minority area (i.e., census block group minority population exceeds 50 percent, or minority population is more than 20 percentage points greater than the minority population of the geographic area). Any census block group with a percentage exceeding this value was considered a minority population. Minority percentages for Wisconsin and a 50-mile radius, and the corresponding criteria, are shown in Table 3.11-4.

A minority category of "Aggregate of All Races" is created when the populations of all the 2018 USCB minority categories are summed. As shown in Table 3.11-4, the 2018 "Aggregate of All Races" category, when compared to the total population, indicates 10.4 percent of the population in a 50-mile radius (region) are minorities. The "Aggregate of All Races" population percentage for Wisconsin is 14.4 percent. None of the percentages exceeded the 50 percent noted for Condition 1, defined above. As such, the criteria calculated using Condition 2 listed in Table 3.11-4 were used for the threshold. Using the alternate approach defined above, where a 50-mile radius is used as the geographic area, any census block group with a combined "Aggregate of All Races" population equal to or greater than 30.4 percent would be considered a minority population. Similarly, the state was evaluated and a series of criteria for each race and low-income category were defined. When the state is used as the geographic area, any census block group with an "Aggregate of All Races" population exceeding 34.4 percent was considered a minority population.

Because Hispanic is not considered a race by the USCB, Hispanics are already represented in the census-defined race categories. However, because Hispanics can be represented in any race category, some white Hispanics not otherwise considered minorities become classified as a minority when categorized in the "Aggregate and Hispanic" category.

The number of census block groups contributing to the minority population count were evaluated using the criteria shown in Table 3.11-4 and summarized in Table 3.11-5. The results of the evaluation are census block groups flagged as having a minority population(s). The resulting maps (Figures 3.11-1, 3.11-2, 3.11-3, 3.11-4, 3.11-5, 3.11-6, 3.11-7, 3.11-8, 3.11-9, 3.11-10, 3.11-11, 3.11-12, 3.11-13, 3.11-14, 3.11-15, and 3.11-16) depict the location of minority population census block groups flagged accordingly for each race or aggregate category. Because no block group met the criteria for the "Native Hawaiian/Other Pacific Islander" race categories, no figures illustrating those race categories were produced.

The percentage of census block groups exceeding the "Aggregate of All Races" minority population criterion was 8.0 percent when a 50-mile radius (region) was used and 5.2 percent when the individual state was used as the geographic area (Table 3.11-5). For the "Aggregate and Hispanic" category, 10.5 percent of the census block groups contained a minority population when the region was used, and 8.2 percent of the block groups contained minority populations when the individual state was used (Table 3.11-5). The minority population values of the block groups were significantly reduced when races were analyzed individually.

The identified minority population closest to the PBN center point is located approximately 14 miles south-southwest of the site: Block Group 550710004005. This census block group contained a total of 493 people, with 105 Black or African American, 8 Asian, 7 Other Race, and 89 Hispanic Ethnicity. Using either the individual state criteria or the regional criteria, the block group contains an Aggregate of all Minority Races and Hispanic population. (USCB 2020h; USCB 2020k)

There are no block groups within a 6-mile radius that meet the criteria for a minority population. There are 75 identified minority population block groups located in, partially within, or adjacent to cities, municipalities, or USCB-defined urban areas. This leaves one block group that does not fall within or is not immediately adjacent to cities, municipalities, or USCB-defined urban areas. (USCB 2020d; USCB 2020k)

As presented in Section 3.1.3, the state of Wisconsin has 11 federally recognized American Indian nations and tribal communities. Within the PBN 50-mile region, the Oneida Nation has tribal lands located southwest of the city of Green Bay in Outagamie and Brown counties.

3.11.2.3 Low-Income Populations

NRC guidance defines "low-income" using USCB statistical poverty thresholds for individuals or families (NRC 2013d). As addressed above with minority populations, two alternative geographic areas (Wisconsin individually and the region) were used as the geographic areas for comparison in this analysis. The guidance indicates that a low-income population is considered present if either of the two following conditions exists:

1. The low-income population in the census block group exceeds 50 percent; or
2. The percentage of households below the poverty level in a block group is significantly greater (typically at least 20 percent) than the low-income population percentage of the geographic area chosen for the comparative analysis (i.e., individual state and region's combined average).

To establish minimum thresholds for the individual low-income category, the population with an income below the poverty level for the state was divided by the total population for whom poverty status is determined in the state. To establish minimum thresholds for the family low-income category, the family population count with an income below the poverty level for the state was divided by the total family population count in the state. This process was repeated for the regional population with an income below the poverty level and regional total population for whom poverty status is determined. As described in Condition 2, above, 20 percent was added to the low-income values for individuals and families and each geographic area. None of the geographic areas described in the first condition exceeded 50 percent.

As shown in Table 3.11-6, when the 2014–2018 census data category "income in the past 12 months below poverty level" (individual) is compared to "total population for whom poverty status is determined," 9.1 percent of the population in the region has an individual income below poverty level. In Wisconsin, the percentage of individuals with an income below poverty level is 11.9.

As shown in Table 3.11-6, Wisconsin has an estimated 267,846 families living below poverty level. When the 2014–2018 census data family category "income in the past 12 months below poverty level" is compared to "total family count," 9.8 percent of the families within the region has an income below poverty level. In Wisconsin, the percentage of the family population with an income below poverty level is 11.4 percent.

As an example, when the region is used as the geographic area, any census block group within a 50-mile radius with populations of low-income individuals equal to or greater than 29.1 percent of the total block group population would be considered a "low-income population." Using this criterion, 31 of the 599 census block groups (5.2 percent) were identified as low-income populations within a 50-mile radius of the PBN site, as shown in Figure 3.11-17. (USCB 2020k)

When Wisconsin is used as the geographic area, any census block group within the region with a low-income (individual) population equal to or greater than 31.9 percent of the total block group, the population would be considered a "low-income population" (individual) (Table 3.11-6). Using this criterion, 22 of the total 599 census block groups (3.7 percent) have low-income individual population percentages that meet or exceed the threshold criteria noted in Table 3.11-5. These census block groups are illustrated in Figure 3.11-18.

Similarly, these criteria are found using both geographic areas and family census counts (Table 3.11-5). Using the family individual state criteria, 31 census block groups were identified as having low-income families. Using the family regional criteria, 19 census block groups were identified as having low-income families (Table 3.11-5). These census block groups are illustrated in Figures 3.11-19 and 3.11-20. (USCB 2020h; USCB 2020k) The closest low-income block group that meets the guidance criteria for individuals or families is located 9 miles south of the PBN center point (Block Group 550710053002). (USCB 2020k)

3.11.2.4 Subsistence Populations

Subsistence refers to the use of natural resources as food for consumption and for ceremonial and traditional cultural purposes, usually by low-income or minority populations. Specific examples of subsistence use include gathering plants for direct consumption (rather than produced for sale from farming operations), for use as medicine or in ritual practices. Fishing or hunting activities associated with direct consumption or use in ceremonies, rather than for sport, are other examples.

Determining the presence of subsistence use can be difficult, as data at the county or block group level are aggregated and not usually structured to identify such uses on or near the site. Frequently, the best means of investigating the presence of subsistence use is through dialogue with the local population who are most likely to know of such activity. This may include county officials, community leaders, and landowners in the vicinity who would have knowledge of subsistence activity.

The area surrounding PBN is largely rural and agricultural, with no known subsistence-based activity. As reported in the 2005 NUREG-1437 Supplement 23, the NRC found no unusual resource dependencies or practices, such as subsistence agriculture, through which the minority and low-income populations could experience disproportionately high and adverse impacts (NRC 2005). No additional subsistence studies have been conducted, but plant staff living and working in the area are not aware of any cases of subsistence activity in the vicinity of PBN.

3.11.2.5 Migrant Workers

Migrant labor, or a migrant worker, is defined by the USDA as "a farm worker whose employment required travel that prevented the migrant worker from returning to his/her permanent place of residence the same day." In 2017, Manitowoc County reported that 304 out of 1,171 total farms employed farm labor. Brown County reported 300 out of 975 total farms employed farm labor. The 2017 census of agriculture reported that seven of the Manitowoc County farms employed migrant farm workers. Twelve farms in Brown County reported employing migrant workers. For Manitowoc County, an estimated total of 1,860 farm laborers were hired, of which 996 were estimated to work fewer than 150 days per year. For Brown County, an estimated total of 1,579 farm laborers were hired, of which 863 were estimated to work fewer than 150 days per year. (USDA 2020b)

Table 3.11-1 Cities, Towns, and Villages Located Totally or Partially within a 50-Mile Radius of PBN (Sheet 1 of 4)

City/Town/Village	County	2000 Census Population[(a)]	2010 Census Population[(a)]	2018 Census Population Estimates[(a)(b)]	Distance to PBN (miles)[(c)(d)]	Direction[(c)(d)]
Adell	Sheboygan	517	516	514	50	SSW
Algoma	Kewaunee	3,357	3,167	3,045	23	NNE
Allouez	Brown	15,443	13,975	13,897	27	WNW
Appleton	Outagamie	70,087	72,623	74,526	44	W
Ashwaubenon	Brown	17,634	16,963	17,272	30	WNW
Bellevue	Brown	11,828	14,570	15,733	22	WNW
Black Creek	Outagamie	1,192	1,316	1,317	47	WNW
Brillion	Calumet	2,937	3,148	3,107	27	WSW
Cascade	Sheboygan	666	709	694	49	SSW
Casco	Kewaunee	572	583	581	20	NNW
Chilton	Calumet	3,708	3,933	3,791	36	WSW
Cleveland	Manitowoc	1,361	1,485	1,454	27	SSW
Combined Locks	Outagamie	2,422	3,328	3,602	39	W
De Pere	Brown	20,559	23,800	25,020	28	WNW
Denmark	Brown	1,958	2,123	2,277	15	WNW
Elkhart Lake	Sheboygan	1,021	967	1,012	39	SW
Forestville	Door	429	430	409	28	N
Fox Crossing[(b)]	Winnebago	N/A	18,281	18,911	47	W

Table 3.11-1 Cities, Towns, and Villages Located Totally or Partially within a 50-Mile Radius of PBN (Sheet 2 of 4)

City/Town/Village	County	2000 Census Population[(a)]	2010 Census Population[(a)]	2018 Census Population Estimates[(a)(b)]	Distance to PBN (miles)[(c)(d)]	Direction[(c)(d)]
Francis Creek	Manitowoc	681	669	645	11	WSW
Glenbeulah	Sheboygan	378	463	461	42	SW
Green Bay	Brown	102,313	104,057	104,879	29	NW
Harrison[(b)]	Calumet	N/A	10,839	12,305	39	WSW
Hilbert	Calumet	1,089	1,132	1,086	33	WSW
Hobart	Brown	5,090	6,182	9,496	34	WNW
Howard	Brown	13,546	17,399	19,909	33	NW
Howards Grove	Sheboygan	2,792	3,188	3,264	34	SSW
Kaukauna	Outagamie	12,983	15,462	16,246	36	W
Kellnersville	Manitowoc	374	332	319	14	WSW
Kewaunee	Kewaunee	2,806	2,952	2,848	12	N
Kiel	Manitowoc	3,450	3,738	3,798	36	SW
Kimberly	Outagamie	6,146	6,468	6,803	40	W
Kohler	Sheboygan	1,926	2,120	2,068	39	SSW
Little Chute	Outagamie	10,476	10,449	11,564	39	W
Luxemburg	Kewaunee	1,935	2,515	2,553	20	NNW
Manitowoc	Manitowoc	34,053	33,736	32,627	15	SSW
Maribel	Manitowoc	264	351	333	13	W

Table 3.11-1 Cities, Towns, and Villages Located Totally or Partially within a 50-Mile Radius of PBN (Sheet 3 of 4)

City/Town/Village	County	2000 Census Population[(a)]	2010 Census Population[(a)]	2018 Census Population Estimates[(a)(b)]	Distance to PBN (miles)[(c)(d)]	Direction[(c)(d)]
Menasha	Winnebago/Calumet	16,331	17,353	17,771	45	W
Mishicot	Manitowoc	1,422	1,442	1,388	6	WSW
Mount Calvary	Fond du Lac	956	762	750	47	SW
Neenah	Winnebago	24,507	25,501	26,062	46	W
New Holstein	Calumet	3,301	3,236	3,075	36	SW
Nichols	Outagamie	307	273	287	50	WNW
Oconto	Oconto	4,708	4,513	4,517	45	NNW
Oconto Falls	Oconto	2,843	2,891	2,804	51	NW
Oostburg	Sheboygan	2,660	2,887	3,007	47	SSW
Plymouth	Sheboygan	7,781	8,445	8,729	43	SSW
Potter	Calumet	223	253	240	30	WSW
Pulaski	Brown	3,060	3,539	3,591	44	NW
Reedsville	Manitowoc	1,187	1,206	1,151	23	WSW
Saint Cloud	Fond du Lac	497	477	464	45	SW
Saint Nazianz	Manitowoc	749	783	752	27	SW
Seymour	Outagamie	3,335	3,451	3,472	42	WNW
Sheboygan	Sheboygan	50,792	49,288	48,180	38	SSW
Sheboygan Falls	Sheboygan	6,772	7,775	7,932	40	SSW

Table 3.11-1 Cities, Towns, and Villages Located Totally or Partially within a 50-Mile Radius of PBN (Sheet 4 of 4)

City/Town/Village	County	2000 Census Population[(a)]	2010 Census Population[(a)]	2018 Census Population Estimates[(a)(b)]	Distance to PBN (miles)[(c)(d)]	Direction[(c)(d)]
Sherwood	Calumet	1,550	2,713	3,045	37	W
Stockbridge	Calumet	649	636	621	41	WSW
Sturgeon Bay	Door	9,437	9,144	8,958	39	NNE
Suamico	Brown	8,686	11,346	13,012	35	NW
Two Creeks[(b)]	Manitowoc	551	437	436	2	NW
Two Rivers	Manitowoc	12,639	11,712	11,100	9	S
Valders	Manitowoc	948	962	922	23	SW
Waldo	Sheboygan	450	503	503	47	SSW
Whitelaw	Manitowoc	730	757	740	17	WSW
Wrightstown	Brown	1,934	2,827	3,452	31	W

a. (USCB 2020j)

b. (USCB 2020m)

c. (USDOT 2020a)

d. Reported distance and directions were calculated from the PBN center point.

N/A = No available data.

Table 3.11-2 County Populations Totally or Partially within a 50-Mile Radius of PBN

State and County	2000 Population[(a)]	2010 Population[(a)]	2018 Population Estimates[(a)]	2053 Projected Permanent Population[(b)]	2053 Projected Total Population[(b)]
Wisconsin (12 counties) Total	**1,045,802**	**1,108,966**	**1,136,480**	**1,296,603**	**1,363,031**
Brown	226,778	248,007	263,378	316,177	335,440
Calumet	40,631	48,971	50,159	64,761	65,725
Door	27,961	27,785	27,610	28,365	37,042
Fond du Lac	97,296	101,633	103,066	111,040	114,754
Kewaunee	20,187	20,574	20,383	21,940	22,524
Manitowoc	82,887	81,442	79,074	82,230	84,901
Marinette	43,384	41,749	40,343	43,400	47,357
Oconto	35,634	37,660	37,830	45,430	47,902
Outagamie	160,971	176,695	187,365	216,206	225,822
Shawano	40,664	41,949	40,796	46,525	48,325
Sheboygan	112,646	115,507	115,456	126,830	132,906
Winnebago	156,763	166,994	171,020	193,699	200,333

a. (USCB 2020i)

b. (SWDA 2020; USCB.2020k; USCB 2020i; WDT 2020)

Table 3.11-3 County Population Growth, 2010–2053

Wisconsin		2010	2018	2020	2025	2030	2035	2040	2045	2050	2053
Brown County	Population	248,007	263,378	270,720	285,650	299,540	308,730	312,320	315,952	316,177	316,177
	Average Annual Growth %		0.75	1.38	1.08	0.95	0.61	0.23	0.23	0.01	0.00
Manitowoc County	Population	81,442	79,074	81,400	82,045	82,230	82,230	82,230	82,230	82,230	82,230
	Average Annual Growth %		-0.37	1.46	0.16	0.05	0.00	0.00	0.00	0.00	0.00

(USCB 2020i; SWDA 2020)

Note: Projected population values are based on the population projection growth trend for the years reported by the UW-Madison Applied Population Laboratory.

Table 3.11-4 Minority Population Evaluated Against Criterion

Geographic Area	Wisconsin[a]			50-Mile Radius (Region)[b]		
Total Population	5,778,394			832,129		
Census Categories	**State Population by Census Category[a]**	**Percent[c]**	**Criteria**	**Regional Population by Census Category[b]**	**Percent[c]**	**Criteria**
Black or African American	368,744	6.4	26.4	14,079	1.7	21.7
American Indian or Alaska Native	50,422	0.9	20.9	11,531	1.4	21.4
Asian	159,356	2.8	22.8	26,973	3.2	23.2
Native Hawaiian/Other Pacific Islander	1,975	0.0	20.0	104	0.0	20.0
Some Other Race	115,941	2.0	22.0	15,498	1.9	21.9
Two or More Races	135,990	2.4	22.4	18,296	2.2	22.2
Aggregate of All Races	832,428	14.4	34.4	86,481	10.4	30.4
Hispanic or Latino	385,779	6.7	26.7	47,173	5.7	25.7
Aggregate and Hispanic[d]	1,067,356	18.5	38.5	114,172	13.7	33.7

a. (USCB 2019)

b. (USCB 2020k)

c. Percent values were calculated by dividing each census category's population by the state or region total population values.

d. Includes everyone except persons who identified themselves as White, Not Hispanic or Latino (NRC 2013d).

Table 3.11-5 Minority Census Block Groups Counts, 50-Mile Radius of PBN

Total Number of Block Groups with Population within 50-mile Radius	Individual State Method	599	50-Mile Radius (Region)	599
Census Categories	**Number of Block Groups with Identified Minority and Low Income Category**	**Percentage of Block Groups within 50 miles**	**Number of Block Groups with Identified Minority and Low Income Category**	**Percentage of Block Groups within 50 miles**
Black or African American	6	1	8	1.3
American Indian or Alaska Native	6	1	6	1
Asian	12	2	11	1.8
Native Hawaiian/Other Pacific Islander	0	0	0	0
Some Other Race	10	1.7	10	1.7
Two or More Races	4	0.7	4	0.7
Aggregate of All Races	31	5.2	48	8
Hispanic or Latino	21	3.5	22	3.7
Aggregate and Hispanic	49	8.2	63	10.5
Low Income (Individuals)	22	3.7	31	5.2
Low Income (Families)	31	5.2	19	3.2

(USCB 2020d; USCB 2020k)

Table 3.11-6 Low-Income Population Criteria Using Two Geographic Areas

Geographic Area	Wisconsin[a]			50-Mile Radius (Region)[b]		
(Income) Total Population	5,628,213			813,546		
(Income) Total Families	2,343,129			773,006		
Census Category	**State Population by Census Category**	**Percent[c]**	**Criteria**	**State Population by Census Category**	**Percent[c]**	**Criteria**
Low Income—Number of Persons Below Poverty Level	668,220	11.9	31.9	74,299	9.1	29.1
Low Income—Number of Families Below Poverty Level	267,846	11.4	31.4	76,023	9.8	29.8

a. (USCB 2019)

b. (USCB 2020k)

c. Percent values were calculated by dividing each census category's population by the state and regional total population values.

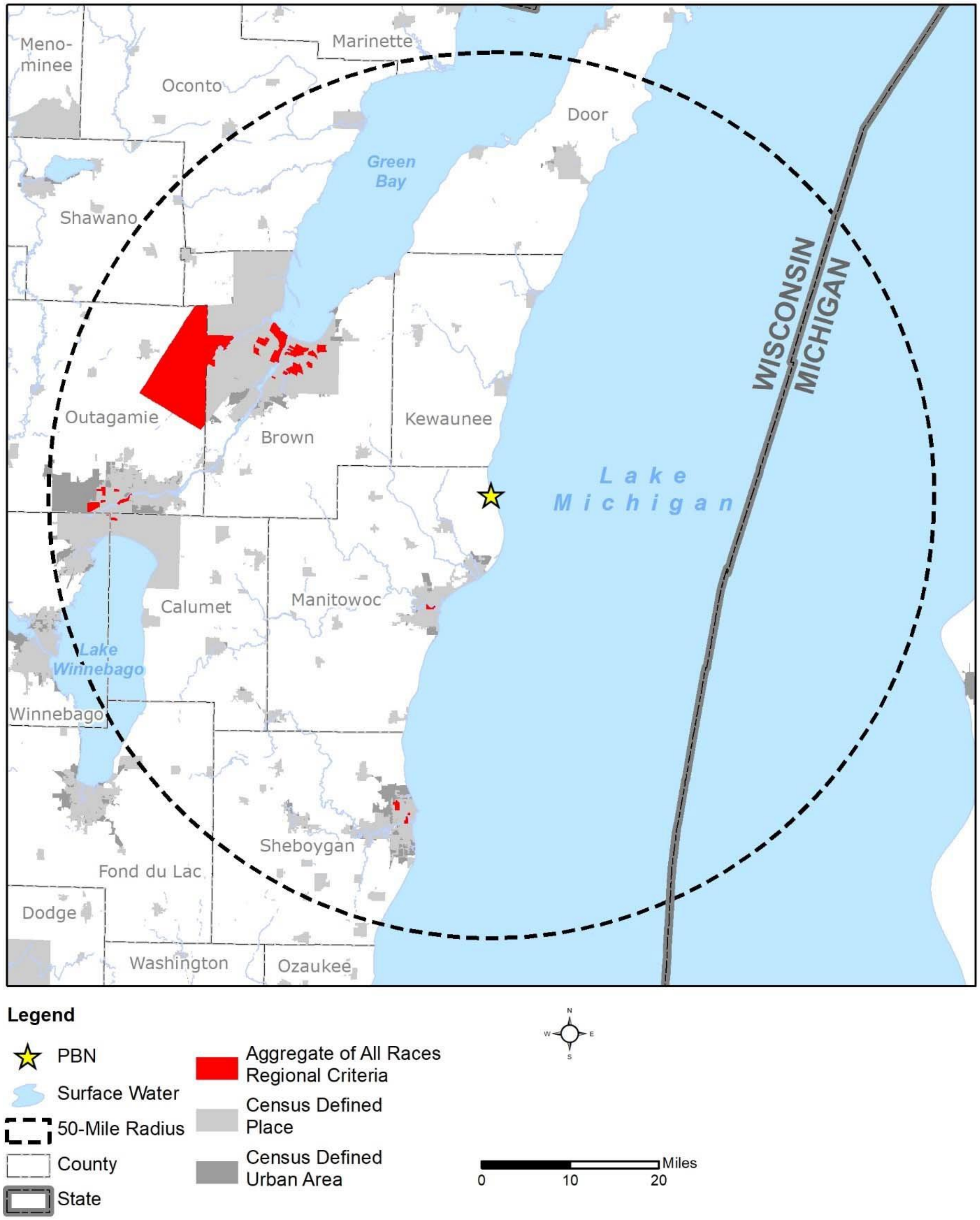


Figure 3.11-1 Aggregate of All Races Populations (Regional)

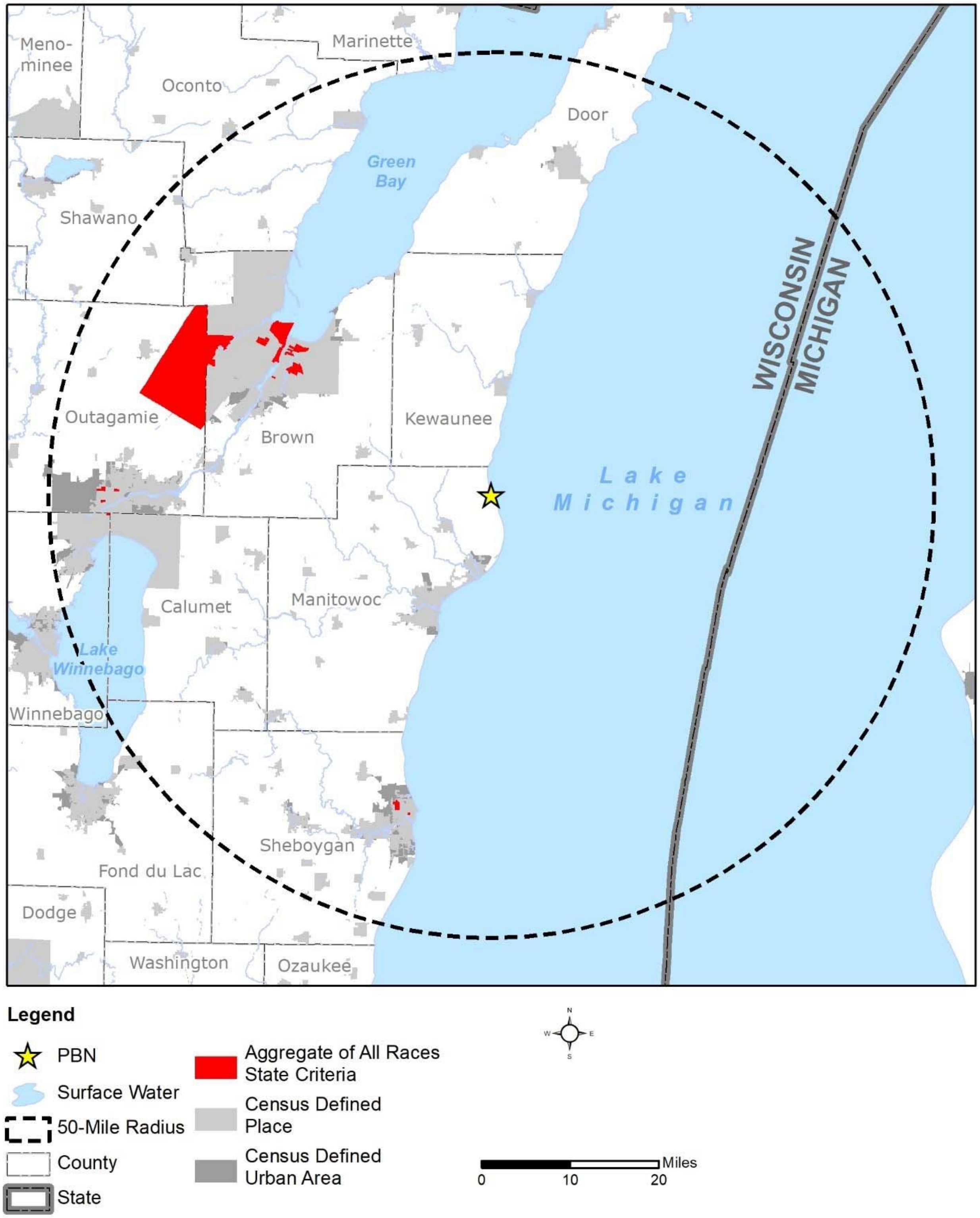


Figure 3.11-2 Aggregate of All Races Populations (Individual State)

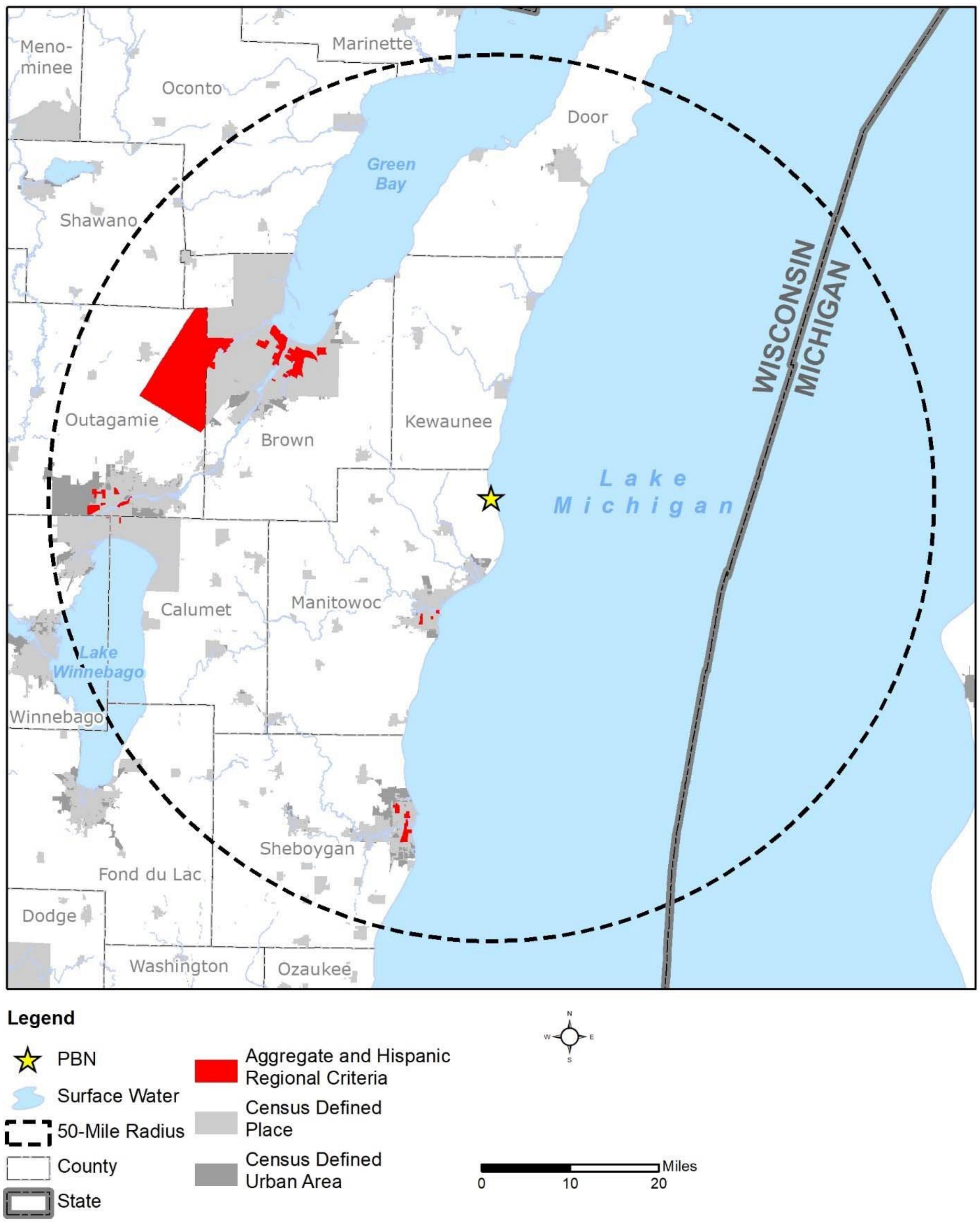


Figure 3.11-3 Aggregate and Hispanic Populations (Regional)

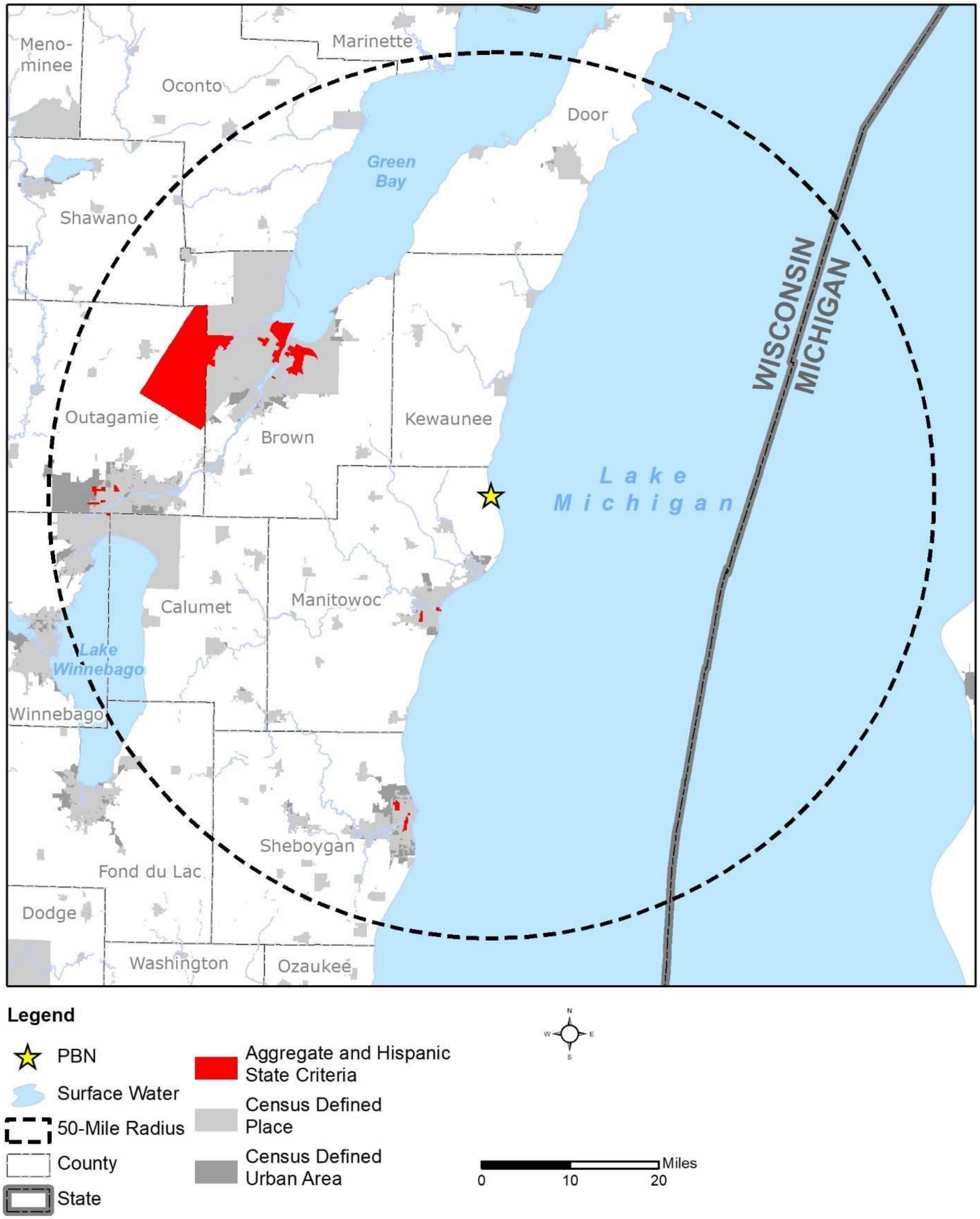


Figure 3.11-4 Aggregate and Hispanic Populations (Individual State)

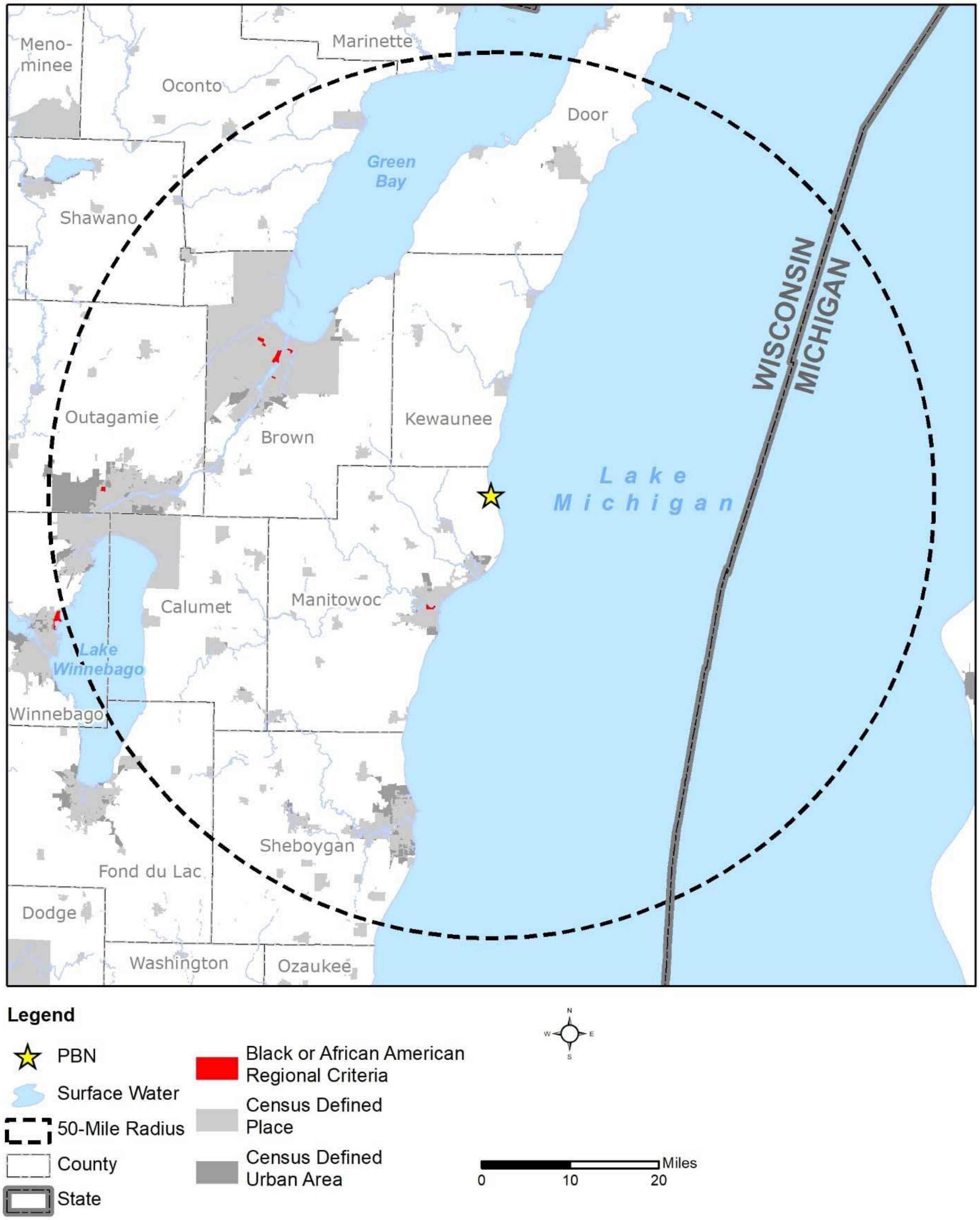


Figure 3.11-5 Black or African American Populations (Regional)

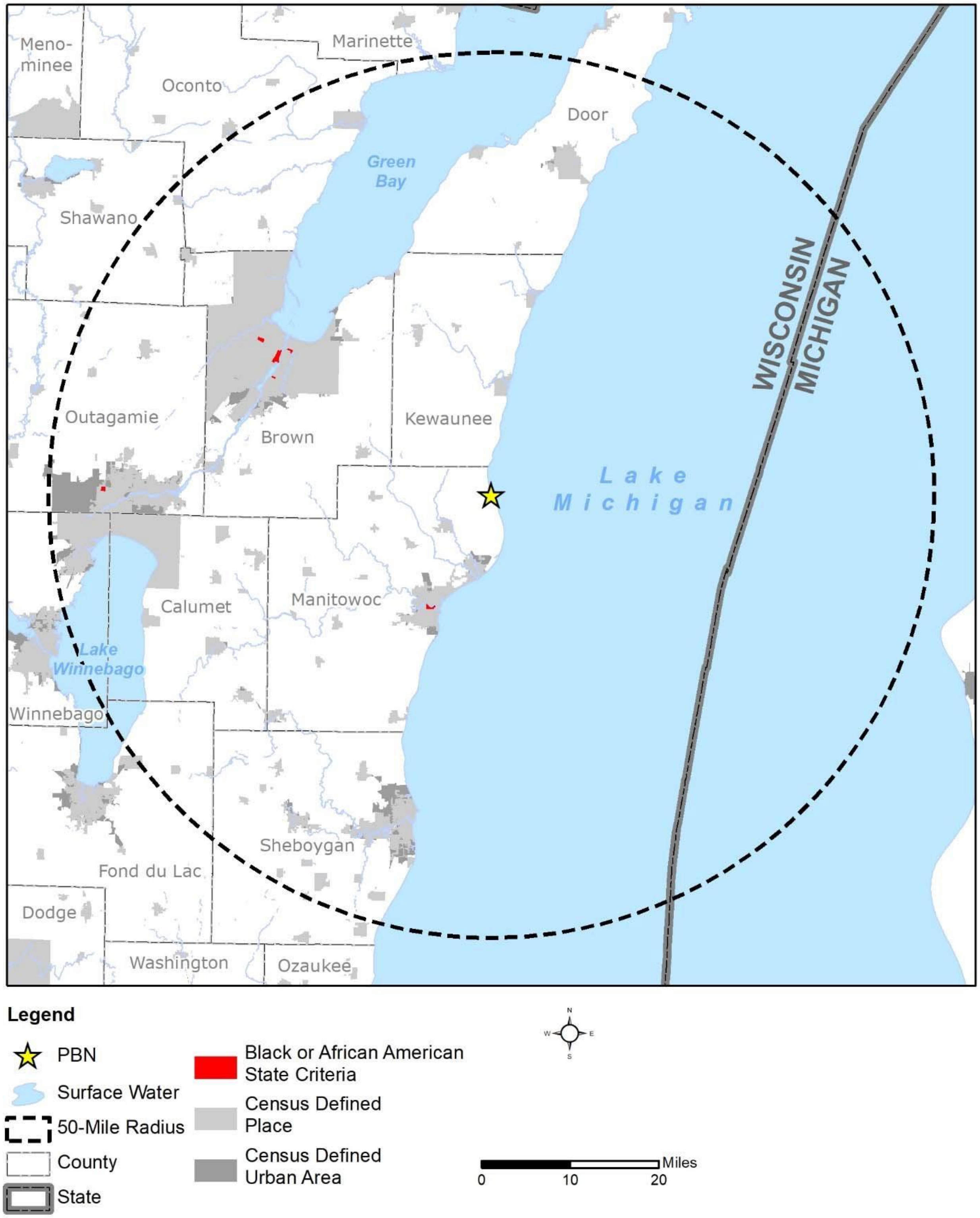


Figure 3.11-6 Black or African American Populations (Individual State)

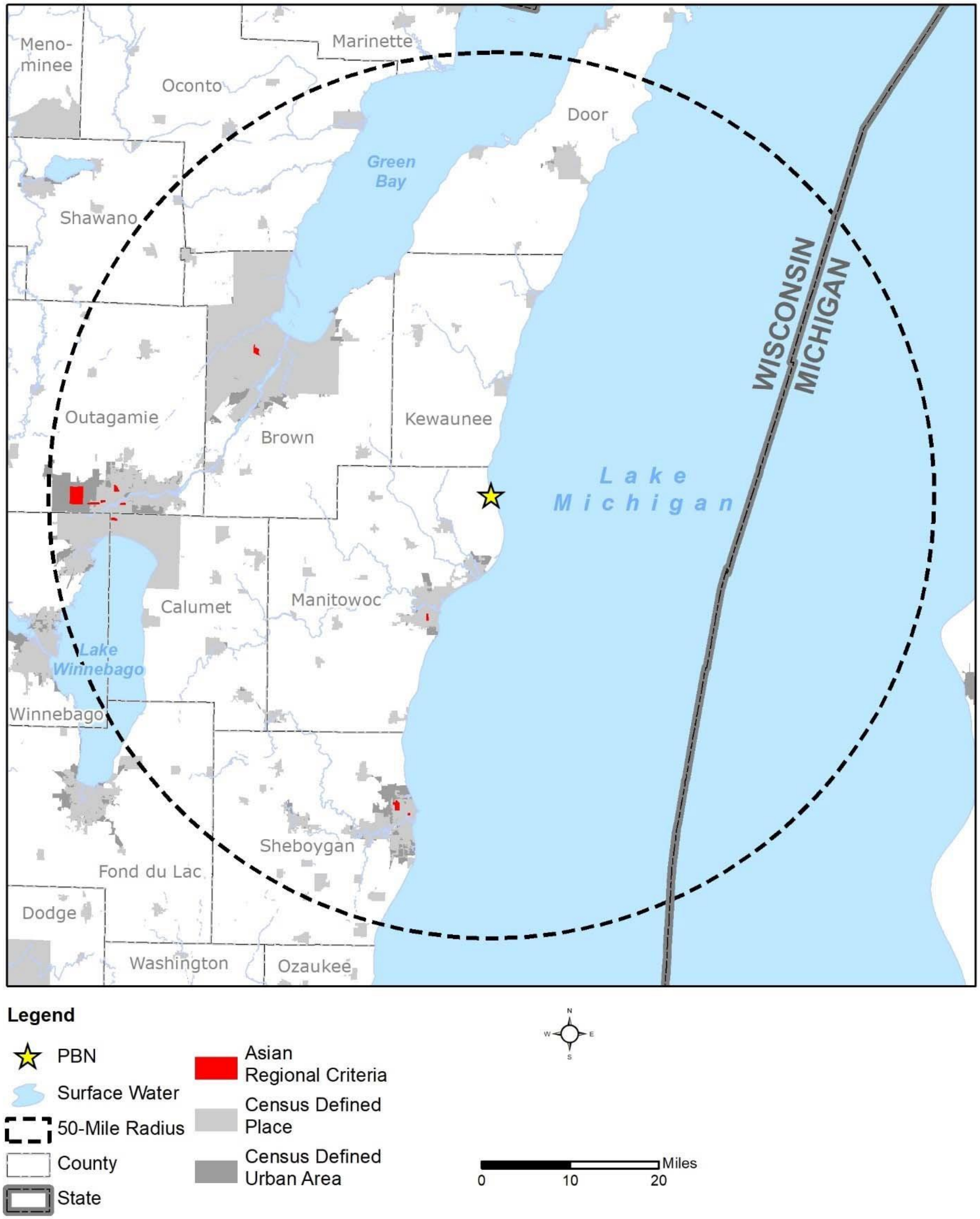


Figure 3.11-7 Asian Populations (Regional)

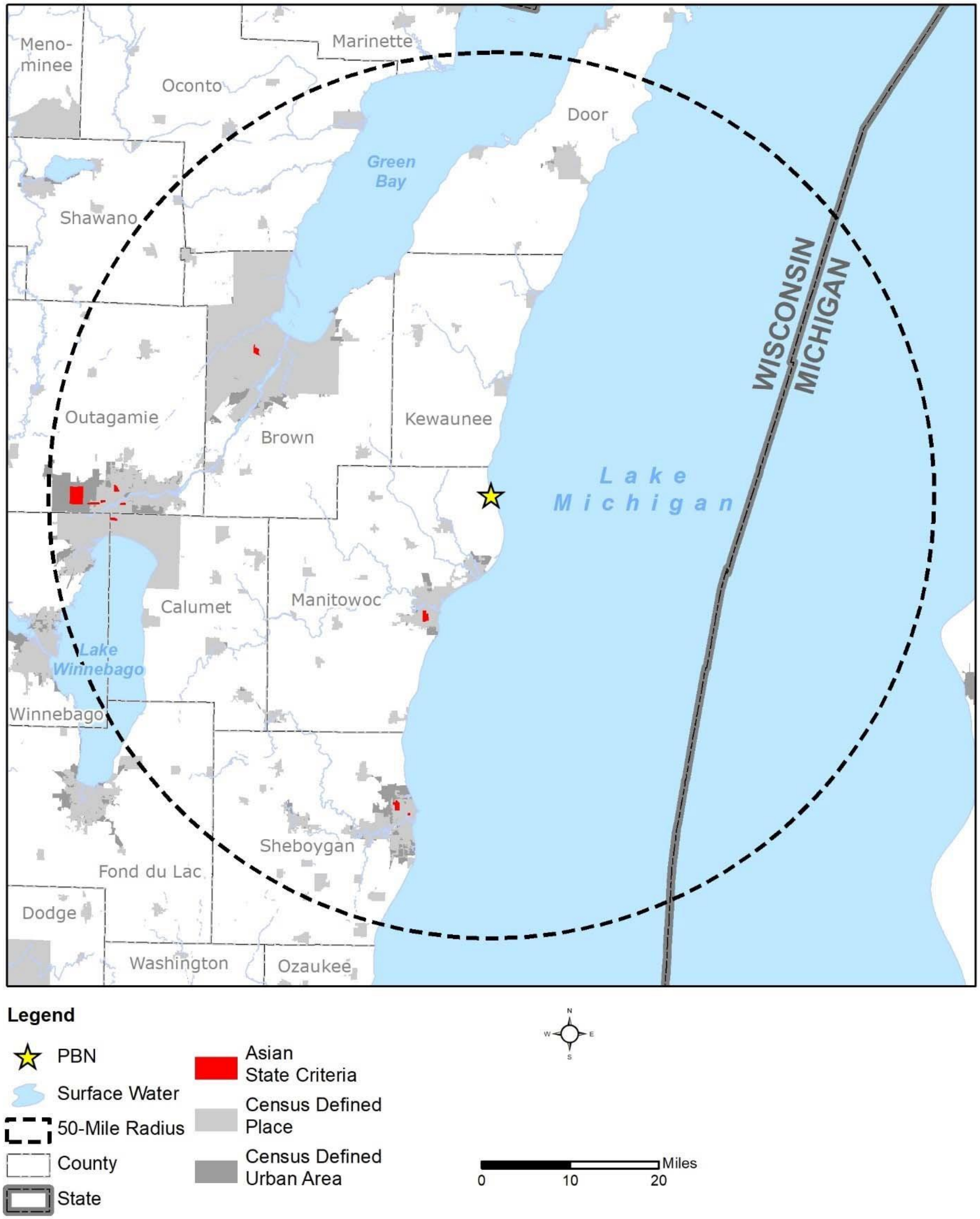


Figure 3.11-8 Asian Populations (Individual State)

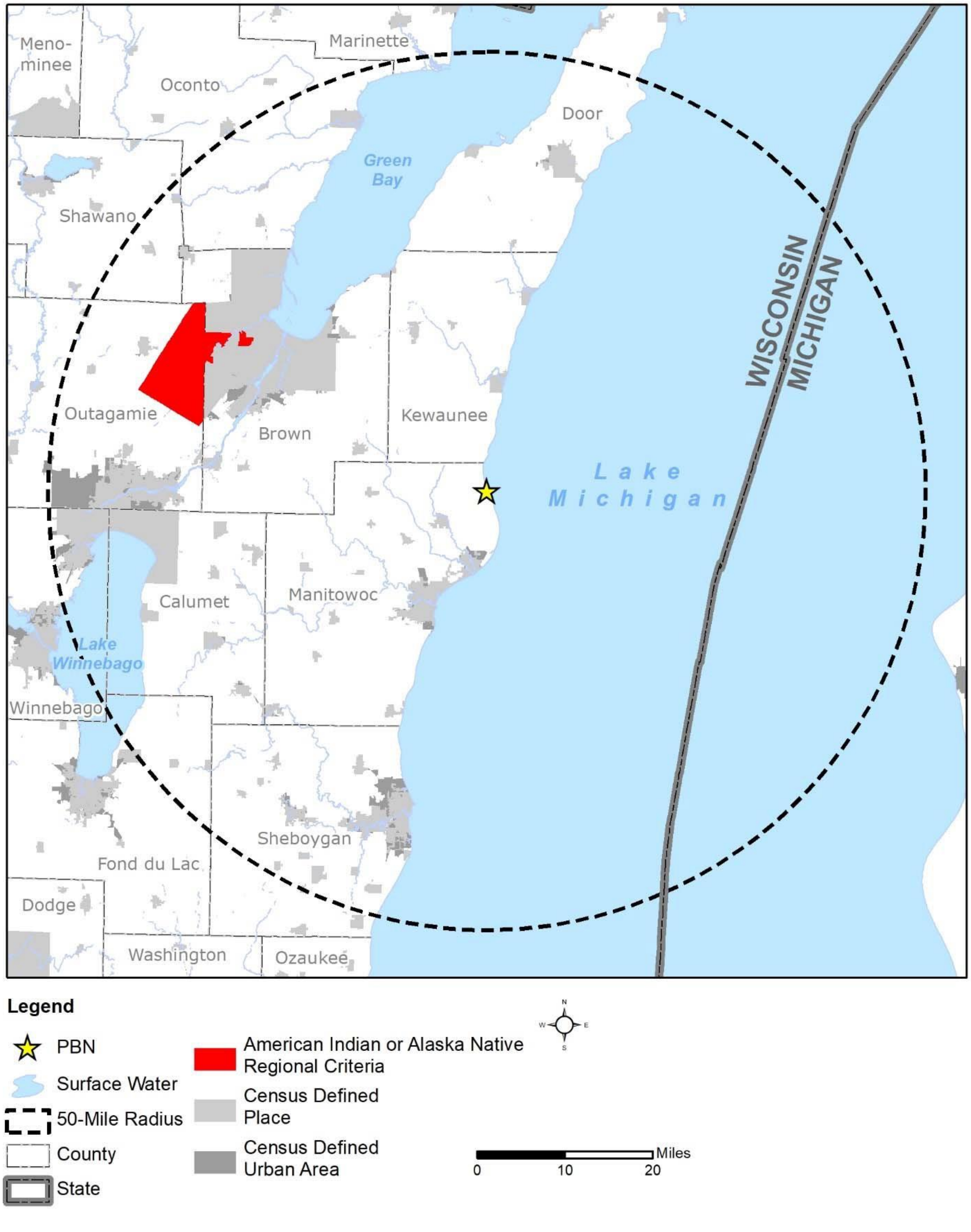


Figure 3.11-9 American Indian or Alaska Native Populations (Regional)

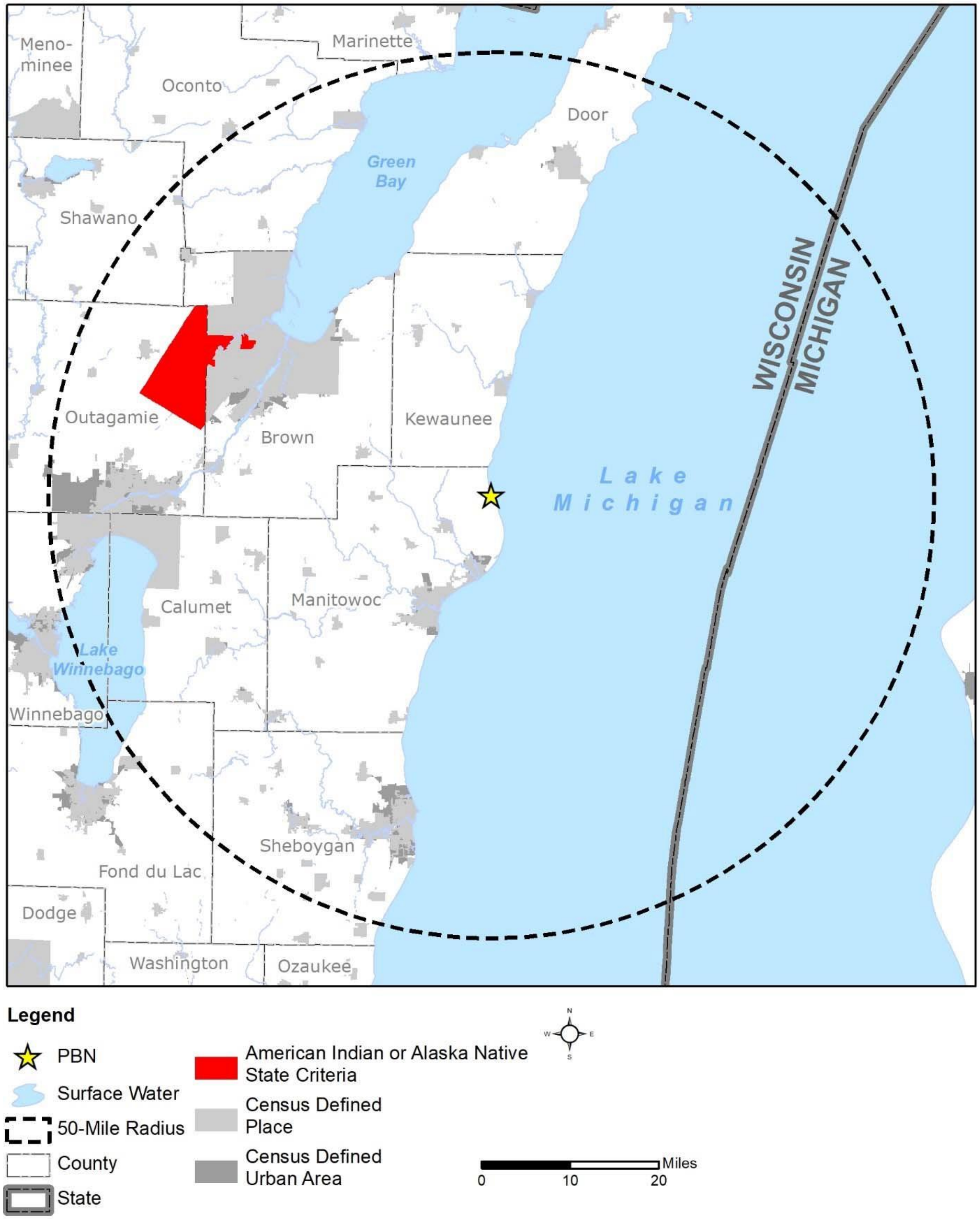


Figure 3.11-10   American Indian or Alaska Native Populations (Individual State)

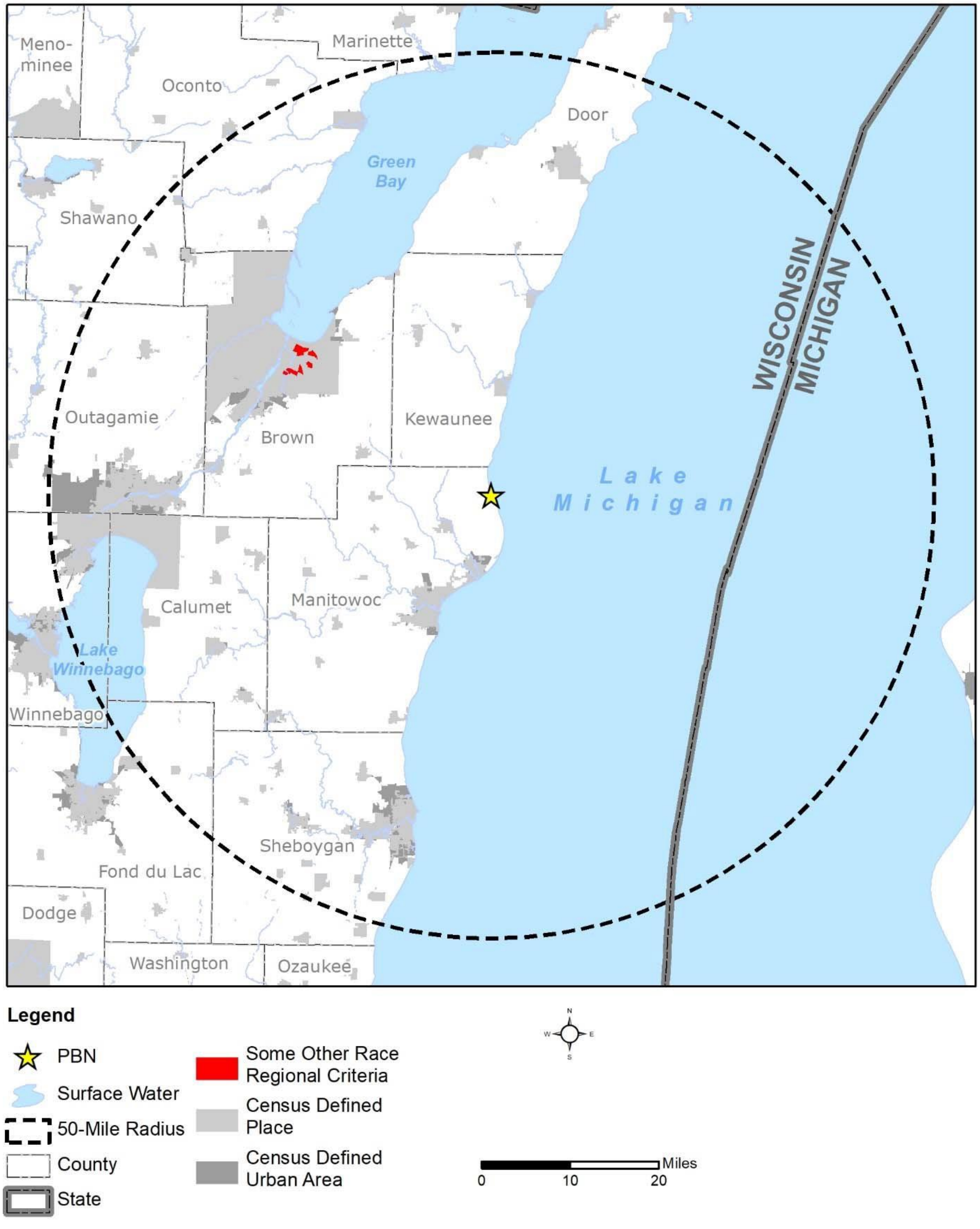


Figure 3.11-11 Some Other Race Populations (Regional)

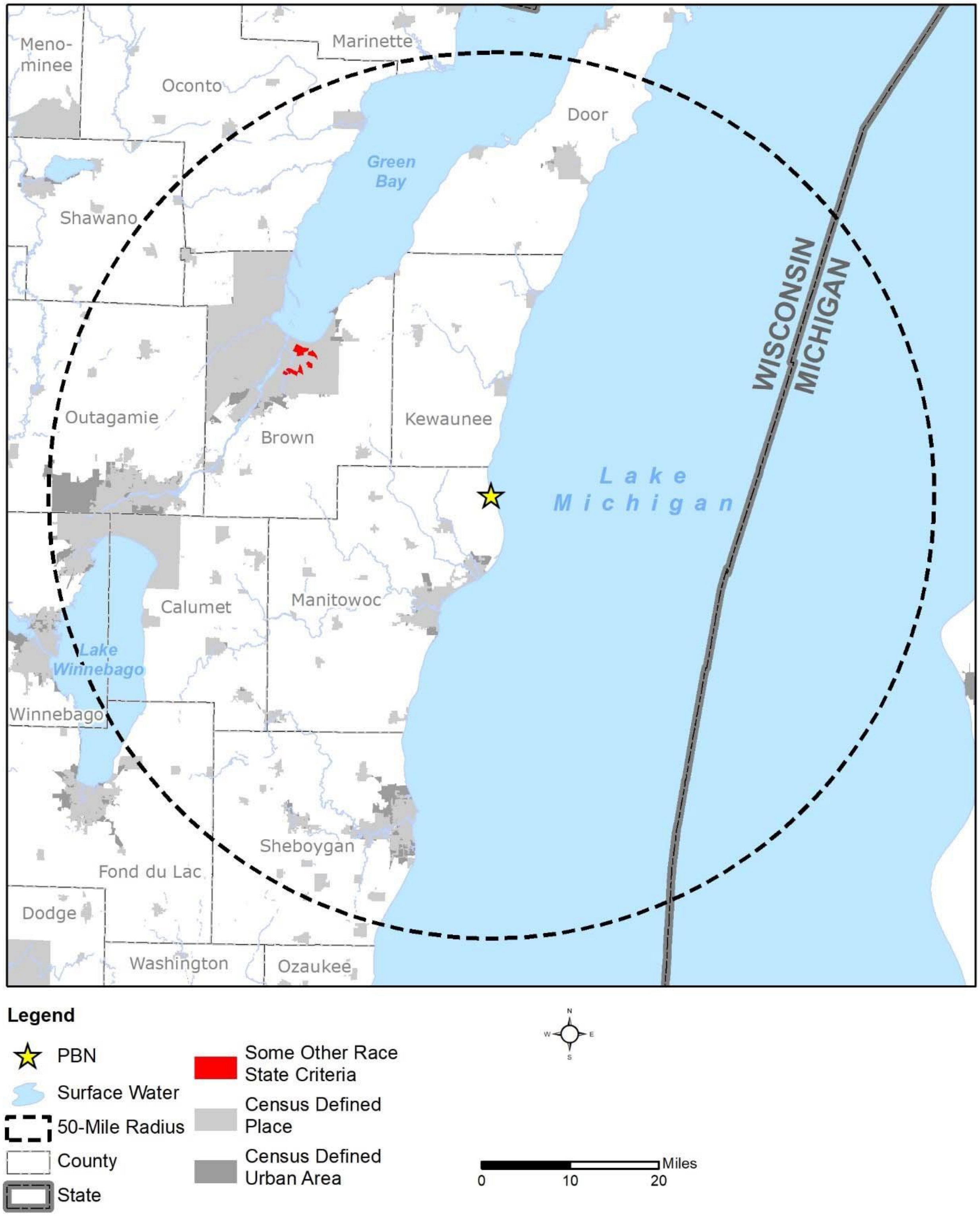


Figure 3.11-12 Some Other Race Populations (Individual State)

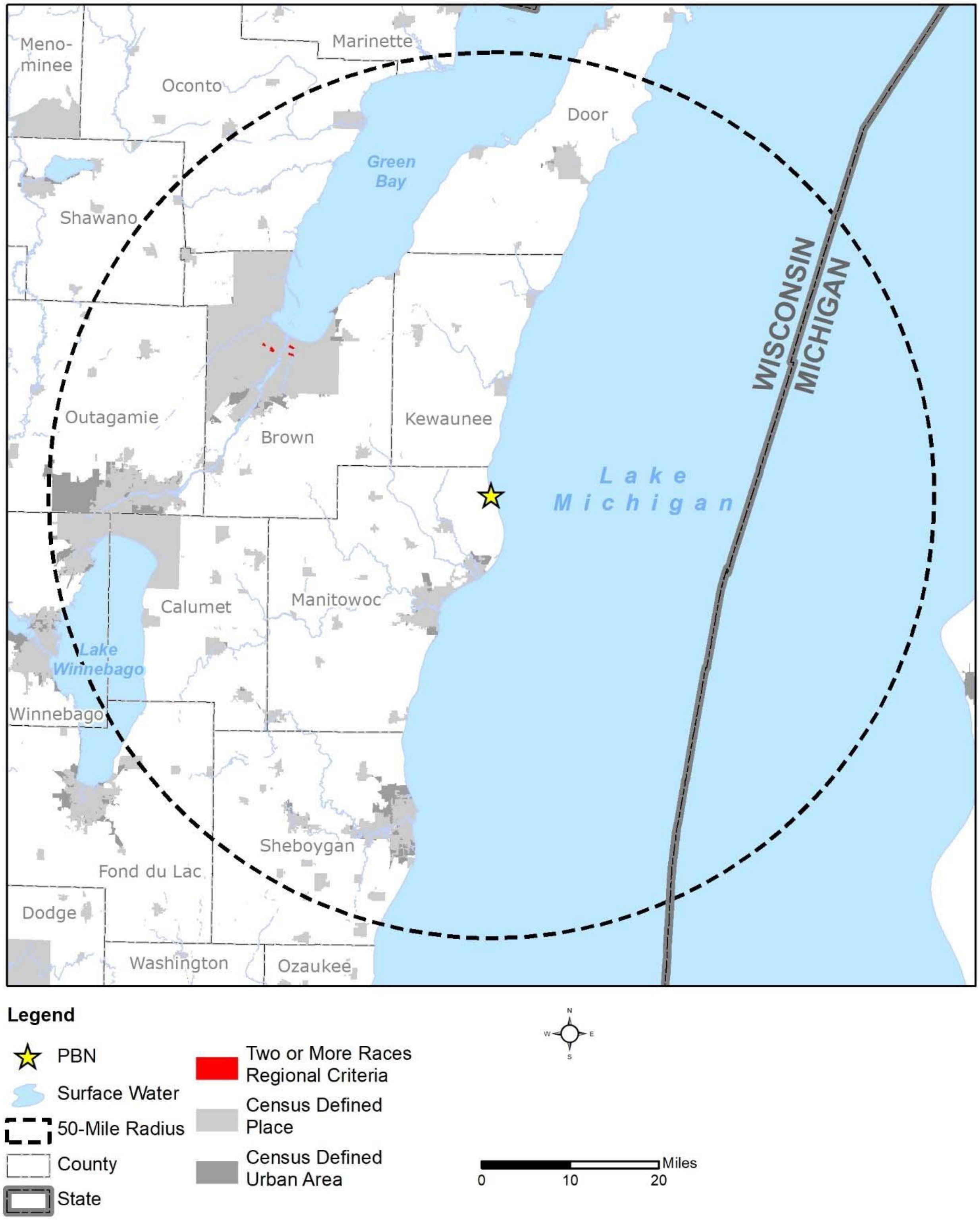


Figure 3.11-13 Two or More Races Populations (Regional)

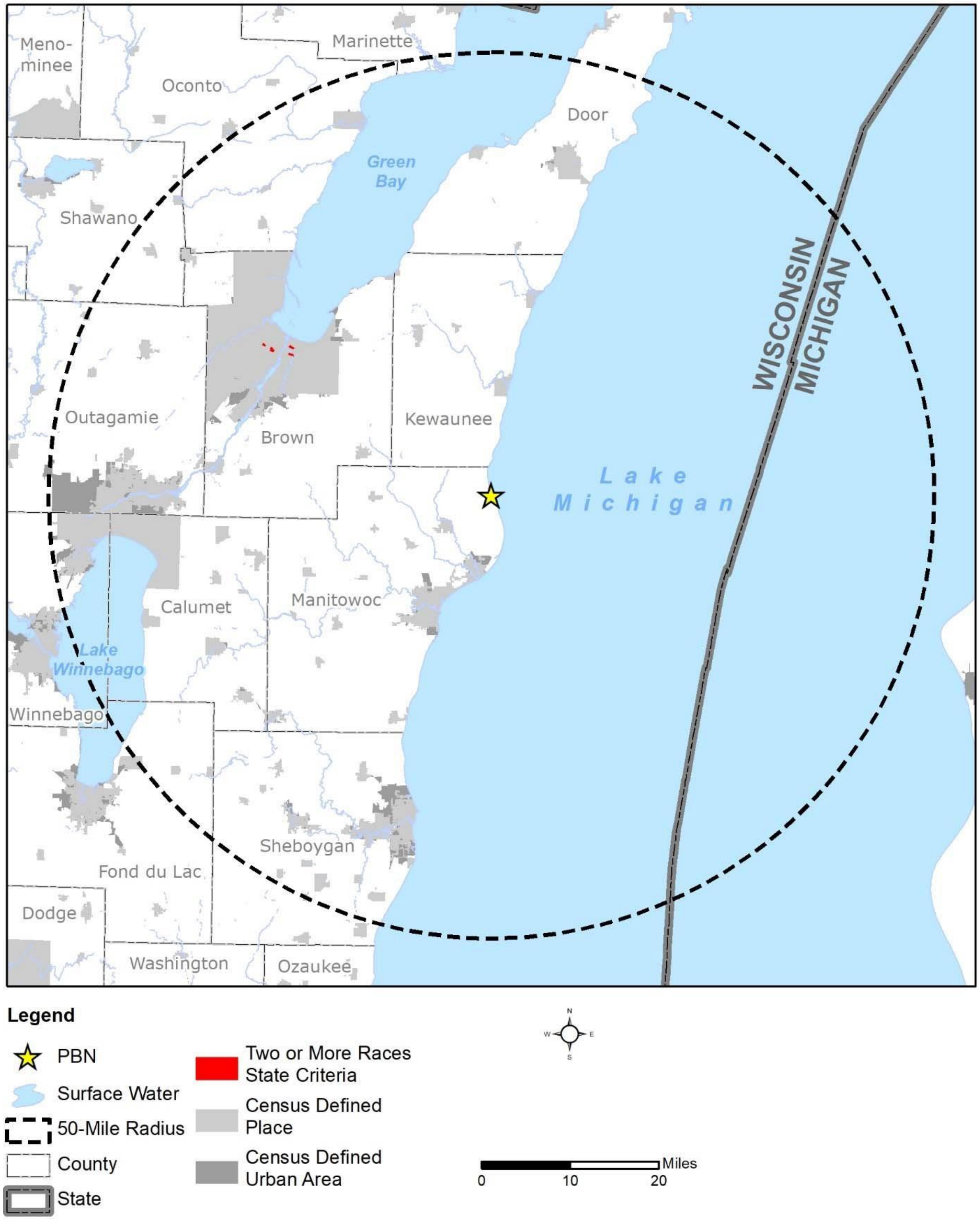


Figure 3.11-14 Two or More Races Populations (Individual State)

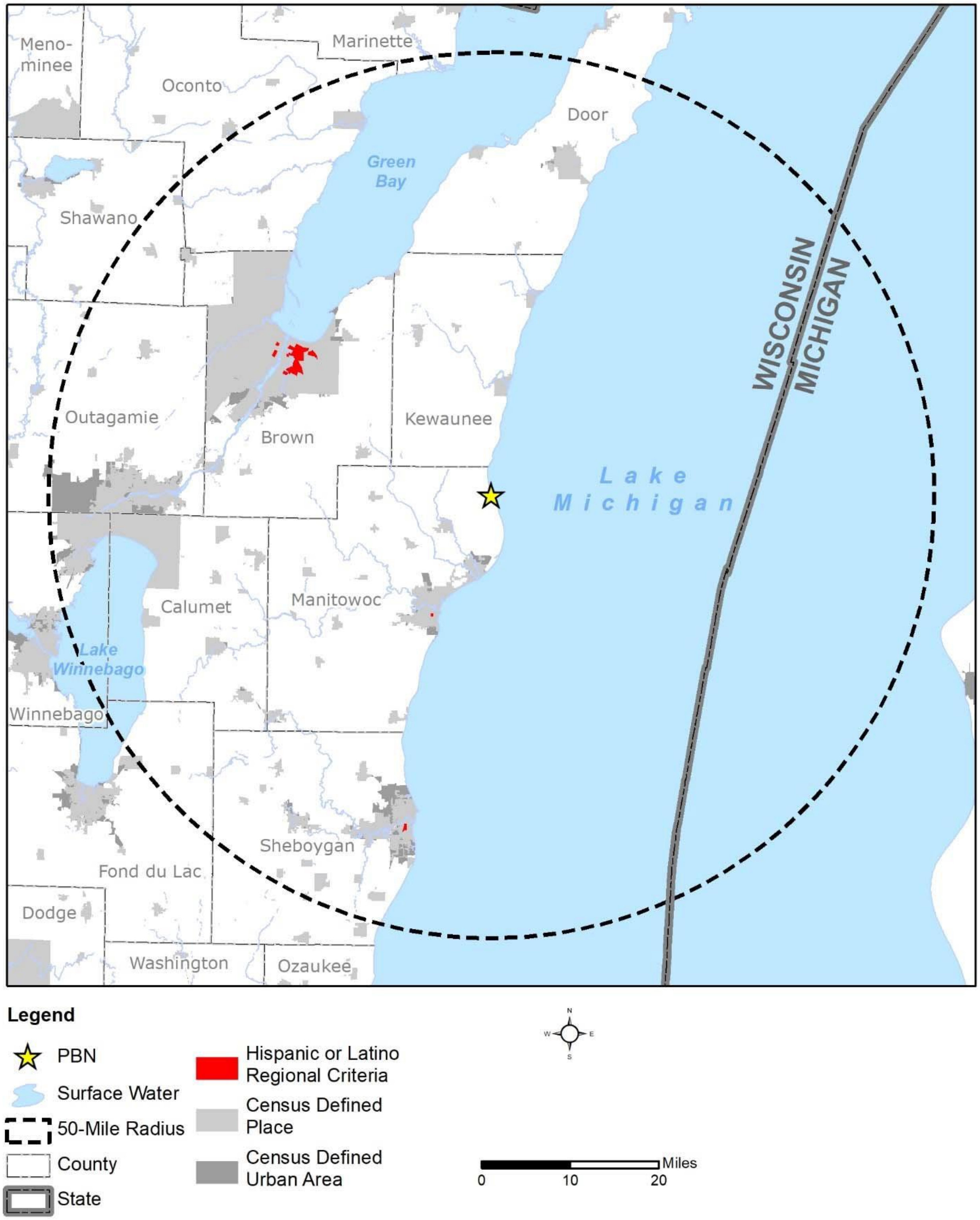


Figure 3.11-15 Hispanic or Latino Populations (Regional)

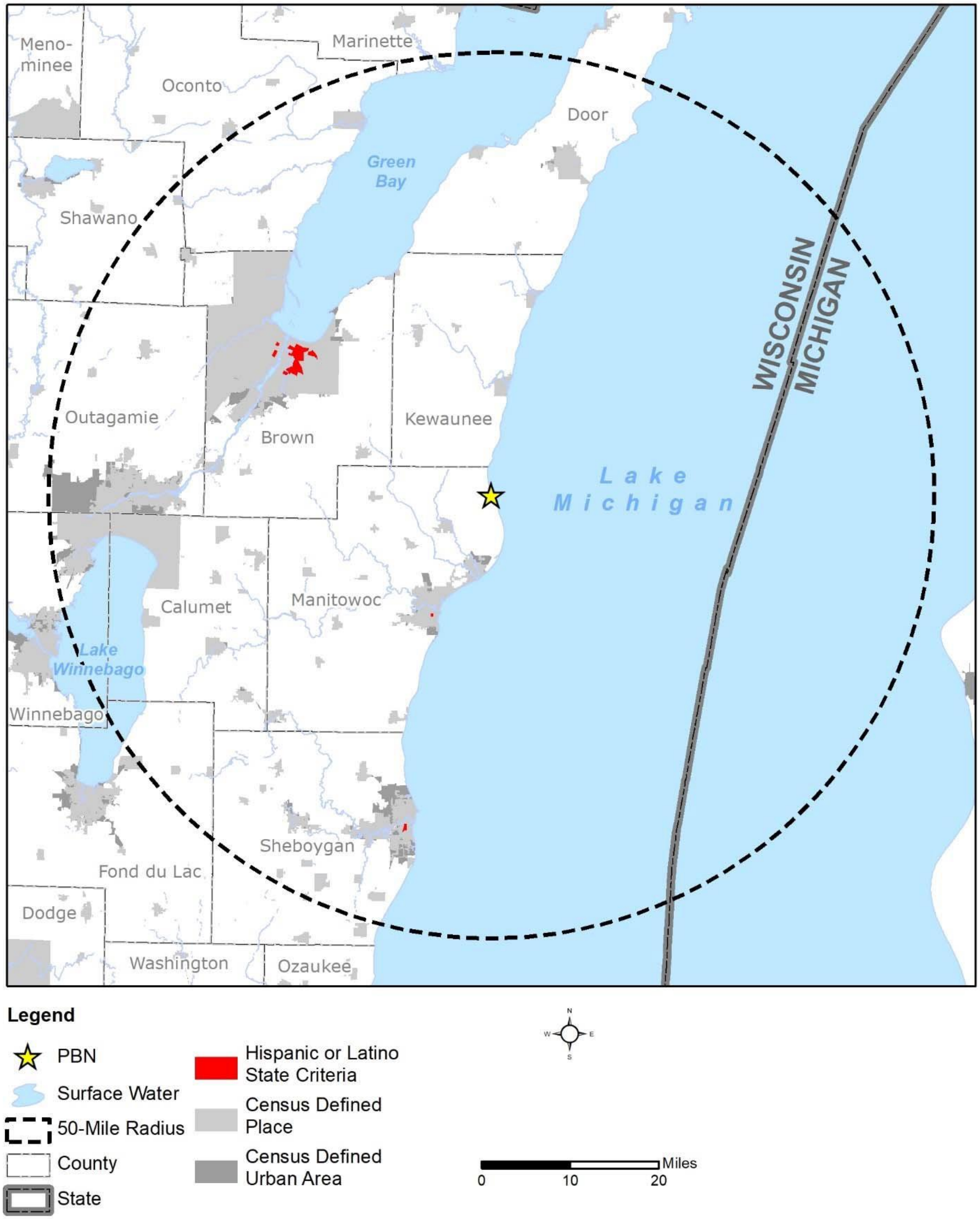


Figure 3.11-16 Hispanic or Latino Populations (Individual State)

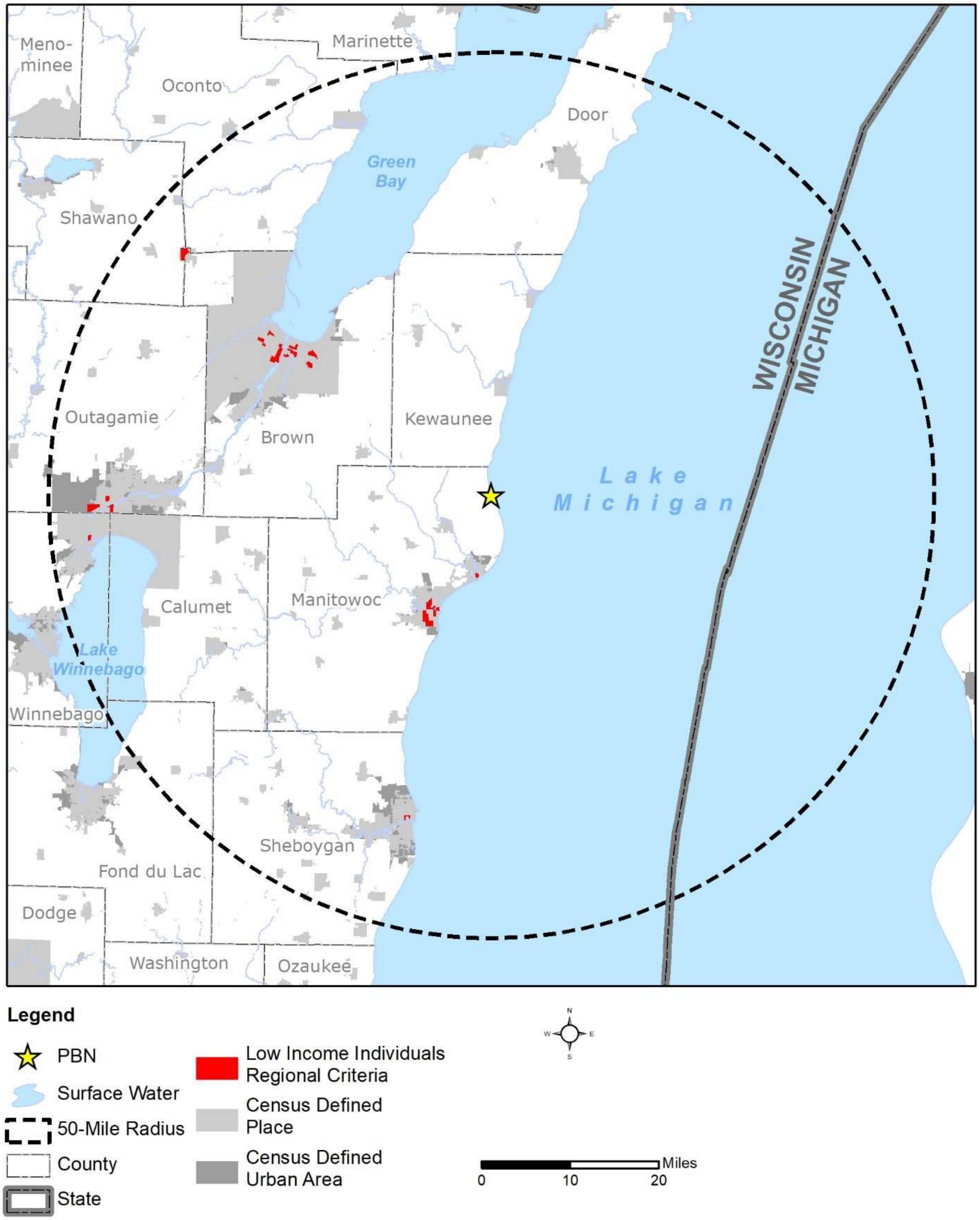


Figure 3.11-17 Low Income Individuals (Regional)

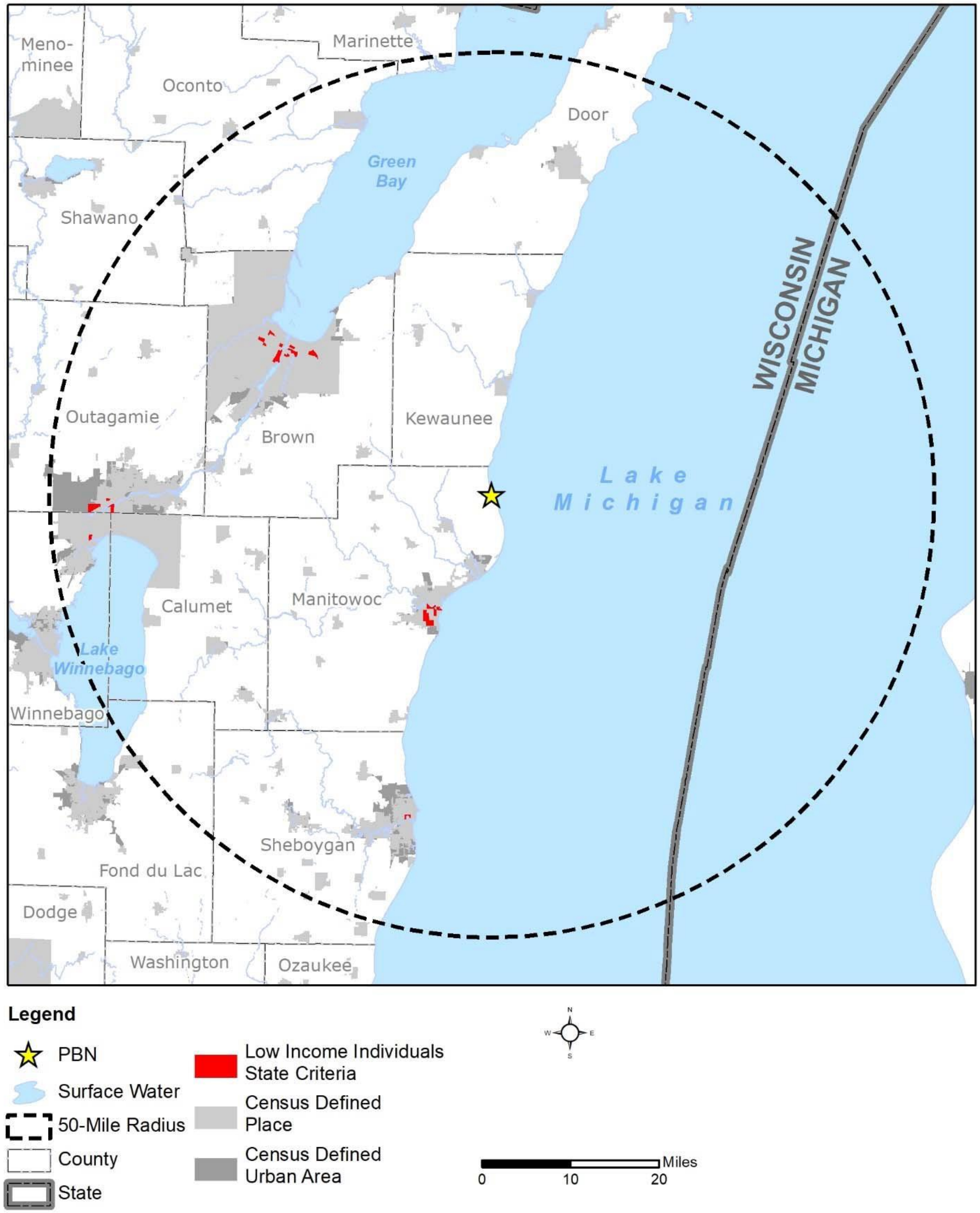


Figure 3.11-18 Low Income Individuals (Individual State)

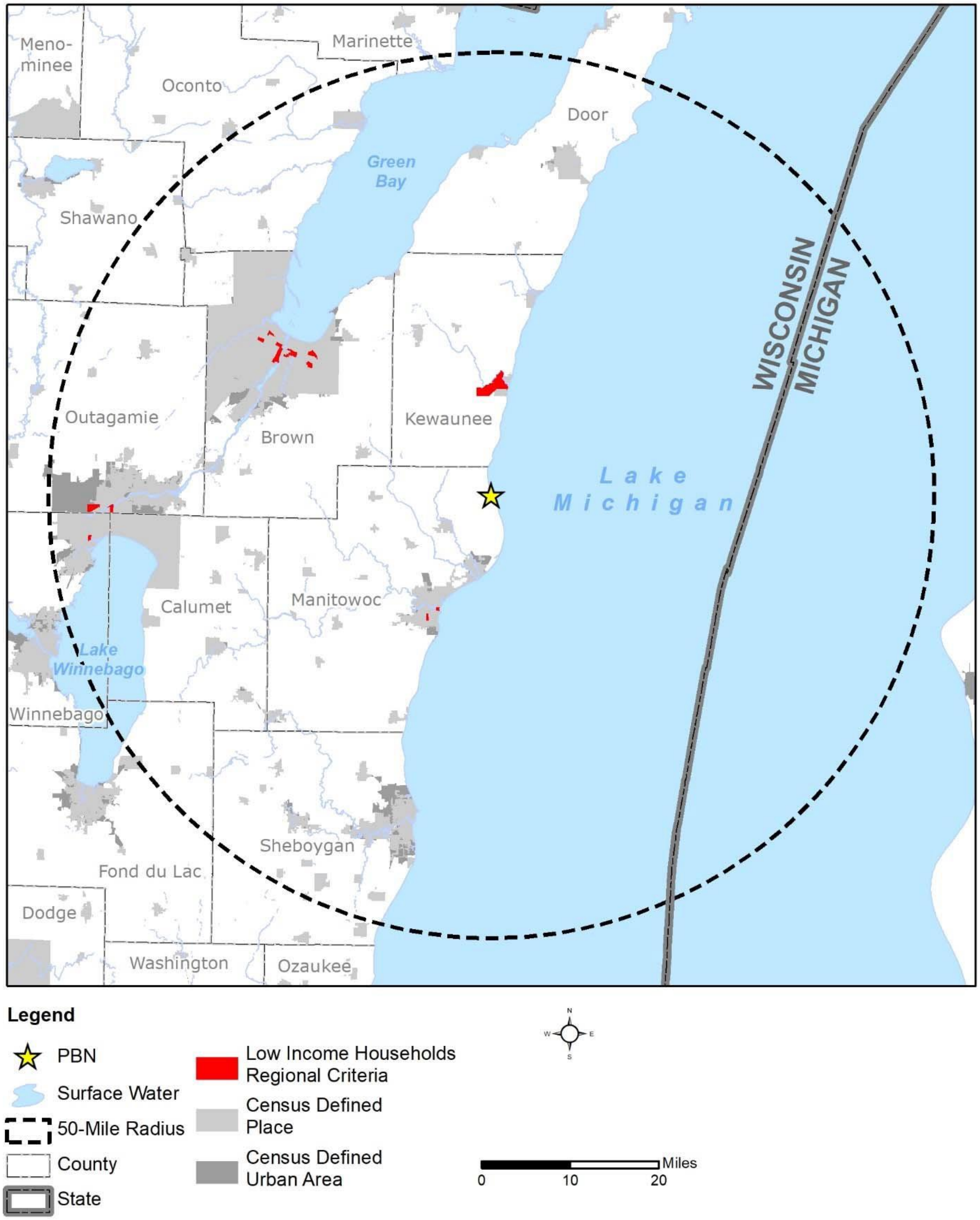


Figure 3.11-19 Low Income Households (Regional)

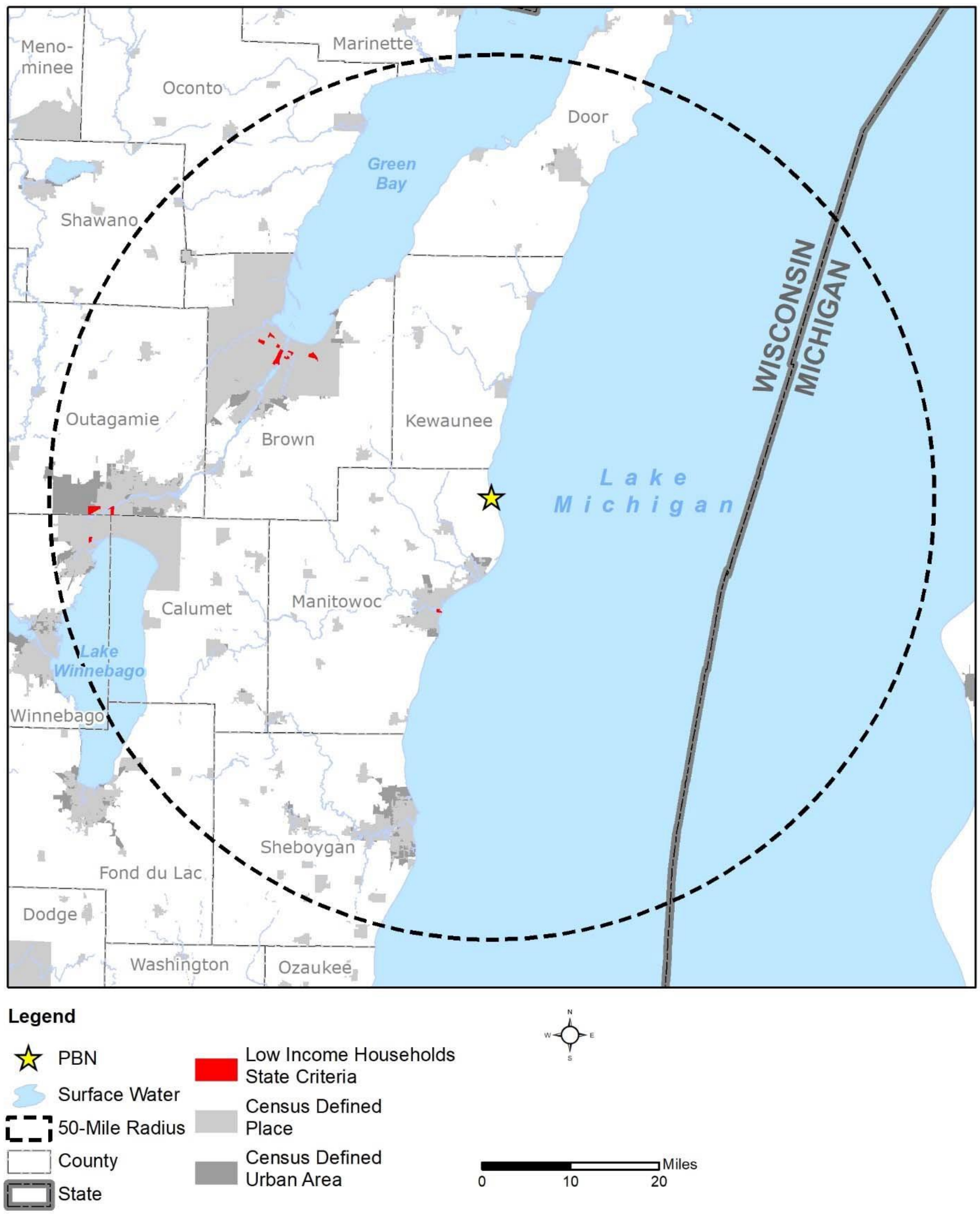


Figure 3.11-20 Low Income Households (Individual State)

3.12 Waste Management

In addressing the plant's radioactive and nonradioactive waste management systems and programs, NRC Regulatory Guide 4.2, Supplement 1, Revision 1, specifies that the information requested in this section can be incorporated by reference to Section 2.2 of the ER (NRC 2013b, Section 3.11). Therefore, consistent with NRC Regulatory Guide 4.2, NEPB is providing the information below to address PBN's radioactive and nonradioactive waste management systems and program.

3.12.1 Radioactive Waste Management

Section 2.2.6 includes a discussion of PBN's liquid, gaseous, and solid radwaste systems. The section provides a description of the systems, management of low-level mixed waste (LLMW), radwaste storage, spent fuel storage, and permitted facilities currently utilized for offsite processing and disposal of radioactive wastes.

3.12.2 Nonradioactive Waste Management

Section 2.2.7 includes a discussion of PBN's RCRA nonradioactive waste management program, types of wastes generated, waste minimization practices, and permitted facilities currently utilized for disposition of wastes.

4.0 ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND MITIGATING ACTIONS

The report must contain a consideration of alternatives for reducing adverse impacts . . . for all Category 2 license renewal issues . . . . [10 CFR 51.53(c)(3)(iii)]

The environmental report must include an analysis that considers . . . the environmental effects of the proposed action . . . and alternatives available for reducing or avoiding adverse environmental effects. [10 CFR 51.45(c)]

The environmental report shall . . . discuss . . . the impact of the proposed action on the environment. Impacts shall be discussed in proportion to their significance. [10 CFR 51.45(b)(1)]

The information submitted . . . should not be confined to information supporting the proposed action but should also include adverse information. [10 CFR 51.45(e)]

The NRC has identified and analyzed 78 environmental issues it considers to be associated with nuclear power plant license renewal and has designated these issues as Category 1, Category 2, or uncategorized. The NRC designated an issue as Category 1 if the following criteria were met:

- The environmental impacts associated with the issue have been determined to apply either to all plants or, for some issues, to plants having a specific type of cooling system or other specified plant or site characteristic.
- A single significance level (i.e., SMALL, MODERATE, or LARGE) has been assigned to the impacts that would occur at any plant, regardless of which plant is being evaluated (except for offsite radiological impacts—collective impacts from other than the disposal of spent fuel and high-level waste).
- Mitigation of adverse impacts associated with the issue has been considered in the analysis, and it has been determined that additional plant-specific mitigation measures are likely to be not sufficiently beneficial to warrant implementation.

If the NRC concluded that one or more of the Category 1 criteria could not be met, the issue was designated as Category 2, which requires plant-specific analysis. The NRC designated one issue as uncategorized (chronic effects of electromagnetic fields), signifying that the categorization and impact definitions do not apply to this issue. Until this uncategorized issue is categorized, applicants for license renewal are not required to submit information on this issue [10 CFR Part 51, Subpart A, Appendix B, Table B-1, Footnote 6]; therefore, this issue is not included in Tables 4.0-1, 4.0-2, or 4.0-3, nor is it addressed in Section 4.9 or Chapter 6. NRC rules do not require analyses of Category 1 issues resolved using generic findings [10 CFR Part 51, Subpart A, Appendix B, Table B-1] as described in the GEIS. Therefore, an applicant may reference the GEIS findings for Category 1 issues, absent new and significant information. The NRC provides guidance on new and significant information in Regulatory Guide 4.2, Supplement 1, Revision 1 (NRC 2013b). In this guidance, new and significant information is defined as follows:

- Information that identifies a significant environmental issue not considered or addressed in the GEIS and, consequently, not codified in Table B-1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Plants, in Appendix B, Environmental Effect of Renewing the Operating License of a Nuclear Power Plant, to Subpart A, National Environmental Policy Act-Regulations Implementing Section 102(2), of 10 CFR Part 51; or
- Information not considered in the assessment of impacts evaluated in the GEIS, leading to a seriously different picture of the environmental consequences of the action than previously considered, such as an environmental impact finding different from that codified in Table B-1.
- Further, any new activity or aspect associated with the nuclear power plant that can act upon the environment in a manner or an intensity and/or scope (context) not previously recognized.

4.0.1 Category 1 License Renewal Issues

The environmental report for the operating license renewal stage is not required to contain analyses of the environmental impacts of the license renewal issues identified as Category 1 issues in Appendix B to subpart A of this part. [10 CFR 51.53(c)(3)(i)]

[A]bsent new and significant information, the analyses for certain impacts codified by this rulemaking need only be incorporated by reference in an applicant's environmental report for license renewal . . . . (61 FR 28483)

NEPB has determined that, of the 60 Category 1 issues, six are not applicable to PBN because they result from design or operational features that do not exist at the facility. Table 4.0-1 lists these six issues and provides a brief explanation of why they are not applicable to the site. Table 4.0-2 lists the 54 issues which are applicable to the site. NEPB reviewed the NRC findings on these 54 issues and identified no new and significant information concerning the impacts addressed by these findings (Chapter 5). Therefore, as permitted by 10 CFR 51.53(a), NEPB adopts and incorporates by reference the NRC findings for these Category 1 issues.

4.0.2 Category 2 License Renewal Issues

The environmental report must contain analyses of the environmental impacts of the proposed action, including the impacts of refurbishment activities, if any, associated with license renewal and the impacts of operation during the renewal term, for those

> *issues identified as Category 2 issues in Appendix B to subpart A of this part. [10 CFR 51.53(c)(3)(ii)]*
>
> *The report must contain a consideration of alternatives for reducing adverse impacts, as required by § 51.45(c), for all Category 2 license renewal issues . . . . [10 CFR 1.53(c)(3)(iii)]*

The NRC designated 17 issues as Category 2. NEPB has determined that of the 17 issues shown in Table 4.0-3, six issues are not applicable to PBN because they are applicable to plants with a different type of cooling system or to a plant with greater groundwater withdrawals. For the 11 issues applicable to the site, the corresponding sections contain the required analyses. These analyses include conclusions regarding the significance of the impacts relative to renewal of the PBN Units 1 and 2 OLs and, when applicable, discuss potential mitigation alternatives to the extent appropriate. With the exception of threatened and endangered species/EFH, historic and cultural resources, and environmental justice, PBN has identified the significance of the impacts associated with each issue as SMALL, MODERATE, or LARGE, consistent with the criteria that the NRC established in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, Footnote 3 as follows:

> SMALL: Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource. For the purposes of assessing radiological impacts, the NRC has concluded that those impacts that do not exceed permissible levels in the NRC's regulations are considered small.
>
> MODERATE: Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
>
> LARGE: Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource. For issues where probability is a key consideration (i.e., accident consequences), probability was a factor in determining significance.

Consistent with NRC guidance, PBN identified the significance of the impacts for the three Category 2 issues of threatened and endangered species/EFH, historic and cultural resources, and environmental justice as follows:

- For threatened and endangered species (Endangered Species Act [ESA]), the significance of the effects from license renewal can be characterized based on a determination of whether continued nuclear power plant operations, including refurbishment, (1) would have no effect on federally listed species; (2) are not likely to adversely affect federally listed species; (3) are likely to adversely affect federally listed species; or (4) are likely to jeopardize a federally listed species or adversely modify designated critical habitat. For EFH (Magnuson Stevens Fishery Conservation and

Management Act), the significance of effects from license renewal can be characterized based on a determination of whether continued nuclear power plant operations, including refurbishment, would have: (1) no adverse impact; (2) minimal adverse impact; or (3) substantial adverse impact to the essential habitat of federally managed fish populations (NRC 2013a).

- For historic and cultural resources (NHPA), the significance of the effects from license renewal can be characterized based on a determination that: (1) no historic properties are present (no effect); (2) historic properties are present but would not be adversely affected (no adverse effect); or (3) historic properties are adversely affected (adverse effect) (NRC 2013b).
- For environmental justice, impacts would be based on disproportionately high and adverse human health and environmental effects on minority and low-income populations (NRC 2013b).

In accordance with NEPA practice, NEPB considered ongoing and potential additional mitigation in proportion to the significance of the impact to be addressed (i.e., impacts categorized as SMALL receive less mitigation consideration than those categorized as LARGE).

4.0.3 Uncategorized License Renewal Issues

The NRC determined that its categorization and impact-finding definitions did not apply to chronic effects of electromagnetic fields. Because the categorization and impact finding definitions do not apply (as noted in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, Footnote 5), applicants are not currently required to submit information on this issue.

4.0.4 Format of Issues Reviewed

The Category 1 and 2 issues identified in NRC Regulatory Guide 4.2, Supplement 1, Revision 1 (NRC 2013b) are presented in the following sections. The format for the review of these issues is described below. Although Chapter 5 describes the process by which Category 1 issues have been evaluated for new and significant information, specific issues are also listed in this chapter for consistency with the recommended NRC Regulatory Guide 4.2, Supplement 1, format.

- *Issue*: Title of the issue.
- *Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1*: The findings for the issue from 10 CFR Part 51, Subpart A, Appendix B, Table B-1, Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants.
- *Requirement:* Restatement of the applicable 10 CFR 51.53 requirement.
- *Background:* A background excerpt from the applicable section of the GEIS. The specific section of the GEIS is referenced for the convenience of the reader.

- *Analysis:* An analysis of the environmental impact, taking into account information provided in the GEIS and 10 CFR Part 51, Subpart A, Appendix B, as well as current site-specific information. If an issue is not applicable, the analysis lists the explanation. The analysis section also provides a summary conclusion of the environmental impacts and identifies, as applicable, either ongoing or additional planned mitigation measures to reduce adverse impacts.

For Category 1 issues listed in this chapter, an analysis is not required absent new and significant information. In such cases, the GEIS finding on the Category 1 issue is adopted and incorporated by reference.

Table 4.0-1 Category 1 Issues Not Applicable to PBN

Issue	Comment
Land Use	
Offsite land use in transmission line rights of way (ROWs)	All in-scope transmission lines subject to the evaluation of environmental impacts for license renewal are located completely within the PBN site.
Surface Water Resources	
Altered salinity gradients	PBN does not have cooling towers and does not discharge to an estuary.
Groundwater Resources	
Groundwater quality degradation (plants with cooling ponds in salt marshes)	PBN is located on a freshwater body and does not utilize cooling ponds.
Terrestrial Resources	
Cooling tower impacts on vegetation (plants with cooling towers)	PBN does not utilize cooling towers.
Aquatic Resources	
Impingement and entrainment of aquatic organisms (plants with cooling towers)	PBN does not utilize cooling towers.
Thermal impacts on aquatic organisms (plants with cooling towers)	PBN does not utilize cooling towers.

Table 4.0-2 Category 1 Issues Applicable to PBN (Sheet 1 of 2)

Resource	Issue
Land Use	Onsite land uses
	Offsite land uses
Visual Resources	Aesthetic impacts
Air Quality	Air quality impacts (all plants)
	Air quality effects of transmission lines
Noise	Noise impacts
Geologic Environment	Geology and soils
Surface Water Resources	Surface water use and quality (non-cooling system impacts)
	Altered current patterns at intake and discharge structures
	Altered thermal stratification of lakes
	Scouring caused by discharged cooling water
	Discharge of metals in cooling system effluent
	Discharge of biocides, sanitary wastes, and minor chemical spills
	Surface water use conflicts (plants with once-through cooling systems)
	Effects of dredging on surface water quality
	Temperature effects on sediment transport capacity
Groundwater Resources	Groundwater contamination and use (non-cooling system impacts)
	Groundwater use conflicts (plants that withdraw less than 100 gallons per minute)
	Groundwater quality degradation resulting from water withdrawals
Terrestrial Resources	Exposure of terrestrial organisms to radionuclides
	Cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds)
	Bird collisions with plant structures and transmission lines
	Transmission line ROW management impacts on terrestrial resources
	Electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)
Aquatic Resources	Entrainment of phytoplankton and zooplankton (all plants)
	Infrequently reported thermal impacts (all plants)
	Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication
	Effects of nonradiological contaminants on aquatic organisms
	Exposure of aquatic organisms to radionuclides
	Effects of dredging on aquatic organisms
	Effects on aquatic resources (non-cooling system impacts)
	Impacts of transmission line ROW management on aquatic resources
	Losses from predation, parasitism, and disease among organisms exposed to sub-lethal stresses

Table 4.0-2 Category 1 Issues Applicable to PBN (Sheet 2 of 2)

Resource	Issue
Socioeconomics	Employment and income, recreation and tourism
	Tax revenues
	Community services and education
	Population and housing
	Transportation
Human Health	Radiation exposures to the public
	Radiation exposures to plant workers
	Human health impact from chemicals
	Microbiological hazards to plant workers
	Physical occupational hazards
Postulated Accidents	Design-basis accidents
Waste Management	Low-level waste storage and disposal
	Onsite storage of spent nuclear fuel
	Offsite radiological impacts of spent nuclear fuel and high-level waste disposal
	Mixed-waste storage and disposal
	Nonradioactive waste storage and disposal
Uranium Fuel Cycle	Offsite radiological impacts—individual impacts from other than the disposal of spent fuel and high-level waste
	Offsite radiological impacts—collective impacts from other than the disposal of spent fuel and high-level waste
	Nonradiological impacts of the uranium fuel cycle
	Transportation
Termination of Nuclear Power Plant Operations and Decommissioning	Termination of plant operations and decommissioning

Table 4.0-3 Applicability of Category 2 Issues to PBN (Sheet 1 of 2)

Resource Issue	Applicability	ER Section
Surface Water Resources		
Surface water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river)	Not Applicable	4.5.1
Groundwater Resources		
Groundwater use conflicts (plants that withdraw more than 100 gallons per minute)	Not Applicable	4.5.3
Groundwater use conflicts (plants with closed-cycle cooling systems that withdraw makeup water from a river)	Not Applicable	4.5.2
Groundwater quality degradation (plants with cooling ponds at inland sites)	Not Applicable	4.5.4
Radionuclides released to groundwater	Applicable	4.5.5
Terrestrial Resources		
Effects on terrestrial resources (non-cooling system impacts)	Applicable	4.6.5
Water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup water from a river)	Not Applicable	4.6.4
Aquatic Resources		
Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds)	Applicable	4.6.1
Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds)	Applicable	4.6.2
Water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river)	Not Applicable	4.6.3
Special Status Species and Habitats		
Threatened, endangered, and protected species and essential fish habitat	Applicable	4.6.6
Historic and Cultural Resources		
Historic and cultural resources	Applicable	4.7
Human Health		
Microbiological hazards to the public (plants with cooling ponds or canals or cooling towers that discharge to a river) Note: 10 CFR Part 51, Subpart A, Appendix B, Table B-1 finding states, "These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals, or that discharge into rivers." Thus, including plants using lakes for cooling as plants where this Category 2 issue is applicable.	Applicable	4.9.1
Electric shock hazards	Applicable	4.9.2
Postulated Accidents		
Severe accidents	Applicable	4.15.2

Table 4.0-3 Applicability of Category 2 Issues to PBN (Sheet 2 of 2)

Resource Issue	Applicability	ER Section
Environmental Justice		
Minority and low-income populations	Applicable	4.10.1
Cumulative Impacts		
Cumulative Impacts	Applicable	4.12

4.1 Land Use and Visual Resources

The following sections address the land use issues applicable to PBN, providing background and environmental analyses representing the proposed SLR operating term.

4.1.1 Onsite Land Use

4.1.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Changes in onsite land use from continued operations and refurbishment associated with license renewal would be a small fraction of the nuclear plant site and would involve only land that is controlled by the licensee.

4.1.1.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.1.1.3 Background [GEIS Section 4.2.1.1]

Operational activities at a nuclear power plant during the license renewal term would be similar to those occurring during the current license term. Generally, onsite land use conditions would remain unchanged. However, additional spent nuclear fuel and low-level radioactive waste generated during the license renewal term could require the construction of new or expansion of existing onsite storage facilities. Should additional storage facilities be required, this action would be addressed in separate license reviews conducted by the NRC. Refurbishment activities, such as steam generator and vessel head replacement, have not permanently changed onsite land use conditions.

4.1.1.4 Analysis

This Category 1 issue was reviewed for new and significant information. As a result of this review, NEPB is aware of no new and significant information regarding the environmental impacts of SLR associated with PBN. Further, and as stated in Section 2.1, NEPB does not anticipate any SLR-related refurbishment. Because no new and significant information has been identified, the analyses and findings regarding this issue in the GEIS (NUREG-1437, Revision 1) are adopted and incorporated herein by reference, and no further analysis is required.

4.1.2 Offsite Land Use

4.1.2.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Offsite land use would not be affected by continued operations and refurbishment associated with license renewal.

4.1.2.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.1.2.3 Background [GEIS Section 4.2.1.1]

The impacts of continued plant operations during the license renewal term and refurbishment on offsite land use were evaluated separately in the 1996 GEIS. The NRC predicted that impacts associated with refurbishment and changes in population and tax revenue on offsite land use could range from SMALL to MODERATE. Subsequent license renewal reviews, however, have shown no power plant-related population changes or significant tax revenue changes due to license renewal. Non-outage employment levels at nuclear power plants have remained relatively unchanged or have decreased. With no increase in the number of workers, there has been no increase in housing, infrastructure, or demand for services beyond what has already occurred. Operational activities during the license renewal term would be similar to those occurring during the current license term and would not affect offsite land use beyond what has already been affected.

For plants that have the potential to impact a coastal zone or coastal watershed, as defined by each state participating in the national Coastal Zone Management Program, applicants for license renewal must submit to the affected state a certification that the proposed license renewal is consistent with the state Coastal Zone Management Program. Applicants must coordinate with the state agency that manages the state Coastal Zone Management Program to obtain a determination that the proposed nuclear plant license renewal would be consistent with the state program.

4.1.2.4 Analysis

This Category 1 issue was reviewed for new and significant information. As a result of this review, NEPB is aware of no new and significant information regarding the environmental impacts of SLR associated with PBN. Further, and as stated in Section 2.1, NEPB does not anticipate any SLR-related refurbishment. Because no new and significant information has been identified, the analyses and findings regarding this issue in the GEIS (NUREG-1437, Revision 1) are adopted and incorporated herein by reference, and no further analysis is required.

4.1.3 Aesthetics Impacts

4.1.3.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. No important changes to the visual appearance of plant structures or transmission lines are expected from continued operations and refurbishments associated with license renewal.

4.1.3.2 Requirement [10 CFR 51.53(c)(3)(iv)

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.1.3.3 Background [GEIS Section 4.2.1.2]

A case study performed for the 1996 GEIS found a limited number of situations where nuclear power plants had a negative effect on visual resources. Negative perceptions were based on aesthetic considerations (for instance, the plant is out of character or scale with the community or the viewshed), physical environmental concerns, safety and perceived risk issues, an anti-plant attitude, or an anti-nuclear orientation. It is believed that these negative perceptions would persist regardless of mitigation measures.

In addition, the visual appearance of transmission lines is not expected to change during the license renewal term. After the containment building and cooling towers, transmission line towers are probably the most frequently observed structure associated with nuclear power plants. Transmission lines from nuclear power plants are generally indistinguishable from those from other power plants. Since electrical transmission lines are common throughout the United States, they are generally perceived with less prejudice than the nuclear power plant itself. Also, the visual impact of transmission lines tends to wear off when viewed repeatedly.

4.1.3.4 Analysis

This Category 1 issue was reviewed for new and significant information. As a result of this review, NEPB is aware of no new and significant information regarding the environmental impacts of SLR associated with PBN. Further, and as stated in Section 2.1, NEPB does not anticipate any SLR-related refurbishment. Because no new and significant information has been identified, the analyses and findings regarding this issue in the GEIS (NUREG-1437, Revision 1) are adopted and incorporated herein by reference, and no further analysis is required.

4.2 Air Quality

The following sections address the air quality issues applicable to PBN, providing background on the issues and the analyses regarding the proposed SLR operating term.

4.2.1 Air Quality Impacts (all plants)

4.2.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Air quality impacts from continued operations and refurbishment associated with license renewal are expected to be small at all plants. Emissions resulting from refurbishment activities at locations in or near air quality nonattainment or maintenance areas would be short-lived and would cease after these refurbishment activities are completed. Operating experience has shown that the scale of refurbishment activities has not resulted in exceedance of the de minimis thresholds for criteria pollutants, and BMPs, including fugitive dust controls and the imposition of permit conditions in state and local air emissions permits, would ensure conformance with applicable state or tribal implementation plans.

Emissions from emergency diesel generators and fire pumps, and routine operations of boilers used for space heating, would not be a concern, even for plants located in or adjacent to nonattainment areas. Impacts from cooling tower particulate emissions, even under the worst-case situations, have been SMALL.

4.2.1.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.2.1.3 Background [GEIS Section 4.3.1.1]

Impacts on air quality during normal plant operations can result from operations of fossil fuel-fired equipment needed for various plant functions. Each licensed plant typically employs emergency diesel generators for use as a backup power source. Emergency diesel generators and fire pumps typically require state or local operating permits. These diesel generators are typically tested once a month with several test burns of various durations (e.g., one to several hours). In addition to these maintenance tests, longer-running endurance tests are also typically conducted at each plant. Each generator is typically tested for 24 hours on a staggered test schedule (e.g., once every refueling outage).

In addition to the emergency diesel generators, fossil fuel (i.e., diesel-, oil-, or natural gas-fired) boilers are used primarily for evaporator heating, plant space heating, and/or feedwater purification. These units typically operate at a variable load on a continuous basis throughout the year unless end use is restricted to one application, such as space heating. The utility boilers at commercial plants are relatively small when compared with most industrial boilers and are typically regulated through state-level operating permits.

As discussed in Section 3.3 of the GEIS, cooling tower drift can increase downwind PM concentrations, impair visibility, ice roadways, cause drift deposition, and damage vegetation and painted surfaces. Thus, although there is the potential for some air quality impacts to occur as a result of equipment and cooling tower operations, even in the worst-case situation (Hope Creek), the impacts have been SMALL, and licensees would be required to operate within state permit requirements.

In the 1996 GEIS, the NRC concluded that the impacts from plant refurbishment associated with license renewal on air quality could range from SMALL to LARGE, although these impacts were expected to be SMALL for most plants. However, findings from license renewal SEISs published since the 1996 GEIS have shown that refurbishment activities, such as steam generator and vessel head replacement, have not required the large numbers of workers and months of time, as well as the degree of land disturbance that was conservatively estimated in the 1996 GEIS. Presumed air pollutant emissions, including levels of fugitive dust, have therefore not been realized.

4.2.1.4 Analysis

This Category 1 issue was reviewed for new and significant information. As a result of this review, NEPB is aware of no new and significant information regarding the environmental impacts of SLR associated with PBN. Further, and as stated in Section 2.1, NEPB does not anticipate any SLR-related refurbishment. Because no new and significant information has been identified, the analyses and findings regarding this issue in the GEIS (NUREG-1437, Revision 1) are adopted and incorporated herein by reference, and no further analysis is required.

4.2.2 Air Quality Effects of Transmission Lines

4.2.2.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Production of ozone and oxides of nitrogen is insignificant and does not contribute measurably to ambient levels of these gases.

4.2.2.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.2.2.3 Background [GEIS SECTION 4.3.1.1]

Small amounts of ozone and substantially smaller amounts of oxides of nitrogen are produced by transmission lines during corona, a phenomenon that occurs when air ionizes near isolated irregularities on the conductor surface such as abrasions, dust particles, raindrops, and insects. Several studies have quantified the amount of ozone generated and concluded that the amount produced by even the largest lines in operation (765 kV) is insignificant.

Ozone concentrations generated by transmission lines are therefore too low to cause any significant effects. The minute amounts of oxides of nitrogen produced are similarly insignificant. A finding of SMALL significance for transmission lines, within this scope of review is supported by the evidence that production of ozone and oxides of nitrogen are insignificant and does not measurably contribute to ambient levels of those gases.

4.2.2.4 Analysis

This Category 1 issue was reviewed for new and significant information. As a result of this review, NEPB is aware of no new and significant information regarding the environmental impacts of SLR associated with PBN. Further, and as stated in Section 2.1, NEPB does not anticipate any SLR-related refurbishment. Because no new and significant information has been identified, the analyses and findings regarding this issue in the GEIS (NUREG-1437, Revision 1) are adopted and incorporated herein by reference, and no further analysis is required.

4.3 Noise

4.3.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Noise levels would remain below regulatory guidelines for offsite receptors during continued operations and refurbishment associated with license renewal.

4.3.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.3.3 Background [GEIS Section 4.3.1.2]

Major sources of noise at operating nuclear power plants are cooling towers, turbines, transformers, large pumps, and cooling water system motors. Nuclear plant operations have not changed appreciably with time, and no change in noise levels or noise-related impacts are expected during the license renewal term. Since no change is expected in the amount of noise generated during the license renewal term, the only issue of concern is the number of people now living close to the nuclear power plant who are exposed to operational noise.

Given the industrial nature of the power plant and the number of years of plant operation, noise from a nuclear plant is generally nothing more than a continuous minor nuisance. However, noise levels may sometimes exceed the 55 dBA level that the EPA uses as a threshold level to protect against excess noise during outdoor activities. However, according to the EPA, this threshold does "not constitute a standard, specification, or regulation," but was intended to provide a basis for state and local governments establishing noise standards. Nevertheless, noise levels at the site boundary are expected to remain well below regulatory standards for offsite residents.

Noise would also be generated by construction-related activities and equipment used during refurbishment. However, this noise would occur for relatively short periods of time (several weeks) and is not expected to be distinguishable from other operational noises at the site boundary nor create an adverse impact on nearby residents.

4.3.4 Analysis

This Category 1 issue was reviewed for new and significant information. As a result of this review, NEPB is aware of no new and significant information regarding the environmental impacts of SLR associated with PBN. Further, and as stated in Section 2.1, NEPB does not anticipate any SLR-related refurbishment. Because no new and significant information has been identified, the analyses and findings regarding this issue in the GEIS (NUREG-1437, Revision 1) are adopted and incorporated herein by reference, and no further analysis is required.

4.4 Geology and Soils

4.4.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. The effect of geologic and soil conditions on plant operations and the impact of continued operations and refurbishment activities on geology and soils would be small for all nuclear power plants and would not change appreciably during the proposed license renewal term.

4.4.2 Requirement [10 CFR 51.53(C)(3)(IV)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.4.3 Background [GEIS Section 4.4.1]

The impact of continued operations and refurbishment associated with SLR on geologic and soil resources would consist of soil disturbance, including sediment and/or any associated bedrock, for projects, such as replacing or adding buildings, roads, parking lots, and belowground and aboveground utility structures. Implementing BMPs would reduce soil erosion and subsequent impacts on surface water quality. These practices include, but are not limited to, minimizing the amount of disturbed land; stockpiling topsoil before ground disturbance; mulching and seeding disturbed areas; covering loose materials with geotextiles; using silt fences to reduce sediment loading to surface water; using check dams to minimize the erosive power of drainages; and installing proper culvert outlets to direct flows in streams or drainages.

Detailed geotechnical analyses would be required to address the stability of excavations, foundation footings, and slope cuts for building construction, road creation, or other refurbishment-related construction projects. Depending on the plant location and design, riverbank or coastline protection might need to be upgraded, especially at water intake or discharge structures if natural flows, such as storm surges, cause an increase in erosion. In addition, the FPPA [7 USC 4201 et seq.] requires federal agencies to consider agency actions affecting the preservation of farmland, including prime and other important farmland soils, as described in Section 3.4 of the GEIS.

4.4.4 Analysis

This Category 1 issue was reviewed for new and significant information. As a result of this review, NEPB is aware of no new and significant information regarding the environmental impacts of SLR associated with PBN. Further, and as stated in Section 2.1, NEPB does not anticipate any SLR-related refurbishment. Because no new and significant information has been identified, the analyses and findings regarding this issue in the GEIS (NUREG-1437, Revision 1) are adopted and incorporated herein by reference, and no further analysis is required.

4.5 Water Resources

The following sections address Category 2 issues. The Category 1 issues of this resource area are listed in Table 4.0-2. The Category 1 issues were reviewed for new and significant information. As a result of this review, NEPB is aware of no new and significant information regarding the environmental impacts of SLR associated with PBN. Further, and as stated in Section 2.1, NEPB does not anticipate any SLR-related refurbishment. Because no new and significant information has been identified, the analyses and findings regarding these issues in the GEIS (NUREG-1437, Revision 1) are adopted and incorporated herein by reference, and no further analysis is required.

4.5.1 Surface Water Use Conflicts (Plants with Cooling Ponds or Cooling Towers Using Makeup Water from a River)

4.5.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL or MODERATE. Impacts could be of small or moderate significance, depending on makeup water requirements, water availability, and competing water demands.

4.5.1.2 Requirement [10 CFR 51.53(c)(3)(ii)(A)]

If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river, an assessment of the impact of the proposed action on water availability and competing water demands, the flow of the river . . . must be provided.

4.5.1.3 Background [GEIS Section 4.5.1.1]

Nuclear power plant cooling systems may compete with other users relying on surface water resources, including downstream municipal, agricultural, or industrial users. Closed-cycle cooling is not completely closed, because the system discharges blowdown water to a surface water body and withdraws water for makeup of both the consumptive water loss due to evaporation and drift (for cooling towers) and blowdown discharge. For plants using cooling towers, the makeup water needed to replenish the consumptive loss of water to evaporation can be significant and is reported at 60 percent or more of the condenser flow rate. Cooling ponds will also require makeup water as a result of naturally occurring evaporation, evaporation of the warm effluent, and possible seepage to groundwater.

Consumptive use by plants with cooling ponds or cooling towers using makeup water from a river during the license renewal term is not expected to change unless power uprates, with associated increases in water use, are proposed. Such uprates would require an environmental assessment by the NRC. In the 1996 GEIS, application of this issue applied only to rivers with low flow to define the difference between plants located on "small" versus "large" rivers. However, any river, regardless of size, can experience low flow conditions of varying severity during periods of drought and changing conditions in the affected watershed such as upstream diversions and use of river water. The NRC subsequently determined that use of the term "low flow" in categorizing river flow is of little value, considering that all rivers can experience low flow conditions.

Population growth around nuclear power plants has increased demand on municipal water systems, including systems that rely on surface water. Municipal intakes located downstream from a nuclear power plant could experience water shortages, especially in times of drought. Similarly, water demands upstream from a plant could impact the water availability at the plant's intake.

Water use conflicts associated with plants with cooling ponds or cooling towers using makeup water from a river with low flow were considered to vary among sites because of differing site-specific factors, such as makeup water requirements, water availability (especially in terms of varying river flow rates), changing or anticipated changes in population distributions, or changes in agricultural or industrial demands.

4.5.1.4 Analysis

As discussed in Section 2.2.3, PBN utilizes a once-through cooling system and does not utilize cooling ponds or cooling towers. Therefore, this issue is not applicable and further analysis is not required.

4.5.2 Groundwater Use Conflicts (Plants with Closed-Cycle Cooling Systems that Withdraw Makeup Water from a River)

4.5.2.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Water use conflicts could result from water withdrawals from rivers during low-flow conditions, which may affect aquifer recharge. The significance of impacts would depend on makeup water requirements, water availability, and competing water demands.

4.5.2.2 Requirement [10 CFR 51.53(c)(3)(ii)(A)]

If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river, an assessment of the impact of the proposed action on water availability and competing water demands . . . must be provided. The applicant shall also provide an assessment of the impacts of the withdrawal of water from the river on alluvial aquifers during low flow.

4.5.2.3 Background [GEIS Section 4.5.1.2]

In the case of plants with cooling towers or cooling ponds that rely on a river for makeup of consumed (evaporated) cooling water, it is possible water withdrawals from the river could lead to groundwater use conflicts with other users. This situation could occur because of the interaction between groundwater and surface water, especially in the setting of an alluvial aquifer in a river valley. Consumptive use of the river water, if significant enough to lower the river's water level, would also influence water levels in the alluvial aquifer. Shallow wells of nearby groundwater users could therefore have reduced water availability or go dry. During times of drought, the effect would occur naturally, although withdrawals for makeup water would increase the effect.

4.5.2.4 Analysis

As discussed in Section 2.2.3, PBN utilizes a once-through cooling system and does not utilize a closed-cycle cooling system. Therefore, this issue is not applicable and further analysis is not required.

4.5.3 Groundwater Use Conflicts (Plants that Withdraw more than 100 GPM)

4.5.3.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Plants that withdraw more than 100 gpm could cause groundwater use conflicts with nearby groundwater users.

4.5.3.2 Requirement [10 CFR 51.53(c)(3)(ii)(C)]

If the applicant's plant pumps more than 100 gallons (total onsite) of groundwater per minute, an assessment of the impact of the proposed action on groundwater must be provided.

4.5.3.3 Background [GEIS Section 4.5.1.2]

A nuclear plant may have several wells with combined pumping in excess of 100 gpm (378 liters per minute [L/min]). Overall site pumping rates of this magnitude have the potential to create conflicts with other local groundwater users if the cone of depression extends to the offsite well(s). Large offsite pumping rates for municipal, industrial, or agricultural purposes may, in turn, lower the water level at power plant wells. For any user, allocation is normally determined through a state-issued permit.

Groundwater use conflicts have not been observed at any nuclear power plants, and no significant change in water well systems is expected over the license renewal term. If a conflict did occur, it might be possible to resolve it if the power plant relocated its well or wellfield to a different part of the property. The siting of new wells would be determined through a hydrogeologic assessment.

4.5.3.4 Analysis

As discussed in Section 3.6.3.2, there are five potable groundwater supply wells installed on the PBN property. The average withdrawal rate for these five active domestic supply wells (Site Well Nos. 001, 003, 004, 005, & 006) was reported by PBN as 10,205.34 gpd (7.1 gpm) in 2019 and averaged 12,542.09 gpd (8.71 gpm) between 2015 and 2019.

It is not anticipated that groundwater withdrawal increases above the reported quantities will be required during the proposed SLR operating term; therefore, this issue is not applicable and further analysis is not required.

4.5.4 Groundwater Quality Degradation (Plants with Cooling Ponds at Inland Sites)

4.5.4.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Inland sites with closed-cycle cooling ponds could degrade groundwater quality. The significance of the impact would depend on cooling pond water quality, site hydrogeologic conditions (including the interaction of surface water and groundwater), and the location, depth, and pump rate of water wells.

4.5.4.2 Requirement [10 CFR 51.53(c)(3)(ii)(D)]

If the applicant's plant is located at an inland site and utilizes cooling ponds, an assessment of the impact of the proposed action on groundwater quality must be provided.

4.5.4.3 Background [GEIS Section 4.5.1.2]

Some nuclear power plants that rely on unlined cooling ponds are located at inland sites surrounded by farmland or forest or undeveloped open land. Degraded groundwater has the potential to flow radially from the ponds and reach offsite groundwater wells. The degree to which this occurs depends on the water quality of the cooling pond; site hydrogeologic conditions (including the interaction of surface water and groundwater); and the location, depth, and pump rate of water wells. Mitigation of significant problems stemming from this issue could include lining existing ponds, constructing new lined ponds, or installing subsurface flow barrier walls. Groundwater monitoring networks would be necessary to detect and evaluate groundwater quality degradation. The degradation of groundwater quality associated with cooling ponds has not been reported for any inland nuclear plant sites.

4.5.4.4 Analysis

As discussed in Section 2.2.3, PBN utilizes a once-through cooling system and does not utilize cooling ponds. Therefore, this issue is not applicable and further analysis is not required.

4.5.5 Radionuclides Released to Groundwater

4.5.5.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL or MODERATE. Leaks of radioactive liquids from plant components and pipes have occurred at numerous plants. Groundwater protection programs have been established at all operating nuclear power plants to minimize the potential impact from any inadvertent releases. The magnitude of impacts would depend on site-specific characteristics.

4.5.5.2 Requirement [10 CFR 51.53(c)(3)(ii)(P)]

An applicant shall assess the impact of any documented inadvertent releases of radionuclides into groundwater. The applicant shall include in its assessment a description of any groundwater protection program used for the surveillance of piping and components containing radioactive liquids for which a pathway to groundwater may exist. The assessment must also include a description of any past inadvertent releases and the projected impact to the environment (e.g., aquifers, rivers, lakes, ponds, ocean) during the license renewal term.

4.5.5.3 Background [GEIS Section 4.5.1.2]

The issue is relevant to license renewal because all commercial nuclear power plants routinely release radioactive gaseous and liquid materials into the environment. These radioactive releases are designed to be planned, monitored, documented, and released into the environment at designated discharge points. But over the years, there have been numerous events at nuclear power reactor sites which involved unknown, uncontrolled, and unmonitored releases of liquids containing radioactive material into the groundwater.

The majority of the inadvertent liquid release events involved tritium, a radioactive isotope of hydrogen. However, other radioactive isotopes, such as cesium and strontium, have also been inadvertently released into the groundwater. The types of events include leakage from spent fuel pools, buried piping, and failed pressure relief valves on an effluent discharge line.

In 2006, the NRC's executive director for operations chartered a task force to conduct a lessons learned review of these incidents. On September 1, 2006, the task force issued its report: *Liquid Radioactive Release Lessons Learned Task Force Report*.

The most significant conclusion dealt with the potential health impacts on the public from the inadvertent releases. Although there were numerous events during which radioactive liquid was released to the groundwater in an unplanned, uncontrolled, and unmonitored fashion, based on the data available, the task force did not identify any instances where public health and safety were adversely impacted.

On the basis of the information and experience with these leaks, the NRC concluded that the impact to groundwater quality from the release of radionuclides could be SMALL or MODERATE, depending on the magnitude of the leak, the radionuclides involved, hydrogeologic factors, the distance to receptors, and the response time of plant personnel in identifying and stopping the leak in a timely fashion.

4.5.5.4 Analysis

A description of the PBN groundwater protection program is presented in Section 3.6.2.4. Table 3.6-3 presents well construction details for the PBN groundwater monitoring wells, while Figure 3.6-6 shows the location of the wells. Table 3.6-5 presents information on 62 registered water wells located within a two-mile band around the PBN property boundary; Figure 3.6-8 shows the location of the wells.

As discussed in Section 3.6.4.2.1, no unplanned liquid or gaseous radioactive releases have occurred at PBN between 2015 and 2019. Tritium has been detected in groundwater monitoring wells in the vicinity of the power block, as discussed in Section 3.6.4.2, but all current measurements are well below the safe drinking water standard. Further, groundwater movement in the area is toward Lake Michigan, where any groundwater migration from the power block would be greatly diluted.

Therefore, since water from plant uses continues to be processed and monitored in compliance with licensing and permitting, NEPB concludes that impacts from radionuclides to groundwater are SMALL and do not warrant additional mitigation measures beyond remaining in accordance with PBN's existing groundwater protection program.

4.6 Ecological Resources

The following sections address Category 2 issues. The Category 1 issues of this resource area are listed in Table 4.0-2. The Category 1 issues were reviewed for new and significant information. As a result of this review, NEPB is aware of no new and significant information regarding the environmental impacts of SLR associated with PBN. Further, and as stated in Section 2.1, NEPB does not anticipate any SLR-related refurbishment. Because no new and significant information has been identified, the analyses and findings regarding these issues in the GEIS (NUREG-1437, Revision 1) are adopted and incorporated herein by reference, and no further analysis is required.

4.6.1 Impingement and Entrainment of Aquatic Organisms (Plants with Once-Through Cooling Systems or Cooling Ponds)

4.6.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, OR LARGE. The impacts of impingement and entrainment are small at many plants, but may be moderate or even large at a few plants with once-through and cooling pond cooling systems, depending on cooling system withdrawal rates and volumes and the aquatic resources at the site.

4.6.1.2 Requirement [10 CFR 51.53(c)(3)(ii)(B)]

If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of current CWA 316(b) determinations or equivalent state permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from impingement and entrainment.

4.6.1.3 Background [GEIS Section 4.6.1.2]

Impingement occurs when organisms are held against the intake screen or netting placed within intake canals. Most impingement involves fish and shellfish. At some nuclear power plants, other vertebrate species may also be impinged on the traveling screens or on intake netting placed within intake canals.

Entrainment occurs when organisms pass through the intake screens and travel through the condenser cooling system. Aquatic organisms typically entrained include ichthyoplankton (fish eggs and larvae), larval stages of shellfish and other macroinvertebrates, zooplankton, and phytoplankton. Juveniles and adults of some species may also be entrained if they are small enough to pass through the intake screen openings, which are commonly 0.38 inches at the widest point.

The magnitude of the impact would depend on plant-specific characteristics of the cooling system (including location, intake velocities, screening techniques, and withdrawal rates) and characteristics of the aquatic resource (including population distribution, status, management objectives, and life history).

4.6.1.4 Analysis

The two nuclear power generating units at PBN use a once-through cooling water system. Cooling water for both units is withdrawn from Lake Michigan. Lake water enters the system from two 14-foot-diameter pipes beneath the lakebed. The intake structure is a cylinder of steel pilings filled with limestone blocks. A trash rack covers the top of the intake structure. Bar gates and traveling screens with 3/8-square-inch mesh are located in the forebay to prevent debris and fish from entering the condensers.

As presented in Section 3.7.7 and discussed below, impingement and entrainment have been studied in detail from 1975–1976 and in 2006 and 2017. The WPDES permit represents the interim best technology available (BTA) for the 316(b) determination. The current permit expires in 2021 and a renewal application will be submitted by PBN in a timely manner (WDNR 2012a). Biweekly sampling was conducted from April through September in 2006 and 2017, with samples collected from the intake forebay at the mid-water column. The water in the forebay is well mixed; therefore, additional sampling at various depths was not required (NEE 2018a).

Starting in 1973, the USGS Great Lakes Science Center conducts yearly fish trawls in Lake Michigan. Two trawl locations buffer the PBN site, with Sturgeon Bay to the north and Port Washington to the south. The overall density of fish species captured between 2006 and 2016 remained unchanged. The number of species per hectare did change for several species between 2006 and 2016. Ninespine stickleback (*Pungitius pungitius*), deepwater sculpin (*Myoxocephalus thompsonii*), slimy sculpin (*Cottus cognatus*), alewife (*Alosa pseudoharengus*), yellow perch (*Perca flavescens*), lake whitefish (*Coregonus clupeaformis*), lake trout (*Salvelinus namaycush*), burbot (*Lota lota*), and rainbow smelt (*Osmerus mordax*) populations all decreased while bloater (*Coregonus hoyi*) and round goby (*Neogobius melanostomus*) populations increased. Rainbow smelt and alewife densities were lower in the 2006–2016 data than in historical counts. The largest increase was from the invasive round goby, which changed from 9.51 individuals per hectare in 2006 to 875.06 individuals per hectare in 2016. The most abundant species captured in the trawls were ninespine stickleback, deepwater sculpin, and bloater. Deepwater sculpin habitat is not located near the intake structure and therefore they are not likely to be impinged or entrained (NEE 2018a).

The entrainment study in 2006 resulted in a collection of 127 ichthyoplankton specimens that represented 15 taxa and five life stages (egg, yolk-sac, post yolk-sac, larvae, and juveniles) (NEE 2018a). Rainbow smelt at all life stages accounted for 62.2 percent of the total entrainment sample, followed by alewife at 18.1 percent. The 2006 study allowed PBN to determine baseline calculations. The estimate for the total number of ichthyoplankton entrained was 10.7 million fish eggs and larvae, of which 83.4 percent was composed of alewife and rainbow smelt. Game and food fish, except for yellow perch, accounted for 4 percent of the estimated baseline. The 2006 entrainment estimate was 60 percent higher than the 1975 estimate. This was due to the fact that there was a significant increase in rainbow smelt classified as juveniles, while they were classified as larvae in 1975. The number of alewife eggs entrained in 2006 was 50 percent lower than the 1975 estimate.

The impingement study performed in 2006 identified 40 fish species and one crayfish species. Alewife composed over 99 percent of impinged species and almost 93 percent of the total biomass. Alewife were followed in percentage and biomass by rainbow smelt, spottail shiner (*Notropis hudsonius*), and gizzard shad (*Dorosoma cepedianum*). Other species where more than 100 individuals were in the sample included the following: mottled sculpin (*Cottus bairdii*), yellow perch, ninespine stickleback, threespine stickleback (*Gasterosteus aculeatus*), white sucker (*Catostomus commersonii*), slimy sculpin, and bloater. Compared to the 1975–1976 study, there were more alewife and fewer rainbow smelt in the 2006 study. Also, the 2006 study saw increases in spottail shiner and yellow perch impingement and decreases for slimy sculpin. Although the number of alewives impinged was substantially larger in 2006 (1,595,015 individuals) compared to 1975 (265,644 individuals), the biomass was lower. The impingement baseline calculation estimated impingement of 8.7 million fish and crayfish weighing 32,086 kg. Alewife composed 99.3 percent of the estimate. Trout (*Salmonidae* spp.), salmon (*Salmonidae* spp.), and other game or food fish composed < 0.1 percent of the estimate. The 2006 study estimate of impingement was eight times higher than the 1975 estimate due to the increase in alewife. Hypotheses for the increase in alewife impingement, while the overall Lake Michigan alewife population has declined, are patchy distribution of alewife in the lake, local die-off, prevailing wind direction, and malfunction of the acoustic deterrent system during the 2006 study. The impingement and entrainment baseline calculations represent actual conditions at PBN that do not meet the EPA's definition of baseline intake because the EPA determined its estimate based on facilities with intake structures oriented parallel to the shoreline near the surface of the water body, which is different than the intake system at PBN (EA Engineering 2007).

The 2017 entrainment study resulted in the collection of 72 ichthyoplankton specimens representing six taxa and six life stages (egg, yolk-sac, post yolk-sac, larvae, juveniles, and adults). Alewife, burbot, and rainbow smelt composed 70 percent of the entrainment samples. Compared to the 2006 study, the 2017 study had a larger proportion of burbot and a smaller proportion of alewife. Larvae, post yolk-sac larvae, and yolk-sac larvae were the life stages most commonly entrained (83 percent). The number of shellfish was similar during both studies; however, the native amphipods, *Diporeia* and *Mysis* species, have been replaced by invasive ones, *Echinogammarus ischnus* and *Hemimysis anomala*. Between the 2006 and 2017 studies, both alewife and rainbow smelt remained the dominant entrained taxa. One difference was that during the 2006 study, juveniles and eggs were the life stages more likely to be entrained, while in the 2017 study it was larvae, yolk-sac, and post-yolk sac larvae that were more likely to be entrained. Alewife entrainment also decreased by 67 percent compared to the 2006 study, which mirrors the population decline throughout Lake Michigan for this species (NEE 2018a).

The intake system was re-designed after cormorant (*Phalacrocorax* spp.) impingement became a problem and caused plant outages in the early 2000s. The warm water around the intake increased alewife presence, which attracted the cormorants to the intake structure. The intake crib was moved 11.5 feet below the lake surface in 2001. At the same time, an acoustic deterrent system was installed to deter alewife from swimming near the intake structure

The PBN facility has operated under a number of WPDES permits and has been withdrawing once-through, non-contact cooling water without any identified problems after the cormorant issue forced a re-design. Ongoing studies performed at PBN will ensure that PBN continues to utilize the best technology available to minimize entrainment and impingement to the fullest extent practicable to maintain compliance with the WPDES permit. NEPB concludes that impacts from impingement and entrainment of aquatic organisms during the proposed operating term would be SMALL. Adherence to the 316(b) rule (79 FR 48300) and Wisconsin legislation (Ch. NR 111), combined with continued compliance to permit regulation with BTA and ongoing studies to identify any potential concerns, will minimize the already existing SMALL impacts.

4.6.2 Thermal Impacts on Aquatic Organisms (Plants with Once-Through Cooling Systems or Cooling Ponds)

4.6.2.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Most of the effects associated with thermal discharges are localized and not expected to affect overall stability of populations or resources. The magnitude of impacts, however, would depend on site-specific thermal plume characteristics and the nature of aquatic resources in the area.

4.6.2.2 Requirement [10 CFR 51.53(c)(3)(ii)(B)]

If the applicant's plant utilizes once-through cooling or cooling pond heat dissipation systems, the applicant shall provide a copy of a 316(a) variance in accordance with 40 CFR Part 125, or equivalent state permits and supporting documentation. If the applicant cannot provide these documents, it shall assess the impact of the proposed action on fish and shellfish resources resulting from thermal changes.

4.6.2.3 Background [GEIS Section 4.6.1.2]

Because characteristics of both the thermal discharges and the affected aquatic resources are specific to each site, NRC classified heat shock as a Category 2 issues that required a site-specific assessment for license renewal. The NRC found the potential for thermal discharge impacts to be greatest at plants with once-through cooling systems, primarily because of the higher discharge temperatures and larger thermal plume area compared to plants with cooling towers.

The impact level at any plant depends on the characteristics of its cooling system (including location and type of discharge structure, discharge velocity and volume, and three-dimensional characteristics of the thermal plume) and characteristics of the affected aquatic resources (including the species present and their physiology, habitat, population distribution, status, management objectives, and life history).

4.6.2.4 Analysis

Section 316(a) of the CWA establishes a process whereby a thermal effluent discharger can demonstrate that thermal discharge limitations are more stringent than necessary and, using a variance, obtain alternative facility-specific thermal discharge limits [33 USC 1326]. The thermal limit associated with the PBN WPDES permit is 8,273 MBtu/hour. The 316(a) determination under the WPDES permit (Attachment B) defines thermal effluent discharge limits that PBN adheres to in order to reduce impacts on aquatic organisms. The current permit expires in 2021 and a renewal application will be submitted by PBN in a timely manner (WDNR 2012a).

As discussed in Section 2.2.3, PBN has a once-through heat dissipation system. PBN withdraws cooling water from Lake Michigan at a peak rate of about 1,080 MGD for both units. The cooling water is discharged via outfall approximately 200 ft from the shoreline. During the winter months (mid-December through March) the circulating water flow is reduced to about 619.2 MGD (AKRF 2009). Studies on the effects of thermal plumes on the aquatic ecological environment were conducted in 1972–1973 and 2004–2008 (EA Engineering 2008).

The WDNR determined in 1976 that no appreciable harm had occurred to the aquatic community as a result of plant operations. This was based on the 1972–1973 study that determined the original thermal plume did not cause prior appreciable harm to the aquatic community and associated species. The 2004–2008 study modeled temperature increases for potential plant upgrades and determined that the plume predicted area, volume, and behavior will not be substantially different from previous conditions (EA Engineering 2008).

The plume remains near the surface of the water for most of the year, except the winter when it sinks deeper below the surface. Changes in species richness and abundance near the discharge area are representative of the changes throughout Lake Michigan. Fish and shellfish can move in and out of the thermal plume depending on their thermal requirements and tolerances. Warm-water fish species will not be at risk from the thermal plume. Cool and cold water fish would have their upper lethal temperatures exceeded in parts of the plume potentially during the summer, but as they usually do not come to the warmer water near the shore, they are not likely to encounter the plume at all. Additionally, thermal studies conducted at other nuclear plants with similar pumping capacities have also determined that aquatic communities near their discharge areas have been protected (EA Engineering 2008).

The operation of PBN appears to have little long-term impact on the aquatic community of Lake Michigan. The thermal discharge associated with the PBN outflow has been demonstrated to be protective of the Lake Michigan aquatic community. PBN is operating in conformance with its WPDES permit and will submit a renewal application at the end of 2020; therefore, it remains in compliance with CWA requirements. Because there are no planned operational changes during the proposed SLR operating term that would increase the temperature of PBN's existing thermal discharge, impacts are anticipated to be SMALL and mitigation measures are not warranted.

4.6.3 Water Use Conflicts with Aquatic Resources (Plant with Cooling Ponds or Cooling Towers Using Makeup Water from a River)

4.6.3.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL or MODERATE. Impacts on aquatic resources in stream communities affected by water use conflicts could be of moderate significance in some situations.

4.6.3.2 Requirement [10 CFR 51.53(c)(3)(ii)(A)]

If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river, an assessment of the impact of the proposed action on water availability and competing water demands, the flow of the river, and related impacts on stream (aquatic)…ecological communities must be provided.

4.6.3.3 Background [GEIS 4.6.1.2]

Increased temperatures and/or decreased rainfall would result in lower river flows, increased cooling pond evaporation, and lowered water levels in the Great Lakes or reservoirs. Regardless of overall climate change, droughts could result in problems with water supplies and allocations. Because future agricultural, municipal, and industrial users would continue to share their demands for surface water with power plants, conflicts might arise if the availability of this resource decreased.

Water use conflicts with aquatic resources could occur when water to support these resources is diminished either because of decreased water availability due to droughts; increased demand for agricultural, municipal, or industrial usage; or a combination of such factors. Water use conflicts with biological resources in stream communities are a concern due to the duration of license renewal and potentially increasing demands on surface water.

4.6.3.4 Analysis

As discussed in Section 2.2.3, PBN utilizes a once-through cooling system and does not utilize cooling ponds or cooling towers. Therefore, this issue is not applicable, and further analysis is not required.

4.6.4 Water Use Conflicts with Terrestrial Resources (Plants with Cooling Ponds or Cooling Towers Using Makeup Water from a River)

4.6.4.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL or MODERATE. Impacts on terrestrial resources in riparian communities affected by water use conflicts could be of moderate significance.

4.6.4.2 Requirement 10 [10 CFR 51.53(c)(3)(ii)(A)]

If the applicant's plant utilizes cooling towers or cooling ponds and withdraws makeup water from a river, an assessment of the impact of the proposed action of water availability and competing water demands, the flow of the river, and related impacts on riparian (terrestrial) ecological communities must be provided.

4.6.4.3 Background [GEIS Section 4.6.1.1]

Water use conflicts with terrestrial resources in riparian communities could occur when water that supports these resources is diminished either because of decreased availability due to droughts; increased water demand for agricultural, municipal, or industrial usage; or a combination of such factors. For future license renewals, the potential range of impact levels at plants with cooling ponds or cooling towers using makeup water from a river cannot be determined at this time.

4.6.4.4 Analysis

As discussed in Section 2.2.3, PBN utilizes a once-through cooling system and does not utilize cooling ponds or cooling towers. Therefore, this issue is not applicable and further analysis is not required.

4.6.5 Effects on Terrestrial Resources (Non-Cooling System Impacts)

4.6.5.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Impacts resulting from continued operations and refurbishment associated with license renewal may affect terrestrial communities. Applications of BMPs would reduce the potential for impacts. The magnitude of impacts would depend on the nature of the activity, the status of the resources that could be affected, and the effectiveness of mitigation.

4.6.5.2 Requirement [10 CFR 51.53(c)(3)(ii)(E)]

All license renewal applicants shall assess the impact of refurbishment, continued operations, and other license renewal-related construction activities on important plant and animal habitats.

4.6.5.3 Background [GEIS Section 4.6.1.1]

Continued operations and refurbishment activities could continue to affect onsite terrestrial resources during the license renewal term at all operating nuclear power plants. Factors that could potentially result in impacts include landscape maintenance activities, stormwater management, and elevated noise levels. These impacts would be similar to past and ongoing impacts.

The characteristics of terrestrial habitats and wildlife communities currently on nuclear powerplant sites have generally developed in response to many years of typical operations and maintenance programs. While some may have reached a relatively stable condition, some habitats and populations of some species may have continued to change gradually over time.

Operations and maintenance activities during the license renewal term are expected to be similar to current activities. Because the species and habitats present on the site (i.e., weedy species and habitats they make up) are generally tolerant of disturbance, it is expected that continued operations during the license renewal term would maintain these habitats and wildlife communities in their current state or maintain current trends of change.

Terrestrial habitats and wildlife could be affected by ground disturbance from refurbishment-related construction activities. Land disturbed during the construction of new ISFSIs would range from about 2.5–10 acres. Other activities may include new parking areas for plant employees, access roads, buildings, and facilities. Temporary project support areas for equipment storage, worker parking, and material laydown areas could also result in the disturbance of habitat and wildlife.

Successful application of environmental review procedures, employed by the licensees at many of the operating nuclear plant sites, would result in the identification and avoidance of important terrestrial habitats. In addition, the application of BMPs to minimize the area affected; to control fugitive dust, runoff and erosion from project sites; to reduce the spread of invasive nonnative plant species; and to reduce wildlife disturbance in adjacent habitats, could greatly reduce the impacts of continued operations and refurbishment activities.

4.6.5.4 Analysis

4.6.5.4.1 Refurbishment Activities

As discussed in Section 2.3, no SLR-related refurbishment activities have been identified. Therefore, there would be no SLR-related refurbishment impacts to important plant and animal habitats, and no further analysis is required.

4.6.5.4.2 Operational Activities

Terrestrial resources are described in Section 3.7.2. No SLR-related construction activities or changes in operational practices have been identified that would involve disturbing habitats. NEPB would continue to conduct ongoing plant operational and maintenance activities during the proposed SLR operating term. However, these activities are anticipated to occur within previously disturbed habitats.

Operational and maintenance activities that NEPB might undertake during the renewal term, such as maintenance and repair of plant infrastructure (e.g., roadways, piping installations, fencing, and other security infrastructure), would likely be confined to previously disturbed areas of the site. Furthermore, as discussed in Section 9.6, NEPB has administrative controls in place at PBN to ensure that operational changes or construction activities are reviewed, and the impacts minimized through implementation of BMPs, permit modifications, or acquisition of new permits as needed. In addition, regulatory programs that the site is currently subject to, such as stormwater management, spill prevention, dredging, and herbicide use, further serve to minimize impacts on terrestrial resources.

In summary, adequate management programs and regulatory controls are in place to ensure that important plant and animal habitats are protected during the proposed SLR operating term for PBN. Therefore, NEPB concludes the impacts to the terrestrial ecosystems from the proposed SLR are SMALL and no additional mitigation measures beyond current management programs and existing regulatory controls are required.

4.6.6 Threatened, Endangered, and Protected Species, and Essential Fish Habitat

4.6.6.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

The magnitude of impacts on threatened, endangered, and protected species, critical habitat, and EFH would depend on the occurrence of listed species and habitats and the effects of power plant systems on them. Consultation with appropriate agencies would be needed to determine whether status species or habitats are present and whether they would be adversely affected by continued operations and refurbishment associated with license renewal.

4.6.6.2 Requirement [10 CFR 51.53(c)(3)(ii)(E)]

All license renewal applicants shall assess the impact of refurbishment, continued operations, and other license renewal-related construction activities on important plant and animal habitats. Additionally, the applicant shall assess the impact of the proposed action on threatened and endangered species in accordance with federal laws protecting wildlife, including but not limited to, the ESA, and EFH in accordance with the Magnuson-Stevens Fishery Conservation and Management Act.

4.6.6.3 Background [GEIS Section 4.6.1.3]

There are several federal acts that provide protection to certain species and habitats that are treated here under a single issue. The issue includes impacts to biological resources such as threatened and endangered species and their critical habitat under the ESA, EFH as protected under the Magnuson-Stevens Fishery Conservation and Management Act, and impacts to mammalian species protected under the Marine Mammal Protection Act.

Factors that could potentially result in impacts on listed terrestrial species include habitat disturbance, cooling tower drift, operation and maintenance of cooling systems, transmission line ROW maintenance, collisions with cooling towers and transmission lines, and exposure to radionuclides. The listed species on or in the vicinity of nuclear power plants also range widely, depending on numerous factors such as the plant location and habitat types present.

Potential impacts of continued operations and refurbishment activities on federally or state-listed threatened and endangered species, protected marine mammals, and EFH could occur during the license renewal term. Factors that could potentially result in impacts to these species and habitats include impacts of refurbishment, other ground-disturbing activities, release of contaminants, effects of cooling water discharge on dissolved oxygen, gas supersaturation, eutrophication, thermal discharges, entrainment, impingement, reduction in water levels due to the cooling system operations, dredging, radionuclides, and transmission line ROW maintenance.

4.6.6.4 Analysis

4.6.6.4.1 Refurbishment Activities

As discussed in Section 2.3, no SLR-related refurbishment activities have been identified. Therefore, there would be no SLR-related refurbishment impacts to threatened, endangered, and protected species, or EFH (which is not present in the Great Lakes), and no further analysis is required.

4.6.6.4.2 Operational Activities

As discussed in Section 3.7.8.1, there are seven federally protected species under the BGEPA or the ESA in Manitowoc and Kewaunee counties. In addition, as discussed in Section 3.7.8.2, the WDNR and WNHI have designated 33 plant, animal, and insect species that do not have a federal listing status, but are state-listed as threatened or endangered.

Of the seven federally protected species under the BGEPA and the ESA, six are known to occur in Manitowoc County: the red knot, the piping plover, the rusty patched bumble bee, Pitcher's thistle, the northern long-eared bat, and the bald eagle. Hine's emerald dragonflies, northern-long eared bats, and bald eagles are known to occur in Kewaunee County. As discussed in Section 3.7.8.1, preferred habitat for rusty patched bumble bees and Hine's emerald dragonflies does not occur on the PBN site. Although no critical habitat exists onsite, potential habitat for the red knot, the piping plover, the northern long-eared bat, the bald eagle, and Pitcher's thistles does occur on or immediately adjacent to the PBN site.

The bald eagle is known to nest on or near the PBN site. The beach habitat on the PBN site provides preferred habitat for nesting piping plovers and migrating red knots. Activities on the PBN site are evaluated to ensure compliance under the BGEPA and MBTA. When necessary, consultation with responsible agencies is conducted to maintain compliance with existing regulations. There are currently no MBTA or BGEPA permits associated with onsite PBN operations or in-scope transmission lines. If any work is conducted that could potentially affect bald eagles, the appropriate agencies would be consulted, work would remain farther than 660' from a known nest, and/or any required permits would be obtained. Compliance with all regulatory requirements associated with these species will continue to be an administrative control practiced by NEPB for the life of the PBN facility. Adherence to these controls, as well as compliance with laws and regulations, will minimize impacts to bald eagles, red knots, and piping plovers. The continued operation of PBN is not likely to adversely affect these species.

There is potential roosting habitat for the northern long-eared bat on the PBN site and there are documented hibernacula in Manitowoc County, however, there are no known occurrences of this species within one mile of the PBN site. Actions requiring removal of trees by NEPB would require adherence to the USFWS 4(d) rule which sets guidelines for incidental take, and consultation with federal wildlife agencies to ensure that no impacts to this species occur from any future activities. Additionally, any tree clearing would occur between October 10 and March 31, if possible, to limit loss of roost trees during summer months when they have the possibility of being occupied by northern long-eared bats. NEPB's compliance with federal, state, and local laws and regulations will minimize the impacts to this species. Continued operations of the PBN facility are not likely to affect this species.

Pitcher's thistles may occur near the PBN site. Occurrences of this species would be restricted to dunes, secondary dunes, and beaches along Lake Michigan and are not likely to occur on portions of the PBN site utilized for plant operations. Continued operation of the PBN facility is not likely to affect this species.

As discussed in Section 3.7.8.2, optimal habitat for the following state listed species is not located within the portions of the PBN site utilized for operations: redfin shiners, longear sunfish, pugnose shiners, slippershell mussels, monkeyface mussels, ellipse mussels, Midwest Pleistocene vertigos, cherrystone drops, fairyslipper orchids, forked asters, harbinger-of-spring, shore buttercup, and sticky tofieldia. Occurrences of these species within these areas would be incidental. Due to the lack of available habitat, and the unlikely probability of these species to occur on the PBN site, the continued operation of PBN is not likely to affect these species.

Habitat for 19 state-listed species is either located on or near the PBN site, or the species are highly mobile and may occur on the site and warrant further discussion. These species are peregrine falcons, black terns, Caspian terns, upland sandpipers, Acadian flycatchers, Henslow's sparrows, cerulean warblers, hooded warblers, tri-colored bats, big brown bats, little brown bats, Blanchard's cricket frogs, hairy-necked tiger beetles, prairie sandreed, shore sedge, thickspike, clustered broomrape, heartleaf willow, and snow trillium.

Migratory movements or local flight patterns might result in the occurrence of peregrine falcons, red-shouldered hawks, black terns, Caspian terns, upland sandpipers, Acadian flycatchers, Henslow's sparrows, cerulean warblers, and hooded warblers on the PBN site. Habitat for these species may be located on portions of the PBN site not utilized for operations. However, activities on the PBN site are evaluated to ensure compliance under the MBTA. When necessary, consultation with responsible agencies is conducted to maintain compliance with existing regulations. Compliance with all regulatory requirements associated with these species will continue to be an administrative control practiced by NEPB for the life of the PBN facility. Adherence to these controls, as well as compliance with laws and regulations, will minimize impacts to these species. The continued operation of PBN is not likely to adversely affect these species.

Roosting habitat for tri-colored, big brown, and little brown bats may be located on portions of the PBN site not utilized for operations and there are documented hibernacula in Manitowoc County. However, continued operations of PBN are not likely to impact bat species utilizing these areas. NEPB's compliance with federal, state, and local laws and regulations will minimize impacts to these species should tree clearing occur on the PBN property. Continued operations of the PBN facility are not likely to affect these species.

Substandard habitat for Blanchard's cricket frogs, hairy-necked tiger beetles, prairie sandreed, shore sedge, thickspike, clustered broomrape, sand dune willow, and snow trillium may be located on portions of the PBN site not utilized for operations. Compliance with all regulatory requirements associated with these species will continue to be an administrative control practiced by NEPB for the life of the PBN facility. Adherence to these controls, as well as compliance with laws and regulations, will minimize impacts to these species. The continued operation of PBN is not likely to adversely affect these species.

NEPB is not aware of any adverse impacts regarding threatened, endangered, and protected species attributable to the site. Maintenance activities necessary to support SLR likely would be limited to previously disturbed areas onsite, and no additional land disturbance has been identified for the purpose of the SLR. Operational noise may displace some individuals; however, their occurrence within suitable habitats onsite or nearby indicates that most adapt to increased noise and activity. In addition, there are no plans to alter plant operations during the proposed SLR operating term which would affect threatened, endangered, and protected species.

As discussed in Section 3.7.8.5, no EFH exists at Lake Michigan and no HAPCs or EFH areas protected from fishing are located on or adjacent to PBN. No EFH exists within any enclosed freshwater habitat, including the Great Lakes. Therefore, PBN operations have no impact on EFH.

As discussed in Section 9.6, NEPB has administrative controls in place at PBN to ensure that operational changes or construction activities are reviewed, and the impacts minimized through implementation of BMPs. In addition, regulatory programs that the site is subject to, such as those presented in Chapter 9, further serve to minimize impacts to any threatened, endangered, and protected species. In an effort to obtain an independent review, letters requesting consultation have been submitted to the USFWS, WDNR, WNHI, and the National Marine Fisheries Service (NMFS). Responses to these requests have not yet been received. Copies of the consultation letters to the USFWS, WDNR, WNHI, and NMFS are included in Attachment C.

In summary, no SLR-related refurbishment activities have been identified. As discussed above, the continued operation of the site would have NOT LIKELY ADVERSELY AFFECT any federally protected or state-listed species. Therefore, NEPB concludes that impacts from the proposed SLR are not likely to affect threatened, endangered, and protected species in the vicinity of PBN and mitigation measures beyond NEPB's current management programs and existing regulatory controls are not warranted.

4.7 Historic and Cultural Resources

4.7.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

Continued operations associated with license renewal are expected to have no SLR-related impacts as no refurbishment or construction activities have been identified; administrative procedure ensures protection of historic properties in the event of excavation activities. The NHPA requires the federal agency to consult with the SHPO and appropriate Native American tribes to determine the potential effects on historic properties and mitigation, if necessary.

4.7.2 Requirement [10 CFR 51.53(c)(3)(ii)(K)]

All applicants shall identify any potentially affected historic or archaeological properties and assess whether any of these properties will be affected by future plant operations and any planned refurbishment activities in accordance with the NHPA.

4.7.3 Background [GEIS Section 4.7.1]

The NRC will identify historic and cultural resources within a defined APE. The license renewal APE is the area that may be impacted by ground-disturbing or other operational activities associated with continued plant operations and maintenance during the license renewal term and/or refurbishment. The APE typically encompasses the nuclear power plant site, its immediate environs, including viewshed, and the transmission lines within this scope of review. The APE may extend beyond the nuclear plant site and transmission lines when these activities may affect historic and cultural resources.

Continued operations during the license renewal term and refurbishment activities at a nuclear power plant can affect historic and cultural resources through (1) ground-disturbing activities associated with plant operations and ongoing maintenance (e.g., construction of new parking lots or building), landscaping, agricultural, or other use of plant property; (2) activities associated with transmission line maintenance (e.g., maintenance of access roads or removal of danger trees); and (3) changes to the appearance of nuclear power plants and transmission lines. Licensee renewal environmental reviews have shown that the appearance of nuclear power plants and transmission lines has not changed significantly over time; therefore, additional viewshed impacts to historic and cultural resources are not anticipated.

4.7.4 Analysis

4.7.4.1 Refurbishment Activities

As presented in Section 2.3, no SLR-related refurbishment activities have been identified. Therefore, there would be no SLR-related refurbishment impacts to historic and cultural resources, and no further analysis is required.

4.7.4.2 Operational Activities

As discussed in Section 3.8.5, there have been five previous cultural resources surveys within the 1,260-acre PBN property (Table 3.8-1). There have been an additional 23 cultural resources surveys documented within a 6-mile radius of the PBN property. While there are 14 entries on the ASI, there are no NRHP-eligible cultural resources confirmed within the 1,260-acre PBN property (Table 3.8-2). Additionally, PBN has already committed to avoiding four previously identified sites which have not been recommended ineligible for the NRHP within the 1,260-acre property. (AVD 2004) The PBN power plant is the only structure within the PBN property listed in the AHI. It is listed as an "astylistic utilitarian building," but has not been considered for NRHP status (Table 3.8-4). Inclusion in the AHI conveys no special status such as NRHP designation, nor any rights or benefits for owners of these properties.

As discussed in Section 3.8.6, although no SLR-related ground-disturbing activities have been identified, NEPB has guidance in place for management of cultural resources ahead of any future ground-disturbing activities at the plant. These consist of a historic resources consultation guidance document to protect known cultural resources as well as unknown cultural resources. Established processes address the potential for impact to cultural resources by establishing procedures for all activities requiring a federal permit or using federal funding that have the potential to impact historic resources. Therefore, NO ADVERSE EFFECTS are anticipated to these sites during the proposed SLR operating term.

The area within a 6-mile radius of the site is archaeologically sensitive (Table 3.8-3). There is one NRHP-eligible site within 6 miles, site 47-MN-0397, which is located approximately 2.5 miles from PBN. Adverse impacts, however, would only occur to such sites as a result of soil-intrusive activities. Because NEPB has no plans to conduct such soil-intrusive activities at any location outside the property boundary under a renewed license, no historic properties will be affected.

There is conflicting information about NRHP structures near PBN. There are no NRHP-listed aboveground historic properties within a 6-mile radius of the site listed in the WHPD (Table 3.8-4). There are only two potentially NRHP-eligible structures within 6 miles of the PBN property listed in WHPD, with the closest being the Mishicot School at approximately 5.66 miles away. The Rawley Point Light Station, located approximately 5.09 miles from PBN, is not listed in the WHPD, but does appear in other databases as a NRHP structure. Due to the distances and the local terrain, aesthetic and noise impacts to these resources as a result of the continued operations of PBN are not expected; therefore, no historic properties will be affected.

As discussed above, no SLR-related refurbishment or construction activities have been identified. No offsite NRHP-listed historic properties will be adversely impacted as a result of continued operations of PBN, and there are no plans to alter operations, expand existing facilities, or disturb additional land for the purpose of SLR. In addition, administrative procedural controls are in place for management of cultural resources ahead of any future ground-disturbing activities at the plant. Therefore, NEPB concludes that no historic properties will be affected as a result of continued operation of PBN during the proposed PBN operating term, and additional mitigation measures beyond NEPB's existing procedural administrative controls are not warranted.

4.8 Socioeconomics

The following sections address the socioeconomic issues applicable to PBN, providing background on the issues and the analysis identified as pertaining to the proposed SLR operating term.

4.8.1 Employment and Income, Recreation and Tourism

4.8.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Although most nuclear plants have large numbers of employees with higher than average wages and salaries, employment, income, recreation, and tourism impacts from continued operations and refurbishment associated with license renewal are expected to be small.

4.8.1.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.8.1.3 Background [GEIS Section 4.8.1.1]

Employees receive income from the nuclear power plant in the form of wages, salaries, and benefits. Employees and their families, in turn, spend this income on goods and services within the community thereby creating additional opportunities for employment and income. In addition, people and businesses in the community receive income for the goods and services sold to the power plant. Payments for these goods and services create additional employment and income opportunities in the community. The measure of a communities' ability to support the operational demands of a power plant depends on the ability of the community to respond to changing socioeconomic conditions.

Some communities experience seasonal transient population growth due to local tourism and recreational activities. Income from tourism and recreational activities creates employment and income opportunities in the communities around nuclear power plants.

Nevertheless, the effects of nuclear power plant operations on employment, income, recreation, and tourism are ongoing and have become well established during the current license term for all nuclear power plants. The impacts from power plant operations during the license renewal term on employment and income in the region around each nuclear power plant are not expected to change from what is currently being experienced. In addition, tourism and recreational activities in the vicinity of nuclear plants are not expected to change as a result of license renewal.

4.8.1.4 Analysis

This Category 1 issue was reviewed for new and significant information. As a result of this review, NEPB is aware of no new and significant information regarding the environmental impacts of SLR associated with PBN. Further, and as stated in Section 2.1, NEPB does not anticipate any SLR-related refurbishment. Because no new and significant information has been identified, the analyses and findings regarding this issue in the GEIS (NUREG-1437, Revision 1) are adopted and incorporated herein by reference, and no further analysis is required.

4.8.2 Tax Revenues

4.8.2.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Nuclear plants provide tax revenue to local jurisdictions in the form of property tax payments, payments in lieu of tax (PILOT), or tax payments on energy production. The amount of tax revenue paid during the license renewal term as a result of continued operations and refurbishment associated with license renewal is not expected to change.

4.8.2.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.8.2.3 Background [GEIS Section 4.8.1.2]

Nuclear power plants and the workers who operate them are an important source of tax revenue for many local governments and public school systems. Tax revenues from nuclear power plants mostly come from property tax payments or other forms of payments such as payments in lieu of (property) taxes, or PILOT payments, although taxes on energy production have also been collected from a number of nuclear power plants. County and municipal governments and public school districts receive tax revenue either directly or indirectly through state tax and revenue-sharing programs.

Counties and municipal governments in the vicinity of a nuclear power plant also receive tax revenue from sales taxes and fees from the power plant and its employees. Changes in the number of workers and the amount of taxes paid to county, municipal governments, and public schools can affect socioeconomic conditions in the counties and communities around the nuclear power plant.

A review of license renewal applications received by the NRC since the 1996 GEIS has shown that refurbishment activities, such as steam generator and vessel head replacement, have not had a noticeable effect on the assessed value of nuclear plants, thus changes in tax revenues are not anticipated from future refurbishment activities.

The primary impact of license renewal would be the continuation or change in the amount of taxes paid by nuclear power plant owners to local governments and public school systems. The impact of nuclear plant operations on tax revenues in local communities and the impact that the expenditure of tax revenues has on the region are not expected to change appreciably from the amount of taxes paid during the current license term. Tax payments during the license renewal term would be similar to those currently being paid by each nuclear plant.

4.8.2.4 Analysis

This Category 1 issue was reviewed for new and significant information. As a result of this review, NEPB is aware of no new and significant information regarding the environmental impacts of SLR associated with PBN. Further, and as stated in Section 2.1, NEPB does not anticipate any SLR-related refurbishment. Because no new and significant information has been identified, the analyses and findings regarding this issue in the GEIS (NUREG-1437, Revision 1) are adopted and incorporated herein by reference, and no further analysis is required.

4.8.3 Community Services and Education

4.8.3.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Changes resulting from continued operations and refurbishment associated with license renewal to local community and educational services would be small. With little or no change in employment at the licensee's plant, value of the power plant, payments on energy production, and PILOT payments expected during the license renewal term, community and educational services would not be affected by continued power plant operations.

4.8.3.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.8.3.3 Background [GEIS Section 4.8.1.3]

Any changes in the number of workers at a nuclear plant will affect the demand for public services from local communities. Environmental reviews conducted by NRC since the 1996 GEIS have shown, however, that the number of workers at relicensed nuclear plants has not changed significantly because of license renewal, so demand-related impacts on community services, including public utilities, are no longer anticipated from future license renewals.

In addition, refurbishment activities, such as steam generator and vessel head replacement, have not required the large numbers of workers and the months of time that were conservatively analyzed in the 1996 GEIS, so significant impacts on community services are no longer anticipated. Because of the relatively short duration of refurbishment-related activities, workers are not expected to bring families and school-age children with them; therefore, impacts from refurbishment on educational services are also no longer anticipated.

Taxes paid by nuclear power plant owners support a range of community services, including public water, safety, fire protection, health, and judicial, social, and educational services. In some communities, tax revenues from power plants can have a noticeable impact on the quality of services available to local residents. Although many of the community services paid for by tax revenues from power plants are used by plant workers and their families, the impact of nuclear plant operations on the availability and quality of community services and education is SMALL and is not expected to change as a result of license renewal.

4.8.3.4 Analysis

This Category 1 issue was reviewed for new and significant information. As a result of this review, NEPB is aware of no new and significant information regarding the environmental impacts of SLR associated with PBN. Further, and as stated in Section 2.1, NEPB does not anticipate any SLR-related refurbishment. Because no new and significant information has been identified, the analyses and findings regarding this issue in the GEIS (NUREG-1437, Revision 1) are adopted and incorporated herein by reference, and no further analysis is required.

4.8.4 Population and Housing

4.8.4.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Changes resulting from continued operations and refurbishment associated with license renewal to regional population and housing availability and value would be small. With little or no change in employment at the licensee's plant expected during the license renewal term, population and housing availability and values would not be affected by continued power plant operations.

4.8.4.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.8.4.3 Background [GEIS Section 4.8.1.4]

Socioeconomic impact analyses of resources (e.g., housing) affected by changes in regional population are based on employment trends at nuclear power plants. Population growth from increased employment and spending at a nuclear power plant is important because it is one of the main drivers of socioeconomic impacts. As previously discussed, however, employment levels at nuclear power plants are expected to remain relatively constant with little or no population growth or increased demand for permanent housing during the license renewal term. The operational effects on population and housing values and availability in the vicinity of nuclear power plants are not expected to change from what is currently being experienced, and no demand-related impacts are expected during the license renewal term.

The increased number of workers at nuclear power plants during regularly scheduled plant refueling and maintenance outages does create a short-term increase in the demand for temporary (rental) housing units in the region around each plant. However, because of the short duration and the repeated nature of these scheduled outages and the general availability of rental housing units (including portable trailers) in the vicinity of nuclear power plants, employment-related housing impacts have had little or no long-term impact on the price and availability of rental housing. Refurbishment impacts would be similar to what is experienced during routine plant refueling and maintenance outages.

4.8.4.4 Analysis

This Category 1 issue was reviewed for new and significant information. As a result of this review, NEPB is aware of no new and significant information regarding the environmental impacts of SLR associated with PBN. Further, and as stated in Section 2.1, NEPB does not anticipate any SLR-related refurbishment. Because no new and significant information has been identified, the analyses and findings regarding this issue in the GEIS (NUREG-1437, Revision 1) are adopted and incorporated herein by reference, and no further analysis is required.

4.8.5 Transportation

4.8.5.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. Changes resulting from continued operations and refurbishment associated with license renewal to traffic volumes would be small.

4.8.5.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.8.5.3 Background [GEIS Section 4.8.1.5]

Transportation impacts depend on the size of the workforce, the capacity of the local road network, traffic patterns, and the availability of alternate commuting routes to and from the plant. Because most sites have only a single access road, there is often congestion on these roads during shift changes.

Transportation impacts are ongoing and have become well established during the current licensing term for all nuclear power plants. As previously discussed, it is unlikely that the number of permanent operations workers would increase at a nuclear power plant during the license renewal term. In addition, refurbishment activities, such as steam generator and vessel head replacement, have not required the numbers of workers and the months of time conservatively estimated in the 1996 GEIS. Consequently, employment at nuclear power plants during the license renewal term is expected to remain unchanged.

4.8.5.4 Analysis

This Category 1 issue was reviewed for new and significant information. As a result of this review, NEPB is aware of no new and significant information regarding the environmental impacts of SLR associated with PBN. Further, and as stated in Section 2.1, NEPB does not anticipate any SLR-related refurbishment. Because no new and significant information has been identified, the analyses and findings regarding this issue in the GEIS (NUREG-1437, Revision 1) are adopted and incorporated herein by reference, and no further analysis is required.

4.9 Human Health

The following sections address Category 2 issues. The Category 1 issues of this resource area are listed in Table 4.0-2. The Category 1 issues were reviewed for new and significant information. As a result of this review, NEPB is aware of no new and significant information regarding the environmental impacts of SLR associated with PBN. Further, and as stated in Section 2.1, NEPB does not anticipate any SLR-related refurbishment. Because no new and significant information has been identified, the analyses and findings regarding these issues in the GEIS (NUREG-1437, Revision 1) are adopted and incorporated herein by reference, and no further analysis is required.

4.9.1 Microbiological Hazards to the Public (Plants with Cooling Ponds or Canals, or Cooling Towers that Discharge to a River)

4.9.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. These organisms are not expected to be a problem at most operating plants except possibly at plants using cooling ponds, lakes, or canals, or that discharge into rivers. Impacts would depend on site-specific characteristics.

4.9.1.2 Requirement [10 CFR 51.53(c)(3)(ii)(G)]

If the applicant's plant uses a cooling pond, lake, or canal or discharges into a river, an assessment of the impact of the proposed action on public health from thermophilic organisms in the affected water must be provided.

4.9.1.3 Background [GEIS Section 4.9.1.1.3]

N. fowleri, which is the pathogenic strain of the free-living amoebae *Naegleria* spp., appears to be the most likely microorganism that may pose a public health hazard resulting from nuclear power plant operations. Increased populations of *N. fowleri* may have significant adverse impacts.

Since *Naegleria* concentrations in freshwater can be enhanced by thermal effluents, nuclear power plants that use cooling lakes, canals, ponds, or rivers experiencing low-flow conditions may enhance the populations of naturally occurring thermophilic organisms.

Changes in microbial populations and in the public use of water bodies might occur after the OL is issued and the application for license renewal is filed. Other factors could also change, including the average temperature of the water, which could result from climate change that affected water levels and air temperature. Finally, the long-term presence of a power plant might change the natural dynamics of harmful microorganisms within a body of water.

4.9.1.4 Analysis

PBN utilizes Lake Michigan for cooling water intake and discharge. The NRC did not consider this issue applicable to PBN for the license renewal environmental impact statement (EIS) issued in 2005 (NRC 2005, Table F-1). The NRC revisited this issue in the 2013 GEIS; while the GEIS did not specifically exclude plants discharging to lakes that are one of the five Great Lakes, the issue was indicated as only being revised to include plants that discharge to any size river (NRC 2013a, Sections 3.9.3.4 and 4.9.1.1.3).

As discussed in Section 3.10.1, PBN's discharge temperatures fall below temperatures that would optimize growth of the pathogens. The momentum of the discharge velocity is sufficient to create a high degree of mixing with the lake surface water in the immediate vicinity. Water temperatures decrease as the thermal plume reaches the unrestricted access area beyond the security zone. Thus, exposure of Lake Michigan users to elevated concentrations of the microorganisms of concern is unlikely given the unlikelihood of the water to create conditions favorable to thermophilic microorganisms, the small area of thermally altered waters, and the restricted access of the public to these areas. Also, as discussed in Section 3.10.1, waterborne illnesses due to the thermophilic microorganisms of concern have not been reported for Wisconsin. Therefore, the public human health risk posed by PBN's thermal discharge's capacity to enhance thermophilic microorganisms is SMALL.

4.9.2 Electric Shock Hazards

4.9.2.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL, MODERATE, or LARGE. Electrical shock potential is of small significance for transmission lines that are operated in adherence with the NESC. Without a review of conformance with NESC criteria of each nuclear power plant's in-scope transmission lines, it is not possible to determine the significance of the electrical shock potential.

4.9.2.2 Requirement [10 CFR 51.53(c)(3)(ii)(H)]

If the applicant's transmission lines that were constructed for the specific purpose of connecting the plant to the transmission system do not meet the recommendations of the NESC for preventing electric shock from induced currents, an assessment of the impact of the proposed action on the potential shock hazard from the transmission lines must be provided.

4.9.2.3 Background [GEIS Section 4.9.1.1.5]

Design criteria for nuclear power plants that limit hazards from steady-state currents are based on the NESC, adherence to which requires that utility companies design transmission lines so that the short-circuit current to ground produced from the largest anticipated vehicle or object is limited to less than 5 milliamperes (mA). With respect to shock safety issues and license renewal, three points must be made. First, in the licensing process for the earlier licensed nuclear plants, the issue of electrical shock safety was not addressed. Second, some plants that received OLs with a stated transmission line voltage may have chosen to upgrade the line voltage for reasons of efficiency, possibly without reanalysis of induction effects. Third, since the initial NEPA review for those utilities that evaluated potential shock situations under the provision of the NESC, land use may have changed, resulting in the need for a reevaluation of this issue. The electrical shock issue, which is generic to all types of electrical generating stations, including nuclear plants, is of SMALL significance for transmission lines that are operated in adherence with the NESC. Without a review of the conformance of each nuclear plant's transmission lines, within this scope of review with NESC criteria, it is not possible to determine the significance of the electrical shock potential generically.

4.9.2.4 Analysis

Analysis of impacts considers (1) location of in-scope transmission lines; (2) status of NESC compliance; (3) mitigation measures that can be taken to bring transmission lines into compliance; and (4) site procedures to minimize the possibility of a plant worker receiving an induced electrical shock from in-scope transmission lines.

The in-scope transmission lines (Figure 2.2-4) are located completely within the PBN property boundary and access is further restricted and controlled by the protected area fencing and security and the switchyard fence. Thus, the in-scope transmission lines do not pose a shock hazard risk to the public. Furthermore, as discussed in Section 3.10.2, the PBN in-scope lines are in compliance with NESC clearance guidelines as demonstrated by a transmission line survey. Work on and near the transmission lines is governed by plant procedures including electrical safety procedures that address clearances and grounding as well as PBN's comprehensive health and safety program. Given these conditions, the human health impact from electric shock hazards during the proposed SLR operating term would be SMALL.

4.10 Environmental Justice

The following sections address the environmental justice issues applicable to PBN, providing background on the issues and the analyses regarding the proposed SLR term.

4.10.1 Minority and Low-Income Populations

4.10.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

Impacts to minority and low-income populations and subsistence consumption resulting from continued operations and refurbishment associated with license renewal will be addressed in plant-specific reviews. See the NRC's policy statement on the treatment of environmental justice matters in NRC regulatory and licensing actions (69 FR 52040).

4.10.1.2 Requirement [10 CFR 51.53(c)(3)(ii)(N)]

Applicants shall provide information on the general demographic composition of minority and low-income populations and communities (by race and ethnicity) residing in the immediate vicinity of the plant that could be affected by the renewal of the plant's OL, including any planned refurbishment activities, and ongoing and future plant operations.

4.10.1.3 Background [GEIS Section 4.10.1]

Disproportionately high and adverse human health effects occur when the risk or rate of exposure to an environmental hazard for a minority or low-income population is significant and exceeds the risk or exposure rate for the general population or for another appropriate comparison group. Disproportionately high environmental effects refer to impacts or risk of impact on the natural or physical environment in a minority or low-income community that are significant and appreciably exceed the environmental impact on the larger community. Such effects may include biological, cultural, economic, or social impacts. Minority and low-income populations are subsets of the general public residing around the site and all are exposed to the same risks and hazards generated from operating a nuclear power plant.

Continued reactor operations and other activities associated with license renewal could have an impact on air, land, water, and ecological resources in the region around each nuclear power plant site, which might create human health and environmental effects on the general population. Depending on the proximity of minority and low-income populations in relation to each nuclear plant, the environmental impacts of license renewal could have a disproportionate effect on these populations.

The location and significance of environmental impacts may affect population groups that are particularly sensitive because of their resource dependencies or practices (e.g., subsistence agriculture, hunting, or fishing) that reflect the traditional or cultural practices of minority and low-income populations. The analysis of special pathway receptors can be an important part of the identification of resource dependencies or practices. Special pathways take into account the levels of contaminants in native vegetation, crops, soils and sediments, surface water, fish, and game animals on or near the power plant sites in order to assess the risk of radiological exposure through subsistence consumption of fish, native vegetation, surface water, sediment, and local produce; the absorption of contaminants in sediments through the skin; and the inhalation of airborne particulates.

4.10.1.4 Analysis

4.10.1.4.1 Refurbishment Activities

As discussed in Section 2.3, no SLR-related refurbishment activities have been identified. Therefore, there would be no SLR-related refurbishment impacts to minority and low-income populations, and no further analysis is applicable.

4.10.1.4.2 Operational Activities

The consideration of environmental justice is required to assure that federal programs and activities will not have disproportionately high and adverse human health or environmental effects on minority populations and low-income populations. NEPB's analyses of the Category 2 issues defined in 10 CFR 51.53(c)(3)(ii) determined that environmental impacts from the continued operation of PBN during the SLR operating term would either be SMALL or non-adverse. Therefore, high or adverse impacts to the general human population would not occur.

As described in Section 3.10, PBN maintains a REMP. With this program, NEPB monitors important radiological pathways and considers potential radiation exposure to plant and animal life in the environment surrounding PBN. The results of the program indicate PBN has created no adverse environmental effects or health hazards. Therefore, no environmental pathways have been adversely impacted and are not anticipated to be impacted during the proposed PBN SLR term.

Section 3.11.2 identifies the locations of minority and low-income populations as defined by NRR Office Instruction LIC-203 (NRC 2013d). Section 3.11.2.4 describes the search for subsistence populations near PBN, of which none were found. The figures accompanying Section 3.11.2 show the locations of minority and low-income populations within a 50-mile radius of PBN. None of those locations, when considered in the context of impact pathways described in this chapter, are expected to be disproportionately impacted.

Therefore, no disproportionately high and adverse impacts or effects on members of the public, including minority, low-income, or subsistence populations, are anticipated as a result of SLR.

4.11 Waste Management

The following sections address the waste management issues applicable to PBN, providing background on the issues and the analyses regarding the proposed SLR term.

4.11.1 Low-Level Waste Storage and Disposal

4.11.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. The comprehensive regulatory controls that are in place and the low public doses being achieved at reactors ensure that the radiological impacts to the environment would remain small during the license renewal term.

4.11.1.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.11.1.3 Background [GEIS Section 4.11.1.1]

The NRC believes that the comprehensive regulatory controls that are in place and the low public doses being achieved at reactors ensure that the radiological impacts on the environment will remain SMALL during the term of a renewed license. The maximum additional onsite land that may be required for low-level waste (LLW) storage during the term of a renewed license and associated impacts would be SMALL. Nonradiological impacts on air and water would be negligible. The radiological and nonradiological environmental impacts of long-term disposal of LLW from any individual plant at licensed sites are SMALL. In addition, the NRC concludes that there is reasonable assurance that sufficient LLW disposal capacity will be made available when needed for facilities to be decommissioned consistent with NRC decommissioning requirements.

4.11.1.4 Analysis

This Category 1 issue was reviewed for new and significant information. As a result of this review, NEPB is aware of no new and significant information regarding the environmental impacts of SLR associated with PBN. Further, and as stated in Section 2.1, NEPB does not anticipate any SLR-related refurbishment. Because no new and significant information has been identified, the analyses and findings regarding this issue in the GEIS (NUREG-1437, Revision 1) are adopted and incorporated herein by reference, and no further analysis is required.

4.11.2 Onsite Storage of Spent Nuclear Fuel

4.11.2.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

During the license renewal term, SMALL. The expected increase in the volume of spent nuclear fuel from an additional 20 years of operation can be safely accommodated onsite during the license renewal term with small environmental impacts through dry or pool storage at all plants.

For the period after the licensed life for reactor operations, the impacts of onsite storage of spent nuclear fuel during the continued storage period are discussed in NUREG-2157 and as stated in § 51.23(b), shall be deemed incorporated into this issue.

4.11.2.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.11.2.3 Background [GEIS Section 4.11.1.2]

As discussed in Section 3.11.1.2 (GEIS), spent nuclear fuel is currently stored at reactor sites either in spent fuel pools or in ISFSIs. The storage of spent fuel in spent fuel pools was considered for each plant in the safety and environmental reviews at the construction permit and operating license stage. This onsite storage of spent fuel and high-level waste is expected to continue into the foreseeable future.

Interim storage needs vary among plants, with older units likely to lose pool storage capacity sooner than newer ones. Given the uncertainties regarding the final disposition of spent fuel and high-level waste, it is expected that expanded spent fuel storage capacity will be needed at all nuclear power plants.

NUREG-2157, *Generic EIS for Continued Storage of Spent Nuclear Fuel* (NRC 2014a, ES.12 and Table ES-3), concluded on a generic basis for all nuclear power plants that spent fuel can be stored onsite for 60 years following the license term with SMALL environmental effects.

4.11.2.4 Analysis

This Category 1 issue was reviewed for new and significant information. As a result of this review, NEPB is aware of no new and significant information regarding the environmental impacts of SLR associated with PBN. Further, and as stated in Section 2.1, NEPB does not anticipate any SLR-related refurbishment. Because no new and significant information has been identified, the analyses and findings regarding this issue in the GEIS (NUREG-1437, Revision 1) are adopted and incorporated herein by reference, and no further analysis is required.

4.11.3 Offsite Radiological Impacts of Spent Nuclear Fuel and High-Level Waste Disposal

4.11.3.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

For the high-level waste and spent-fuel disposal component of the fuel cycle, the EPA established a dose limit of 0.15 millisievert (mSv; 15 millirem) per year for the first 10,000 years and 1.0 mSv (100 millirem) per year between 10,000 years and 1 million years for offsite releases of radionuclides at the proposed repository at Yucca Mountain, Nevada.

The NRC concluded that the impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the NRC has not assigned a single level of significance for the impacts of spent fuel and high-level waste disposal, this issue is considered Category 1.

4.11.3.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.11.3.3 Background [GEIS Section 4.11.1.3]

As a result of the *New York v. NRC* decision, and pending the issuance of a generic EIS and revised waste confidence decision and rule, the NRC has revised the Category 1 issue, "Offsite radiological impacts of spent nuclear fuel and high-level waste disposal." This issue pertained to the long-term disposal of spent nuclear fuel and high-level waste, including possible disposal in a deep geologic repository. Although the waste confidence decision and rule did not assess the impacts associated with disposal of spent nuclear fuel and high-level waste in a repository, it did reflect the NRC's confidence, at the time, in the technical feasibility of a repository and when that repository could have been expected to become available. Without the analysis in the waste confidence decision, the NRC cannot assess how long the spent fuel will need to be stored onsite. Therefore, the NRC reclassified this GEIS issue from a Category 1 issue with no assigned impact level to an uncategorized issue with an impact level of uncertain. Moreover, the ultimate disposal of spent nuclear fuel in a potential future geologic repository is a separate and independent licensing action that is outside the regulatory scope of license renewal.

4.11.3.4 Analysis

This Category 1 issue was reviewed for new and significant information. As a result of this review, NEPB is aware of no new and significant information regarding the environmental impacts of SLR associated with PBN. Further, and as stated in Section 2.1, NEPB does not anticipate any SLR-related refurbishment. Because no new and significant information has been identified, the analyses and findings regarding this issue in the GEIS (NUREG-1437, Revision 1) are adopted and incorporated herein by reference, and no further analysis is required.

4.11.4 Mixed Waste Storage and Disposal

4.11.4.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. The comprehensive regulatory controls and the facilities and procedures that are in place ensure proper handling and storage, as well as negligible doses and exposure to toxic materials for the public and the environment at all plants. License renewal would not increase the small, continuing risk to human health and the environment posed by mixed waste at all plants. The radiological and nonradiological environmental impacts of long-term disposal of mixed waste from any individual plant at licensed sites are small.

4.11.4.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.11.4.3 Background [GEIS Section 4.11.1.4]

Mixed waste is regulated both by the EPA or the authorized state agency under RCRA and by the NRC or the agreement state agency under the Atomic Energy Act (AEA; Public Law 83-703). The waste is either treated onsite or sent offsite for treatment followed by disposal at a permitted landfill. The comprehensive regulatory controls and the facilities and procedures that are in place at nuclear power plants ensure that the mixed waste is properly handled and stored and that doses to and exposure to toxic materials by the public and the environment are negligible at all plants. License renewal will not increase the small but continuing risk to human health and the environment posed by mixed waste at all plants. The radiological and nonradiological environmental impacts from the long-term disposal of mixed waste at any individual plant at licensed sites are considered SMALL for all sites.

4.11.4.4 Analysis

NEPB previously established its radiological waste programs and controls as described in Section 2.2.6 in accordance with NRC regulations. NEPB has established oversight and controls for handling and storage of hazardous and mixed waste that implements the regulatory requirements for management, storage, inspections, and shipping. PBN has not received any violations for hazardous waste management in the past 5 years based on a review of its compliance history. NEPB would continue to store and dispose of mixed waste in accordance with NRC, EPA, and state regulations and dispose of the wastes in appropriately permitted treatment and disposal facilities during the proposed SLR term. As discussed in Section 4.11.4.3, continuation of existing systems and procedures to ensure proper storage and disposal would allow the impacts to be of small magnitude. No new and significant information has been identified for this issue; therefore, no further analysis is required.

4.11.5 Nonradioactive Waste Storage and Disposal

4.11.5.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. No changes to systems that generate nonradioactive waste are anticipated during the license renewal term. Facilities and procedures are in place to ensure continued proper handling, storage, and disposal, as well as negligible exposure to toxic materials for the public and the environment at all plants.

4.11.5.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.11.5.3 Background [GEIS Section 4.11.1.5]

The management of hazardous wastes generated at all of these facilities, both onsite and offsite, is strictly regulated by the EPA or the responsible state agencies per the requirements of RCRA. As does any industrial facility, nuclear power plants and the rest of the uranium fuel cycle facilities also generate nonradioactive nonhazardous waste. These wastes are managed by following good housekeeping practices and are generally disposed of in local landfills permitted under RCRA Subtitle D regulations.

In the 1996 GEIS, the impacts associated with managing nonradioactive wastes at uranium fuel cycle facilities, including nuclear power plants, were found to be SMALL. It was indicated that no changes to nonradioactive waste generation would be anticipated for license renewal, and that systems and procedures are in place to ensure continued proper handling and disposal of the wastes at all plants.

4.11.5.4 Analysis

Management of nonradioactive waste is discussed in Section 2.2.7. NEPB has established oversight and controls for handling and storage of hazardous waste to implement the regulatory requirements for management, storage, inspections, and shipping. PBN has not received any violations for hazardous waste management 2015 through 2019 based on a review of its compliance history.

NEPB would continue to store and dispose of hazardous and nonhazardous waste in accordance with EPA, state, and local regulations, and dispose of the wastes in appropriately permitted disposal facilities during the proposed SLR term. As discussed in Section 4.11.5.3, continuation of existing systems and procedures to ensure proper storage and disposal would allow the impacts to be of small magnitude. No new and significant information has been identified for this issue; therefore, no further analysis is required.

4.12 Cumulative Impacts

4.12.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

Cumulative impacts of continued operations and refurbishment associated with license renewal must be considered on a plant-specific basis. Impacts would depend on regional resource characteristics, the resource-specific impacts of license renewal, and the cumulative significance of other factors affecting the resource.

4.12.2 Requirement [10 CFR 51.53(c)(3)(ii)(O)]

Applicants shall provide information about other past, present, and reasonably foreseeable future actions occurring in the vicinity of the nuclear plant that may result in a cumulative effect.

4.12.3 Background [GEIS Section 4.13]

Actions to be considered in cumulative impact analyses include new and continuing activities, such as license renewal, that are conducted, regulated, or approved by a federal agency. The cumulative impacts analysis takes into account all actions, however minor, since impacts from individually minor actions may be significant when considered collectively over time. The goal of the analysis is to identify potentially significant impacts to improve decisions and move toward more sustainable development.

For some resource areas (e.g., water and aquatic resources), the contributions of ongoing actions within a region to cumulative impacts are regulated and monitored through a permitting process (e.g., NPDES) under state or federal authority. In these cases, it may be assumed that cumulative impacts are managed as long as these actions (facilities) are in compliance with their respective permits.

4.12.4 Analysis

Cumulative impacts analysis involves determining if there is an overlapping or compounding of the anticipated impacts of the continued operation of PBN during the proposed SLR operating term with past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such actions.

NEPB considered potential cumulative impacts during the license renewal period in its environmental analysis associated with the resources discussed in the following sections. For the purposes of this analysis, past actions are those related to the resources at the time of plant licensing and construction, present actions are those related to the resources at the time of current operation of the power plant, and future actions are considered to be those that are reasonably foreseeable through the end of plant operation, which would include the 20-year license renewal term. These criteria are in line with Regulatory Guide 4.2, Supplement 1, Revision 1 (NRC 2013b). The geographic area over which past, present, and future actions would occur is dependent on the type of action considered and is described below for each impact area. The effects of past actions are already reflected in the description of the affected environment in Chapter 3.

The impacts of the proposed action are combined with other past, present, and reasonably foreseeable future actions regardless of which agency (federal or non-federal) or person undertakes such other actions. These combined impacts are defined as "cumulative" in 40 CFR 1508.7 and include individually minor, but collectively significant, actions taking place over a period of time. It is possible that an impact that may be SMALL by itself could result in a MODERATE or LARGE impact when considered in combination with the impacts of other actions on the affected resource. Likewise, if a resource is regionally declining or imperiled, even a SMALL individual impact could be important if it contributes to or accelerates the overall resource decline.

As indicated in Section 3.1.4, no major changes to PBN Units 1 and 2 operations or plans for future expansion of plant infrastructure during the proposed SLR term are anticipated. Expansion of storage capacity for SNF might be needed to accommodate SNF from the proposed SLR operating term if the DOE has not begun accepting SNF. An expansion of the ISFSI was not considered as a project in the cumulative impacts analysis because uncertainties exist, such as need, scope, and alternatives, requiring a pause in planning. Furthermore, plans and funding have not been identified for this yet-to-be-determined need. If needed, the ISFSI expansion would likely be located within the existing ISFSI-defined area, would be constructed using best management practices, and would comply with all siting and operational requirements maintaining radiological exposure within permissible limits, and protecting protected species, wetlands, and cultural resources. The site selection process would consider regulations for, and commitments to, the protection of protected species, wetlands, and cultural resources, and maintain radiological exposure within NRC limits and as low as reasonably achievable.

Section 3.1.4 describes other (non-PBN) projects in the vicinity of PBN. The Point Beach and Two Creeks solar power generation facilities are currently being constructed in Manitowoc and Kewaunee counties, WI (see Figure 3.1-3). The cumulative impacts for these facilities were determined to be SMALL as discussed further in this section. The KPS is currently undergoing decommissioning activities and the cumulative impacts due to KPS were also determined to be SMALL, as discussed in Section 4.12.4.1. To date, no additional federal and non-federal projects have been identified as taking place in the vicinity of PBN. In Manitowoc County, the Cherney Maribel Caves County Park is building a pavilion and recreational facilities, with expectations the site will grow as a tourism destination. A Meijer Super Center opened in 2020 in the city of Manitowoc. The changes to the Cherney Maribel Caves County Park and the addition of the Meijer Super Center were considered in the cumulative impacts analysis, but no impact pathways were identified.

The NRC completed a cumulative impacts assessment of PBN operations during the license renewal term. In summary, the NRC concluded that for each impact area, the potential cumulative impacts resulting from PBN operations during the license renewal period would be SMALL and mitigation is not warranted (NRC 2005, Section 4.8.6)

4.12.4.1 Land Use and Visual Resources

The land use impact of PBN was characterized as SMALL in Section 4.1. Land use changes are anticipated for the Point Beach and Two Creeks solar power generation facilities currently under construction. The land use changes expected for the Two Creeks solar facility are approximately 781 acres (PSC 2018). The Point Beach solar project has a proposed array and an alternative array. The proposed array is expected to change approximately 455 acres while the alternative array is expected to change approximately 105 acres (PSC 2019a). The plans for each project avoid wetlands and are expected to impact less than 0.1 acres of wetlands. Collectively, both projects are expected to change approximately 885 to 1,235 acres of mostly agricultural lands.

The PBN vicinity is described in Section 3.2, with a rural nature dominating on the west bank of Lake Michigan where PBN is located. Agricultural lands dominate the land use in both Brown and Manitowoc counties. Combined, Manitowoc and Brown counties have 423,616 acres of land dedicated to farmland. Disturbing less than 1,246 acres of agricultural lands would not noticeably alter agriculture in either county. Therefore, the cumulative land use impact would be SMALL.

As stated in Section 3.2.3, the continued use of existing structures associated with PBN would not alter their visual impact. PBN would continue to have minimal visual impact on the neighboring properties or from the viewpoint of Lake Michigan. The Point Beach and Two Creeks solar power generation facilities expect to use panels that can range from 6 to 8 feet in height, which would not be visible at distances greater than 0.5 miles (PSC 2018). Because the visual impacts due to PBN are SMALL and not expected to change, and no visual impacts from the Point Beach and Two Creeks solar power generation facilities are expected, the cumulative visual impacts are expected to be SMALL.

4.12.4.2 Air Quality

Air Quality

PBN's impacts on air quality are provided in Section 4.2, and Section 3.3.3 discusses regional air quality and PBN air emission sources. PBN is located in a region that has four counties in non-attainment status for 8-hour ozone (2015), and one county in non-attainment for 8-hour ozone (2008). The remaining counties are in attainment for air quality.

PBN Units 1 and 2 air pollutant emissions are minimal and stem from intermittent use, maintenance, and testing of auxiliary boilers and diesel generators. Section 4.2 concluded that the impact to air quality from the continued operation of Units 1 and 2 during the proposed license renewal term is anticipated to be SMALL as generically determined by NRC for all nuclear power plants. The pending present actions and anticipated future actions along with continued operation of PBN is expected to have a SMALL impact on cumulative air quality.

Climate Change

Climate change can impact air quality as a result of changes in meteorological conditions. Air pollutant concentrations are sensitive to winds, temperature, humidity, and precipitation. Ozone levels have been found to be particularly sensitive to climate change influences. Sunshine, high temperatures, and air stagnation are favorable meteorological conditions which lead to higher levels of ozone. Although surface temperatures are expected to increase, ozone levels will not necessarily increase because ozone formation is also dependent on the relative amounts of precursors available. The combination of higher temperatures, stagnant air masses, sunlight, and emissions of precursors may make it difficult to meet ozone NAAQS. States, however, must continue to comply with the CAA and ensure air quality standards are met. (NRC 2015, Section 4.16.1.1) Because the fuel source for Units 1 and 2 does not produce carbon dioxide (CO_2) or other GHG emissions, the continued operation of Units 1 and 2 would avoid millions of tons of GHGs from a fossil fuel-fired alternative such as the natural gas combined cycle (NGCC) presented in Chapter 7.

Given that climate change trends in air temperature and precipitation are increasing, but continued operation would contribute only small emissions of GHGs from minor air emission sources, the cumulative impact on climate change from present and future actions would be SMALL. Moreover, continued operation of PBN avoids millions of tons of CO_2 from alternative fossil-fuel generation, positively impacting the climate change factor of CO_2 concentrations.

4.12.4.3 Noise

PBN operations have a SMALL impact on the noise environment as described in Section 4.3. The surrounding land use discussed above in Section 4.12.1 influences the noise sources and characterizes the noise environment as well. The Point Beach and Two Creeks solar power generation projects addressed noise impacts in their licensing applications. Noise impacts are expected to be below background or near background to nearby sensitive receptors (PSC 2018; PSC 2019a). Because the noise impacts from continued plant operations over the license renewal term would be SMALL and the expected noise impacts from the solar projects are expected to be at or near background levels, cumulative noise impacts would be SMALL.

4.12.4.4 Geology and Soils

Impacts to geology and soils could result from ground-disturbing activities and stormwater runoff. As stated in Section 2.1, NEPB has no plans to conduct SLR-related refurbishment or replacement activities. Through application of the PBN site SWPPP, Section 4.4 concluded that PBN's impact on geology and soils would be SMALL. Any ground-disturbing activities onsite during the proposed SLR operating term would be governed by a stormwater construction permit and/or the SWPPP. The Point Beach and Two Creeks solar power generation facilities have project-specific SWPPP and WPDES permits. As discussed in Section 4.12.4.1, the projects call for limited disturbance of soil. Given ground disturbances at the PBN site and the surrounding area would be subject to WPDES stormwater permitting and applicable BMPs, the cumulative land use impact would be SMALL.

4.12.4.5 Water Resources

Surface Water

As described in Section 4.5, surface water use impacts for once-through cooling was generically determined to be SMALL (10 CFR Part 51, Subpart A, Appendix B, Table B-1) and NEPB did not identify any new and significant information for the environmental issue. Any modifications would be under a WPDES permit issued by the WDNR, and water use impacts would be considered by WDNR prior to issuance of the permit. There are no plant operations or modifications planned for the proposed SLR operating term that would alter current patterns at the intake and discharge structures. The Point Beach and Two Creeks solar power generation projects plan to use city water for operation and maintenance (PSC 2018; PSC 2019a).

As for surface water quality cumulative impacts, PBN complies (see Chapter 9) with its WPDES discharge limits and the discharge rapidly mixes with Lake Michigan. As discussed in Section 3.6.4.1, the water quality at several tributaries to Lake Michigan near PBN are impaired; however, PBN operations do not contribute to these impairments. Therefore, the cumulative impact to surface water quality would be SMALL. Given PBN compliance with its WPDES permit and compliance with stormwater permits and regulations, PBN would have only a small contribution to the surface water quality cumulative impact.

Groundwater

As discussed in Section 4.5.3.4, the groundwater supply wells' average withdrawal rate was reported as 10,205.34 gpd (7.09 gpm) in 2019 and averaged 12,542.09 gpd (8.71 gpm) between 2015 and 2019. The groundwater is used for drinking, sanitary purposes, and fire suppression for the plant. Based on Table 3.6-6, this constitutes approximately 0.22 percent of the county's groundwater withdrawals. It is not anticipated that groundwater withdrawal increases above the reported quantities will be required during the proposed SLR operating term. As noted above, development in the PBN vicinity is not anticipated. Currently the water supply wells mentioned in Section 3.6.3.2 are primarily used for domestic purposes. Future well development in the area should be primarily domestic. The Point Beach and Two Creeks solar power generation facilities are expected to use approximately 3 acre-feet (977,553 gallons) of water annually for panel washing, but expect to use city water supplies (PSC 2019a). As stated in Section 3.6.3.2, PBN is permitted with approved maximum withdraw rates ranging from 2,000 gpd to 100,000 gpd. There is enough permitted reserve capacity at PBN to accommodate the water requirements for both solar plants. PBN will continue to maintain and implement its site-specific spill prevention plans to prevent spills that would contaminate soils, groundwater, and surface water during the proposed SLR operating term. Therefore, the cumulative impact to groundwater resources would be SMALL.

Climate Change

In the Great Lakes region, precipitation has been increasing over the past several decades. Although Lake Michigan's water temperature is expected to increase due to climate change, currently no trend has been identified in the PBN area (USCRT 2020). As discussed in Section

3.6.1.2.6, all water temperature effects are expected to be indiscernible within less than 1 mile from the point of discharge.

As noted above, PBN operations do not require significant surface water consumption or groundwater withdrawals, and PBN operates in compliance with its permits for water withdrawals and discharges. There are no anticipated or reasonably foreseeable changes in surface water or groundwater withdrawal rates. In addition, there are currently no trends in water temperature due to climate change in Lake Michigan and the local nature of the temperature effects of PBN operations. Based on these findings, the potential cumulative impacts of thermal discharges originating from present and future actions combined with climate change would be SMALL.

4.12.4.6 Ecological Resources

The impacts of the plant on ecological resources are presented in Section 4.6.

Terrestrial

The impacts on terrestrial species during the proposed SLR operating term are described as SMALL in Section 4.6.5.4. The continued operation of PBN Units 1 and 2 is governed by regulations, PBN procedures, and plans. As discussed in Section 9.6, NEPB has administrative controls in place at PBN to ensure that operational changes or construction activities are reviewed, and the impacts minimized through implementation of BMPs, permit modifications, or acquisition of new permits as needed. Successful application of the regulations, procedures, plans, and administrative controls would result in the identification and avoidance of important terrestrial habitats. In addition, the application of BMPs to minimize the area affected; to control fugitive dust, runoff, and erosion from project sites; to reduce the spread of invasive nonnative plant species; and to reduce disturbance of wildlife in adjacent habitats could greatly reduce the impacts of continued operations (NRC 2013a). Regulatory programs that the site is currently subject to such as stormwater management, spill prevention, dredging, and herbicide usage further minimize impacts on terrestrial resources. With continued application of these programs and procedures, the land-based impacts would largely be confined to PBN property and would have minimal opportunity to contribute to cumulative impacts.

As discussed in Sections 3.7.8 and 4.6.6.4, habitat for federally and state-listed terrestrial species exists on the PBN site. However, adherence to regulatory and permit requirements to avoid take of protected species and NEPB administrative controls such as those regarding response to avian collisions with transmission lines will minimize or avoid impact to these species. NEPB is not aware of any adverse impacts regarding threatened, endangered, and protected species attributable to the site. Maintenance activities necessary to support license renewal likely would be limited to previously disturbed areas onsite, and construction of an ISFSI pad, if undertaken, during the proposed SLR term would be among operational areas of the PBN site rather than within any other habitat on the PBN site. According to their applications, the Point Beach and Two Creeks solar power generation projects are expected to have no impacts on wildlife (PSC 2018; PSC 2019a). As discussed in Section 3.8.1, development in this area has been slow. Therefore, cumulative impacts on protected species would be SMALL. Overall, the cumulative impacts to terrestrial ecological resources are anticipated to be SMALL.

Aquatic

Aquatic resource impacts during the proposed SLR operating term were concluded to be SMALL in Section 4.6.1.4. The aquatic ecological communities could be impacted through surface water discharges that are governed by PBN's WPDES permit. In addition, aquatic ecological communities could be impacted by impingement and entrainment of species in PBN surface water intake. Impingement and entrainment impacts are addressed through CWA 316(b) compliance implemented through the WPDES system. Ongoing studies performed at PBN ensure that PBN continues to utilize the best technology available to minimize entrainment and impingement to the fullest extent practicable to maintain compliance with the WPDES permit. Continued compliance with WPDES permit conditions during the proposed SLR term (the permit is subject to renewal every 5 years) would ensure that PBN's direct and indirect impacts to aquatic ecological communities are minimized. NEPB meets its WPDES permit conditions and the temperature quickly returns to ambient temperatures, minimizing the potential for ongoing activities to combine with impacts from other actions and lead to cumulative impacts.

The Point Beach and Two Creeks solar power generation projects are working with WDNR and have a SWPPP and plan to use city water for operations (PSC 2018; PSC 2019a). Because of NEPB's adherence to CWA regulations, the PBN WPDES permit and the Point Beach and Two Creeks solar projects are working to minimize surface water impacts, cumulative impacts to aquatic ecological communities would be SMALL.

Climate Change

Temperatures in the Great Lakes region have been increasing over the past several decades. Annual precipitation has also increased. Although climate change is expected to increase the water temperature of Lake Michigan, currently no trend has been identified in the PBN area. With a changing climate, there will be changes in the range and distribution of species (USCRT 2020).

The NEPB adherence to regulatory and permit requirements to avoid take of protected species and NEPB administrative controls such as those regarding response to avian collisions with transmission lines will minimize or avoid impacts to species affected by changing aquatic or terrestrial habitat. The Point Beach and Two Creeks solar projects' activities will minimize or avoid impacts to terrestrial resources due to their expected coordination with WDNR. Because development of the area has been slow historically, development impacts are expected to be minimal. No changes in the temperature of PBN's existing thermal discharge are expected with no planned operational changes during the proposed SLR operating term. Therefore, cumulative impacts to ecological communities from PBN, Point Beach and Two Creeks solar power generation facilities, development in the vicinity, and climate change are anticipated to be SMALL during the proposed SLR operating term.

4.12.4.7 Historic and Cultural Resources

As presented in Section 4.7, NEPB has administrative controls in place for management of cultural resources ahead of any future ground-disturbing activities at the plant. PBN has a procedure specific to ground-disturbing activities that requires disruptive activity at the site be halted and PBN staff be notified if any archeological areas are identified during construction or other land-disturbing activities. PBN staff would consult with the SHPO to determine the appropriate steps to be taken prior to resuming the activity. Established processes address the potential for impacts on cultural resources by establishing procedures for all activities that require a federal permit or use federal funding and have the potential to impact historic resources. Therefore, no historic properties will be affected during the proposed SLR operating term. Section 4.7 also discussed the potential for continued operation of PBN to affect cultural resources in the surrounding area and concluded that the physical or historical integrity of these sites will not be affected. Therefore, PBN is not anticipated to contribute cumulative impacts to historic and cultural resources.

4.12.4.8 Socioeconomics

As discussed in Section 4.8, the proposed SLR does not include plans to add permanent workers, so the SMALL adverse impacts that are the result of workers' impact on community services, education, and infrastructure including transportation would not change. NEPB's annual payment of the WDR gross-receipts license fee on electricity to the state are expected to remain relatively constant throughout the license renewal term. The economic contributions of the plant's workers would remain the same. Thus, significant beneficial socioeconomic impacts would also continue during the proposed SLR operating term.

Construction of the Point Beach and Two Creeks solar power generation facilities is expected to employ 200 to 300 construction workers and once built, employ three full-time operators (PSC 2018; PSC 2019a). Tax payments will contribute to state and local governments. Combined with the expected growth of the Cherney Maribel Caves County Park and the addition of a Meijer Super Center, the cumulative impacts are SMALL and beneficial.

4.12.4.9 Human Health

Radiological dose limits for protection of the public and workers have been developed by the EPA and the NRC to address the cumulative impacts of acute and long-term exposure to radiation and radioactive material. These dose limits are codified in 10 CFR Part 20 and 40 CFR Part 190. For this analysis, the region of influence is the surrounding 50-mile region.

As presented in Section 3.10, NEPB prepares annual radiological environmental operating reports and annual radiological effluent reports. The reports for 2015–2019 indicate that doses to members of the public were controlled within NRC and EPA radiation protection standards. The direct radioactivity measured by thermoluminescent dosimetry at various sampling locations, has remained relatively constant with previous years. The 3-year (2016–2018) average annual occupational dose (TEDE) was 0.105 rem. The annual TEDE limit is 5 rems [10 CFR 20.1201(a)(1)].

As described in Section 3.1.1, the only other NRC-licensed operating nuclear power plants, fuel cycle facilities, or radiological waste treatment and disposal facilities within the 50-mile region of PBN is the KPS. This nuclear plant is located approximately 5 miles north of PBN in Kewaunee County, WI, and currently undergoing post-shutdown decommissioning activities. All of KPS's nuclear fuel is contained in its ISFSI. Major decommissioning and dismantlement activities are scheduled to begin in 2069.

Operating PBN for an additional 20-year period would not cause an increase in annual radioactive effluent releases. The cumulative impact of PBN's Units 1 and 2 operation, and the decommissioning of the KPS, would be expected to be SMALL because the plant and ISFSI are designed to maintain doses as low as reasonably achievable, and all routine releases and occupational exposure would be subject to federal regulations.

As for nonradiological human health impacts, as pointed out in Section 4.9.1.4, PBN operations occur with temperatures below the temperatures optimal to grow pathogens, and the pathogens have never been recorded within the state of Wisconsin. Therefore, it is unlikely to pose a risk to human health. Compliance with NESC and PBN procedures minimize occupational risk from electrical shock hazards (Section 4.9.2.4). As described in Section 2.2.5.5, PBN maintains a comprehensive occupational safety program. Therefore, cumulative impacts to human health from non-radiological hazards are not expected.

Based on their license applications, the Point Beach and Two Creeks solar power generation facilities are expected to collaborate with local governments to ensure community safety. The plants are also expected to follow federal, state, and local safety regulations.

The cumulative impacts on human health are expected to be SMALL.

4.12.4.10 Waste Management

As presented in Section 4.11, the comprehensive regulatory controls in place for management of radiological waste and NEPB's compliance with these regulations and use of only licensed treatment and disposal facilities would allow the impacts to remain SMALL during the proposed SLR operating term. The NRC oversees the licensing of radiological waste treatment and disposal facilities. There are four facilities providing LLRW disposal services in the United States (NRC 2017). As discussed in Section 3.10, PBN's annual reports for 2015–2019 indicate that radiological doses to members of the public were controlled within NRC and EPA radiation protection standards. There are no other operating nuclear power plants, fuel cycle facilities, or radiological waste treatment and disposal facilities within the 50-mile region of PBN.

PBN has programs in place to manage its hazardous and nonhazardous waste streams. PBN also ensures that only licensed or permitted facilities are used for treatment and disposal of its waste streams. Continuation of existing systems and procedures to ensure proper storage and disposal during the proposed SLR operating term would allow the impacts to be SMALL. The other facilities within the 50-mile region of PBN are also required to comply with appropriate EPA and state requirements for the management of radioactive and nonradioactive wastes. Thus, the cumulative waste management impact would be SMALL.

4.13 Impacts Common to all Alternatives: Uranium Fuel Cycle

4.13.1 Offsite Radiological Impacts—Individual Impacts from other than the Disposal of Spent Fuel and High-Level Waste

4.13.1.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. The impacts to the public from radiological exposures have been considered by the NRC in Table S-3 of this part. Based on information in the GEIS, impacts to individuals from radioactive gaseous and liquid releases, including radon-222 and technetium-99, would remain at or below the NRC's regulatory limits.

4.13.1.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.13.1.3 Background [GEIS Section 4.12.1.1]

The primary indicators of impact are the concentrations of radionuclides in the effluents from the fuel cycle facilities and the radiological doses received by a maximum exposed individual (MEI) on the site boundary or at some location away from the site boundary. The basis for establishing the significance of individual effects is the comparison of the releases in the effluents and the MEI doses with the permissible levels in applicable regulations. The analyses performed by the NRC in the preparation of GEIS Table S-3 and found in the 1996 GEIS indicate that as long as the facilities operate under a valid license issued by either the NRC or an agreement state, the individual effects will meet the applicable regulations. On the basis of these considerations, the NRC has concluded that the impacts on individuals from radioactive gaseous and liquid releases during the license renewal term would remain at or below the NRC's regulatory limits. Accordingly, the NRC concludes that offsite radiological impacts of the uranium fuel cycle (individual effects from sources other than the disposal of spent fuel and high-level waste) are SMALL.

4.13.1.4 Analysis

This issue concerns the direct impacts from facilities involved in supplying nuclear fuel to nuclear power plants. The issue was considered in NEPB's new and significant review as described in Chapter 5, and no new and significant information was identified as it relates to offsite radiological impacts—individual impacts from other than the disposal of spent fuel and high-level waste. The issue was considered in the initial license renewal's new and significant review and no new and significant information was found at that time (NRC 2005, Section 6.1). Based on NEPB's finding of no new and significant information, further analysis is not required.

4.13.2 Offsite Radiological Impacts—Collective Impacts from other than the Disposal of Spent Fuel and High-Level Waste

4.13.2.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

There are no regulatory limits applicable to collective doses to the general public from fuel-cycle facilities. The practice of estimating health effects on the basis of collective doses may not be meaningful. All fuel-cycle facilities are designed and operated to meet the applicable regulatory limits and standards. The NRC concluded that the collective impacts are acceptable.

The NRC concluded that the impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the NRC has not assigned a single level of significance for the collective impacts of the uranium fuel cycle, this issue is considered Category 1.

4.13.2.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.13.2.3 Background [GEIS Section 4.12.1.1]

There are no regulatory limits applicable to collective doses to the general public from fuel cycle facilities. All regulatory limits are based on individual doses. All fuel cycle facilities are designed and operated to meet the applicable regulatory limits.

As discussed in the 1996 GEIS, despite the lack of definitive data, some judgment as to the regulatory NEPA implications of these matters should be made and it makes no sense to repeat the same judgment in every case. The NRC concludes that these impacts are acceptable in that these impacts would not be sufficiently large to require the NEPA conclusion, for any plant, that the option of extended operation under 10 CFR Part 54 should be eliminated. Accordingly, while the NRC has not assigned a single level of significance for the collective effects of the fuel cycle, this issue was considered Category 1.

4.13.2.4 Analysis

This issue concerns the direct impacts from facilities involved in supplying nuclear fuel to nuclear power plants. The issue was considered in NEPB's new and significant review and no new and significant information was identified as it relates to offsite radiological impacts—collective impacts from other than the disposal of spent fuel and high-level waste. The issue was considered in the initial license renewal's new and significant review and no new and significant information was found at that time (NRC 2005, Section 6.1). Based on NEPB's finding of no new and significant information, further analysis is not required.

4.13.3 Nonradiological Impacts of the Uranium Fuel Cycle

4.13.3.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. The nonradiological impacts of the uranium fuel cycle resulting from the renewal of an operating license for any plant would be small.

4.13.3.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.13.3.3 Background [GEIS Section 4.12.1.1]

Data on the nonradiological impacts of the fuel cycle are provided in GEIS Table S-3. These data cover land use, water use, fossil fuel use, and chemical effluents. The significance of the environmental impacts associated with these data was evaluated in the 1996 GEIS on the basis of several relative comparisons. It was noted that the impacts associated with uses of all of the above resources would be SMALL. Any impacts associated with nonradiological liquid releases from the fuel cycle facilities would also be SMALL. As a result, the aggregate nonradiological impact of the uranium fuel cycle resulting from the renewal of an operating license for a plant would be SMALL, and it was considered a Category 1 issue in the 1996 GEIS.

4.13.3.4 Analysis

This issue concerns the direct impacts from facilities involved in supplying nuclear fuel to nuclear power plants. The issue was considered in NEPB's new and significant review and no new and significant information was identified as it relates to nonradiological impacts of the uranium fuel cycle. The issue was considered in the initial license renewal's new and significant review and no new and significant information was found at that time (NRC 2005, Section 6.1). Based on NEPB's finding of no new and significant information, further analysis is not required.

4.13.4 Transportation

4.13.4.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. The impacts of transporting materials to and from uranium fuel-cycle facilities on workers, the public, and the environment are expected to be small.

4.13.4.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.13.4.3 Background [GEIS Section 4.12.1.1]

The impacts associated with transporting fresh fuel to one 1,000 MWe model light-water reactor and with transporting spent fuel and radioactive waste (LLW and mixed waste) from that light water reactor are provided in Table S-4 in 10 CFR 51.52. Similar to GEIS Table S-3, and as indicated in 10 CFR 51.52, every ER prepared for the construction permit stage of a commercial nuclear power plant must contain a statement concerning the transport of fuel and radioactive waste to and from the reactor. A similar statement is also required in LRAs. Table S-4 forms the basis of such a statement.

In 1999, the NRC issued an addendum to the 1996 GEIS in which the agency evaluated the applicability of Table S-4 to future license renewal proceedings, given that the spent fuel is likely to be shipped to a single repository (as opposed to several destinations, as originally assumed in the preparation of Table S-4) and given that shipments of spent fuel are likely to involve more highly enriched fresh fuel (more than 4 percent as assumed in Table S-4) and higher-burnup spent fuel (higher than 33,000 MWd/MTU as assumed in Table S-4). In the addendum, the NRC evaluated the impacts of transporting the spent fuel from reactor sites to the candidate repository at Yucca Mountain and the impacts of shipping more highly enriched fresh fuel and higher-burnup spent fuel. On the basis of the evaluations, the NRC concluded that the values given in Table S-4 would still be bounding, as long as the (1) enrichment of the fresh fuel was 5 percent or less; (2) burnup of the spent fuel was 62,000 MWd/MTU or less; and (3) higher-burnup spent fuel (higher than 33,000 MWd/MTU) was cooled for at least 5 years before being shipped offsite.

4.13.4.4 Analysis

The NRC did not revisit the radiological impact analysis of transporting spent nuclear fuel to away-from-reactor storage locations in the 2014 GEIS for continued storage of nuclear fuel, and again stated (as in 1999) that the radiological impact analysis can be found in Table S-4 (NRC 2014a, ES.16.2.16).

As stated earlier, the NRC considered the impacts of this issue to be SMALL, provided three conditions were met (NRC 2013a). PBN reviewed its plans and protocols for future fuel enrichment specifications, fuel loading plans, and spent fuel cooling with regard to the three Table S-4 conditions. NEPB anticipates the maximum enrichment of fuel to be used at PBN during the proposed SLR operating term to be below 5 percent. As discussed in Section 2.2.1.1, for normal fuel batches, the average burnup level of the peak rod is not planned to exceed 62,000 MWd/MTU during the proposed SLR operating term. Furthermore, as discussed in Section 2.2.6, spent fuel is stored onsite in spent fuel pools for adequate cooling prior to transfer to onsite dry storage.

The three Table S-4 conditions are met and the NRC's recent review of away-from-reactor storage of spent nuclear fuel indicated that the impacts continued to be considered SMALL. NEPB's new and significant review included compliance with the criteria of Table S-4, and concludes that there is no new and significant information related to transportation impacts of the uranium fuel cycle. The issue was considered in the initial license renewal's new and significant review and no new and significant information was found at that time (NRC 2005, Section 6.1). Based on PBN's finding of no new and significant information, further analysis is not required.

4.14 Termination of Nuclear Power Plant Operations and Decommissioning

4.14.1 Findings from 10 CFR Part 51, Subpart A, Appendix B, Table B-1

SMALL. License renewal is expected to have a negligible effect on the impacts of terminating operations and decommissioning on all resources.

4.14.2 Requirement [10 CFR 51.53(c)(3)(iv)]

The environmental report must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware.

4.14.3 Background [GEIS Sections 4.12.2 and 4.12.2.1]

The impacts of decommissioning nuclear plants were evaluated by the NRC in NUREG-0586, *Generic Environmental Impact Statement for Decommissioning Nuclear Facilities: Supplement 1, Regarding the Decommissioning of Nuclear Power Reactors*.

This section describes and discusses the environmental consequences of terminating nuclear power plant operations and decommissioning, but the only impacts attributable to the proposed action (license renewal) are the effects of an additional 20 years of operations on the impacts of decommissioning. The majority of the impacts associated with plant operations would cease with reactor shutdown; however, some impacts would remain unchanged, while others would continue at reduced or altered levels. Some new impacts might also result directly from terminating nuclear power plant operations.

Terminating nuclear power plant operations would result in the cessation of actions necessary to maintain the reactor, as well as a significant reduction in the workforce. The NRC presumes that terminating nuclear power plant operations would not immediately lead to the dismantlement of the reactor or other infrastructure, much of which would still be in use to support other units on site that continued to operate. Even for sites with just one unit, some facilities would remain in operation to ensure that the site was maintained in safe shutdown condition.

4.14.4 Analysis

Only the incremental increase in the impacts of termination of plant operations and decommissioning attributable to continued operation during the proposed SLR operating term is within the scope of this issue. The additional operating years would generate additional spent nuclear fuel to be managed during the decommissioning period as well as potentially greater volumes of radioactive waste or radioactive materials. As noted in Sections 2.3 and 2.5, the proposal to continue operation during an SLR operating term does not include construction of additional plant structures that would require decommissioning, and additional workers are not anticipated for the licensing term that would incrementally increase socioeconomic impacts of termination of plant operations.

PBN would plan and conduct decommissioning activities in accordance with NRC-reviewed methods and evaluate anticipated environmental impacts to ensure that they are bounded by previously issued environmental assessments or are SMALL. Site restoration activities would be conducted in accordance with state and local regulations and permits, ensuring that environmental impacts would be SMALL.

The decommissioning impacts component of this issue was considered in the initial license renewal's new and significant review and no new and significant information was found at that time (NRC 2005, Section 7.1). The 2013 GEIS combined several Category 1 decommissioning issues in the 1996 GEIS and added consideration of termination of plant operations (NRC 2013a). No new and significant information has been identified for this issue. Based on NEPB's finding of no new and significant information, further analysis is not required.

4.15 Severe Accident Mitigation Alternatives (SAMA) Analysis

4.15.1 Category 1 Issue—Design-Basis Accidents

The following Category 1 issue pertaining to postulated accidents is applicable to PBN and was therefore evaluated for new and significant information.

Issue 65: Design-basis Accidents

In the GEIS (NRC 2013a), the NRC determined that impacts related to this issue from continued plant operations over the license renewal term would be SMALL. No new and significant information was identified for this issue. The analyses and findings regarding this issue in the GEIS (NRC 2013a) are adopted and incorporated herein by reference, and no further analysis is required.

4.15.2 Category 2 Issue—Severe Accidents

In 2004, PBN submitted an application for OL renewal, which was approved in 2005. The original 40-year OL for PBN was thereby extended out to 60 years. As part of that initial license renewal process, a detailed evaluation of potential severe accident mitigation alternatives (SAMAs) was performed. A detailed cost-benefit analysis was performed on the SAMAs that could not be qualitatively screened (NMC 2004a). The cost-benefit analysis included development of a Level 3 probabilistic risk assessment (PRA) for PBN, which was used to calculate conditional offsite doses and property damage for each of the PRA source term categories (STCs). By calculating the reduction in STC frequencies for each potential SAMA, a bounding present value dollar benefit of each was determined, utilizing the guidance of NUREG/BR-0184 (NRC 1997). The benefit was then compared to a cost estimate for each to complete the cost-benefit comparison. The conclusion of the analysis was that none of the proposed SAMAs was cost-beneficial to PBN.

The review for new and significant information was informed by the current PBN PRA. Over the course of plant operation, changes are made to the plant design, operation, and maintenance practices. Periodic updates to the PBN PRA have ensured that the PRA includes the relevant changes and continues to reflect the current plant design and operation. PRA updates also include those to the plant-specific initiating event and equipment data utilized, and improvements in state-of-the-art analysis of severe accidents. Therefore, the PRA provides valuable insights into the risk significance of the plant changes over time.

The analyses follow the model approach in NEI 17-04 Revision 1 (NEI 2019) for determination of whether there is new and significant information regarding the SAMA analyses. The NRC staff has reviewed the NEI 17-04 Rev. 1 document and endorsed its interim use (NRC 2019b). For the PBN SLR, the consideration of new and significant changes since the time of the initial license renewal is consistent with the GEIS (NRC 2013a), Supplement 49 (NRC 2014b). Section 5.3.9 of GEIS Supplement 49 states the following:

> *New information is significant if it provides a seriously different picture of the impacts of the Federal action under consideration. Thus, for mitigation alternatives such as SAMAs, new information is significant if it indicates that a mitigation alternative would substantially reduce an impact of the Federal action on the environment. Consequently, with respect to SAMAs, new information may be significant if it indicated a given cost-beneficial SAMA would substantially reduce the impacts of a severe accident or the probability or consequences (risk) of a severe accident occurring.*

The implication of this statement is that “significance” is not solely related to whether a SAMA is cost-beneficial, but depends also on a SAMA’s potential to significantly reduce risk to the public (NEI 2019).

The following Category 2 issue (requirement) related to severe accidents has been defined by the NRC in 10 CFR 51.53(c)(3)(ii)(L):

> *If the staff has not previously considered severe accident mitigation alternatives for the applicant’s plant in an environmental impact statement or related supplement or in an environmental assessment, a consideration of alternatives to mitigate severe accidents must be provided.*

The NRC finding regarding severe accidents is stated in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, as follows:

> *The probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are small for all plants. However, alternatives to mitigate severe accidents must be considered for all plants that have not considered such alternatives.*

The NRC has ruled that when a plant qualifies for the exception from the requirement to consider SAMAs in 10 CFR 51.53(c)(3)(ii)(L), the exception operates to designate this

Category 2 issue as the "functional equivalent" of a Category 1 issue (NRC 2013e). Accordingly, NEPB reviewed this issue for new and significant information that would cause the following generic conclusions in the GEIS (NRC 2013a) concerning this issue to be inapplicable to PBN.

1. The probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are SMALL for all plants.
2. License renewal ERs for plants for which SAMAs have been previously considered need not consider SAMAs again.

The assessment process for new and significant information related to the first conclusion included (1) interviews with subject matter experts on the validity of the 2013 GEIS conclusions as they relate to PBN; and (2) review of documents related to predicted impacts of severe accidents at PBN. Consideration was given to developments in plant operation and accident analysis that could have changed the assumptions made concerning severe accident consequences after SAMAs were previously evaluated by the NRC for PBN during initial license renewal (NMC 2004a). Developments in the following areas included:

- New internal events information
- External events
- New source term information
- Power uprates
- Higher fuel burnup
- Other considerations including population increase and risk-beneficial plant changes implemented in response to recommendations from the Fukushima Daiichi Near Term Task Force.

No new and significant information was identified. Core damage frequency (CDF) from internal events has followed a decreasing trend at both PBN units since the previous SAMA analysis was performed (NMC 2004a). Physical changes in the plant have significantly reduced risk in all aspects of the PRA. Also, changes have been implemented at the site in response to Fukushima Daiichi Near Term Task Force recommendations and other plant-specific programs that are "risk-beneficial" but not fully credited in PBN PRA models. Of these changes, FLEX modifications included in the fire PRA are Westinghouse SHIELD™ low leakage RCP seals and permanent diesel fire water connections to service water. These modifications have not been fully credited in the internal events PRA. Results from the detailed internal flooding PRA show a decrease in flooding CDF to approximately one-third of that used in the first license renewal. Although, PBN does not have a quantifiable seismic PRA based on component level fragilities, a bounding plant level evaluation using the 2013 EPRI hazard curves shows a decrease in plant level seismic CDF by one-half over the value used in the first license renewal. In addition, population in the surrounding counties has not changed appreciably. Therefore, the NRC conclusion in the 2013 GEIS that "the probability-weighted consequences of atmospheric releases, fallout onto open bodies of water, releases to groundwater, and societal and economic impacts from severe accidents are small" is considered appropriate for the PBN SLR, is incorporated herein by reference, and no further analysis is needed.

Regarding the second conclusion, the subsections below describe the methodology and review of SAMAs to demonstrate there is no new and significant information.

The NRC approved a 1.4 percent measurement uncertainty recapture power uprate for PBN in 2002, and an extended power uprate of 17 percent in 2011. As part of the uprate, NEPB implemented some plant changes to offset any potential increase in CDF and large early release frequency (LERF), and ultimately reduced the CDF and LERF compared to pre-EPU values (NRC 2011b). In addition, since the EPU, the PRA was updated to include impacts related to the EPU, which are therefore also included in the quantitative SLR SAMA evaluations.

4.15.3 Methodology for Evaluation of New and Significant SAMAs

4.15.3.1 Overview

The evaluations of the PBN SLR SAMAs are consistent with the NEI 17-04 Revision 1 methodology (NEI 2019), which describes a three-stage process for determining whether there is any "new and significant" information relevant to a previous SAMA analysis. In Stage 1, the SLR applicant uses PRA risk insights and/or risk model quantifications to estimate the percent reduction in the maximum benefit (MB) associated with (1) all unimplemented final plant-specific SAMAs for the analyzed plant; and (2) those SAMAs identified as potentially cost-beneficial for other U.S. nuclear power plants and which are applicable to but not already implemented at the analyzed plant. Consistent with the NRC's rulings that new and significant information is that which "presents 'a seriously different picture' of the environmental impacts . . . compared to the previously issued final environmental impact statement" (NRC 2016a), the first stage examines whether these potentially cost-beneficial SAMAs might reduce severe accident risk substantially. If it can be demonstrated that none of these SAMAs being evaluated can reduce the MB by 50 percent or more, then the applicant may document the conclusion that there is no "new and significant" information relevant to the previous SAMA analysis. If one or more of those SAMAs are shown to reduce the MB by 50 percent or more, then the applicant must complete Stage 2 by developing updated averted cost-risk estimates for implementing those SAMAs. If the Stage 2 assessment confirms that one or more SAMAs reduce the MB by 50 percent or more, then the applicant must complete Stage 3 by performing a cost-benefit analysis for the "potentially significant" SAMAs identified in Stage 2. Applicants that are able to demonstrate through the Stage 1 screening process that there is no potentially significant new information are not required to perform the Stage 2 or Stage 3 evaluations. The application of the NEI 17-04 methodology is described in the following subsections.

4.15.3.1.1 Definitions of New and Significant Information

"New" information pertains to data used in a SAMA analysis that have changed or become available since the time the preceding SAMA analysis was performed.

There are some inputs to the SAMA analysis that are expected to change, or to potentially change, for all plants. These inputs include the following:

- Updated Level 3 model consequence results, which may be impacted by multiple inputs, including, but not limited to, the following:
    - Population
    - Value of farm and non-farm wealth
    - Core inventory (e.g., due to power uprate)
    - Evacuation timing and speed
    - Level 3 methodology updates
- NUREG/BR-0058 (NRC 2004) cost-benefit methodology updates.

In addition, other changes that could be considered "new information" are dependent on plant activities or site-specific changes. These types of changes include the following:

- Identification of a new hazard (e.g., a fault that was not previously analyzed in the seismic analysis).
- Updated plant risk model (e.g., a fire PRA that replaces the individual plant examination of external events [IPEEE] analysis).
    - Impacts of plant changes that are included in the plant risk models will be reflected in the model results and do not need to be assessed separately.
- Non-modeled modifications/changes to the plant.
    - Modifications determined to have no risk impact need not be included (e.g., replacement of the condenser vacuum pumps), unless they impact a specific input to SAMA (e.g., a new low-pressure turbine in the power conversion system that results in a greater net electrical output).

For risk model updates performed to reflect the latest PRA model state of the practice, it is noted that the actual physical plant risk may not have changed; however, because the best-estimate assessment or understanding of the risk has changed, it is considered new information.

The current PBN PRA models (internal events, internal floods and fire) were used to determine the level of significance of new information. Consistent with the NEI methodology, these PRA models reflected the most up-to-date understanding of plant risk at the time of analysis (NEI 2019). As noted above, the criterion established for a potential SAMA being "significant" is if the MB calculated for PBN would be reduced by a factor of two or more if the SAMA were implemented. If it can be shown that a particular SAMA would not reduce the core damage frequency (CDF) or any of the significant Level 2 release category group frequencies in the models of record by more than a factor of two, then that particular SAMA could not reduce the MB by more than a factor of two. Therefore, that SAMA would not be considered potentially significant and would not be evaluated further in assessing the significance of new information. This criterion was applied to the SAMA screening evaluation presented in Section 4.15.4.

As seen in the subsequent sections, for PBN, all SAMAs were screened out either qualitatively or quantitatively in accordance with the NEI 17-04 methodology. Therefore, the "Stage 2" NEI 17-04 was not required, and the Level 3 PRA was not updated. Existence of a SAMA that would reduce MB by 50 percent or more and also be potentially cost-beneficial, would indicate the existence of "new and significant" information relevant to the previous SAMA analysis.

4.15.4 Analysis

4.15.4.1 Stage 1 Assessment: Overview

The list of candidate SAMAs for the PBN SLR was developed from plant-specific and industry sources. For the plant-specific portion, the initial PBN license renewal SAMA evaluation was examined to identify all SAMAs that could not be qualitatively screened, and that were found not to be cost effective. Evaluating these items is appropriate for determining if there is any new and significant information for PBN and the PRA since the time of the initial license renewal in regard to the potential plant improvements.

For evaluation of the industry sources, the GEIS (NRC 2013a) supplements were examined for SAMAs found to be potentially cost effective at plants similar to PBN. SAMAs found to be cost effective at similar plants (pressurized water reactors) were considered for their significance at PBN (NRC 2014b).

The list of SAMAs collected was evaluated qualitatively to screen any that are not applicable to PBN, or already exist at PBN. In addition, two other screening criteria were applied to eliminate SAMAs that have excessive cost. First, SAMAs were screened if they were found to reduce the PBN MB by >50 percent in the initial PBN license renewal, but also found not to be cost-effective due to high cost in the first license renewal. Second, SAMAs related to creating a containment vent were screened due to excessive cost because this plant modification has been evaluated industry-wide and explicitly found to not be cost-effective in large/dry containments.

The remaining SAMAs were then grouped based on similarities in mitigation equipment or risk-reduction benefits, and all were evaluated for the impact they would have on the PBN CDF and significant STC group frequencies if implemented. If any of the SAMAs reduced the total CDF or at least one significant STC group frequency by at least 50 percent, then the SAMA would be retained for a full Level 3 PRA evaluation of the reduction in MB. As seen in Sections 4.15.4.2 and 4.15.4.3, all SAMAs were screened without the need to perform a Level 3 update.

The quantitative evaluations performed for this analysis use the PBN internal events, internal flood and internal fire models. Each of these was utilized to calculate CDF and LERF. The first PBN license renewal SAMA analysis (NMC 2004a) demonstrated that the only significant contributors to the offsite consequences at PBN are late steam generator tube rupture (SGTR), early SGTR, containment isolation failures and interfacing systems loss-of-coolant accident (ISLOCA). In the current PBN PRA, all of these are categorized as LERF. Therefore, for this analysis, the significant STC group (i.e., LERF) is examined as a whole for percentage reduction. If neither the total CDF nor total LERF was reduced by >50 percent, then the MB would also not be reduced by >50 percent. SAMAs screened in this manner will not be considered "significant" and will be conclusively screened as part of the Stage 1 assessment.

4.15.4.2 Stage 1 Assessment – Identification and Qualitative Screening

A total of 282 industry SAMAs were collected for evaluation in the PBN SLR. All but 88 were qualitatively screened using the criteria discussed in Section 4.15.4.1. Sixty-five PBN-specific SAMAs were reviewed, 42 of which were retained for the new and significant evaluation. Twenty-two were screened either due to a plant modification that removed the vulnerability or due to excessive cost.

Table 4.15-1 presents the 88 industry SAMAs that were not qualitatively screened, combined with the 42 PBN-specific SAMAs selected for further evaluation. The first column presents the number assigned to each SAMA for tracking purposes. The second column identifies the plant from which the SAMA originated (i.e., PBN or an industry SAMA); the third column identifies the SAMA number from the source plant; the fourth column provides a description of the SAMA. The fifth column discusses the grouping of the SAMAs, and the sixth column identifies the case name assigned to the SAMA group.

A total of 25 SAMA groups were identified for quantitative screening evaluation.

4.15.4.3 Stage 1 Assessment – Quantitative Screening

This section presents the quantitative screening of the PBN SAMAs. The NEI 17-04 methodology considers a potential SAMA to be significant if it reduces the MB by at least 50 percent. The Stage 1 quantitative screening process evaluates this using the criteria of total CDF and no STC frequency being reduced by at least 50 percent. Because the MB is the sum total of the contribution of each STC, if no STC decreases by at least 50 percent, then the total MB reduction cannot exceed 50 percent. However, the approach of evaluating every STC is not necessary to ensure the MB reduction is less than 50 percent. In reality, many individual STCs have a frequency that is insignificant, and while an insignificant STC could in theory be reduced by >50 percent, its impact on MB would be negligible. Additionally, many STCs have conditional offsite consequences that are negligible compared to the dominant STC groups. The first PBN license renewal SAMA analysis demonstrated that the only significant contributors to the offsite consequences at PBN are late SGTR, early SGTR, containment isolation failures and ISLOCA. In the current PBN PRA, all of these are categorized as LERF. Therefore, for this analysis, the significant STC group (i.e., LERF) is examined as a whole for percentage reduction. If neither the total CDF nor total LERF was reduced by >50 percent, then the MB would also not be reduced by >50 percent. SAMAs screened in this manner will not be considered "significant" and will be conclusively screened as part of the Stage 1 assessment.

Table 4.15-2 presents the quantitative screening results from the bounding SAMA evaluations. As seen in Table 4.15-2, none of the bounding quantitative screening evaluations resulted in a reduction of total CDF or total LERF greater than 50 percent. The evaluations were selected conservatively to provide assurance that they are bounding. In some cases, some measures (e.g., internal flooding LERF) yielded an individual reduction greater than 50 percent, but when combined with the other hazards, no SAMA resulted in a collective CDF or significant STC group frequency (LERF) reduction of greater than 50 percent.

4.15.5 Conclusions

Appropriate qualitative screening criteria were applied to the industry SAMAs identified for consideration. For the remaining industry SAMAs and for the PBN-specific SAMAs to evaluate, a series of bounding quantitative analyses were performed. These analyses demonstrated that none of the SAMAs considered for quantitative evaluation would reduce the PBN MB by 50 percent or greater.

Therefore, it is concluded that there is no new and significant information that would alter the conclusions of the original SAMA analysis for PBN.

Table 4.15-1 Grouping of Related Industry and PBN-Specific SAMAs for Bounding Evaluation (Sheet 1 of 12)

PBN SAMA #	Plant	Plant SAMA #	SAMA Description	Grouped Assessment	Case Name
23	Braidwood 1, 2	11	Implement diverse mitigation system (DMS). A portable 480-V generator is aligned to support diesel driven AFW makeup or a portable SG makeup pump.	Quantitatively evaluate the maximum benefit associated with AFW.	AFW
24	Braidwood 1, 2	13	Alternate AFW cooling with seal protection.		
48	Byron 1, 2	11	Implement diverse mitigation system (DMS). A portable 480-V generator is aligned to support diesel driven AFW makeup or a portable SG makeup pump.		
49	Byron 1, 2	13	Alternate AFW cooling with seal protection.		
54	Byron 1, 2	26	Diverse mitigation system (DMS) using a dedicated generator, self-cooled charging pump, and a portable AFW pump.		
73	Callaway	188	Install a permanent, dedicated generator for the normal charging pump (NCP), and an MDAFW pump and battery charger to address station blackout (SBO) events in which the TDAFP is unavailable.		
116	Farley 1, 2	166	Proceduralize local manual operation of auxiliary feedwater (AFW) when control power Is lost.		
146	Indian Point 3	52	Open city water supply valve for alternative AFW pump suction.		
151	Kewaunee	66	Install a new feedwater source [proceduralize use of existing sources].		
170	Millstone 3	112	Proceduralize local manual operation of AFW when control power is lost.		
171	Millstone 2, 3	159'	Credit fire water connection to AFW (NRC suggested SAMA approach).		

Table 4.15-1 Grouping of Related Industry and PBN-Specific SAMAs for Bounding Evaluation (Sheet 2 of 12)

PBN SAMA #	Plant	Plant SAMA #	SAMA Description	Grouped Assessment	Case Name
174	Palisades	3	Add a direct drive diesel-driven injection pump (DDDIP). This SAMA involves installing a non-safety-related DDDIP to supplement the turbine-driven AFW pump and reduce the risk of SBO scenarios.	Quantitatively evaluate the maximum benefit associated with AFW. (cont.)	AFW (cont.)
175	Palisades	10	Modify the turbine-driven AFW train so that it can operate indefinitely without alternating current (AC), direct current (DC), or pneumatic support.		
181	Palo Verde 1, 2, 3	5	Install an automatic transfer switch for the non-safety AFW pump (AFN-P01) power supply		
184	Palo Verde 1, 2, 3	12	Install an automatic transfer switch for the AFW pump AFB-P01 power supply		
259	Vogtle 1, 2	5	Install permanent, dedicated generator for one motor driven AFW pump and a battery charger		
282	Wolf Creek	14	Install a permanent, dedicated generator for the NCP (similar to SAMA 1), and a motor-driven AFW pump and battery charger to address SBO events in which the TD AFW pump is unavailable.		
299	Point Beach	78	Tornado causes failure of power and upper surge tanks.		
327	Point Beach	165	Perform surveillances on manual valves used for backup AFW pump suction.		
284	Point Beach	32	Install MG set trip breakers in control room.	Quantitatively evaluate the maximum benefit associated with reducing ATWS.	ATWS
288	Point Beach	50	Install a containment vent large enough to remove anticipated transient without scram (ATWS) decay heat.		

Table 4.15-1 Grouping of Related Industry and PBN-Specific SAMAs for Bounding Evaluation (Sheet 3 of 12)

PBN SAMA #	Plant	Plant SAMA #	SAMA Description	Grouped Assessment	Case Name
322	Point Beach	153	A system of relief valves that prevents any equipment damage from a pressure spike during an ATWS.	Quantitatively evaluate the maximum benefit associated with reducing ATWS.	ATWS
301	Point Beach	93	Provide Auxiliary Building Vent/Seal structure.	Quantitatively evaluate maximum benefit of enhancing ventilation capability in Auxiliary Building.	AUXBLDG
332	Point Beach	180	Provide automatic repowering of the battery chargers following a loss of offsite power event.	Quantitatively evaluate the maximum benefit of improving operator action to repower the battery chargers following a loss of offsite power event.	BATT HEP
347	Point Beach	199	Reduce likelihood of failure of Bus 1B03. 480-BS—LP—1B03	Quantitatively evaluate the maximum benefit of increasing the reliability of Bus 1B03	BUS 1B03
61	Callaway	64	Implement procedure and hardware modifications to allow manual alignment of the fire water system to CCW system or install a CCW header cross-tie.	Quantitatively evaluate the maximum benefit from CCW improvements.	CCW-XTIE
221	Sequoyah 1, 2	45	Enhance procedural guidance for use of cross-tied component cooling pumps.		
285	Point Beach	45	Procedural guidance for use of cross-tied CCW or SW pumps.		

Table 4.15-1 Grouping of Related Industry and PBN-Specific SAMAs for Bounding Evaluation (Sheet 4 of 12)

PBN SAMA #	Plant	Plant SAMA #	SAMA Description	Grouped Assessment	Case Name
287	Point Beach	48	Provide a centrifugal charging pump.	Quantitatively evaluate the maximum benefit of adding diverse charging pump capability.	CHARGING CCF
289	Point Beach	52	Add redundant and diverse limit switch to each containment isolation valve.	Quantitatively evaluate the maximum benefit of reducing the probability of containment isolation failure.	CONTISO
290	Point Beach	53	Self-actuating containment isolation valves .		
291	Point Beach	54	Provide containment isolation design per GDC and SRP.		
292	Point Beach	55	Add Penetration valve leakage control system.		
80	Calvert Cliffs 1, 2	74	Automate demineralized water (DW) makeup to condensate storage tank.	Quantitatively evaluate maximum benefit of CST improvements.	CST
109	Crystal River 3	38	Additional condensate storage tank (CST) replacement water sources.		
161	Kewaunee	172	Provide additional alarm for extremely low CST level.		
202	Salem 1, 2	7	Install "B" train auxiliary feedwater storage tank (AFWST) makeup including alternate water source.		
203	Salem 1, 2	8	Install high pressure pump powered with portable diesel generator and long-term suction source to supply the AFW header.		
328	Point Beach	166	Install a new CST (AFWST).		
97	Cook 1, 2	160	Provide self-cooled ECCS seals.	Quantitatively evaluate the maximum benefit of removing CCW dependence for ECCS pumps.	ECCS-CCW
286	Point Beach	47	Provide self-cooled ECCS seals.		

Table 4.15-1 Grouping of Related Industry and PBN-Specific SAMAs for Bounding Evaluation (Sheet 5 of 12)

PBN SAMA #	Plant	Plant SAMA #	SAMA Description	Grouped Assessment	Case Name
64	Callaway	162	Install a large volume EDG fuel oil tank at an elevation greater than the EDG fuel oil day tanks.	Quantitatively evaluate maximum benefit of removing dependence on fuel oil transfer pumps.	FUELOILXFER
281	Wolf Creek	13	Install an alternative fuel oil tank with gravity feed capability to address fuel oil transfer failure events.		
183	Palo Verde 1, 2, 3	8	Add auto start/load capability to the GTGS (gas turbine generator system)	Quantitatively evaluate the maximum benefit improving the gas turbine generator system.	GASTURB
283	Point Beach	4	Install tornado protection on gas turbine generator.		
314	Point Beach	137	Provide an additional high-pressure injection pump with independent diesel.	Quantitatively evaluate the maximum benefit of adding HPI capability.	HPI
315	Point Beach	138	Install independent AC high pressure injection system.		
27	Braidwood 1, 2	19	Replace motor-operated valves (MOVs) in the RHR discharge line with valves that can isolate an ISLOCA event.	Quantitatively evaluate to determine the maximum benefit of SAMAs associated with ISLOCAs.	ISLOCA
52	Byron 1, 2	19	Replace MOVs in the RHR discharge line with valves that can isolate an ISLOCA event.		
131	Indian Point 2	21	Install additional pressure or leak monitoring instrumentation for ISLOCA.		
132	Indian Point 2	22	Add redundant and diverse limit switches to each containment isolation valve.		
144	Indian Point 3	19	Install additional pressure or leak monitoring instrumentation for ISLOCA.		
261	Vogtle 1, 2	16	Enhance procedures for ISLOCA response		

Table 4.15-1 Grouping of Related Industry and PBN-Specific SAMAs for Bounding Evaluation (Sheet 6 of 12)

PBN SAMA #	Plant	Plant SAMA #	SAMA Description	Grouped Assessment	Case Name
279	Wolf Creek	4	Proceduralize operator actions to perform local isolations of any valves that fail to close remotely in an interfacing system LOCA (ISLOCA).		
302	Point Beach	96	Install additional instrumentation for ISLOCA sequences.		
303	Point Beach	97	Increase frequency of valve leak testing.		
304	Point Beach	98	Improvement of operator training on ISLOCA coping.		
305	Point Beach	100	Revise EOPs to improve ISLOCA identification.		
306	Point Beach	101	Ensure all ISLOCA releases are scrubbed.		
345	Point Beach	196	Reduce likelihood of RHR A and B full flow test lines being left open (pre-initiator) RH—VLV-RE-0706A, RH—VLV-RE-0706B		
308	Point Beach	103	Digital large break LOCA protection.	Quantitatively evaluate the maximum benefit of reducing the frequency of Large LOCAs.	LLOCA
300	Point Beach	89	Digital feedwater upgrade.	Quantitatively evaluate the maximum benefit of improved MFW availability.	MFW
307	Point Beach	102	Secondary side guard pipes up to the MSIVs.	Quantitatively evaluate the maximum benefit of reducing the frequency and consequences of main steam line breaks (MSLBs).	MSLB

Table 4.15-1 Grouping of Related Industry and PBN-Specific SAMAs for Bounding Evaluation (Sheet 7 of 12)

PBN SAMA #	Plant	Plant SAMA #	SAMA Description	Grouped Assessment	Case Name
81	Calvert Cliffs 1, 2	77	Increase size of PORVs for bleed and feed	Quantitatively evaluate to determine the maximum benefit increased PORV capabilities.	PORV
108	Crystal River 3	35	Update PORV controls to open automatically when operator action was previously required.		
320	Point Beach	150	Create/enhance reactor coolant system depressurization ability.		
4	Arkansas Nuclear One-2	CW-06	Proceduralize shedding CCW loads to extend the CCW heat-up time.	Quantitatively evaluate the maximum benefit of reducing the frequency of RCP Seal LOCAs.	RCP-SEAL
14	Braidwood 1, 2	2	Replace the positive displacement pump with a self-cooled, auto-start pump.		
16	Braidwood 1, 2	4	Install “no leak” reactor coolant pump (RCP) seals.		
40	Byron 1, 2	2	Replace the positive displacement pump with a self-cooled, auto-start pump.		
42	Byron 1, 2	4	Install “no leak” RCP seals.		
86	Cook 1, 2	10	Eliminate RCP thermal barrier dependence on CCW, such that loss of CCW does not result directly in core damage.		
87	Cook 1, 2	12	Create an independent RCP seal injection system, with dedicated diesel.		
88	Cook 1, 2	13	Create an independent RCP seal injection system, without dedicated diesel.		
99	Cook 1, 2	184	Provide a means to ensure RCP seal cooling so that RCP seal LOCAs are precluded for SBO events.		
114	Farley 1, 2	11	Use existing hydro test pump for RCP seal injection.		

Table 4.15-1 Grouping of Related Industry and PBN-Specific SAMAs for Bounding Evaluation (Sheet 8 of 12)

PBN SAMA #	Plant	Plant SAMA #	SAMA Description	Grouped Assessment	Case Name
117	Fort Calhoun	4	Implement procedure and operator-training enhancements to anticipate problems and cope with events that lead to loss of cooling to RCP seals.	Quantitatively evaluate the maximum benefit of reducing the frequency of RCP Seal LOCAs. (cont.)	RCP-SEAL (cont.)
169	Millstone 2	3	Enhance loss of reactor building closed cooling water (RBCCW) procedure to ensure cool down of the reactor coolant system (RCS) prior to seal LOCA. The resolution of this issue is expected to be either a new procedure or a procedure modification that will require actions to prevent/mitigate a seal LOCA upon loss of RBCCW.		
180	Palisades	23	Make procedural changes to direct the cooldown of the primary coolant pump (PCP) seals on loss of PCP seal cooling.		
205	Salem 1, 2	10	Provide procedural guidance for faster cooldown on loss of RCP seal cooling.		
206	Salem 1, 2	11	Modify plant procedures to make use of other unit's PDP for RCP seal cooling.		
228	Sequoyah 1, 2	215	Provide a means to ensure reactor coolant pump seal cooling so that reactor coolant pump seal loss of coolant accidents are precluded for station blackout events.		
238	Sequoyah 1, 2	Added	Automate the tripping of RCPs on loss of component cooling water		
240	Three Mile Island-1	2	Install damage resistant high temperature RCP seals with a portable 480V AC generator for extended EFW operation.		

Table 4.15-1 Grouping of Related Industry and PBN-Specific SAMAs for Bounding Evaluation (Sheet 9 of 12)

PBN SAMA #	Plant	Plant SAMA #	SAMA Description	Grouped Assessment	Case Name
241	Three Mile Island-1	7	Use fire service water as an alternate cooling source for the intermediate closed cooling water (ICCW) heat exchangers.	Quantitatively evaluate the maximum benefit of reducing the frequency of RCP Seal LOCAs. (cont.)	RCP-SEAL (cont.)
242	Three Mile Island-1	8	Automate reactor coolant pump trip on high motor bearing cooling temperature.		
252	Three Mile Island-1	24	Install damage resistant high temperature RCP seals, a diesel engine as an alternate drive for an EFW pump, and a portable 480V AC generator for extended EFW operations.		
269	Waterford 3	26	Install improved reactor coolant pump seals		
276	Wolf Creek	1	Install a permanent, dedicated generator for the NCP to provide RCP seal cooling in SBO events.		
310	Point Beach	119	Create an independent RCP seal injection system, with dedicated diesel.		
316	Point Beach	140	Prevent charging pump flow diversion from the relief valves.		
317	Point Beach	142	Use firewater pumps as a backup seal injection and high-pressure makeup.		
1	Arkansas Nuclear One-1	129	Emphasize timely recirculation swapover in operator training.	Quantitatively evaluate to determine the maximum benefit of improved recirculation reliability.	RECIRC
19	Braidwood 1, 2	7	Establish flow to the residual heat removal (RHR) heat exchanger (HX) on RHR pump start.		
44	Byron 1, 2	7	Establish flow to the residual heat removal (RHR) HX on RHR pump start.		
71	Callaway	185	Automate initiation of CCW flow to the RHR heat exchangers.		

Table 4.15-1 Grouping of Related Industry and PBN-Specific SAMAs for Bounding Evaluation (Sheet 10 of 12)

PBN SAMA #	Plant	Plant SAMA #	SAMA Description	Grouped Assessment	Case Name
220	Sequoyah 1, 2	32	Automatically align emergency core cooling system to recirculation.	Quantitatively evaluate to determine the maximum benefit of improved recirculation reliability.	RECIRC
225	Sequoyah 1, 2	105	Delay containment spray actuation after a large loss of coolant accident.		
226	Sequoyah 1, 2	106	Install automatic containment spray pump header throttle valves.		
247	Three Mile Island-1	15	Automatic swap to recirculation mode.		
311	Point Beach	126	Create automatic swapover to recirculation on RWST depletion.		
312	Point Beach	127	Improve RHR sump reliability.		
119	Fort Calhoun	92	Conserve make up borated-water storage tank (BWST) inventory post-accident (SGTR).	Quantitatively evaluate maximum benefit of increased RWST capability.	RWST
214	Seabrook 1	165	RWST fill from firewater during containment injection—modify 6" RWST flush flange to have a 2½" female fire hose adapter with isolation valve.		
229	Sequoyah 1, 2	249	High-volume makeup to the refueling water storage tank.		
243	Three Mile Island-1	10	Automate BWST refill.		
298	Point Beach	77	Tornado damage to RWST and penetration rooms.		
143	Indian Point 3	18	Route the discharge from the MSSVs through a structure where spray water would condense the stream and remove fission products.	Quantitatively evaluate to determine the maximum benefit of SAMAs associated with SGTRs.	SGTR
187	Palo Verde 1, 2, 3	23	Enhance procedures to direct steam generator flooding for release scrubbing.		

Table 4.15-1 Grouping of Related Industry and PBN-Specific SAMAs for Bounding Evaluation (Sheet 11 of 12)

PBN SAMA #	Plant	Plant SAMA #	SAMA Description	Grouped Assessment	Case Name
192	Prairie Island 1, 2	Added	Purchase of a gagging device that could be used to close a stuck-open SG safety valve on the ruptured steam generator prior to core damage in SGTR events.	Quantitatively evaluate to determine the maximum benefit of SAMAs associated with SGTRs.	SGTR (cont.)
239	Sequoyah 1, 2	Added	Purchase or manufacture a "gagging device" that could be used to close a stuck-open steam generator safety valve for a SGTR event prior to core damage		
273	Waterford 3	61	Direct steam generator flooding after a steam generator tube rupture, prior to core damage		
274	Waterford 3	71	Manufacture a gagging device for a steam generator safety valve and develop a procedure or work order for closing a stuck open valve		
309	Point Beach	108	Improved SGTR coping abilities.		
319	Point Beach	149	Install a redundant spray system to depressurize the primary system during a SGTR.		
323	Point Beach	154	Adding other SGTR coping features.		
324	Point Beach	155	Increase secondary side pressure capacity such that a SGTR would not cause the relief valves to lift.		
325	Point Beach	157	A maintenance practice that inspects 100 percent of the tubes in a steam generator.		
313	Point Beach	130	Upgrade CVCS to mitigate small LOCAs.	Quantitatively evaluate the maximum benefit of increasing the capability of CVCS to mitigate small LOCAs.	SLOCA

Table 4.15-1 Grouping of Related Industry and PBN-Specific SAMAs for Bounding Evaluation (Sheet 12 of 12)

PBN SAMA #	Plant	Plant SAMA #	SAMA Description	Grouped Assessment	Case Name
13	Braidwood 1, 2	1	Diesel-driven SX pump in a new dedicated building.	Quantitatively evaluate the maximum benefit of having additional SW capability.	SW
15	Braidwood 1, 2	3	Auto-start of standby SX pump.		
39	Byron 1, 2	1	Diesel-driven SX pump in a new dedicated building.		
41	Byron 1, 2	3	Auto-start of standby SX pump.		
102	Crystal River 3	8	Provide a temporary pump to replace RWP.		
331	Point Beach	177	Provide additional SW pump.		
136	Indian Point 2	54	Install flood alarm in the 480-V AC switchgear room.	Quantitatively evaluate the maximum benefit of flood detection capability and related flood response procedures to mitigate flood events in the cable spread room.	SWCSRFLOOD
150	Indian Point 3	62	Install flood alarm in the 480-V AC switchgear room.		
160	Kewaunee	169	Provide flood protection for MCC-52E, -62E, and -62H.		
201	Salem 1, 2	6	Enhance flood detection for 84' auxiliary building and enhance procedural guidance for responding to service water flooding.		
232	Sequoyah 1, 2	279	Improve internal flooding response procedures and training to improve the response to internal flooding events.		

Table 4.15-2 Summary of Aggregate Maximum Benefits for Bounding SAMA Cases (Sheet 1 of 2)

Case	Figure of Merit	Unit 1			Unit 2		
		Base	SAMA	MB%	Base	SAMA	MB%
AFW	CDF	7.93E-05	4.36E-05	44.99%	6.83E-05	4.80E-05	29.79%
	STC LERF	1.73E-06	1.21E-06	30.25%	3.41E-06	2.87E-06	15.86%
ATWS	CDF	7.93E-05	7.90E-05	0.39%	6.83E-05	6.80E-05	0.44%
	STC LERF	1.73E-06	1.73E-06	0.03%	3.41E-06	3.41E-06	0.03%
AUXBLDG	CDF	7.93E-05	7.89E-05	0.48%	6.83E-05	6.82E-05	0.18%
	STC LERF	1.73E-06	1.67E-06	3.64%	3.41E-06	3.38E-06	0.98%
BATT HEP	CDF	7.93E-05	6.74E-05	15.03%	6.83E-05	5.60E-05	17.95%
	STC LERF	1.73E-06	1.71E-06	1.36%	3.41E-06	3.21E-06	5.98%
BUS 1B03	CDF	7.93E-05	7.93E-05	0.00%	6.83E-05	6.82E-05	0.15%
	STC LERF	1.73E-06	1.73E-06	0.00%	3.41E-06	3.41E-06	0.00%
CCW-XTIE	CDF	7.93E-05	7.62E-05	3.90%	6.83E-05	5.94E-05	13.02%
	STC LERF	1.73E-06	1.52E-06	11.94%	3.41E-06	2.83E-06	17.06%
CHARGING CCF	CDF	7.93E-05	7.93E-05	0.00%	6.83E-05	6.83E-05	0.00%
	STC LERF	1.73E-06	1.73E-06	0.00%	3.41E-06	3.41E-06	0.00%
CONTISO	CDF	7.93E-05	7.93E-05	0.00%	6.83E-05	6.83E-05	0.00%
	STC LERF	1.73E-06	1.52E-06	12.07%	3.41E-06	2.18E-06	36.11%
CST	CDF	7.93E-05	6.71E-05	15.33%	6.83E-05	5.67E-05	17.03%
	STC LERF	1.73E-06	1.68E-06	2.92%	3.41E-06	3.08E-06	9.71%
ECCS-CCW	CDF	7.93E-05	7.92E-05	0.13%	6.83E-05	6.82E-05	0.10%
	STC LERF	1.73E-06	1.73E-06	0.21%	3.41E-06	3.40E-06	0.15%
FUELOILXFER	CDF	7.93E-05	6.88E-05	13.15%	6.83E-05	6.10E-05	10.64%
	STC LERF	1.73E-06	1.58E-06	8.50%	3.41E-06	3.38E-06	0.84%
GASTURB	CDF	7.93E-05	7.83E-05	1.21%	6.83E-05	6.74E-05	1.33%
	STC LERF	1.73E-06	1.72E-06	0.38%	3.41E-06	3.40E-06	0.23%
HPI	CDF	7.93E-05	7.79E-05	1.72%	6.83E-05	6.76E-05	1.07%
	STC LERF	1.73E-06	1.49E-06	13.73%	3.41E-06	2.12E-06	37.69%

Table 4.15-2 Summary of Aggregate Maximum Benefits for Bounding SAMA Cases (Sheet 2 of 2)

Case	Figure of Merit	Unit 1			Unit 2		
		Base	SAMA	MB%	Base	SAMA	MB%
ISLOCA	CDF	7.93E-05	7.89E-05	0.48%	6.83E-05	6.82E-05	0.18%
	STC LERF	1.73E-06	1.67E-06	3.64%	3.41E-06	3.38E-06	0.98%
LLOCA	CDF	7.93E-05	7.83E-05	1.27%	6.83E-05	6.73E-05	1.49%
	STC LERF	1.73E-06	1.73E-06	0.10%	3.41E-06	3.41E-06	0.06%
MFW	CDF	7.93E-05	7.90E-05	0.33%	6.83E-05	6.81E-05	0.37%
	STC LERF	1.73E-06	1.73E-06	0.02%	3.41E-06	3.41E-06	0.03%
MSLB	CDF	7.93E-05	7.91E-05	0.20%	6.83E-05	6.81E-05	0.23%
	STC LERF	1.73E-06	1.73E-06	0.07%	3.41E-06	3.41E-06	0.03%
PORV	CDF	7.93E-05	7.88E-05	0.59%	6.83E-05	6.79E-05	0.56%
	STC LERF	1.73E-06	1.73E-06	0.21%	3.41E-06	3.40E-06	0.15%
RCP-SEAL	CDF	7.93E-05	7.51E-05	5.21%	6.83E-05	5.71E-05	16.40%
	STC LERF	1.73E-06	1.53E-06	11.65%	3.41E-06	2.07E-06	39.27%
RECIRC	CDF	7.93E-05	7.40E-05	6.64%	6.83E-05	6.24E-05	8.58%
	STC LERF	1.73E-06	1.73E-06	0.09%	3.41E-06	3.41E-06	0.06%
RWST	CDF	7.93E-05	7.40E-05	6.64%	6.83E-05	6.24E-05	8.58%
	STC LERF	1.73E-06	1.73E-06	0.14%	3.41E-06	3.41E-06	0.09%
SGTR	CDF	7.93E-05	7.92E-05	0.08%	6.83E-05	6.82E-05	0.09%
	STC LERF	1.73E-06	1.31E-06	24.08%	3.41E-06	2.78E-06	18.35%
SLOCA	CDF	7.93E-05	7.79E-05	1.74%	6.83E-05	6.79E-05	0.53%
	STC LERF	1.73E-06	1.61E-06	6.81%	3.41E-06	3.40E-06	0.25%
SW	CDF	7.93E-05	7.63E-05	3.73%	6.83E-05	6.59E-05	3.57%
	STC LERF	1.73E-06	1.64E-06	5.45%	3.41E-06	3.33E-06	2.24%
SWCSRFLOOD	CDF	7.93E-05	7.63E-05	3.72%	6.83E-05	6.53E-05	4.35%
	STC LERF	1.73E-06	1.56E-06	9.86%	3.41E-06	3.24E-06	5.07%

5.0 NEW AND SIGNIFICANT INFORMATION

The ER must contain any new and significant information regarding the environmental impacts of license renewal of which the applicant is aware. [10 CFR 51.53(c)(3)(iv)] The NRC has stated, however, that an applicant is not required to perform site-specific validation of GEIS conclusions. (NRC 1996c)

License renewal applicants are required to analyze only those issues the NRC has not resolved generically. While NRC regulations do not require an applicant's ER to contain analyses of the impacts of those Category 1 environmental issues that have been generically resolved [10 CFR 51.53(c)(3)(i)], the regulations do require that an applicant identify any new and significant information of which the applicant is aware. [10 CFR 51.53(c)(3)(iv)] The NRC has stated, however, that an applicant is not required to perform site-specific validation of GEIS conclusions (NUREG-1529).

5.1 New and Significant Information Discussion

The NRC provides guidance on new and significant information in Regulatory Guide 4.2, Supplement 1, Revision 1 (NRC 2013b). In this guidance, new and significant information is defined as follows:

1) Information that identifies a significant environmental impact issue that was not considered or addressed in the GEIS and, consequently, not codified in Table B-1, "Summary of Findings on NEPA Issues for License Renewal of Nuclear Plants," in Appendix B, "Environmental Effect of Renewing the Operating License of a Nuclear Power Plant," to Subpart A, "National Environmental Policy Act—Regulations Implementing Section 102(2)," of 10 CFR Part 51; or
2) Information not considered in the assessment of impacts evaluated in the GEIS leading to a seriously different picture of the environmental consequences of the action than previously considered, such as an environmental impact finding different from that codified in Table B-1.
3) Further, any new activity or aspect associated with the nuclear power plant that can act upon the environment in a manner or an intensity and/or scope (context) not previously recognized.

Based on available guidance and the definitions of SMALL, MODERATE, and LARGE impacts provided by NRC in 10 CFR Part 51, Appendix B, Table B-1, Footnote 3, NEPB considers any new information regarding Category 1 issues with MODERATE or LARGE impacts would be significant. Section 4.0.2 presents the NRC's definitions of SMALL, MODERATE, and LARGE.

5.2 NEPB's New and Significant Information Review Process

The new and significant information assessment described below meets or addresses regulatory guidance provided above.

NEPB's process is collectively carried out through its ongoing environmental planning, assessment, monitoring, and compliance activities performed by corporate and PBN management and staff and ER-specific reviews. This team has collective knowledge of the license renewal process, the PBN site, licensing and permitting, environmental and regulatory issues, initial license renewals, the NEPA process, and other nuclear industry activities which could potentially provide new and significant information.

NEPB's new and significant information review included establishment of applicable and non-applicable Category 1 issues through:

- Review of the initial license renewal ER and the GEIS for its Category 1 discussions and Supplement 2 to the GEIS;
- Identification and review of past or potential modifications to PBN, including environmental impacts; and
- Identification and assessment of equipment and operations with the potential to result in changes in emissions, releases, discharge points, land use, noise levels, etc., considering environmental reviews since initial license renewal, and those anticipated during the proposed license renewal term.

NEPB applied an investigative process for purposely seeking new information related to the Category 1 environmental issues through:

- Environmental review team discussions with NEPB and PBN subject matter experts on the Category 1 issues as they relate to the plant;
- Review of permits and reference materials related to environmental issues at the plant, the environmental resource areas related to Category 1 issues, and information collected for regulatory compliance status;
- Review of recent publicly available information, or information held by NEPB, particularly data or reports from the past 5 years, related to the resource area and each applicable Category 1 impact issue, as summarized in the appropriate section of the SLR ER in Chapter 3.0, Affected Environment;
- Review of environmental monitoring and reporting required by regulations related to the PBN site and operations;
- Review of NEPB environmental programs and procedures related to the PBN site and operations;

- Review of correspondence and permitting documentation related to oversight of PBN facilities and operations by state and federal regulatory agencies (activities that would bring significant issues to the plant's attention), to identify site-specific environmental concerns; and
- Review of previous initial and SLRAs for issues relevant to this PBN Units 1 and 2 SLR application.

In addition, NEPB is made aware of and stays abreast of new and emerging environmental issues and concerns on an ongoing basis through:

- Review of nuclear industry publications, operational experience, and participation in nuclear industry organizations
- Routine interface with non-nuclear NEER business units;
- Contact with state and federal resource agencies with regulatory jurisdiction over environmental regulation; and
- Development and periodic review of regulatory guidance procedures that address ongoing and emergent issues.

Information resulting from the information-seeking process was assessed to determine if it is new, and/or significant, applying the following considerations:

- Was the information included in or available for the GEIS analysis of the Category 1 issue?
- Was the information included in or available for the initial license renewal supplemental EIS (SEIS) for PBN?
- Does the information identify an environmental issue not generically considered in the GEIS, and consequently, not codified in 10 CFR Part 51 Appendix B Table B-1?
- Does the information present a seriously different picture of the environmental consequences of the action than previously considered, leading to an impact finding different from that included in the GEIS or codified in regulation?
- Does the information involve a new activity or aspect associated with the nuclear power plant that can act upon the environment in a manner or an intensity (MODERATE or LARGE) and/or scope (context) not previously recognized?

5.3 NEPB's New and Significant Information Review Results

As a result of this review, NEPB is aware of no new and significant information regarding the environmental impacts of SLR associated with PBN. The findings in NUREG-1437, Revision 1 for the applicable Category 1 issues are therefore incorporated by reference. New and significant information review methodology and results applicable to the issue of severe accidents, which is the functional equivalent of a Category 1 issue for PBN (NRC 2013f). SAMA analysis is addressed separately in Section 4.15.

6.0 SUMMARY OF LICENSE RENEWAL IMPACTS AND MITIGATING ACTIONS

6.1 License Renewal Impacts

Chapter 4 incorporates by reference NRC findings for the 54 Category 1 issues that apply to PBN, all of which have SMALL environmental impacts. In addition, Chapter 4 presents site-specific analyses of the 17 Category 2 issues. Table 6.1-1 identifies the environmental impacts that subsequent renewal of the PBN OLs would have on resources associated with Category 2 issues.

NEPB has reviewed the environmental impacts of renewing the PBN OLs and concluded that further mitigation measures beyond those presented in Section 6.2 and listed in Table 6.1-1 of this ER to avoid, reduce the severity of, or eliminate adverse impacts are not warranted. This ER documents the basis for NEPB's conclusion.

Table 6.1-1 Environmental Impacts Related to Subsequent License Renewal at PBN (Sheet 1 of 3)

Resource Issue	ER Section	Environmental Impact
Surface Water Resources		
Surface water use conflicts (plants with cooling ponds or cooling towers using makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	4.5.1	No impact. Issue is not applicable because PBN utilizes a once-through cooling system and does not utilize cooling ponds or cooling towers for condenser cooling purposes.
Groundwater Resources		
Groundwater use conflicts (plants that withdraw more than 100 gallons per minute) [10 CFR 51.53(c)(3)(ii)(C)]	4.5.3	No impact. Issue is not applicable because PBN does not withdraw more than 100 gallons per minute.
Groundwater use conflicts (plants with closed-cycle cooling systems that withdraw makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	4.5.2	No impact. Issue is not applicable because PBN utilizes a once-through cooling system and does not utilize a closed-cycle cooling system.
Groundwater quality degradation (plants with cooling ponds at inland sites) [10 CFR 51.53(c)(3)(ii)(D)]	4.5.4	No impact. Issue is not applicable because PBN uses a once through cooling system and does not utilize cooling ponds.
Radionuclides released to groundwater [10 CFR 51.53(c)(3)(ii)(P)]	4.5.5	SMALL impact. Water for station uses continues to be processed and monitored in compliance with licensing and permitting resulting in SMALL impacts and do not warrant additional mitigation measures.
Terrestrial Resources		
Effects on terrestrial resources (non-cooling system impacts) [10 CFR 51.53(c)(3)(ii)(E)]	4.6.5	SMALL impact. No refurbishment or other SLR-related construction activities have been identified; adequate management programs and regulatory controls in place to prevent impacts outside of previously disturbed areas.
Water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	4.6.4	No impact. Issue is not applicable because PBN utilizes a once-through cooling system and does not utilize cooling ponds or cooling towers for condenser cooling purposes.

Table 6.1-1 Environmental Impacts Related to Subsequent License Renewal at PBN (Sheet 2 of 3)

Resource Issue	ER Section	Environmental Impact
Aquatic Resources		
Impingement and entrainment of aquatic organisms (plants with once-through cooling systems or cooling ponds) [10 CFR 51.53(c)(3)(ii)(B)]	4.6.1	SMALL impact. Because the plant complies with the current WPDES permit, will comply with the future renewal of the permit, and will implement best available technology requirement to minimize impacts of impingement and entrainment, the impacts would be SMALL during the proposed SLR operating term.
Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds) [10 CFR 51.53(c)(3)(ii)(B)]	4.6.2	SMALL impact. Because the thermal discharges associated with PBN outflow have been demonstrated and determined under CWA 316(a) to be protective of the Lake Michigan aquatic community and PBN is operating in conformance with its WPDES permit, impacts are anticipated to be SMALL. Because there are no planned operational changes during the proposed SLR operating term, the impacts would be SMALL during the proposed SLR operating term.
Water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river) [10 CFR 51.53(c)(3)(ii)(A)]	4.6.3	No impact. Issue is not applicable because PBN utilizes a once-through cooling system and does not utilize cooling ponds or cooling towers for condenser cooling purposes.
Special Status Species and Habitats		
Threatened, endangered, and protected species and essential fish habitat [10 CFR 51.53(c)(3)(ii)(E)]	4.6.6	Not likely to adversely affect No refurbishment or other SLR-related construction activities have been identified. The continued operation of the site would not likely adversely affect any federally or state-listed species. License renewal would not likely adversely affect threatened, endangered, and protected species in the vicinity of PBN.
Historic and Cultural Resources		
Historic and cultural resources [10 CFR 51.53(c)(3)(ii)(K)]	4.7	No adverse effects on historic properties. No refurbishment or other SLR-related construction activities have been identified; administrative procedure ensures protection of these type resources in the event of excavation activities.

Table 6.1-1 Environmental Impacts Related to Subsequent License Renewal at PBN (Sheet 3 of 3)

Resource Issue	ER Section	Environmental Impact
Human Health		
Microbiological hazards to the public (plants with cooling ponds or canals or cooling towers that discharge to a river) [10 CFR 51.53(c)(3)(ii)(G)]	4.9.1	SMALL impact. Conditions necessary for optimal growth of pathogens are limited by water temperatures in the discharge area. Therefore, the public human health risk posed by PBN's thermal discharge's capacity to enhance thermophilic microorganisms is SMALL
Electric shock hazards [10 CFR 51.53(c)(3)(ii)(H)]	4.9.2	SMALL impact. PBN in-scope lines are in compliance with NESC clearance guidelines. Work on and near the transmission lines is governed by plant procedures. Given these conditions, the human health impact from electric shock hazards during the proposed SLR operating term would be SMALL.
Postulated Accidents		
Severe accidents [10 CFR 51.53(c)(3)(ii)(L)]	4.15.2	SMALL impact. A series of bounding quantitative analyses demonstrated that none of the SAMAs considered would reduce the PBN maximum benefit by 50 percent or greater. Therefore, it was concluded that there is no new and significant information that would alter the conclusions of the original SAMA analysis for PBN (i.e., none of the proposed SAMAs were cost beneficial).
Environmental Justice		
Minority and low-income populations [10 CFR 51.53(c)(3)(ii)(N)]	4.10.1	No disproportionately high and adverse impacts or effects on minority and low-income populations identified.
Cumulative Impacts		
Cumulative Impacts [10 CFR 51.53(c)(3)(ii)(O)]	4.12	SMALL adverse to SMALL beneficial impacts. SMALL for land use and visual resources, air quality and noise, geology and soils, surface water, ground water, terrestrial and aquatic ecological resources, waste management and human health. SMALL adverse to SMALL beneficial for climate change. SMALL beneficial for socioeconomics. No Impact for historic and cultural resources.

6.2 Mitigation

6.2.1 Requirements [10 CFR 51.45(c) and 10 CFR 51.53(c)(3)(iii)]

The environmental report must include an analysis that considers and balances . . . alternatives available for reducing or avoiding adverse environmental effects. [10 CFR 51.45(c)]

The report must contain a consideration of alternatives for reducing adverse impacts . . . for all Category 2 license renewal issues . . . . [10 CFR 51.53(c)(3)(iii)]

6.2.2 NEPB Response

NRC Regulatory Guide 4.2, Supplement 1, Revision 1, specifies that the applicant should identify any ongoing mitigation and address the potential need for additional mitigation. Applicants are only required to consider mitigation alternatives in proportion to the significance of the impact. (NRC 2013b)

As discussed in Section 6.1, impacts associated with the proposed PBN SLR do not require the implementation of additional mitigation measures. The permits and programs presented in Chapter 9 (i.e., NPDES permit; stormwater program; air permit; spill prevention, control, and countermeasure (SPCC) plan; hazardous waste management program; cultural resource description process; and environmental review programs) that currently mitigate the operational environmental impacts of PBN are adequate. Therefore, additional mitigation measures are not sufficiently beneficial as to be warranted.

6.3 Unavoidable Adverse Impacts

6.3.1 Requirement [10 CFR 51.45(b)(2)]

The environmental report shall . . . discuss . . . any adverse environmental effects which cannot be avoided should the proposal be implemented . . . . [10 CFR 51.45(b)(2)]

6.3.2 NEPB Response

An environmental review conducted at the license renewal stage differs from the review conducted in support of a construction permit because the facility is in existence at the license renewal stage and has already operated for years. As a result, adverse impacts associated with the initial construction have been avoided, mitigated, or already occurred.

As discussed in Chapter 4, NEPB does not anticipate the continued operations of PBN to adversely affect the environment. NEPB also does not anticipate any SLR-related refurbishment as a result of the technical and aging management program information that will be submitted in accordance with the NRC license renewal process. Therefore, the environmental impacts to be evaluated for SLR are those associated with continued operation during the renewal term.

NEPB adopts by reference the NRC findings for the 54 Category 1 issues applicable to PBN, including discussions of any unavoidable adverse impacts (NRC 2013a). In addition, NEPB identified the following site-specific unavoidable adverse impacts associated with PBN:

- The majority of the land use at PBN would continue to be designated as industrial until the plant is shut down and decommissioned (decommissioning can take up to 60 years after permanent shutdown of PBN). Uranium mining associated with the nuclear fuel cycle also has offsite land use implications.
- Aquatic organisms would continue to be impinged and entrained at the low-level intake structure, but as discussed in Section 4.6.1, these impacts were determined to be SMALL.
- As discussed in Section 3.6.1, normal plant operations result in industrial wastewater discharges containing small amounts of water treatment chemical additives to Lake Michigan at or below WDNR-approved concentrations. Compliance with the WPDES permit (Attachment B) would ensure that impacts remain SMALL.
- As discussed in Section 3.6.3.1, plant operation of PBN results in consumptive water use of Lake Michigan. PBN uses a once-through cooling system that returns withdrawn cooling water to the lake with minimal net loss.
- Operation of PBN results in the generation of spent nuclear fuel and waste material, including LLRW, hazardous waste, and nonhazardous waste. Specific plant design features in conjunction with a waste minimization program, employee safety training programs and work procedures, and strict adherence to applicable regulations for storage, treatment, transportation, and ultimate disposal of this waste ensure that the impact is SMALL.
- Operation of PBN results in a very small increase in radioactivity in the air and water emissions. The incremental radiation dose to the local population resulting from PBN operations is typically less than the magnitude of the fluctuations that occur in natural background radiation. Doses to the public from PBN's gaseous releases would be well within the allowable limits of 10 CFR Part 20 and 10 CFR Part 50, Appendix I. Operation of PBN also creates a very low probability of accidental radiation exposure to inhabitants of the area.

6.4 Irreversible or Irretrievable Resource Commitments

6.4.1 Requirement [10 CFR 51.45(b)(5)]

The environmental report shall . . . discuss . . . any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented. [10 CFR 51.45(b)(5)]

6.4.2 NEPB Response

The term "irreversible" applies to the commitment of environmental resources (e.g., permanent use of land) that cannot by practical means be reversed to restore the environmental resources to their former state. In contrast, the term "irretrievable" applies to the commitment of material resources (e.g., irradiated steel, petroleum) that, once used, cannot by practical means be recycled or restored for other uses. The continued operation of PBN for the proposed SLR operating term will result in irreversible and irretrievable resource commitments, including the following:

- Uranium in the nuclear fuel consumed in the reactor that becomes high-level radioactive waste if the used fuel is not recycled through reprocessing.
- Land required for permanent storage or disposal of spent nuclear fuel, LLRW generated as a result of plant operations, and sanitary waste generated from normal industrial operations.
- Elemental materials that will become radioactive.
- Materials used for the normal industrial operations of PBN that cannot be recovered or recycled, or that are consumed or reduced to unrecoverable forms.

Other than the above, no SLR-related refurbishment activities have been identified that would irreversibly or irretrievably commit significant environmental components of land, water, and air.

If PBN ceases operations on or before the expiration of the current OLs, the likely power generation alternatives would require a commitment of resources for construction of the replacement plant as well as for fuel to run the plant. Significant resource commitments would also be required if transmission lines are needed to connect a replacement generation plant to the electrical grid.

6.5 Short-Term Use Versus Long-Term Productivity of the Environment

6.5.1 Requirement [10 CFR 51.45(b)(4)]

The environmental report shall . . . discuss . . . the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity .... [10 CFR 51.45(b)(4)]

6.5.2 NEPB Response

The current balance between short-term use and long-term productivity of the environment at the site has remained relatively constant since PBN began operations. The SEIS for PBN evaluated the relationship between the short-term uses of the environment and the maintenance and enhancement of the long-term productivity associated with the construction and operation of PBN (NRC 2005, Section 9.1.3). The proposed SLR operating term will not alter the short-term uses of the environment from the uses previously evaluated in the PBN final environmental statements (FESs). The proposed SLR operating term will postpone the availability of the site resources (land, air, water) for other uses. Denial of the application to renew the PBN OLs would lead to the shutdown of the plant and would alter the balance in a manner that depends on the subsequent uses of the site. For example, the environmental consequences of turning the site area occupied by PBN into a park or an industrial facility after decommissioning are quite different. Extending PBN operations would not alter, but only postpone, the potential long-term uses of the site that are currently possible.

In summary, no SLR-related refurbishment activities have been identified that would alter the evaluation of the PBN FES for the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity of these resources.

7.0 ALTERNATIVES TO THE PROPOSED ACTION

The environmental report shall . . . discuss . . . alternatives to the proposed action . . . . [10 CFR 51.45(b)(3)]

The applicant shall discuss in this report the environmental impacts of alternatives and any other matters . . . . The report is not required to include discussion of need for power or economic costs and benefits of . . . alternatives to the proposed action except insofar as such costs and benefits are either essential for a determination regarding the inclusion of an alternative in the range of alternatives considered or relevant to mitigation . . . . [10 CFR 51.53(c)(2)]

A reasonable alternative must be commercially viable on a utility scale and operational prior to the expiration of the reactor's operating license, or expected to become commercially viable on a utility scale and operational prior to the expiration of the reactor's operating license . . . . The amount of replacement power generated must equal the base-load capacity previously supplied by the nuclear plant and reliably operate at or near the nuclear plant's demonstrated capacity factor. (NRC 2013a, Section 2.3)

The purpose and need for the proposed action (issuance of a renewed license) is to provide an option that allows for baseload power generation capability beyond the term of the current nuclear power plant operating license to meet future system generating needs (NRC 2013a, Section 1.3). Therefore, an alternative to the proposed action would likewise be capable to meeting this purpose and need. This chapter explores the potential alternatives and the environmental impacts are detailed for those selected as meeting this purpose and need.

7.1 No Action Alternative

The proposed action as described in Section 2.1 is for the NRC to renew the OLs for PBN Units 1 and 2 for an additional 20 years. Therefore, the only other alternative under consideration by the NRC is the no-action alternative, which would be a decision to not renew the PBN OLs. If the PBN OLs are not renewed, the 1,200 MWe of baseload power would not be available for distribution in Wisconsin and other markets during the proposed SLR operating term from 2030–2050 for PBN Unit 1 and from 2033–2053 for PBN Unit 2. The no-action alternative will identify replacement power sources for the loss of PBN generation.

In accordance with 10 CFR 51.53(b)(3), this ER will discuss a no-action alternative to the proposed license renewal and a range of alternatives for replacement baseload power sources. A reasonable alternative as described by the NRC must be technically feasible and must be (or expected to become) commercially viable on a utility scale and operational prior to the expiration of the reactors' OLs (NRC 2013a). The replacement power alternative generation must also provide adequate baseload power capacity that was previously supplied by the nuclear plant.

The replacement power sources being considered under the no-action alternative are discussed in Section 7.2.1. Section 7.2.2 identifies the no-action alternative power sources evaluated that were not considered reasonable power sources for the replacement of the PBN generation.

7.1.1 Decommissioning Impacts

The NRC's definition of decommissioning as stated in 10 CFR 50.2 is the safe removal of a nuclear facility from service and the reduction of residual radioactivity to a level that permits the following:

- Release of the property for unrestricted use and termination of the license; or
- Release of the property under restricted conditions and termination of the license.

The NRC-evaluated decommissioning options include the following:

- Immediate dismantling soon after the facility closes (DECON).
- Safe storage and monitoring of the facility for a period of time that allows the radioactivity to decay, followed by dismantling and additional decontamination (SAFSTOR).
- Permanent entombment on the site in structurally sound material such as concrete that is maintained and monitored (ENTOMB).

All the decommissioning options must be completed within a 60-year period following permanent cessation of operations and permanent removal of fuel.

Under the no-action alternative, NEPB would continue operating PBN until the existing OLs expire. Upon expiration of the OLs, NEPB would initiate decommissioning procedures in accordance with NRC requirements. The NRC GEIS evaluated decommissioning environmental impacts for land use, visual resources, air quality, noise, geology and soils, hydrology, ecology, historic and cultural resources, socioeconomics, human health, environmental justice, and waste management and pollution prevention. NEPB considers the GEIS description of decommissioning impacts as representing the actions it would perform for PBN decommissioning. Therefore, NEPB relies on the NRC's conclusions regarding the environmental impacts of decommissioning PBN.

Decommissioning and its associated impacts are not considered evaluation criteria used to proceed with the proposed action or select the no-action alternative. PBN will have to be decommissioned eventually regardless of the NRC decision on license renewal. License renewal would only postpone decommissioning for another 20 years. The GEIS states the timing of the decommissioning does not change the environmental impacts associated with this activity. The NRC findings as described in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 state that delaying decommissioning until after the renewal term would result in SMALL environmental impacts. NEPB relies on the NRC's findings.

The primary criteria used to evaluate the proposed action and the no-action alternative are the power options available for replacement of PBN generation. NEPB concludes that the decommissioning impacts under the no-action alternative would not be substantially different from those following license renewal as identified in the GEIS. Decommissioning impacts would be SMALL and could overlap with operation of a PBN replacement.

7.2 Energy Alternatives that Meet System Generating Needs

In accordance with 10 CFR 51.53(c)(2), NEPB considered a range of alternatives to replace generation if the PBN OLs are not renewed. The alternatives considered for replacement power were developed based on the following:

- Alternatives evaluated in this ER would need to be capable of providing approximately 1,200 MWe net for the regional grid.
- Alternatives evaluated in this ER would need to provide baseload generation.
- Alternatives considered must be capable of being fully operational by 2030 considering development of the technology, permitting, construction of the facilities, and connection to the grid.
- Alternatives must be electricity-generating sources that are technically feasible and commercially viable.

The following subsections identify the power sources considered as reasonable (Section 7.2.1), and the power sources considered as unreasonable (Section 7.2.2).

7.2.1 Energy Alternatives Considered as Reasonable

A reasonable alternative as described by the NRC must be technically feasible and must be (or expected to become) commercially viable on a utility scale and operational prior to the expiration of the reactors' OLs (NRC 2013a). The replacement power alternative generation must also equal the baseload capacity previously supplied by the nuclear plant. The alternatives analysis identified the following power sources as meeting the NRC criteria for reasonableness in the replacement of PBN generation during the proposed SLR operating term.

New Nuclear Alternative:

- Option 1: ALWR with mechanical draft cooling towers located at the PBN site.
- Option 2: Cluster of small modular reactors (SMRs) with mechanical draft cooling towers located at the PBN site.

Combination Alternative:

- Configuration of natural gas combined cycle units with mechanical draft cooling towers located at the PBN site.
- Expansion of the Point Beach solar facility using the identified alternative array location.

7.2.1.1 New Nuclear

The new nuclear alternative involves two options for reactor types, ALWR and SMR, to be located at the PBN site. One type of ALWR design is the AP1000 design which has a design gross-electrical output of approximately 1,200 MWe. For each of the licensed AP1000 units at Turkey Point, Florida Power & Light estimated the station and auxiliary service load at 108 MWe for a net electrical output of 1,092 MWe. (NRC 2016b, Table 3-6) A second ALWR design is the economic simplified BWR design with a design gross electrical output of approximately 1,605 MWe. For the unit licensed for the Enrico Fermi Nuclear Generating Station in Michigan, Detroit Edison estimated a net output of 1,535 MWe. (NRC 2013c, Section 3.2.1) Given the capacity of both designs, a single-unit ALWR plant is proposed as the PBN replacement under the new nuclear ALWR option.

The SMR option would consist of SMR units. The Nuscale design is 60 MW gross per unit with a greater than 95 percent capacity factor with up to 12 units controlled by a single control room (NuScale 2019a). Replacement of PBN generation would require 21 SMR units of the Nuscale capacity.

NEPB assumes either nuclear option would utilize mechanical draft cooling towers and, like PBN, the plant would utilize Lake Michigan for cooling water and discharge. It is also assumed that the existing intake and discharge structures would be used, with some modifications and pump replacement as appropriate. The existing transmission infrastructure is assumed to be sufficient for the alternative plant.

7.2.1.2 Combination Alternative, Natural Gas-Fired Generation and Solar

The combination alternative would include an NGCC plant at the PBN site and an expansion of the Point Beach solar facility. The expansion would be within the alternate array site identified west and north of the existing ISFSI (see Figure 3.1-1) (PB Solar 2019, Appendix A). This expansion would be an array with a nameplate of 25 MW, and battery storage would be added to provide 25 MWe of baseload energy to the regional grid (PB Solar 2019, Section 1.4.2.1). The NGCC plant would consist of multiple combustion turbines, a heat recovery steam generator, and a steam turbine generator assembled in appropriate power-train configurations. Based on a capacity factor of 87 percent (EIA 2020a), the replacement NGCC plant would be 1,351 MWe gross to yield 1,175 MWe net for the regional grid.

NEPB assumes that the plant would utilize mechanical draft cooling towers and like PBN, the NGCC plant would utilize Lake Michigan for cooling water and discharge. The existing intake and discharge structures would be used, with some modifications and pump replacement as appropriate, for the NGCC plant. NEPB also assumed that the existing PBN transmission line infrastructure is adequate for the combination alternative. The NGCC plant would require development of approximately 10 miles of natural gas pipeline to connect the plant to a natural gas supply. An existing natural gas pipeline terminates in Two Rivers, WI (USDOT 2020b).

7.2.2 Energy Alternatives Not Considered Reasonable

The full range of energy alternatives as described in the GEIS includes power sources that will require development of new generation and power alternatives that will not require new generation, such as purchased power (NRC 2013a, Section 2.3). NEPB considered all the alternatives described in the GEIS for replacement of the PBN generation. This section addresses the energy alternatives that were considered not reasonable for additional evaluation.

7.2.2.1 Alternatives not Requiring New Generating Capacity

7.2.2.1.1 Purchased Power

NEPB currently sells power from PBN to the Wisconsin Electric Power Company (FPL Energy PB 2006). The loss of PBN's generating capacity could introduce uncertainties in energy reliability within the Wisconsin Electric Power Company's service area. To replace PBN's generation on a long-term basis through purchased power would likely require the development of new generation facilities.

Potential environmental impacts associated with purchased power could be substantial and could exceed the impacts associated with the continued operation of PBN. Potential environmental impacts associated with purchased power would include those associated with the source of the generation and the transmission of the power into the regional grid. Fossil generation results in air emissions, water use and quality issues, and land use impacts associated with the plant footprint. Renewable energy generation, specifically solar and wind, have a large development footprint that can convert natural habitats to an industrial site. The conversion of forest and even agricultural lands to an industrial site can result in impacts to habitat that may adversely impact wildlife and plant species. Additional transmission capacity may be required to transport renewable or fossil generation into the region and this may result in impacts to communities and lands within and adjacent to the corridor. These impacts could include loss of sensitive habitat, visual and view shed impairment, and degradation of wetlands and stream crossings.

Purchasing power from non-utility generators such as PBN can be a reasonable short-term alternative for utilities such as Wisconsin Electric Power Company to meet demand. However, given the uncertainties of purchasing baseload power at the scale of PBN's generation capacity on a long-term basis and the environmental impacts for developing new generation as well as the operational impacts of fossil-fuel generation, purchased power was not considered a reasonable replacement alternative.

7.2.2.1.2 Plant Reactivation or Extended Service Life

PBN is the only nuclear plant that NEER operates in Wisconsin. Therefore, NEER does not have any other units for which NEER could delay retirement or reactivate. Another generation company could agree to reactivate or delay retirement of a plant.

Like many states, Wisconsin is experiencing a transition away from coal-fired generating plants, with many coal plants across the nation being shut down. The Wisconsin Electric Power Company retired one of the larger coal plants in Wisconsin in 2018, the Pleasant Prairie plant. This coal plant was constructed in 1980 with a gross generating capacity of 1,233 MW, and was retired early to reduce carbon dioxide emissions (WEPC 2019). This plant has the potential to be reactivated; however, the air pollutant emissions would exceed that of continued operation of PBN as evidenced by NRC's assessment of the air quality impacts of license renewal of the Sequoyah Nuclear Plant versus operation of a more advanced coal-fired plant (NRC 2018, Table 2-2). Therefore, plant reactivation and extended service life is not considered a reasonable alternative because of the environmental impacts associated with continued use of these generation sources.

7.2.2.1.3 Conservation or Demand-Side Management

Demand-side management (DSM) includes demand response that shifts electricity from a peak-use period to times of lower demand, and energy efficiency or conservation programs that reduce the amount of electricity required for existing activities and processes. A DSM alternative would be required to reduce the baseload demand within the service area by 1,200 MWe to be considered a reasonable alternative that could replace PBN generation. Because NEPB is a merchant generator and does not have a retail customer base in Wisconsin, it does not have DSM program in Wisconsin or the ability to implement such a program in Wisconsin. Therefore, DSM is not considered a reasonable alternative.

7.2.2.2 Alternatives Requiring New Generation Capacity

7.2.2.2.1 Wind

Onshore Wind

Because wind generation is intermittent by nature, with generation capacities dependent on wind speed, generation can fluctuate from hour to hour. The U.S. Energy Information Administration (EIA) estimated the generating capacity factor for wind generation for U.S. facilities at 40 percent, significantly higher than solar, but significantly lower that the generation capacities of nuclear and natural gas-fired generation facilities at approximately 90 and 87 percent, respectively (EIA 2020a). The wind resource potential varies across the United States with the Midwest having greater wind resources than other regions. Wisconsin's wind speed at 80 meters above the surface averages 5.0 to 7.9 meters per second (NREL 2017). Wisconsin's potential for onshore wind is estimated at more than 100,000 MW. The state has 17 onshore wind facilities with a total installed wind capacity of 737 MW. (AWEA 2020).

Wind is intermittent and therefore by itself is not capable of providing baseload power. For a wind farm to replace a baseload energy source, energy storage would have to be included for the facility. Energy storage technology has progressed in recent years, increasing the potential for wind farms coupled with energy storage such as battery storage to mitigate intermittent generation. However, onshore wind as a discrete generation source is an unreasonable alternative to the proposed action given that wind generation must be coupled with energy storage to provide baseload energy.

NEER is constructing a 500-MW wind installation at the Wheatridge Renewal Energy Facility in Oregon (NEER 2018) and NEER is constructing a 409-MW battery storage facility in Florida (FPL 2019). Given these projects, NEER considered the commercial viability of wind generation plus battery storage as a generating alternative to PBN. Replacing PBN's generating capacity would require multiple utility scale wind farms and each facility would require thousands of acres. The Wheatridge Renewal Energy Facility encompasses more than 16,000 acres (NEER 2018). Given Wisconsin's private property holdings are generally of much smaller acreage than a western state such as Oregon, the number of landowners that would have to be involved in acquiring land use rights on such acreage is not a viable commercial venture. Moreover, the property setback requirements for non-participating landowners would further increase the required acreage. Finally, in much of Wisconsin, the need to clear forested land for a single wind farm of 500 MW would approach 1,000 acres. Therefore, onshore wind plus battery storage was not considered a commercially viable alternative to the proposed action. Furthermore, the land disturbances and conversion to power generation at each of the multiple wind farm sites could result in MODERATE to LARGE impacts on wildlife habitats, vegetation, land use, and aesthetics.

<u>Offshore Wind</u>

Wisconsin has potential for offshore wind of more than 14,000 MW (AWEA 2020). However, there are currently no offshore wind installations on the Great Lakes. The first is anticipated to be the Icebreaker Wind demonstration project of 20.7 MW in Lake Erie offshore from Cleveland, OH, projected for operation in 2022. One of the project's challenges has been designing the installation to withstand the force of ice floes. (EE News 2019) Installation and siting require careful consideration to bathymetry and offshore construction concerns. Siting is further complicated by shipping lanes, fishing rights, wildlife migration patterns, military operations, and other environmental concerns. Wind installations also pose aesthetic impact concerns, so the larger turbines require longer offshore distances to minimize aesthetic impacts. Environmental impacts associated with the construction and operation of a large utility-scale offshore wind facility could range from MODERATE to LARGE and would require multiple installations. Given that offshore wind installations on the Great Lakes are still pending the demonstration phase and the challenges of siting and potential for environmental impacts, offshore wind is not considered a reasonable alternative. Furthermore, to mitigate the intermittent nature of wind as a generating source to replace the baseload generation of PBN, the offshore wind facility would have to be coupled with energy storage.

7.2.2.2.2 Solar

Solar PV systems consist of interconnected PV cells that convert sunlight into electricity. Concentrated solar power (CSP) systems utilize mirrors to reflect and concentrate sunlight onto receivers to convert solar energy into thermal energy that in turn produces electricity. Solar PV can make use of both direct solar radiation and diffuse horizontal radiation, which is one reason PV is technically feasible in more areas of the United States than CSP technologies. The amount of direct and horizontal solar irradiation varies across the United States with northernmost states, including Wisconsin, experiencing the lowest annual solar irradiation in the United States. The annual average direct solar irradiation for Wisconsin is less than 4.0 to 4.4 kWh/m2/day and horizontal solar irradiance is less than 4.0 to 4.25 kWh/m2/day (NREL 2018a; NREL 2018b). The solar irradiance factors into the generating capacity of a facility. EIA estimated the generating capacity factor for solar generation for U.S. facilities at 30 percent (EIA 2020a); however, NEER estimated the generation capacity for the PB solar facility co-located with PBN to be 19.77 to 23.19 percent. (PB Solar 2019, Section 2.1). In contrast, the generation capacities of nuclear and natural gas-fired generation facilities are approximately 90 and 87 percent, respectively (EIA 2020a).

Solar generation is intermittent by nature with no generation during nighttime hours. During the day, generation can fluctuate from hour to hour as solar irradiance varies. For a solar power facility to replace a baseload energy source, energy storage would have to be included for the solar facility. Energy storage technology has progressed in recent years, increasing the potential for solar facilities coupled with energy storage such as battery storage to mitigate solar's intermittent generation. For example, FPL has implemented a utility-scale battery storage facility to provide energy storage for one of its solar farms located in Florida (FPL 2019).

A solar facility with the generating capacity to replace PBN's baseload generation would require a large amount of land and multiple sites. The Point Beach solar PV facility, a facility without energy storage, is approximately 565 acres with an installed capacity of 100 MW. (PB Solar 2019, Sections 1.1.1.3 and 2.1) The ratio of the acreage of the PB solar facility to its capacity can be used as a planning guide for the acreage needed to site a solar facility in Wisconsin. Using this ratio of 5.65 acres per 100 MW, the acreage needed for solar to replace PBN generation would be 6,780 acres. To consider solar as a replacement for a baseload energy source, battery storage, or other energy storage means, would have to be added at the facilities. Energy storage would require additional acreage. Due to the amount of solar generating capacity needed to replace the entire PBN baseload generation and the lower efficiencies in producing electricity from solar power versus nuclear power, the land acreage required to install solar generation would be significant. Depending on the location of the solar facilities, the land use disturbances could result in MODERATE to LARGE impacts on wildlife habitats, vegetation, land use, and aesthetics.

Solar by itself is not considered a reasonable alternative for the replacement of the PBN generation because it cannot provide baseload energy. Solar with battery storage could be a reasonable alternative; however, its generation capacity is far less than nuclear generation. Furthermore, the solar generation capacity estimated for a Wisconsin location is also approximately two-thirds of that estimated by EIA as a U.S. average. The generation capacity would require the facilities to encompass more than 6,780 acres. Thus, discrete solar is an unreasonable alternative to the proposed action given that (1) solar must be coupled with energy storage to provide baseload energy; (2) the generation capacity of solar is significantly lower than other generation sources and lower still due to Wisconsin's solar irradiation levels; and (3) while solar coupled with energy storage could provide baseload energy, more than 6,780 acres would be converted to solar generation, which would result in significant impacts to wildlife habitats, vegetation, land use, and aesthetics at multiple sites. Solar with energy storage is a component of both combination alternatives and was not considered further as a discrete alternative due to the acreage requirements.

7.2.2.2.3 Hydropower

The DOE's Oak Ridge National Laboratory assessed the ability of existing non-powered dams across the country to generate electricity. The non-powered dams in Wisconsin do not provide the scale of power generation capacity needed to replace PBN's generation capacity. The study found that the dam with the greatest potential generated approximately 46.2 MWe. (ORNL 2012, Table 4 and Appendix A)

Construction of a new dam and large-scale hydropower facility would require considerable siting considerations, such as the area that would be inundated to provide water storage for generation, as well as the overall environmental impacts associated with the development of the facility. The environmental impacts would be LARGE for land use, water resources, socioeconomics, ecology, and cultural resources.

The lack of potential for large hydroelectric power facilities at existing dams in Wisconsin and the environmental constraints associated with the development of a new hydropower facility make hydropower an unreasonable alternative to replace the PBN generation.

7.2.2.2.4 Geothermal

The National Renewable Energy Laboratory rates most of Wisconsin as least favorable for geothermal resources with only a corner of the state being rated as third most favorable out of five favorability ranges. (NREL 2018c). Therefore, geothermal energy is not considered a reasonable power source for Wisconsin.

7.2.2.2.5 Biomass

Biomass includes wood waste, municipal waste, manure, certain crops, and other types of waste residues used to create electricity. Using biomass-fired generation for baseload power depends on the geographic distribution, available quantities, constancy of supply, and energy content of biomass resources.

Biomass plants tend to be much smaller than nuclear or fossil fuel plants. To replace the PBN baseload generation, it would take the construction of several biomass plants located near reliable fuel sources that continuously produce enough biomass to fuel the plants. Large biomass plants are generally 50 MWe, with the largest ones being slightly more than 100 MWe (NRC 2019c). Replacing the generating capacity of PBN using only biomass would require the construction of 12 large facilities.

Biomass plants require storage facilities for the fuel products and for waste ash/residue for the wood, crop, and agriculture waste types. Wood waste plants require a large land area for storage and processing, and, like coal generation, they produce ash that must be disposed of in a manner that does not pollute waterways and air. Therefore, environmental impacts associated with construction of a wood waste plant would be MODERATE to LARGE, with the impact intensity level being dependent on the siting and proximity to a source of wood waste.

Utilizing municipal solid waste for electricity is also dependent on being close to large population centers that generate large amounts of waste. Air emissions are also an issue with biomass plants, and construction of a plant would require installation of maximum achievable control technology to comply with the CAA regulations. The combustion of the fuel also results in air emissions that must be controlled to meet air quality regulations.

Overall, the construction and operation of number of biomass plants with the combined generating capacity necessary to act as an alternative to PBN would result in MODERATE environmental impacts to land use, water quality, ecological resources, and air quality.

Generating baseload generation from biomass sources is limited because of the need to site facilities near substantial fuel sources and impacts to land from constructing and operating the facility. In addition, without the construction of multiple smaller facilities, biomass plants are unable to produce the large baseloads of electricity that nuclear and fossil fuel plants generate. Therefore, biomass is not considered a reasonable alternative to PBN's baseload generation.

7.2.2.2.6 Fuel Cells

Current fuel cell installations provide from hundreds of kilowatts to tens of megawatts of power, which is a significantly smaller scale than what is needed as a reasonable replacement of PBN's generating capacity. Fuel cells as a utility-scale generation alternative are not presently economically or technologically competitive with other alternatives. Therefore, fuel cells are not considered a reasonable alternative to PBN's baseload generation.

7.2.2.2.7 Wave and Current Energy

The technology to harness wave and current (i.e., hydrokinetic) energy is in development with many demonstration projects deployed around the world (DOE 2019). The Federal Energy

Regulatory Commission has licensing authority over hydrokinetic energy projects deployed in the United States. Currently, there are three licensed pilot projects and four projects seeking permits or holding a preliminary permit. The largest project is a 20-MWe marine project. The largest inland project is a 6-MWe project proposed for the Mississippi River. (FERC 2020; 83 FR 11192).

Given hydrokinetic technology is in the early stages of commercial application and projects have low generation capacities, ocean wave and current energy is not considered a reasonable alternative in the necessary time frame for power supply.

7.2.2.2.8 Petroleum-fired

Petroleum-fired generation emits large amounts of carbon dioxide and hazardous air pollutants, making it undesirable for utilities looking to reduce air pollutants and comply with regulations. Based on the greater environmental impacts and cleaner energy source policies and regulations, petroleum-fired generation is not a reasonable alternative.

7.2.2.2.9 Coal-fired

As presented in Section 7.2.2.1.2, coal-fired plants are being retired throughout the United States, including Wisconsin. The NRC recently considered a supercritical pulverized coal facility as an alternative to renewing the River Bend Station Unit 1 OL, finding license renewal the preferred alternative. The supercritical pulverized coal facility alternative had operating impacts greater than license renewal, in addition to the environmental impacts inherent with new construction projects. (NRC 2018, Table 2-2)

Based on the greater potential environmental impacts and limited technical viability, coal-fired generation is not a reasonable alternative.

7.2.3 Environmental Impacts of Alternatives

7.2.3.1 <u>New Nuclear</u>

As described in Section 7.2.1.1, the new nuclear alternative includes two options. Option 1 is an ALWR unit located on the PBN site and Option 2 is a cluster of 21 SMR units at the PBN site. Either option would utilize mechanical draft cooling towers with Lake Michigan for cooling water makeup and discharge. The existing intake and discharge structures would be used, with some modifications and pump replacement as appropriate. The existing transmission infrastructure would be used and is assumed to be sufficient.

7.2.3.1.1 Land Use

<u>Option 1, ALWR Unit</u>

The existing site has adequate open space to support construction of an additional nuclear unit and mechanical draft cooling towers. The PBN site has open area both north and south of the power block. Excluding the area identified as the co-located Point Beach solar facility (Figure 3.1-3), there is open area north of the PBN power block of about 60 acres and the area south of the power block including existing parking, the training building, the firing range, and the Point Beach Energy Center is about 146 acres (Figure 3.1-1). The existing units occupy about 11 acres of the power block and this small number of acres along with additional acres for the cooling towers can be accommodated by the available acreage on the PBN site. The existing infrastructure needed to support operations would remain and other structures would remain or be removed if the area was needed to support the new unit. The land use at the PBN site would not change under the new nuclear alternative for construction or operations, so the land use would be same as that for continued operations, SMALL.

Option 2, SMR Units

The land requirement for the SMR units would be less than that of a conventional nuclear power plant. One of the SMR design developers, NuScale, indicates that the land requirement of an SMR facility of 1,000 MWe is less than 20 percent of that required for a 1,000-MWe conventional nuclear plant (NuScale 2019b). As presented for Option 1, the PBN site has open space both north and south of the power block of sufficient acreage. The land use at the PBN site would not change under the new nuclear alterative for construction or operations, so the land use would be same as that for continued operations, SMALL.

7.2.3.1.2 Visual Resources

Option 1, ALWR Unit

Construction activities and the completed structures especially the reactor containment building would be visible from Lake Michigan, but the activities and structures would be within the character of the existing industrial site. Landward the construction activities would be largely screened by the distance to the site boundary and existing structures as well as the Point Beach solar facility. The unit and associated mechanical draft cooling towers once constructed would blend with the existing units in the area's viewscape. Plumes from the mechanical draft cooling towers would be less visually noticeable than from a natural draft cooling tower given the low profile of mechanical draft cooling towers. Also, plume abatement technology could be implemented to minimize plumes. The visual resource impacts associated with construction and operation of the ALWR unit would be SMALL.

Option 2, SMR Units

The visual resources impact for the SMR units would be similar to that of the ALWR unit, SMALL for both construction and operation.

7.2.3.1.3 Air Quality

GHG emissions associated with nuclear power are lower than fossil fuel-based energy sources. Nuclear power lifecycle GHG emissions are within the same order of magnitude as renewable energy sources (NRC 2013a, Section 4.12.3). The new nuclear alternative would have greatly reduced GHG emissions compared to emissions from a fossil fuel plant. Therefore, new nuclear results in a beneficial air quality impact when compared with fossil-fuel fired alternatives.

Option 1, ALWR Unit

Temporary and minor effects on local ambient air quality could occur as a result of construction activities. Fugitive dust and fine particulate matter would be generated during earthmoving activities, material-handling activities, by wind erosion, and other activities and managed as required by Wisconsin Code 415.04. Mitigation measures (e.g., paving or stabilizing disturbed areas, water suppression, reduced material handling) would minimize such emissions. Vehicles used to haul debris, equipment, and supplies, as well as equipment used for evacuation and earthmoving, would create pollutants. All equipment would be serviced regularly, and all industrial activities would be conducted in accordance with federal, state, and local emission requirements. Emissions from construction activities would be temporary and intermittent for the duration of construction activities. With implementation of mitigation measures and properly serviced equipment impacts would be SMALL.

Air quality impacts from operation would include intermittent releases from the periodic testing and occasional use of stand-by equipment and use of other minor sources of air emissions. PBN has an onsite emergency diesel-fired combustion turbine. This equipment could be maintained for use or replaced with other fossil-fuel fired stand-by equipment. Air quality impacts would also result from vehicular emissions associated with plant operations. Potential impacts from operation of the ALWR unit and infrastructure on air quality from emissions of criteria pollutants, CO_2 emissions, cooling system emissions, and transmission lines would be minimal and similar to current conditions (Section 3.3) with the exception of the addition of the mechanical draft cooling towers.

The mechanical draft cooling towers, which would be located onsite, would also have air emissions and atmospheric effects from drift and plumes. Cooling tower drift is the liquid droplets that become entrained in the exhaust air stream and a plume forms when the saturated water vapor that leaves the top of the tower encounters cooler air and very small water droplets condense out of the air. Drift that leaves the top of the tower will reflect the same water chemistry as that of the circulating water. The water chemistry would be controlled by NEPB and would be in accordance with permit limits and restrictions for use of water treatment chemicals and discharge limits.

When the small droplets within the drift or plumes are released into the air, evaporation occurs, leaving behind the solids that were once dissolved. This has the effect of introducing fine particulate matter into the atmosphere. Particulate matter emissions (e.g., PM_{10} and $PM_{2.5}$) are regulated air emissions (Wisconsin Code 415.04). The dissolved solids from both drift and plumes could also be deposited on the surrounding land. If the deposited solids have levels of salt and contaminants that could have impacts on vegetation, the deposition would be expected to be localized and primarily onsite. Onsite electrical equipment and the solar arrays could be impacted from drift as well as plumes. Atmospheric effects of plumes could include icing, fogging, and shadowing. The cold winters of the PBN area would enhance the potential for icing and fogging. The impacts due to shadowing, could impact the amount of sunlight on the solar arrays onsite and offsite and on the surrounding cultivated fields. Air modeling would be needed to quantify the amount and extent of drift and the potential for plumes. Siting of the cooling towers away from site boundaries and use of drift eliminators would mitigate offsite effects.

Overall, air quality impacts of operations and the effects of drift to offsite areas would be expected to be SMALL.

Option 2, SMR Units

Construction activities for site preparation installation of SMR units that could impact air quality would be similar to that of Option 1 and SMALL. Through adherence to regulatory requirements, permit conditions, and siting and design of mechanical draft cooling towers to mitigate offsite effects, the impacts of the operation of SMR units and infrastructure on air quality would be expected to be SMALL.

7.2.3.1.4 Noise

Option 1, ALWR unit

Sources of noise during construction would include clearing, earthmoving, foundation preparation, pile driving (if needed), concrete mixing and pouring, steel erection, and various stages of facility equipment fabrication, assembly, and installation. Additionally, a substantial number of diesel- and gasoline-powered vehicles and other equipment would be used. Projected noise levels from most construction activities at the site boundary would have levels below the 60 to 65 dBA range of acceptable day-night, 24-hour average (Ldn) noise levels set by the U.S. Department of Housing and Urban Development. Construction activities resulting in offsite sound levels above this range would be temporary.

Noise sources associated with the operation of the ALWR unit and infrastructure would include pumps, cooling towers, transformers, switchyard equipment, and loudspeakers. Many of these noise sources are confined indoors or would be infrequent. The operating ALWR unit would have noise sources and levels similar to PBN with the addition of the mechanical draft cooling towers. Noise from a cooling tower generally consists of sounds created by the motors, the speed reduction or power transmission units, the fans and the cascading water, all of which combine to produce a typical sound level of 70 dBA at a horizontal distance of 1,000 feet (NRC 2019d). The sound would be attenuated by the surrounding buildings and structures and distance to the site border. The nearest residence is located approximately 1.2 miles west from the PBN center point (Section 3.1.2). Given sound attenuation and distance to the nearest residence, noise impacts to sensitive receptors are not expected. Therefore, operations-related noise impacts associated with the ALWR unit would be SMALL.

Option 2, SMR Units

Construction activities and associated noise levels for the SMR units would be like those of Option 1 described above. Likewise, the operating SMR units would have noise sources and levels similar to Option 1. Therefore, construction and operations-related noise impacts associated with Option 2 of the new nuclear alternative would be SMALL.

7.2.3.1.5 Geology and Soils

Option 1, ALWR Unit

Construction of the ALWR unit, cooling towers, and connections with existing infrastructure could result in erosion and sediment. Stormwater runoff and water from excavation dewatering would be managed and regulated by a combination of WPDES and USACE permitting, a construction site erosion control and stormwater management plan as required by Wisconsin WPDES regulations (WDNR 2019q) and use of BMPs. Through compliance with permit conditions, adherence to stormwater regulations, and applying erosion control and stormwater management BMPs, construction-related impacts on geology and soils would be SMALL.

Operations-related impacts on geology and soils from the ALWR unit would be minimized by adherence to PBN's industrial site SWPPP. Operations-related impacts would be SMALL.

Option 2, SMR Units

The impact on geology and soils due to construction and operation of the SMR units would be similar to Option 1, SMALL.

7.2.3.1.6 Hydrology (Surface Water and Groundwater)

Surface Water: Option 1, ALWR Unit

Water needs for construction of an ALWR unit would be similar to typical uses of water for large industrial projects. These uses include dust abatement, concrete mixing, and potable water needs. The impacts of construction activities on any surface water resources used to meet these needs would be of limited duration. As discussed in Section 3.6.3.2, PBN's potable water needs are met with groundwater and the site is not connected to municipal water supply. If construction non-potable water needs are to be meet with withdrawals from Lake Michigan, the appropriate permit or modification of the existing WPDES permit would be undertaken.

Construction of the ALWR unit, cooling towers, and connections with existing infrastructure could result in erosion and sediment dissolved solids entering Lake Michigan. A construction stormwater permit would be obtained for the construction activities and adherence to the permit conditions and required BMPs would mitigate impacts to Lake Michigan and other surface water resources. Stormwater runoff and erosion and sedimentation would be managed and regulated by a combination of WPDES and USACE permitting (for shoreline construction activities), the site's SWPPP, and use of BMPs. Through compliance with permit conditions, adherence to stormwater regulations, and applying SWPPP mitigation and BMPs, construction-related impacts on surface water quality would be SMALL.

The ALWR unit would require makeup water for cooling. The makeup flow is required to offset water losses that occur by three primary mechanisms: evaporation, drift, and blowdown. The ALWR unit would have water withdrawals of approximately 33 MGD and consume approximately 19 MGD based on water use factors developed by the National Energy Technology Laboratory of 1.101 gal/kWh for withdrawals and 0.624 gal/kWh for consumption (NETL 2010a, Appendix D). As presented in Table 3.6-4a, PBN's average surface water withdrawal rate for 2015–2019 was 925 MGD. Nearly all of this withdrawal would have been returned; however, assuming a 0.43 percent consumption rate (NETL 2010a, Appendix D), PBN's consumption would be approximately 4.0 MGD. Surface water use impacts from operating the ALWR unit would be SMALL.

Impacts on surface water quality from the operation of the ALWR would stem from ongoing discharge of treated sanitary wastewater, stormwater, groundwater, and other plant wastewater and the new discharge of cooling towers blowdown. The blowdown discharge would include discharge of residual heat, water treatment chemicals, and concentrated solutes from use of Lake Michigan water. These discharges would be governed by the plant's WPDES permits for discharge and industrial stormwater which would include limits and practices to protect water quality and the aquatic community. Surface water quality impacts from operating the ALWR unit would be SMALL.

Surface Water: Option 2, SMR Units

The surface water use and quality impacts for the SMR units would be similar to those of the ALRW unit as described above. The onsite construction activities could be less in scale and duration that an ALRW unit given that the SMR units would be manufactured offsite. However, if an onsite barge landing is developed for transport of the SMR units additional shoreline and near shore construction would be required. For such work, USACE permits for dredging and fill would be needed. The impacts to surface water quality would be SMALL with adherence to regulations, permit conditions, and application of BMPs.

Groundwater: Option 1, ALWR Unit

Potable water demand during construction would be meet by groundwater resources. As mentioned above, non-potable water needs for construction activities could be meet by surface water with the appropriate permits but would otherwise be met by groundwater use. PBN's annual groundwater withdrawals presented in Table 3.6-8a, maximum of 5.4 MGY, are well below the permitted withdrawals for the five groundwater wells at PBN, 8.6 MGY based on average use gpd withdrawal (WDNR 2011a).

Excavations for the unit would require dewatering. PBN currently operates a subsurface drainage system. The groundwater flow is from the west to Lake Michigan. Dewatering activities would be governed by WDNR Water Use General Permit No. 3, temporary construction dewatering, or an individual permit if dewatering volumes averaged greater than 100,000 gallons per day (WDNR 2011c). Dewatering could temporarily result in drawdown in the area but given the flow direction and the ongoing need for subsurface drainage for the existing plant, would be unlikely to impact offsite areas. Groundwater impacts from construction activities would be of limited magnitude, localized, and temporary, and therefore SMALL.

Potential impact on groundwater quality would be from spills or stormwater infiltration. BMPs would be applied to prevent spills and minimize their effects. PBN has an SPCC plan to address oil spills, a spill response procedure that addresses how to recognize and control spills including oil, chemical, hazardous material, and radioactive material spills, and a chemical control program for managing storage areas and assessing and mitigating risk from hazardous and toxic chemicals. PBN's spill control procedures and plans will mitigate impacts on local groundwater because spills would be quickly attended to and not allowed to penetrate to groundwater. Construction activities would be conducted under a construction stormwater permit. With implementation of the SPCC plan and SWPPP and adherence to permit conditions, groundwater quality impacts would be SMALL.

Groundwater: Option 2, SMR Units

The groundwater use and quality impacts for the SMR units would be similar to those of the ALRW unit as described above, SMALL with adherence to regulations, permit conditions, and application of BMPs.

7.2.3.1.7 Ecological Resources (Terrestrial and Aquatic)

Terrestrial: Option 1, ALRW Unit

The terrestrial ecology setting for the PBN site is discussed in Section 3.7.1. Development at the PBN site for the ALWR unit would impact onsite acreage in close proximity to the existing plant structures would have the co-located Point Beach solar facility to the west and south. Development would avoid the small wetland areas north of the existing power block (Figure 3.7-2) and is largely open area with some previous clearing/development. The undeveloped acreage south and southwest of the power block includes some wooded area. The plant communities in these woodlots include a variety of trees, such as aspen, blue beech, hemlock, and maples and provide food, cover, and nesting sites for a variety of wildlife species. The terrestrial wildlife that occurs at PBN and the surrounding areas are those typically found in similar habitats throughout Wisconsin. (NMC 2004a, Section 2.4). Prior to tree removal, wildlife surveys would be conducted as appropriate to identify protected species (e.g., bald eagles and norther long-eared bats) and habitat and design appropriate avoidance and minimization measures. Given that the ALRW unit would be constructed on an operating industrial site and NEPB would take appropriate mitigation measures prior to tree removal, the construction of the unit and cooling towers would have a SMALL impact on terrestrial ecology.

The operating ALWR unit would have the same types of operational noise and emissions as PBN with the exception of noise and emissions from the mechanical draft cooling towers. The sound levels from the cooling towers would attenuate with the existing structures and distance to the site boundary. Particulate matter in the cooling towers emissions and dissolved solids in the drift would reflect the water chemistry governed by the WPDES permit. The WPDES permit would restrict water treatment chemicals and pollutant levels to be protective of the biological community. Modeling would be needed to quantify the extent of impacts from cooling towers plumes, drift, and particulate matter emissions. However, since the PBN site would remain an operating industrial site and provides little terrestrial habitat and siting and drift eliminators for the cooling towers could mitigate offsite effects to the surrounding cultivated acreage, the operating ALWR unit would be expected to have a SMALL input on terrestrial ecology.

Terrestrial: Option 2, SMR Units

The construction and operational impacts of the SMR units on terrestrial ecology would be similar to those of an ALWR unit as described above, anticipated to be SMALL.

Aquatic: Option 1, ALWR Unit

The project could require construction at the Lake Michigan shoreline and within the forebay for connection of the ALWR unit to existing intake and discharge structures and any needed modification of the intake and discharge. Conditions and requirements of CWA Section 404/ Section 10 of the Rivers and Harbors Act of 1899 permits would be designed to minimize impacts to the aquatic ecological community of Lake Michigan. In addition, compliance with permit requirements and use of BMPs to prevent spills would further minimize the potential for impact to aquatic species. Construction of the ALWR unit, cooling towers, and connections with existing infrastructure could result in erosion and sediment dissolved solids entering Lake Michigan. A construction stormwater permit would be obtained for the construction activities and adherence to the permit conditions and required BMPs would mitigate impacts to Lake Michigan and other surface water resources. Stormwater runoff would be managed and regulated by a combination of WPDES and USACE permitting, the site's SWPPP, and use of BMPs. Through compliance with permit conditions and regulatory requirements, spill controls, and applying SWPPP mitigation and BMPs, construction-related impacts on aquatic resources would be SMALL.

The ALWR unit using closed-cycle cooling would require substantially less water to be withdrawn from Lake Michigan for cooling than is required for PBN as discussed in Section 7.2.3.1.6. Entrainment impacts would be less than those of PBN given the smaller withdrawal volume; impingement impacts from through-put velocity would be similar. Therefore, the impingement and entrainment impact of an ALWR unit would be less than those of the existing units and SMALL.

Operation of the closed-cycle cooling system would also result in water returned to the Lake Michigan as blowdown. The volume of the discharge would be less than the existing discharge and it is expected that any physical impacts localized at the end of the discharge pipe such as scouring of the bottom would be less with the closed-cycle cooling system than the existing once-through cooling system. The discharge would be subject to the plant's WPDES permit. The permitting process is designed to consider impacts to aquatic communities in the receiving waters. The discharge limits imposed by the WPDES permit would be protective of aquatic organisms and therefore given compliance with the WPDES permit SMALL impact on aquatic ecology would be expected.

Aquatic: Option 2, SMR Units

The construction and operational impacts of the SMR units on aquatic ecology would be similar to those of an ALWR unit as described above. The onsite construction activities could be less in scale and duration than an ALRW unit given that the SMR units would be manufactured offsite. However, if an onsite barge landing is developed for transport of the SMR units, additional shoreline and near shore construction would be required. For such work, the USACE permits for dredging and fill would be needed, and permit conditions would be established to protect aquatic resources. The impacts to aquatic ecology would be SMALL with adherence to regulations, permit conditions, and application of BMPs.

Special Status Species: Option 1, ALWR Unit

Special status species at the PBN site are discussed in Section 4.6.6. Section 4.6.6 indicates habitat for the federally listed red knot, piping plover, northern long-eared bat, and Pitcher's thistle occurs on or immediately adjacent to the PBN site. The federally listed rusty patched bumblebee occurs in Manitowoc County, but the PBN site is not located in or adjacent to a rusty patched bumblebee high potential zone (USFWS 2020e). The closest high potential zone is near Two Creeks. The federally listed Hine's emerald dragonfly occurs in Kewaunee County, but preferred habitat does not occur on the PBN site. No federally listed aquatic species occur in the vicinity of PBN.

The American bald eagle, which is protected under the BGEPA and the MBTA, is known to nest on or near the PBN site (Section 4.6.6.4.2).

Construction activities would be confined to the PBN site, primarily utilizing developed land and open space next to operating industrial facilities. Wetlands would be avoided, and shoreline activities would be confined to developed areas. Prior to tree removal, wildlife surveys would be conducted to identify protected species and habitat and design appropriate avoidance and minimization measures. Tree removal would be conducted in adherence to practices that avoid take of the northern long-eared bat and the bald eagle; if take cannot be avoided, take permits for one or both of the species would be required. To protect the northern long-eared bat, the USFWS 4(d) rule restricts tree removal within 0.25 mile of a known hibernaculum and within a 150-foot radius of a known occupied maternity roost tree during June and July (USFWS 2019g). To avoid take of the bald eagle, timber harvesting operations would avoid clear-cutting within 330 feet of active or inactive nests at any time and avoid encroaching within 660 feet of an active nest during nesting season (USFWS 2019h).

Construction activities at the Lake Michigan shoreline would be confined to the existing forebay and discharge and would not disturb undeveloped areas where the potential for disturbing protected species that prefer shoreline habitats would be greater. The Pitcher's thistle is found on open sand dunes adjacent to the Great Lakes (WDNR 2019r). As noted above, construction activities would require stormwater and USACE Section 404/Section 10 Rivers and Harbors Act permitting.

Given that the ALWR unit would be constructed on an operating industrial site and NEPB would take appropriate mitigation measures prior to tree removal and comply with USACE and WDNR requirements for prevent and mitigating impacts to wetlands and aquatic environments, the construction is NOT LIKELY TO ADVERSELY AFFECT special status species.

Ongoing operations activity would be confined to work areas and would not impact habitats potentially occupied by special status species. The operating ALWR unit would have the similar types of operational noise and emissions as PBN with the addition of noise and emissions from the mechanical draft cooling towers. Sound levels will attenuate with distance and the surrounding structures and air emissions will be governed by permit limits. Like for PBN, ALWR operations would likely not impact federal-or state-listed species. Therefore, operations are NOT LIKELY TO ADVERSELY AFFECT special status species.

Special Status Species: Option 2, SMR Units

The construction and operational impacts of the SMR units on special status species would be similar to those of an ALWR unit as described above. However, if an onsite barge landing is developed for transport of the SMR units, additional shoreline and near-shore construction would be required. For such work, USACE permits for dredging and fill would be needed, and permit conditions would be established to protect listed species. Construction and operation are anticipated to NOT LIKELY TO ADVERSELY AFFECT special status species.

7.2.3.1.8 Historic and Cultural Resources

Option 1, ALRW Unit

As discussed in Section 3.8, previous desktop and/or field surveys identified historic and archaeological sites on or near the PBN site boundary. One of the sites identified, 47MN267, is northwest of the power block and within the 50-acre area identified as a potential area for siting a new nuclear replacement. This site has not been field verified or surveyed. (AVD 2004) However, the area is in close proximity to previously developed areas. Prior to construction activities, field surveys would be conducted as appropriate for undeveloped areas, and any historic or archaeological sites identified would be avoided or management plans developed in consultation with the Wisconsin SHPO for sites that cannot be avoided.

The operating ALWR unit would have the same types of operational impacts as those of the existing units which as assessed as NO ADVERSE EFFECT in Section 4.7 with the exception of noise and emissions from the mechanical draft cooling towers. The archaeological sites would not be impacted by air emissions or noise.

Because cultural resources, both historic and archaeological, would be avoided or protected during construction and anticipated impacts from operations would be small, NO ADVERSE EFFECT would be expected to occur to cultural resources.

Option 2, SMR Units

Given the location of the SMR units would be the same as the ALWR option and construction activities would be similar, the construction impacts of the SMR units on historic and cultural resources would be similar to those of the ALWR option. The operation impacts would also be similar to those of the ALWR option. Construction and operation are anticipated to have NO ADVERSE EFFECT on historic and cultural resources.

7.2.3.1.9 Socioeconomics

Socioeconomic Issues other than Transportation: Option 1, ALWR Unit

The construction and operation of an ALWR unit would create construction employment and continue employment of operations workers transitioned from the existing units. The construction employment would be short-term and would provide a stimulus to the local economy. Plant operations employment would be long-term stimulus to the local economy.

The NRC considered the socioeconomic impacts of construction of a new nuclear ALWR unit at the North Anna Power Station in Virginia. The peak construction was estimated 2,500 to 3,500 workers. The NRC concluded that adverse socioeconomic impacts from increased use and demand for community services and infrastructure would range from SMALL to MODERATE, and beneficial impacts from the economic stimulus would range from SMALL to MODERATE (NRC 2010a, Section 4.5.5).

The new unit at the North Anna Power Station was estimated to require a workforce of 500 (NRC 2010a, Section 5.5.2). The workforce for the existing units is 681 (Section 2.5). This workforce would allow for the continuation of the beneficial socioeconomic impact of the current units. Use of and demand for community services and infrastructure would continue and given the resources have developed to support the current employment level no additional pressure on the services and infrastructure would result. Adverse socioeconomic impacts would be SMALL.

As discussed in Section 3.9.5, NEPB pays a gross-receipts license fee on PBN electricity sales to the WDR instead of paying property taxes (i.e., PILOT). The fee payments are then distributed to local appropriate municipal and county taxing authorities as public utility aid disbursements. As presented in Table 3.9-2, the shared revenue utility aid payment attributable to PBN represented approximately 30 to 64 percent of the revenues of Two Creeks between 2015–2018. During the same 2015–2018 time period, the shared revenue utility payment attributable to PBN represented approximately 2 to 3 percent of the revenues of Manitowoc County. The socioeconomic impact from PILOT would be LARGE and beneficial to Two Creeks.

Socioeconomic Issues other than Transportation: Option 2, SMR Units

The peak construction workforce for the 800-MWe Clinch River SMR facility was estimated at 3,300 workers (NRC 2019d, Table 4-4). This workforce falls within the range of the ALWR unit discussed above. Therefore, the socioeconomic impacts for construction activities for the SMR units would be similar to those of the ALWR unit.

The workforce for the 800-MWe Clinch River SMR facility was estimated at 500 workers (NRC 2019d, Table 3-5). A review of the economics of SMR facilities estimated the operational workforce at 500 for a 1,000-MWe facility (SMR Start 2017). Therefore, the SMR units are assumed to require 500 workers. With this workforce size and location of the units on the PBN site, the SMR units would have similar socioeconomic impacts as those described above for the ALWR unit.

Transportation: Option 1, ALWR Unit

The employment peak of 3,500 construction workers would significantly add to the vehicles on the local road system. This increase in traffic combined with the current PBN workforce of 681 would be noticed by commuters. Increased use of the roads during construction could create some safety and maintenance issues. The work shifts during construction would be staggered, which could minimize some of the increased road use. Overall, construction-related traffic impacts would be temporary and range from MODERATE to LARGE.

Traffic-related impacts would be reduced after construction to levels similar to that of the current units. The local road infrastructure supports the current employment level no additional traffic congestion would be excepted. Adverse socioeconomic impacts would be SMALL.

Transportation: Option 2, SMR Units

The construction workforce for the SMR units would likely be within the range of that presented for the ALWR unit above. Increased use of the roads during construction could create some safety and maintenance issues. The work shifts during construction would be staggered, which could minimize some of the increased road use. Overall, construction-related traffic impacts would be temporary and range from MODERATE to LARGE.

Traffic-related impacts would be reduced after construction to levels similar to that of the current units. The local road infrastructure supports the current employment level no additional traffic congestion would be excepted. Adverse socioeconomic impacts would be SMALL.

7.2.3.1.10 Human Health

Option 1, ALWR Unit

Impacts on human health from construction of an ALWR unit would be similar to those associated with a large industrial facility construction project. Compliance with OSHA worker protection rules would prevent safety-related accidents. The NRC evaluated nonradiological impacts on public and construction worker health from fugitive dust, occupational injuries, noise, and transport of materials and personnel to and from the construction site during environmental review of various construction and operations licensing applications for new nuclear power plants including Turkey Point Units 6 & 7 and North Anna Unit 3. No significant impacts related to the nonradiological health of the public or workers were identified (NRC 2010a; NRC 2016b). Worker safety would be addressed by adherence to OSHA worker protection and other initiatives such as the contractor safety meetings. The nonradiological health impacts of construction would be SMALL.

Sources of radiation exposure for construction workers include direct radiation exposure, exposure from liquid effluents, and exposure from gaseous radioactive effluents from operation of PBN Units 1 and 2. The radiological human health impact on construction workers due to working in proximity to PBN would be SMALL due to compliance with NRC regulations and adherence to ALARA principles.

Occupational injuries in the nuclear power industry are historically below the average U.S. industrial rate. NEPB would adhere to OSHA safety standards and comply with EPA and NRC exposure limits for the public and workers for operation of the ALWR unit. Therefore, health impacts from operations would be SMALL.

Option 2, SMR Units

The human health impacts of the construction and operation of SMR units would be similar to that of an ALWR unit described above. NEPB would adhere to OSHA safety standards and comply with EPA and NRC exposure limits for the public and workers for operation of the SMR units. Therefore, health impacts from construction and operations would be SMALL.

7.2.3.1.11 Environmental Justice

Option 1, ALWR Unit

Section 3.11.2 presents the minority and low-income population in the region surrounding the PBN site. The identified minority population closest to the PBN center point is located approximately 14 miles south-southwest of the site: The closest low-income block group that meets the guidance criteria for individuals or families is located nine miles south of the PBN center point (Block Group 550710053002).

Potential impacts from construction of an ALWR unit would primarily be associated with socioeconomic effects. These impacts would consist of the short-term increase in worker expenditures at local businesses and potential rental housing shortages during the construction phase of the project. The increase in traffic on roads would likely result in no disproportionately high and adverse effects to local low-income and minority communities. Given that construction activities would be conducted in accordance with permits for stormwater regulatory requirements for fugitive air emissions, BMPs, and implementation of SWPPPs and SPCC plans, no disproportionately high and adverse effects to low-income and minority populations are expected from the construction of the ALWR unit.

No disproportionately high and adverse impacts to minority or low-income populations are expected to occur for operations of a ALWR unit because the activities associated with operating plant would be similar to those occurring at PBN with the exception of air emissions and noise from the mechanical draft cooling towers, which would be subject to regulatory requirements and would not be located at site boundaries.

Option 2, SMR Units

The potential for impacts to minority or low-income populations for construction and operation of SMR units would be similar to those described above for the ALWR unit. No disproportionately high and adverse impacts to minority or low-income populations are expected to occur for construction or operations of SMR units.

7.2.3.1.12 Waste Management

Option 1, ALWR Unit

Solid, liquid, and gaseous wastes generated during the construction of the ALWR unit would be handled according to county, state, and federal regulations and disposed at permitted offsite treatment or disposal facilities. Therefore, construction-related waste impacts would be SMALL.

The operation of the ALRW unit would result in nonhazardous, hazardous, spent nuclear fuel, and radioactive waste. The nonhazardous and hazardous waste would be managed in compliance with state regulations and disposed of in permitted facilities. NEPB would implement recycling and waste minimization programs that would reduce waste volumes. The nonradiological waste impacts from operations would be SMALL given NEPB's compliance with regulations, use of permitted facilities, implementation of effective practices for recycling, minimizing, managing, and waste disposal as described in Section 4.10. This conclusion is valid for the SMR option as well. Radioactive waste would be managed onsite, transported, and disposed of in permitted facilities in accordance with NRC, DOT, and state regulations. Spent nuclear fuel would be managed onsite in accordance with NRC and state regulations. Therefore, environmental impacts associated with radioactive waste would be SMALL.

Option 2, SMR Units

Construction of an SMR units at PBN would generate waste types and volumes similar to those of associated with the construction of an ALWR unit. In addition, if an onsite barge landing is developed for transport of the SMR units, USACE permits for disposal of any dredged spoils would be obtained. The wastes generated would be handled according to county, state, and federal regulations. Therefore, construction-related waste impacts would be SMALL.

Operations would generate similar waste types and in similar volumes to those of an ALWR unit described above. The nonradiological waste impacts from operations would SMALL given NEPB compliance with regulations, use of permitted facilities, implementation of waste minimization practices. Radioactive waste would be managed onsite, transported, and disposed of in permitted facilities in accordance with NRC, DOT, and state regulations. Spent nuclear fuel would be managed onsite in accordance with NRC and state regulations. Therefore, environmental impacts associated with radioactive waste would be SMALL.

7.2.3.2 Combination Alternative, Natural Gas-Fired Generation and Solar

The combination of alternatives involves the construction and operation of an NGCC plant at the PBN site and expansion of the Point Beach solar facility. The expansion would be within the alternate array site identified west and north of the existing ISFSI. This expansion would be an array with a nameplate of 25 MW and battery storage would be added to provide 25 MWe of baseload energy to the regional grid. The NGCC plant would consist of multiple combustion turbines, heat recovery steam generator, and a steam turbine generator assembled in appropriate power-train configurations. Based on a capacity factor of 87 percent (EIA 2020a), the replacement NGCC plant would be 1,351 MWe gross to yield 1,175 MWe net for the regional grid. The NGCC plant would utilize mechanical draft cooling towers and, like PBN, the would utilize Lake Michigan for cooling water and discharge. The existing intake and discharge structures would be used, with some modifications and pump replacement as appropriate, for the NGCC plant. NEPB also assumed that the existing PBN transmission line infrastructure is adequate for the combination alternative. The NGCC plant would require development of approximately 10 miles of natural gas pipeline to connect the plant to a natural gas supply. An existing natural gas pipeline terminates in Two Rivers, WI (USDOT 2020b).

7.2.3.2.1 Land Use

The land use at the PBN site would not change under the combination alternative. The existing site has adequate open space to support construction of an NGCC plant and mechanical draft cooling towers. The PBN site has open area both north and south of the power block. Excluding the area identified as part of the co-located Point Beach solar facility, there is open area north of the PBN of about 60 acres and the area south of the power block including existing parking, the training building, the firing range, and the Point Beach Energy Center is about 146 acres. As noted above, the solar expansion would be within the alternate array site previously identified west and north of the existing ISFSI.

The NGCC plant would require approximately 58 to 63 acres based on a land use factor of 0.02 square meters per megawatt hour (NETL 2010b) and the acreage used by the typical U.S. NGCC plant (Leidos 2016). However, the 1,150-MWe NGCC plant with mechanical draft cooling towers co-located on NEE's Turkey Point site (NRC 2016b) occupies about 16 acres. The PBN site has adequate acreage to accommodate the NGCC plant and mechanical draft cooling towers, and the solar array area of approximately 98 acres was identified as an alternate array site by Point Beach Solar, LLC. The existing infrastructure needed to support operations would remain and other structures would remain or be removed if the area was needed to support the NGCC plant or expansion of the Point Beach solar facility. The continued use of the PBN site for energy generation would have a SMALL land use impact.

The NGCC plant would require development of approximately 10 miles of natural gas pipeline to connect the plant to a natural gas supply. An existing natural gas pipeline terminates in Two Rivers, WI (USDOT 2020b). It is assumed that the NGCC plant natural gas pipeline would be installed in a new corridor. The development of a new pipeline corridor could change the land use for the area depending on the selected corridor and would require a managed vegetation community devoid of woody vegetation.

In addition to onsite and pipeline corridor land requirements, offsite land is typically required for natural gas wells and related infrastructure. However, no new gas wells are assumed to be needed, because there is currently an abundant supply of natural gas in the United States.

Construction-related impacts to land use would be SMALL from the NCGG plant and solar PV because the plant and solar array would use land already in use for energy production. The impact to land use from installation of the pipeline would be SMALL to MODERATE from the potential reclassification of acreage within the region for the new corridor and its maintenance as a permanent corridor.

No changes to land use would occur from operation of the combination alternative and land use impacts would be SMALL.

7.2.3.2.2 Visual Resources

During the construction phase of the project, the NGCC plant site and solar expansion would require some tree removal and land clearing and potentially some demolition of existing structures. Some construction activities would be visible from Lake Michigan, but would be largely screened landward due to distance and surrounding solar arrays and wooded areas. Because the site currently has an existing power plant, the ongoing construction activity associated with the NGCC plant and installation of the solar array would be similar in scope to the existing industrial character of the site. Any offsite acreage used would be located in close proximity to existing structures, so the development would be an extension of the industrial character. Visual impacts during construction under the combination alternative would be SMALL.

During operations, the tallest structures would be the exhaust stacks. The exhaust stacks would be visible from offsite landward. The stacks and other NGCC structures would be visible from Lake Michigan. The additions to the viewscape would be similar in type and magnitude to the existing PBN and the Point Beach solar facility.

It is assumed that the NGCC plant natural gas pipeline corridor would be installed in a new pipeline corridor. Construction activities would result in temporary and localized visual impacts. The new corridor would also incur visual impacts from clearing the land, especially forested lands that would be converted to cleared right-of-way after installation of the pipeline. However, the new corridor would undergo a selection process that includes avoidance of sensitive areas such as scenic areas, sensitive wildlife habitats, and cultural sites that could result in greater visual impacts.

Overall, the addition of an NGCC plant and additional solar array would not significantly alter the viewshed at the PBN site. Through a selection process for the pipeline corridor, the potential for visual impacts would be mitigated. Therefore, visual impacts associated with the construction and operation of the combination alternative would be SMALL.

7.2.3.2.3 Air Quality

Air quality impacts associated with the construction of a NGCC plant and installation of a solar array would result in the emissions of various criteria pollutants such as CO, No_x, sulfur oxides (SO_x), particulate matter (PM), and VOCs. These criteria pollutants would be released from the use of construction vehicles and equipment. VOC releases would also result from the onsite storage and dispensing of vehicle and equipment fuels. Some GHGs would also be emitted from the use of construction equipment and vehicles. Onsite activities such as clearing and grubbing would also result in fugitive dust. The air quality impacts would be short-term, as gas-fired power plants are generally constructed in 2 to 3 years. The air impacts during construction would be minimized by the implementation of a fugitive dust control plan and adherence to BMPs such as the idling of vehicles and construction equipment. Therefore, the construction-related impacts on air quality under the combination alternative would be SMALL.

The operational NGCC plant would be equipped with air pollution controls to ensure compliance with air quality regulations. Emission estimates for the NGCC plant based on EPA AP-42 emission factors and scaled from emission estimates of an NGCC plant in Citrus County, FL, are shown in Table 7.2-1.

The NGCC plant would qualify as a new major source of criteria pollutants and would be subject to the CAA prevention of significant deterioration air quality review. Therefore, the plant would have to comply with the new source performance standard for NGCC plants set forth in 40 CFR Part 60, Subpart KKKK and 40 CFR Part 60, Subpart TTTT. The plant would also qualify as a major source because of its potential to emit greater than 100 tons per year of criteria pollutants. The plant would be required to obtain a Title V operating permit.

The NGCC plant would be subject to the national emission standards for hazardous air pollutants (HAPs) for stationary combustion turbines if the plant was a major source of HAPs (having the potential to emit 10 tons per year of more of any single HAP or 25 tons per year or more of any combination of HAPs) [40 CFR 63.6085(b)].

A new NGCC plant would also have to comply with Title IV of CAA [42 USC 7651] reduction requirements for SO_2 and NO_x, which are the main precursors of acid rain and the major causes of reduced visibility.

As discussed in Section 7.2.3.1, for the new nuclear alterative, use of the mechanical draft cooling towers would result in particulate matter (PM_{10} and $PM_{2.5}$) emissions and dissolved solids deposition and have atmospheric effects from drift and plumes. Particulate matter emissions (e.g., PM_{10} and $PM_{2.5}$) are regulated air emissions (Wisconsin Code 415.04). The dissolved solids from both drift and plumes could also be deposited on the surrounding land. If the deposited solids have levels of salt and contaminants that could have impacts on vegetation, the deposition would be expected to be localized and primarily onsite. Onsite electrical equipment and the solar arrays could be impacted from drift as well as plumes. Atmospheric effects of plumes could include icing, fogging, and shadowing. The cold winters of the PBN area would enhance the potential for icing and fogging. The impacts due to shadowing, could impact the amount of sunlight on the solar arrays onsite and offsite and on the surrounding cultivated fields. Air modeling would be needed to quantify the amount and extent of drift and the potential for plumes. Siting of the cooling towers away from site boundaries and use of drift eliminators would mitigate offsite effects.

A new NGCC plant would be a major source of criteria pollutants and GHGs. The solar component of the combination alternative would not release any air emissions during operation. Compliance with existing air quality regulations would ensure air quality impacts are minimized. Therefore, the operations-related impacts on air quality under the NGCC plant alternative would be MODERATE.

Overall, the air quality impacts from the operation of the combination alternative would be MODERATE due to the NGCC plant component of the combination alternative.

7.2.3.2.4 Noise

Construction-related noise impacts would include the operation of vehicles, earthmoving equipment, and other equipment such as generators and compressors used in the construction of the facility. The NGCC plant and expanded solar installation would be located on the existing PBN site (an industrial site). The NGCC plant would be located near the existing power block and away from the site boundaries allowing distance and intervening structures to attenuate noise levels prior to reaching offsite areas. Noise from construction of the associated pipeline is expected to be of a short duration, in the range of a few weeks at any one location along the corridor as the pipeline installation progresses. Therefore, construction-related noise impacts would be SMALL.

Noise impacts associated with plant operations would include noise from transformers, turbines, pumps, compressors, exhaust stack, combustion inlet filter house, condenser fans, the mechanical draft cooling towers, and high-pressure steam piping. Noise from a cooling tower generally consists of sounds created by the motors, the speed reduction or power transmission units, the fans and the cascading water, all of which combine to produce a typical sound level of 70 dBA at a horizontal distance of 1,000 feet (NRC 2019d). The cooling towers would be located near the Lake Michigan side of the site and the sound would be attenuated by the surrounding buildings and distance to the landward site borders. No noise impacts would occur from operation of the solar array. The nearest residence is located approximately 1.2 miles west from the PBN center point (Section 3.1.2). Given sound attenuation and distance to the nearest residence, noise impacts from the NCGG plant to sensitive receptors are not expected. No noise impacts would occur from operation of the pipeline beyond intermittent maintenance activities. Therefore, operations-related noise impacts associated with the combination alternative would be SMALL.

7.2.3.2.5 Geology and Soils

Construction-related impacts to geology would be minimal as the excavation depths associated with plant installation would not be expected to damage geologic formations at the site. In addition, materials such as stone and gravel used in the construction of the plant and associated infrastructure would be obtained from local or regional sources. Commercial stone and gravel sources typically sell material obtained from local quarries and other sources. Therefore, construction-related impacts to geology would be SMALL.

Construction-related impacts to soil would occur during land clearing and filling and the construction of the plant. NEPB assumes that the NGCC plant would be constructed on the PBN site on land ranging from developed land use, open spaces, and land with trees that will require clearing. Installation of a new natural gas pipeline to transport fuel to the site would disturb soil temporarily until installation of the pipeline is complete. The exposure of soils during clearing and grubbing will increase the risk of erosion from precipitation and high wind events. Soils excavated and removed during clearing and construction would be stockpiled onsite for use as backfill after construction is completed. Because the ground disturbance would exceed one acre, NEPB would obtain a stormwater construction general permit from WDNR. This is a general permit for construction activities that require an erosion control and stormwater management plan and installation of BMPs to minimize erosion and sediment loss resulting from precipitation. Overall, with the installation and implementation of BMPs, construction-related impacts to soils would be SMALL.

Land disturbance activities initiated during the operation of the NGCC-solar plant would comply with applicable WDNR regulations for stormwater permitting. The PBN SWPPP would be modified to address the NGCC-solar plant, identifying proper BMPs to minimize sediment releases. If stormwater is an issue at the facilities, BMPs would be installed to minimize the impact of erosion and runoff. Therefore, construction and operational impacts on geology and soils would be SMALL.

7.2.3.2.6 Hydrology (Surface Water and Groundwater)

<u>Surface Water</u>

The construction-related impacts to surface water include those related to construction of the NGCC plant and expanded solar installation that would alter surface drainage features. The clearing of vegetation on the PBN site may also alter drainage features that convey runoff onsite. As discussed in Section 7.2.3.1.1, the acreage needed for a NGCC plant is approximately 60 acres, with approximately 180 acres available onsite, much of which was previously developed. For the solar expansion, the alternate array location would occupy approximately 98 acres. Some clearing and tree removal would be needed.

The impacts from drainage alterations would be minimized by the implementation of BMPs identified in the stormwater general permit and erosion control and stormwater management plan. Adherence to the BMPs and SWPPP would minimize stormwater runoff from the construction site, which would minimize sediment release and provide protection to Lake Michigan from accidental releases of oils or other chemicals being used during the construction of the facility.

NEPB assumes the PBN intake and discharge structures will be used, with some modification, for the NGCC plant alternative. Closed cycle cooling for the NGCC plant alternative would result in water consumption due to evaporation and drift. A new WPDES permit or modifications to the existing permit would be required for the NGCC plant discharge.

A new natural gas pipeline would be required to provide fuel for the NGCC plant alternative. It is assumed that this pipeline would be installed in a new utility corridor. The pipeline would cross streams, rivers, and potentially wetlands that may require permitting. Stream, river, and wetland impacts would be minimized by avoidance and by installing the pipeline under these features via horizontal directional drilling. For installation near streams and stream crossing, USACE Section 404 permitting could be required. This permit would identify BMPs and other mitigation to minimize impacts to waterways and wetlands. Typically, pipeline installation impacts to streams and rivers are temporary in duration. Through compliance with permit conditions and implementation of BMPs, surface water impacts from NGCC plant construction and installation of a new natural gas pipeline would be SMALL.

The NGCC plant and solar expansion construction-related impacts on surface water and water quality would be SMALL.

Operating the NGCC plant would require water to be obtained from Lake Michigan for cooling. The NGCC plant would have water withdrawals of approximately 4.86 MGD and consume approximately 4.21 MGD based on the water use factors developed by the National Energy Technology Laboratory of 0.15 gal/kWh for withdrawals and 0.13 gal/kWh for consumption (NETL 2010a, Appendix D). As presented in Table 3.6-4a, PBN's average withdrawal rate from 2015–2019 was 925 MGD. Nearly all of this withdrawal would have been returned to the lake; however, assuming a 0.43 percent consumption rate (NETL 2010a, Appendix D), PBN's consumption would be approximately 4.0 MGD.

The closed-cycle cooling system would require the use of water treatment chemicals to prevent scaling and biofouling. The water treatment chemicals and the discharge would be subject to the plant's WPDES prevent which would be designed to be protective of water quality. NEPB would operate the NGCC and solar facilities in compliance with stormwater regulations. Surface water use and quality impacts from operating combination alternative would be SMALL.

<u>Groundwater</u>

NEPB assumes water used for construction purposes such as dust suppression, equipment washing, sanitary systems, and potable water would be obtained through existing onsite groundwater wells. Excavations for the NGCC foundations may intrude into groundwater zones, but measures such as slurry walls and grouting are readily available to control water inflow to the excavation if needed. Dewatering activities would be governed by WDNR water use general permit No. 3, temporary construction dewatering, or an individual permit if dewatering volumes averaged greater than 100,000 gallons per day (WDNR 2011c). Dewatering could temporarily result in drawdown in the area, but given the flow direction and the ongoing need for subsurface drainage for the existing plant, would be unlikely to impact offsite areas. Groundwater use impacts from construction activities would be of limited magnitude, localized, and temporary, and therefore SMALL.

Potential impact on groundwater quality would be from spills or stormwater infiltration. BMPs would be applied to prevent spills and minimize their effects. PBN's spill control plans and procedures would mitigate impacts on local groundwater because spills would be quickly attended to and not allowed to penetrate to groundwater. Construction activities would be conducted under a construction stormwater permit and erosion control and stormwater management plan. With implementation of the spill and erosion control measures and adherence to permit conditions, groundwater quality impacts would be SMALL.

Like for PBN, the NGCC plant operations would require groundwater for drinking water, sanitary purposes, and likely for some processes. Operations for the solar array and its battery storage would not have process water needs, but water would be needed for washing solar panels. Also, solar operations would require few onsite workers. Groundwater use for operations of the NGCC plant and solar expansion would be expected to be less than current groundwater demand.

Operations-related groundwater quality impacts would be minor and mitigated through use of BMPs and stormwater systems on the industrial site. In addition, waste management and spill mitigation would minimize the spread of contaminants through the soil into the groundwater. Therefore, operations-related impacts on groundwater use and quality under the combination alternative would be SMALL.

7.2.3.2.7 Ecological Resources (Terrestrial and Aquatic)

Terrestrial

Terrestrial ecology impacts resulting from the construction of the NGCC plant and expanded solar would primarily result from development at the PBN site (approximately 60 acres for the NGCC plant and 98 acres for the solar installation) from land clearing, noise, and emissions of construction activities. As described in Section 7.2.3.1.1, the area proposed for construction is a mix of cleared, developed, and forested land uses. The clearing of vegetation and tree removal would displace wildlife that occupies the industrial site, and these would disperse to nearby habitats. NEER identified that installation of the alternate array would result in less than 384 square feet (0.01 acre) of temporary impact to the farmed wetland which will be restored to preconstruction conditions upon completion of the cable installation (PB Solar 2019, Section 6.2.2)

Based on implementation of construction BMPs for erosion and dust control, noise abatement, proper equipment maintenance, adherence to tree removal requirements for protected species, and adherence to applicable permit conditions, the overall impact of construction-related activities on terrestrial ecological resources would be SMALL.

The installation of the natural gas pipeline would also result in the clearing of woody and herbaceous vegetation. It is expected the project would displace wildlife along the pipeline corridor. However, the corridor would be revegetated after installation of the pipeline and some wildlife species would reoccupy portions of the corridor. Pipeline installations typically result in temporary disruptions to wildlife. Therefore, the pipeline installation on terrestrial wildlife would be SMALL.

Operational impacts on terrestrial resources would be similar to those occurring with the operation of the PBN plant. Air emissions associated with the NGCC plant may cause some impacts to the agricultural areas near the site. No operational impacts to terrestrial ecological resources would occur from the solar PV component of the combination alternative. Overall, the operation of the NGCC plant and the solar expansion would result in SMALL impacts to terrestrial resources.

<u>Aquatic</u>

Impacts on aquatic resources during construction would be minimal through implementation of BMPs, which would minimize impacts from surface water discharges and potential shoreline construction needed to modify existing intake and discharge structures. Additionally, no dredging activities are anticipated. The SWPPP and BMPs would also minimize potential spills and releases associated with the construction of the plant. Installation of the pipeline could require a USACE Section 404 permit depending on the location and the need to cross any wetlands. The permit would identify proper mitigation techniques for installation of the pipeline at aquatic crossings. Therefore, construction-related impacts on aquatic ecological resources under the combination alternative are anticipated to be SMALL.

During operations, the NGCC plant would require less cooling water to be withdrawn from Lake Michigan than is required for PBN. The NGCC plant would also require an WPDES permit. No operations-related impacts are associated with the solar PV component of the combination alternative. Overall, operations-related impacts on aquatic ecological resources under the combination alternative would be SMALL.

<u>Special Status Species</u>

As discussed for the ALWR unit in Section 7.2.3.1.7, habitat for federally protected species occurs on or adjacent to the PBN site. Like the ALWR unit, construction activities for the combination alternative would be confined to an operating industrial site and NEPB would take appropriate mitigation measures prior to tree removal and comply with USACE and WDNR requirements for prevent and mitigating impacts to wetlands and aquatic environments, the construction is NOT LIKELY TO ADVERSELY AFFECT special status species.

For the solar expansion, NEE's site selection process was designed to minimize impacts to special species. Tree clearing for the solar expansion would be minimized to the extent practicable. If tree removal is necessary, the construction would either clear outside of the northern long-eared bat and affected migratory birds of concern roosting and nesting seasons and follow USFWS guidelines regarding acceptable dates for clearing in Wisconsin or conduct appropriate surveys prior to construction to avoid impacts to active roosts or nests. Point Beach Solar LLC presented preliminary project information for the project study area (inclusive of the alternate array area which is the area for the solar expansion under this alternative) regarding natural and biological resources in the study area to the USFWS which responded on March 20, 2019, with no concerns for listed species within the project study area. (PB Solar 2019, Sections 5.4.2 and 5.9)

Ongoing operations activity would be confined to work areas and would not impact habitats potentially occupied by special status species. The operating NGCC plant would have the similar types of operational noise and emissions as PBN with the addition of noise and emissions from the mechanical draft cooling towers. Sound levels will attenuate with distance and the surrounding structures and air emissions will be governed by permit standards and limitations. Like for PBN, operation of the NGCC and solar facilities would likely not impact federally listed species. Therefore, operations are NOT LIKELY TO ADVERSELY AFFECT special status species.

The natural gas pipeline corridor could cross habitat for federally protected species. Siting the corridor outside of special status species habitat would be a critical path issue in the siting process. If threatened and endangered species habitat could not be avoided in the siting process, field surveys would be required to determine if the species is present within or adjacent to the corridor and appropriate avoidance or mitigation measures would have to be implemented. Depending on the corridor location, installation of the pipeline could result in MAY AFFECT, NOT LIKELY to ADVERSELY AFFECT special status species with the implementation of mitigation measures.

Operations of the NGCC plant and pipeline and the expanded solar installation would likely not impact special status species. Ongoing operations activity would be confined to work areas and would not impact habitats potentially occupied by special status species. Pipeline corridor maintenance activities could be modified (e.g., manual cutting, no herbicide use) as necessary to protect special status species, if present. Therefore, impacts to special status species from the combination alternative operations are NOT LIKELY TO ADVERSELY AFFECT special status species.

7.2.3.2.8 Historic and Cultural Resources

The onsite areas where an NGCC plant could be sited are the same as those for a new nuclear alterative, an approximately 50-acre area north of the existing power block and a larger, approximately 130-acre area, south of the power block inclusive of existing parking areas, a training building, firing range, and the Point Beach Energy Center. As presented in Section

7.2.3.1.8, one cultural site has been recorded within this area. This area has not been verified or investigated. NEPB's site planning process would seek to avoid or mitigate impacts to cultural resources. This would include coordination with the Wisconsin SHPO and conducting field investigations if required. The results of these investigations and communications would be used in the site planning process to avoid or mitigate impacts and develop protective measures as appropriate.

The solar expansion area is the same as the alternate array site studied for the Point Beach solar project. Point Beach Solar, LLC, completed a Phase I cultural resource review of archaeological and historical sites within the project study area and areas of potential indirect impact. The investigation included a review of the Wisconsin Historical Society database and the Wisconsin AHI. The conclusion of the cultural resource review for the Point Beach solar project was that the project, as designed, would not impact known historic or cultural resources. (PB Solar 2019, Section 5.8)

In addition, siting the natural gas pipeline corridor to avoid cultural resource areas would be a critical path issue in the siting process. The cultural resources survey conducted before construction would identify any sites, which would be avoided during construction of the pipeline. In addition, if a USACE Section 404 permit is required for the project (including NGCC plant and pipeline), potential NHPA Section 106 consultation would be required if cultural resources are impacted by the proposed activities.

Cultural resources, both historic and archaeological, will be avoided or protected during the construction and operation of the facilities under the combination alternative through the siting and consultation process. Impacts to historic and cultural resources from constructing and operating the NGCC and solar PV facilities would be NO ADVERSE EFFECT.

7.2.3.2.9 Socioeconomics

Socioeconomic Issues Other than Transportation

The jobs created to complete the construction of the NGCC plant, solar expansion, and natural gas pipeline would be temporary. A construction workforce of up to approximately 1,200 workers would be needed for the NGCC plant (NRC 2019c, Section 4.10.5) and a workforce of 200 to 300 for eight months for the larger Point Beach solar project (PB Solar 2019, Section 12.2.4). Some of the workers associated with the construction activity may relocate to the area during construction of these facilities. However, most of these workers would return to their permanent places of residence at the completion of the construction. Therefore, any boost to the local economy would be short-term, and beneficial socioeconomic impacts related to the construction of the plant would be SMALL. The additional demand on community services and infrastructure from the temporary construction workforce would result in SMALL adverse impacts.

Approximately 150 workers would be needed for NGCC plant operations (NRC 2019c, Section 4.10.5) and a full-time operations workforce of 1 to 3 for the larger Point Beach solar project (PB

Solar 2019, Section 12.2.4). This number of workers is significantly less than PBN's non-outage workforce of 681 (Section 2.5). Workers employed at the NGCC and solar facilities are assumed to live in Manitowoc and surrounding counties. They would contribute to the local economies via housing, living expenses, taxes, and other revenue contributions. Jobs associated with the operation of the NGCC plant and the solar expansion would be permanent and would contribute long-term socioeconomic benefits. Some economic loss would be expected in communities where PBN employees live and shop because fewer workers will be employed at the NGCC plant and solar expansion.

As discussed in Section 3.9.5, NEPB pays a gross-receipts license fee on PBN electricity sales to the WDR instead of paying property taxes (i.e., PILOT). The fee payments are then distributed to local appropriate municipal and county taxing authorities as public utility aid disbursements. As presented in Table 3.9-2, the shared revenue utility aid payment attributable to PBN represented approximately 30 to 64 percent of the revenues of Two Creeks between 2015–2018. During the same 2015–2018 time period, the shared revenue utility payment attributable to PBN represented approximately 2 to 3 percent of the revenues of Manitowoc County. The socioeconomic impact from PILOT would be a significant benefit to Two Creeks. The socioeconomic impacts of the combination alternative would range from SMALL for construction and LARGE beneficial for operations.

Transportation

Construction of the NGCC plant and expanding the solar facilities would increase vehicle traffic on the roads accessing the PBN property. The principal road access to the PBN site is Two Creeks Road to Lake Shore Road on the north end and Nuclear Road on the south end. Both Two Creeks Road and Nuclear Road have intersections with STH 42. The four roads are two-lane paved roads. It is expected that equipment used in construction would also be shipped via these roadways. This increase in traffic would be short-term, noticeable, and could exceed local roadway capacity during peak times given that existing PBN units would remain in operation during construction. Mitigation measures such as staggering shifts and deliveries would be used as needed. Therefore, construction traffic impacts would be MODERATE.

Traffic impacts associated with the operation of the NGCC plant and expanded solar facilities would be minimal. Because the operations would require fewer workers, operations-related transportation impacts under the combination alternative would be SMALL.

7.2.3.2.10 Human Health

Human health impacts associated with the construction of the NGCC plant, expansion of solar on the site, and natural gas pipeline connection would be primarily related to potential accidents and injuries resulting from accidents. Worker safety would be addressed by adherence to OSHA worker protection and other initiatives such as contractor safety meetings. The radiological human health impact on construction workers due to working in proximity to PBN would be SMALL due to compliance with NRC regulations and adherence to ALARA principles as presented under Section 7.2.3.1.10. Construction activities at the PBN site should not have any impact on local residents because the impacts would primarily be restricted to the PBN site. Construction-related impacts on human health under the combination alternative would be SMALL.

Impacts resulting from the operation of the NGCC plant would primarily be from air pollutant emissions. The NGCC plant would emit criteria air pollutants (Table 7.2-1). Some pollutants, such as NO_x, contribute to ozone formation that can create health problems. These criteria pollutants are regulated, and technology will be installed in the plant to limit the criteria air pollutant releases. Plant operation human health impacts would also be avoided and minimized from adherence to safety standards. No operations-related impacts to human health are expected under the solar PV component of the combination alternative. Operations-related impacts to human health under the combination alternative would be SMALL.

7.2.3.2.11 Environmental Justice

Section 3.11.2 presents the minority and low-income population in the region surrounding the PBN site. The identified minority population closest to the PBN center point is located approximately 14 miles south-southwest of the site. The closest low-income block group that meets the guidance criteria for individuals or families is located 9 miles south of the PBN center point (Block Group 550710053002).

Potential impacts from construction of an NGCC plant and expansion of solar facilities would primarily be associated with socioeconomic effects. These impacts would consist of the short-term increase in worker expenditures at local businesses and potential rental housing shortages during the construction phase of the project. The increase in traffic on roads would likely result in no disproportionately high and adverse effects to local low-income and minority communities. Overall, environmental impacts would be minor and would not result in disproportionately high and adverse effects to low income and minority communities.

No disproportionately high and adverse impacts to minority or low-income populations are expected to occur for operations of the NGCC plant and the solar facilities alternative because the activities associated with operating plant would be similar to those occurring at PBN with the exception of air emissions, which would be subject to permit and regulatory restrictions. Operation of the solar PV components would not have disproportionately high and adverse human health and environmental effects on minority and low-income populations.

Overall, the construction and operations of the combination alternative would not have disproportionately high and adverse human health and environmental effects on minority and low-income populations.

7.2.3.2.12 Waste Management

The construction of the NGCC plant and expansion of solar facilities would generate land-clearing waste that would be recycled for use (e.g., wood chips for mulch, dirt for fill) or sent to area construction and demolition landfills. If structures are demolished, scrap metal and other recyclable material would be recycled if practical and the remainder sent to area construction and demolition landfills. Construction activities would also generate sanitary and industrial wastes. These wastes will be properly managed onsite and disposed at approved offsite treatment or disposal facilities. Therefore, construction-related waste impacts would be SMALL.

Operation of the NGCC plant would result in different waste streams being created from spent catalytic reduction catalysts used to control nitrous oxide emissions. This waste stream is considered hazardous and would be disposed of at a facility that handles hazardous materials. Other waste generated at the site would be characterized as hazardous or non-hazardous. The operation of the solar PV array and battery storage is expected to generate minimal waste. Solar panels and batteries taken out of service could be characterized as hazardous waste due to levels of the heavy metals in the components but would be properly managed. These wastes would be properly managed and disposed in a permitted offsite facility. Recycling and waste minimization programs would also be implemented to minimize waste streams at the plant. Therefore, waste management impacts expected during operation of the Combination alternative would be SMALL.

Table 7.2-1 Air Emissions Estimated for NGCC Plant in the Combination Alternative

Emission	Based on EPA AP 42 (annual amount)	Scaled from Citrus County NGCC plant (annual amount)
Gas consumption	87.3 billion ft^3	87.3 billion ft^3
Sulfur dioxide	154 tons	223 tons
Nitrogen oxides[(a)]	587 tons	223 tons
Carbon monoxide	1,350 tons	516 tons
Particulate matter	298 tons	268 tons
Nitrous oxide	135 tons	NA
Volatile organic compounds	95.0 tons	56.0 tons
Carbon dioxide	4.96 million tons	4.64 million tons

a. Assumes 90 percent reduction in emissions due to operation of air pollution control equipment (selective catalytic reduction).

Formulas and Sources for Estimates Based on EPA AP 42

Annual gas consumption ($feet^3$)	Plant size in MWe x heat rate, 7,649 Btu/kWh x 1,000 x (1/ heat content = 1,033 Btu/$feet^3$) x hours in a year						
Heat content of natural gas 2018 = 1,033 Btu/$feet^3$ (EIA 2020b)							
Heat rate = 7,627 Btu/kWh (EIA 2020c)							
Annual MBtu = (annual gas consumption x fuel heating average value)/1,000,000							
Emission factor for processed natural gas (lbs/MBtu)	CO_2	NO_X	CO	PM	SO_2	VOC	N_2O
	110	0.13	0.03	0.0066	0.0034	.0.0021	0.003
Annual emissions (tons) = (emission factor) x (annual MBtu)/2000							
Air emission factors (EPA 2000, Tables 3.1-1 and 3.1-2a)							
CO_2 = carbon dioxide; NO_x = nitrogen oxides; CO = carbon monoxide; PM = total filterable particulates; SO_x = oxides of sulfur; VOC = volatile organic compound; NO_2 = nitrous oxide; Btu = British thermal unit							

7.3 Alternatives for Reducing Adverse Impacts

7.3.1 Alternatives Considered

As noted in 10 CFR 51.53(c)(3)(iii), "The report must contain a consideration of alternatives for reducing adverse impacts, as required by 51.45(c), for all Category 2 license renewal issues in Appendix B to Subpart A of this part." A review of the environmental impacts associated with the Category 2 issues in Chapter 4 identified no significant adverse effects that would require consideration of additional alternatives. Therefore, NEPB concludes that the impacts associated with renewal of the PBN OLs would not require consideration of alternatives for reducing adverse impacts as specified in NRC Regulatory Guide 4.2, Revision 1 (NRC 2013b, Section 7.2). This determination assumes the existing mitigation measures discussed in Section 6.2 adequately minimize and avoid environmental impacts associated with operating PBN.

7.3.2 Environmental Impacts of Alternatives for Reducing Adverse Impacts

No additional alternatives were considered by NEPB to reduce impacts because as determined in Chapter 4, the adverse impacts identified for continued operation of PBN were of small magnitude. PBN continues to have beneficial socioeconomic impacts, as discussed in Section 3.9.

8.0 COMPARISON OF THE ENVIRONMENTAL IMPACT OF SUBSEQUENT LICENSE RENEWAL WITH THE ALTERNATIVES

To the extent practicable, the environmental impacts of the proposal and the alternatives should be presented in comparative form . . . . [10 CFR 51.45(b)(3)]

The proposed action is renewal of the PBN Units 1 and 2 OLs, which would preserve the option to continue to operate PBN to provide reliable baseload power and meet Wisconsin's future system generating needs throughout the proposed 20-year SLR operating term. Chapter 4 analyzes the environmental impacts of the proposed action. The proposed action is compared to the no-action alternative, which includes both the termination of operations and decommissioning of PBN and reasonably foreseeable replacement of its baseload generating capacity. The termination of operations and decommissioning impacts are presented in the GEIS (NRC 2013a), Section 14.2.2, and decommissioning impacts are analyzed in the GEIS on decommissioning, NUREG-0586, Supplement 1 (NRC 2002). The energy alternatives component of the no-action alternative is described and its impacts analyzed in Chapter 7.

Table 8.0-1 summarizes the environmental impacts of the proposed action and the alternatives deemed reasonable for comparison purposes. Tables 8.0-2 and 8.0-3 provide a more detailed comparison. The environmental impacts compared in Tables 8.0-1, 8.0-2, and 8.0-3 are Category 1 and 2 issues that apply to the proposed action or issues that the GEIS identified as major considerations in an alternatives analysis.

In conclusion, there is no reasonable alternative that is environmentally preferable to the continued operation of PBN. All alternatives capable of meeting the needs currently served by PBN entail impacts greater than or equal to the proposed action of PBN SLR. The continued operation of PBN would create significantly less environmental impact than the construction and operation of new alternative generating capacity. In addition, the continued operation of PBN will have a significant positive economic impact on Manitowoc County through tax revenues paid by NEPB for PBN. Continued employment of plant workers will continue to provide economic benefits to the communities surrounding the station.

Table 8.0-1 Environmental Impacts Comparison Summary (Sheet 1 of 2)

Impact Area[(a)]	Proposed Action	No-Action Alternative			
		Termination of Operations and Decommissioning	New Nuclear Plant Alternative		Combination Alternative
			ALWR	SMR	
Land Use	SMALL	SMALL	SMALL	SMALL	Construction: SMALL (NGCC plant and solar array) MODERATE (natural gas pipeline) Operations: SMALL
Visual Resources	SMALL	SMALL	SMALL	SMALL	SMALL
Air Quality	SMALL	SMALL	SMALL	SMALL	Construction: SMALL Operations: MODERATE
Noise	SMALL	SMALL	SMALL	SMALL	SMALL
Geology and Soils	SMALL	SMALL	SMALL	SMALL	SMALL
Surface Water	SMALL	SMALL	SMALL	SMALL	SMALL
Groundwater	SMALL	SMALL	SMALL	SMALL	SMALL
Terrestrial	SMALL	SMALL	SMALL	SMALL	SMALL
Aquatic	SMALL	SMALL	SMALL	SMALL	SMALL
Special Status Species	NO ADVERSE EFFECT	(b)	NOT LIKELY TO ADVERSELY AFFECT	NOT LIKELY TO ADVERSELY AFFECT	NOT LIKELY TO ADVERSELY AFFECT
Historic and Cultural	NO ADVERSE EFFECT	NO ADVERSE EFFECT	NO ADVERSE EFFECT	NO ADVERSE EFFECT	NO ADVERSE EFFECT

Table 8.0-1 Environmental Impacts Comparison Summary (Sheet 2 of 2)

Impact Area[(a)]	Proposed Action	No-Action Alternative: Termination of Operations and Decommissioning	New Nuclear Plant Alternative: ALWR	New Nuclear Plant Alternative: SMR	Combination Alternative
Socioeconomics	SMALL	Termination: SMALL to LARGE; Decommissioning: SMALL	Construction: SMALL to MODERATE, adverse; SMALL to MODERATE, beneficial Operations: SMALL, adverse; LARGE beneficial	Construction: SMALL to MODERATE, adverse; SMALL to MODERATE, beneficial Operations: SMALL adverse; LARGE beneficial	Construction: SMALL adverse; SMALL beneficial Operations: SMALL adverse; LARGE, beneficial
Transportation	SMALL	SMALL	Construction: MODERATE to LARGE Operations: SMALL	Construction: MODERATE to LARGE Operations: SMALL	Construction: MODERATE Operations: SMALL
Human Health	SMALL	SMALL	SMALL	SMALL	SMALL
Environmental Justice	No disproportionately high and adverse effects	(b)	No disproportionately high and adverse effects	No disproportionately high and adverse effects	No disproportionately high and adverse effects
Waste Management	SMALL	SMALL	SMALL	SMALL	SMALL

a. As defined in 10 CFR Part 51, Subpart A, Appendix B, Table B-1, Footnote 3:

SMALL: Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.

MODERATE: Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.

LARGE: Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

b. NUREG-0586 Supplement 1 (NRC 2002), the decommissioning GEIS, identifies this resource area as requiring a site-specific analysis based on site conditions at the time of decommissioning, as well as the proposed decommissioning method and activities. Decommissioning PBN would at a minimum occur after the expiration of the current license term. The magnitude of impacts could vary widely based on site-specific conditions at the time and analysis of special status species and/or their habitat(s), a consideration of their presence or their habitats' presence, and environmental justice analysis, the potential for disproportionately high and adverse impacts from the impacts of decommissioning being experienced by minority or low-income populations as determined by the most recent USCB decennial census data when the alternative is implemented. Thus, NEPB cannot forecast a level of impact for this resource area.

Table 8.0-2 Environmental Impacts Comparison Detail

	New Nuclear Alternative		
	ALWR Option	**SMR Option**	**Combination Alternative**
Summary of Alternative	One-unit nuclear plant for a total of 1,200 net MWe. (Section 7.2.1.1)	21 SMR units. (Section 7.2.1.1)	Multiple combustion turbines assembled in appropriate power train configurations for a total of 1,725 net MWe and 25 MWe solar array with 25 MWe battery storage. (Section 7.2.1.2)
Location	At existing PBN site. (Section 7.2.1.1)	At existing PBN site. (Section 7.2.1.1)	At existing PBN site. (Section 7.2.1.2)
Cooling System	Closed-cycle cooling with mechanical draft cooling towers; some infrastructure upgrades may be required. (Section 7.2.1.1)	Closed-cycle cooling with mechanical draft cooling towers; some infrastructure upgrades may be required. (Section 7.2.1.1)	Closed-cycle cooling with mechanical draft cooling towers; some infrastructure upgrades may be required. (Section 7.2.1.2)
Land Requirements	Adequate acreage available on existing PBN site. (Section 7.2.3.1.1)	Adequate acreage available on existing PBN site. (Section 7.2.3.1.1)	Adequate acreage available on existing PBN site, no additional gas fields required. (Section 7.2.3.2.1)
Workforce	2,500 to 3,500 during peak construction; 500 during operations. (Section 7.2.3.1.9)	3,300 during peak construction; 500 during operations. (Section 7.2.3.1.9)	NGCC: 1,200 during peak construction; 150 during operations; Solar: 200 to 300 construction, 1 to 3 during operations. (Section 7.2.3.2.9)

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 1 of 15)

Land Use		
Proposed action		**SMALL:** Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following: Onsite land use Offsite land use
Termination of operations and decommissioning		**SMALL:** Temporary onsite land use changes during decommissioning are anticipated to be comparable to changes that occur during construction and operations and would not require additional land. Temporary changes in onsite land use would not change the fundamental use of the reactor site. (NRC 2013a, Section 4.12.2.1)
New nuclear plant alternative	**ALWR Option**	**SMALL:** Plant to be constructed onsite near existing structures on developed and undeveloped land. Some tree removal.
	SMR Option	**SMALL:** Plant to be constructed onsite near existing structures on developed and undeveloped land. Some tree removal.
Combination Alternative NGCC Plant and Solar		**SMALL:** NGCC and solar facilities to be constructed onsite near existing structures on developed and undeveloped land. Some tree removal. **SMALL to MODERATE:** New 10-mile gas pipeline assumed to require new corridor. Existing gas supply wells assumed adequate to support NGCC plant operations.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 2 of 15)

Visual Resources		
Proposed action		**SMALL:** Adopting by reference the Category 1 issue finding for aesthetic impacts in 10 CFR Part 51, Subpart A, Appendix B, Table B-1.
Termination of operations and decommissioning		**SMALL:** Terminating nuclear power plant operations would not change the visual appearance of the nuclear power plant until demolition of structures. Decommissioning activities would be localized and reduced with implementation of BMPs. (NRC 2013a, Section 4.12.2.1)
New nuclear plant alternative	**ALWR Option**	**SMALL:** Construction and operations activities would appear similar to other ongoing onsite industrial activities because the PBN property is already aesthetically altered by the presence of existing generating units and infrastructure.
	SMR Option	**SMALL:** Construction and operations activities would appear similar to other ongoing onsite industrial activities because the PBN property is already aesthetically altered by the presence of existing generating units and infrastructure.
Combination Alternative NGCC Plant and Solar		**SMALL:** Construction and operations activities would appear similar to other ongoing onsite industrial activities because the PBN property is already aesthetically altered by the presence of existing generating units and infrastructure.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 3 of 15)

<table>
<tr><th colspan="3">Air Quality</th></tr>
<tr><td colspan="2">Proposed action</td><td>SMALL: Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following:
Air quality impacts (all plants)
Air quality effects of transmission lines</td></tr>
<tr><td colspan="2">Termination of operations and decommissioning</td><td>SMALL: After termination of operations, air emissions from the nuclear power plant would continue, but at greatly reduced levels. The most likely impact of decommissioning on air quality is degradation by fugitive dust. Use of BMPs, such as seeding and wetting, can be used to minimize fugitive dust. (NRC 2013a, Section 4.12.2.1)</td></tr>
<tr><td rowspan="2">New nuclear plant alternative</td><td>ALWR Option</td><td>SMALL: Construction impacts would be temporary; operations impacts would be minor, and emissions being maintained within federal and state regulatory limits.</td></tr>
<tr><td>SMR Option</td><td>SMALL: Construction impacts would be temporary; operations impacts would be minor, and emissions being maintained within federal and state regulatory limits.</td></tr>
<tr><td colspan="2">Combination Alternative NGCC Plant and Solar</td><td>SMALL (construction); MODERATE (operations): Construction impacts would be temporary; emission estimates during the operations period are as follows:
<u>NGCC Plant</u>
Sulfur dioxide = 154 tons per year
Nitrogen oxides = 587 tons per year
Carbon monoxide = 1,350 tons per year
Particulate matter = 298 tons per year
Nitrous oxide = 135 tons per year
Volatile organic compounds = 95 tons per year
Carbon dioxide = 4.96 million tons per year
<u>Solar PV Plant</u>
The solar alternative would not release any air emissions during operation.</td></tr>
</table>

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 4 of 15)

Noise		
Proposed action		**SMALL:** Adopting by reference the Category 1 issue finding for noise impacts in 10 CFR Part 51, Subpart A, Appendix B, Table B-1.
Termination of operations and decommissioning		**SMALL:** During decommissioning, noise would generally be far enough away from sensitive receptors outside the plant boundaries that the noise would be attenuated to nearly ambient levels and would be scarcely noticeable offsite. Noise abatement procedures could also be used during decommissioning in order to reduce noise. (NRC 2013a, Section 4.12.2.1)
New nuclear plant alternative	**ALWR Option**	**SMALL:** Noise impacts from construction activities would be intermittent and last only through the duration of construction; noise impacts during operations would be similar to those currently associated with PBN with addition of the mechanical draft cooling towers.
	SMR Option	**SMALL:** Noise impacts from construction activities would be intermittent and last only through the duration of construction; noise impacts during operations would be similar to those currently associated with PBN with addition of the mechanical draft cooling towers.
Combination Alternative NGCC Plant and Solar		**SMALL:** Noise impacts from construction activities would be intermittent and last only through the duration of construction; noise impacts during operations would be similar to those currently associated with PBN with the addition of mechanical draft cooling towers; operation of the solar array.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 5 of 15)

Geology and Soils		
Proposed action		**SMALL:** Adopting by reference the Category 1 issue finding for geology and soils in 10 CFR Part 51, Subpart A, Appendix B, Table B-1.
Termination of operations and decommissioning		**SMALL:** Termination of nuclear plant operations is not expected to impact geology and soils. Erosion problems could be mitigated by using BMPs during decommissioning. Site geologic resources would not be affected by decommissioning. (NRC 2013a, Section 4.12.2.1)
New nuclear plant alternative	**ALWR Option**	**SMALL:** Construction activities would be localized and minimized with implementation of BMPs; land disturbance activities during operations would be conducted in compliance with a stormwater permit and associated BMPs.
	SMR Option	**SMALL:** Construction activities would be localized and minimized with implementation of BMPs; land disturbance activities during operations would be conducted in compliance with a stormwater permit and associated BMPs.
Combination Alternative NGCC Plant and Solar		**SMALL:** Construction activities would be localized and minimized with implementation of BMPs; land disturbance activities during operations would be conducted in compliance with a stormwater permit and associated BMPs.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 6 of 15)

<table>
<tr><th colspan="3">Surface Water</th></tr>
<tr><td colspan="2">Proposed action</td><td>SMALL: Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following:
Surface water use and quality (non-cooling system impacts)
Altered current patterns at intake and discharge structures
Altered thermal stratification of lakes
Scouring caused by discharged cooling water
Discharge of metals in cooling system effluent
Discharge of biocides, sanitary waste, and minor chemical spills
Surface water use conflicts (plants with once-through cooling systems)
Effects of dredging on surface water quality
Temperature effects on sediment transport capacity</td></tr>
<tr><td colspan="2">Termination of operations and decommissioning</td><td>SMALL: The NRC concluded that the impacts on water use and water quality from decommissioning would be SMALL for all plants. (NRC 2013a, Section 4.12.2.1)</td></tr>
<tr><td rowspan="2">New nuclear plant alternative</td><td>ALWR Option</td><td>SMALL: Construction impacts would be minimized through implementation of BMPs; during operations, impacts to surface water would be related to use of Lake Michigan to supply makeup water and water discharges to Lake Michigan would be regulated under a WPDES permit to protect water quality.</td></tr>
<tr><td>SMR Option</td><td>SMALL: Construction impacts would be minimized through implementation of BMPs; during operations, impacts to surface water would be related to use of Lake Michigan to supply makeup water and water discharges to Lake Michigan would be regulated under a WPDES permit to protect water quality.</td></tr>
<tr><td colspan="2">Combination Alternative NGCC Plant and Solar</td><td>SMALL: Construction impacts would be minimized through implementation of BMPs; during operations, impacts to surface water would be related to use of Lake Michigan to supply makeup water and water discharges to Lake Michigan would be regulated under a WPDES permit to protect water quality. No impacts are associated with the solar and battery facilities.</td></tr>
</table>

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 7 of 15)

Groundwater		
Proposed action		**SMALL:** Adopting by reference the Category 1 issue finding for groundwater contamination and use (non-cooling system impacts) and groundwater quality degradation resulting from water withdrawals in 10 CFR Part 51, Subpart A, Appendix B, Table B-1. **SMALL** (groundwater use conflicts [plants that withdraw less than 100 gpm]): Groundwater withdrawals are permitted by WDNR and reported to WDNR as a condition of the permits. PBN has five permitted wells including one high capacity well with approved maximum use of 100,000 gpd (WDNR 2011a). PBN groundwater withdrawals averaged 12,542.09 gpd between 2015 and 2019 (Table 3.6-7a). It is not anticipated that groundwater withdrawal increases above permitted quantities will be required during the license period. **SMALL** (radionuclides released to groundwater): The groundwater tritium concentrations are below the EPA drinking water standards and the drinking water contains no tritium. None of the tritium in the upper soil layer is migrating off-site toward the surrounding population. No unplanned radioactive liquid or gaseous releases were reported between 2015 and 2019.
Termination of operations and decommissioning		**SMALL:** Decommissioning activities include some that may affect groundwater quality through the infiltration of water used for various purposes (e.g., cooling of cutting equipment, decontamination spray, and dust suppression). BMPs are expected to be employed as appropriate to collect and manage these waters. Groundwater chemistry may change as rainwater infiltrates through rubble. The increased pH could promote the subsurface transport of radionuclides and metals. However, this effect is expected to occur only over a short distance as a function of the buffering capacity of soil. Offsite transport of groundwater contaminants is not expected. (NRC 2013a)
New nuclear plant alternative	**ALWR Option**	**SMALL:** During construction and operations, potable water would be supplied by PBN's five existing groundwater supply wells; any drawdown in the water table from dewatering activities would be limited by the proximity of Lake Michigan and under a WDNR permit; BMPs would minimize impacts to groundwater quality as a result of stormwater runoff during construction and operation. The ALRW would be operated in compliance with NRC radiological release/effluent standards.
	SMR Option	**SMALL:** During construction and operations, potable water would be supplied by PBN's five existing groundwater supply wells; any drawdown in the water table from dewatering activities would be limited by the proximity of Lake Michigan and under a WDNR permit; BMPs would minimize impacts to groundwater quality as a result of stormwater runoff during construction and operation. The ALRW would be operated in compliance with NRC radiological release/effluent standards.

Groundwater	
Combination Alternative NGCC Plant and Solar	**SMALL:** During NGCC plant construction any drawdown in the water table from dewatering activities would be limited by the proximity of Lake Michigan and under a WDNR permit; potable water for construction and operation of the NGCC plant and solar array would be supplied by PBN's five existing groundwater supply wells; BMPs would minimize impacts to groundwater quality as a result of stormwater runoff during construction and operation.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 8 of 15)

Terrestrial		
Proposed action		**SMALL:** Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following: Exposure of terrestrial organisms to radionuclides Cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds) Bird collisions with plant structures and transmission lines Transmission line right-of-way management impacts on terrestrial resources Electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock) **SMALL** (effects on terrestrial resources—non-cooling system impacts): adequate management programs and regulatory controls in place to protect onsite important terrestrial ecosystems.
Termination of operations and decommissioning		**SMALL:** The termination of nuclear power plant operations would reduce some impacts and eliminate others. Impacts from systems that continue operating to support other units (i.e., where the license term for each unit does not end at the same time) on the plant site may continue to affect terrestrial biota, but at a reduced level of impact. Areas disturbed or used to support decommissioning are within the operational areas of the site and are also within the protected area. Decommissioning activities conducted within the operational areas are not expected to have a detectable impact on important terrestrial resources. (NRC 2013a, Section 4.12.2.1)
New nuclear plant alternative	**ALWR Option**	**SMALL:** Construction activities would be in close proximity to developed and operational areas. Wetlands would be avoided. Tree removal would be in accordance with USFWS guidelines; cooling tower impacts would be similar to other nuclear plants with cooling towers.
	SMR Option	**SMALL:** Construction activities would be in close proximity to developed and operational areas. Wetlands would be avoided. Tree removal would be in accordance with USFWS guidelines; cooling tower impacts would be similar to other nuclear plants with cooling towers.
Combination Alternative NGCC Plant and Solar		**SMALL:** Construction activities would be in close proximity to developed and operational areas. Wetlands would be avoided. Tree removal would be in accordance with USFWS guidelines; cooling tower impacts would be similar to other nuclear plants with cooling towers.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 9 of 15)

Aquatic	
Proposed action	**SMALL:** Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following: Entrainment of phytoplankton and zooplankton (all plants) Infrequently reported thermal impacts (all plants) Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication Effects of nonradiological contaminants on aquatic organisms Exposure of aquatic organisms to radionuclides Effects of dredging on aquatic organisms Effects on aquatic resources (non-cooling system impacts) Impacts of transmission line right-of-way management on aquatic resources Losses from predation, parasitism, and disease among organisms exposed to sub-lethal stresses **SMALL** (impingement and entrainment of aquatic organisms—plants with once-through cooling systems or cooling ponds)**:** PBN has a once-through cooling system that operates in compliance with the WPDES permit. Based on current and future permit compliance and the results of past and current impingement and entrainment studies impingement and entrainment impacts would be small. **SMALL** (thermal impacts on aquatic organisms—plants with once-through cooling systems or cooling ponds): PBN has a thermal discharge that has been demonstrated to be protective of the Lake Michigan aquatic community.
Termination of operations and decommissioning	**SMALL:** The termination of nuclear power plant operations would reduce some impacts and eliminate others. Impacts from systems that continue operating to support other units (i.e., where the license term for each unit does not end at the same time) on the plant site may continue to affect aquatic biota, but at a reduced level of impact. Some aquatic organisms may have become established in the mixing zone because of the warmer environment, and these organisms likely would be adversely affected as the water temperature cooled and the original conditions were restored within the body of water. The NRC concluded that for facilities at which the decommissioning activities would be limited to existing operational areas, the potential impacts on aquatic resources would be SMALL. (NRC 2013a, Section 4.12.2.1)

Aquatic		
New nuclear plant alternative	**ALWR Option**	**SMALL:** Implementation of BMPs would minimize impacts on aquatic ecosystems during construction. Aquatic life impacts resulting from operations is primarily related to the intake and discharge structures. The closed cycle cooling system would require less withdrawals and the discharge would be operated under a WPDES permit.
	SMR Option	**SMALL:** Implementation of BMPs would minimize impacts on aquatic ecosystems during construction. Aquatic life impacts resulting from operations is primarily related to the intake and discharge structures. The closed cycle cooling system would require less withdrawals and the discharge would be operated under a WPDES permit.
Combination Alternative NGCC Plant and Solar		**SMALL:** Implementation of BMPs would minimize impacts on aquatic ecosystems during construction. Aquatic life impacts resulting from operations is primarily related to the intake and discharge structures. The closed cycle cooling system would require less withdrawals and the discharge would be operated under a WPDES permit. No impacts would result from the solar PV component.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 10 of 15)

Special Status Species		
Proposed action		**NO ADVERSE EFFECT:** The continued operation of PBN would have no adverse effects to any federally or state-listed species. The proposed SLR would have no effect on threatened, endangered, and protected species in the vicinity of PBN.
Termination of operations and decommissioning		**Site Specific:** The termination of nuclear power plant operations would reduce some impacts and eliminate others. Impacts from systems that continue operating to support other units (i.e., where the license term for each unit does not end at the same time) on the plant site may continue to affect aquatic biota, but at a reduced level of impact. Some aquatic organisms may have become established in the mixing zone because of the warmer environment, and these organisms likely would be adversely affected as the water temperature cooled and the original conditions were restored within the body of water. The magnitude of impacts could vary widely based on site-specific conditions at the time of decommissioning and the presence or absence of special status species and habitats when the alternative is implemented. (NRC 2013a, Section 4.12.2.1)
New nuclear plant alternative	**ALWR Option**	**NO ADVERSE EFFECT:** The ALWR unit would be constructed on an operating industrial site and NEPB would take appropriate mitigation measures prior to tree removal and comply with USACE and WDNR requirements for preventing and mitigating impacts to wetlands and aquatic environments, the construction would have NO EFFECT on special status species. Operations in compliance with regulations and permit conditions would have NO EFFECT on special status species.
	SMR Option	**NO ADVERSE EFFECT:** The SMR units would be installed on an operating industrial site and NEPB would take appropriate mitigation measures prior to tree removal and comply with USACE and WDNR requirements for preventing and mitigating impacts to wetlands and aquatic environments, the construction would have NO EFFECT on special status species. Operations in compliance with regulations and permit conditions would have NO EFFECT on special status species.
Combination Alternative NGCC Plant and Solar		**NO ADVERSE EFFECT (NGCC plant and solar array):** The NGCC plant and solar expansion would be installed on an operating industrial site and NEPB would take appropriate mitigation measures prior to tree removal and comply with USACE and WDNR requirements for preventing and mitigating impacts to wetlands and aquatic environments, the construction would have NO EFFECT on special status species. Operations in compliance with regulations and permit conditions would have NO EFFECT on special status species. **MAY AFFECT, NOT LIKELY to ADVERSELY AFFECT (Natural gas pipeline):** The siting process would seek to avoid habitat for federally protected species. Field surveys would be conducted as required and appropriate avoidance or mitigation measures would have to be implemented.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 11 of 15)

Historic and Cultural Resources		
Proposed action		**NO ADVERSE EFFECT:** No SLR-related refurbishment or construction activities identified; administrative controls ensure protection of cultural resources in the event of construction/excavation activities.
Termination of operations and decommissioning		**NO ADVERSE EFFECT:** The termination of nuclear plant operations would not affect historic or cultural resources. The NRC conducted an analysis of the potential effects of decommissioning on historic and archaeological (cultural) resources and found that the potential onsite impacts at sites where the disturbance of lands would not go beyond the operational areas would be SMALL. (NRC 2013a, Section 4.12.2.1)
New nuclear plant alternative	**ALWR Option**	**NO ADVERSE EFFECT:** Prior to construction activities, field surveys would be conducted as appropriate for undeveloped areas, and any historic or archaeological sites identified would be avoided or management plans developed in consultation with the Wisconsin SHPO for sites that cannot be avoided.
	SMR Option	**NO ADVERSE EFFECT:** Prior to construction activities, field surveys would be conducted as appropriate for undeveloped areas, and any historic or archaeological sites identified would be avoided or management plans developed in consultation with the Wisconsin SHPO for sites that cannot be avoided.
Combination Alternative NGCC Plant and Solar		**NO ADVERSE EFFECT:** Prior to construction activities for the NGCC plant, field surveys would be conducted as appropriate for undeveloped areas, and any historic or archaeological sites identified would be avoided or management plans developed in consultation with the Wisconsin SHPO for sites that cannot be avoided. The solar array location and design was previously reviewed and determined to not impact known historic or cultural resources.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 12 of 15)

<table>
<tr><th colspan="3">Socioeconomics</th></tr>
<tr><td colspan="2">Proposed action</td><td>SMALL: Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following: Employment and income, recreation and tourism
Tax revenues
Community services and education
Population and housing
Transportation</td></tr>
<tr><td colspan="2">Termination of operations and decommissioning</td><td>When a nuclear power plant is closed and decommissioned, most of the important socioeconomic impacts will be associated with the plant closure rather than with the decommissioning process (NRC 2002, Section 4.3.12).
SMALL to LARGE: Terminating nuclear plant operations would have a noticeable adverse impact on socioeconomic conditions in the region around the nuclear power plant. There would be immediate socioeconomic impacts from the loss of jobs. The impacts from the loss or reduction of revenue due to the termination of plant operations on community and public education services could range from SMALL to LARGE. (NRC 2013a, Section 4.12.2.1) NEPB pays the Wisconsin Department of Revenue a gross-receipts license fee on electricity sales (i.e., payments in lieu of taxes (PILOT)) which is then distributed to the appropriate municipal and county taxing authorities. The PILOT attributable to PBN are a small percentage of total revenues of Manitowoc County, but more are more than 60 percent of the overall revenues of Two Creeks in 2018 (Section 3.9.5). The plant staff residing in Manitowoc County, approximately 250 (Section 2.5), is a small percentage of Manitowoc County's employed population of 44,172 (Section 3.9.1). Therefore, the loss of jobs would affect a small percentage of the population, but the revenue loss would have a noticeable and potentially destabilizing impact on Two Creeks.
SMALL: Decommissioning itself has no impact on the tax base and no detectable impact on the demand for public services. The impacts of decommissioning on socioeconomics are neither detectable nor destabilizing; therefore, the impacts on socioeconomics are SMALL. (NRC 2002, Section 4.3.12.3 and 4.3.12.4)</td></tr>
<tr><td>New nuclear plant alternative</td><td>ALWR Option</td><td>SMALL to MODERATE (construction, adverse due to increased pressure on housing and demand for community services): The peak construction workforce is estimated at 2,500 to 3,500 workers. The temporary in-migration of workers would result in increased demand for housing, recreation, and infrastructure and community services.</td></tr>
</table>

Socioeconomics		
New nuclear plant alternative (cont.)	**ALWR Option (cont.)**	**SMALL to MODERATE (construction, beneficial economic)**: Construction would provide a stimulus to the local economy. **SMALL (operations, adverse):** The estimated operational workforce of 500 could be drawn from the existing workforce and would not put additional stress on existing public services such as education, medical, fire, and police services would be small across the region. **LARGE (operations, beneficial):** Use of existing workforce would allow for the continuation of long-term employment. PILOT would continue as with the existing units for a beneficial socioeconomic impact. **MODERATE to LARGE (construction traffic):** Construction would increase traffic on the roads and congestion. Impacts could be mitigated by use of staggered shifts and implementation of planned upgrades and improvements to the road systems. **SMALL (operations traffic):** Traffic-related impacts would be reduced after construction to levels similar to that of the current units.
	SMR Option	**SMALL to MODERATE (construction, adverse due to increased pressure on housing and demand for community services):** The peak construction workforce is estimated at 3,300 workers. The temporary in-migration of workers would result in increased demand for housing, recreation, and infrastructure and community services. **SMALL to MODERATE (construction, beneficial economic)**: Construction would provide a stimulus to the local economy. **SMALL (operations, adverse):** The estimated operational workforce of 500 could be drawn from the existing workforce and would not put additional stress on existing public services such as education, medical, fire, and police services would be small across the region. **LARGE (operations, beneficial):** Use of existing workforce would allow for the continuation of long-term employment. PILOT would continue as with the existing units for a beneficial socioeconomic impact. **MODERATE to LARGE (construction traffic):** Construction would increase traffic on the roads and congestion. Impacts could be mitigated by use of staggered shifts and implementation of planned upgrades and improvements to the road systems. **SMALL (operations traffic):** Traffic-related impacts would be reduced after construction to levels similar to that of the current units.

Socioeconomics	
Combination Alternative NGCC Plant and Solar	**SMALL (construction, adverse due to increased pressure on housing and demand for community services):** The jobs created to complete the construction of the NGCC plant (1,200), solar array (200 to 300), and natural gas pipeline would be temporary in duration and any in-migration would be temporary. The temporary in-migration of workers would result in increased demand for housing, recreation, and infrastructure and community services. **SMALL (construction, beneficial):** The jobs created to complete the construction of the NGCC plant, solar array, and natural gas pipeline would be temporary in duration and would have a temporary stimulus to the local economy. **SMALL (operations, adverse):** The NGCC plant and solar array would have approximately 150 workers, fewer workers than PBN and would have less demand on local services. **MODERATE (operations, beneficial):** The socioeconomic impacts resulting from the operation of the NGCC plant would be less than the current socioeconomic impact of PBN as fewer workers would be employed. PILOT would have a significant beneficial impact to Two Creeks. **MODERATE (construction traffic):** The increase in traffic during construction would be short-term and noticeable and could exceed local roadway capacity during peak times given that existing units would remain operational during the construction time period. Mitigation measures such as staggering shifts and deliveries would be used as needed. **SMALL (operations traffic):** Traffic impacts associated with the operation of the NGCC plant and solar array would be less than current operations given the smaller operations workforce.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 13 of 15)

Human Health		
Proposed action		**SMALL**: Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following: Radiation exposures to the public Radiation exposures to plant workers Human health impact from chemicals Microbiological hazards to plant workers Physical occupational hazards **SMALL** (microbiological hazards to the public [plants with cooling ponds or canals or cooling towers that discharge to a river]): PBN's discharge temperatures fall below temperatures that would optimize growth of the pathogens. Exposure of Lake Michigan users to elevated concentrations of the microorganisms of concern is unlikely given the unlikelihood of the water to create conditions favorable to thermophilic microorganisms, the small area of thermally altered waters, and the restricted access of the public to these areas. **SMALL** (electric shock hazards): Transmission lines located entirely within PBN property and PBN has occupational safety and health measures in place to maintain minimal ground clearances and minimize shock hazards from overhead lines.
Termination of operations and decommissioning		**SMALL:** The human health impacts from physical, chemical, and microbiological hazards during the termination of plant operations and decommissioning would be SMALL for all plants. (NRC 2013a, Section 4.12.2.1)
New nuclear plant alternative	**ALWR Option**	**SMALL:** Compliance with OSHA worker protection rules would control impacts on workers at acceptable levels during construction; human health impacts during operation would be similar to PBN. The radiological human health impact would be SMALL due to compliance with NRC regulations and adherence to ALARA principals.
	SMR Option	**SMALL:** Compliance with OSHA worker protection rules would control impacts on workers at acceptable levels during construction; human health impacts during operation would be similar to PBN. The radiological human health impact would be SMALL due to compliance with NRC regulations and adherence to ALARA principals.
Combination Alternative NGCC Plant and Solar		**SMALL:** Compliance with OSHA worker protection rules would control impacts on workers at acceptable levels during NGCC plant construction and operations; air emissions would be subject to regulatory standards that are protective of human health; impacts from solar PV component construction would be similarly keep impacts on workers at acceptable levels and there are no expected operational impacts.

a. Category 2 issue requiring site-specific evaluation.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 14 of 15)

Environmental Justice		
Proposed action		**No disproportionately high and adverse effects on minority and low-income populations:** There are no known pathways by which disproportionately high and adverse impacts could be imposed on minority or low-income populations from the proposed action.
Termination of operations and decommissioning		**Site Specific:** Termination of power plant operations and the resulting loss of jobs, income, and tax revenue could have a disproportionate effect on minority and low-income populations (NRC 2013a, Section 4.12.2). **Site Specific:** The determination of whether the minority or low-income populations are disproportionately highly and adversely impacted by facility decommissioning activities needs to be made on a site-by-site basis because their presence and their socioeconomic circumstances will be site specific (NRC 2002, Section 4.3.13.3).
New nuclear plant alternative	**ALWR Option**	**No disproportionately high and adverse effects on minority and low-income populations:** The closest low-income block group and minority population is located 9 miles and 14 miles from the PBN center point, respectively. Impacts during construction would be temporary and likely would result in no disproportionately high and adverse impacts to minority and low-income populations. There are no known pathways by which disproportionately high and adverse impacts could be imposed on minority or low-income populations from the operation of a new nuclear plant alternative.
	SMR Option	**No disproportionately high and adverse effects on minority and low-income populations:** The closest low-income block group and minority population is located 9 miles and 14 miles from the PBN center point, respectively. Impacts during construction would be temporary and likely would result in no disproportionately high and adverse impacts to minority and low-income populations. There are no known pathways by which disproportionately high and adverse impacts could be imposed on minority or low-income populations from the operation of a new nuclear plant alternative.
Combination Alternative NGCC Plant and Solar		**No disproportionately high and adverse effects on minority and low-income populations:** The closest low-income block group and minority population is located 9 miles and 14 miles from the PBN center point, respectively. Impacts during construction would be temporary and likely would result in no disproportionately high and adverse impacts to minority and low-income populations. There are no known pathways by which disproportionately high and adverse impacts could be imposed on minority or low-income populations from the operation of a new nuclear plant alternative.

Table 8.0-3 Environmental Impacts Comparison Detail (Sheet 15 of 15)

Waste Management		
Proposed action		**SMALL:** Adopting by reference the Category 1 issue findings in 10 CFR Part 51, Subpart A, Appendix B, Table B-1 for the following: Low-level waste storage and disposal Onsite storage of spent nuclear fuel Offsite radiological impacts of spent nuclear fuel and high-level waste disposal Mixed waste storage and disposal Nonradioactive waste storage and disposal
Termination of operations and decommissioning		**SMALL:** After termination of nuclear plant operations, there would be a period before the beginning of decommissioning when the reactor would be placed in a cold shutdown condition and maintained. The quantities of waste generated would be smaller than the quantities generated during either operations or decommissioning. The impacts associated with the management of LLRW, hazardous waste, mixed waste, and nonradioactive and nonhazardous waste during operations and decommissioning would be SMALL. (NRC 2013a, Section 4.12.2.1)
New nuclear plant alternative	**ALWR Option**	**SMALL:** Construction-related waste would be properly characterized and disposed of at permitted offsite facilities; during operations, nonhazardous, hazardous, and radioactive wastes would be managed in compliance with federal and state regulations and disposed of in permitted facilities.
	SMR Option	**SMALL:** Construction-related waste would be properly characterized and disposed of at permitted offsite facilities; during operations, nonhazardous, hazardous, and radioactive wastes would be managed in compliance with federal and state regulations and disposed of in permitted facilities.
Combination Alternative NGCC Plant and Solar		**SMALL:** Construction-related waste would be properly characterized and disposed of at permitted offsite facilities; during operations, nonhazardous and hazardous wastes would be managed in compliance with federal and state regulations and disposed of in permitted facilities. Operation of the NGCC plant would result in spent catalytic reduction catalysts used to control emissions.

9.0 STATUS OF COMPLIANCE

The ER shall list all federal permits, licenses, approvals, and other entitlements which must be obtained in connection with the proposed action and shall describe the status of compliance with these requirements. The ER shall also include a discussion of the status of compliance with applicable environmental quality standards and requirements, including, but not limited to, applicable zoning and land-use regulations, and thermal and other water pollution limitations or requirements which have been imposed by federal, state, regional, and local agencies having responsibilities for environmental protection [10 CFR 51.45 (d)].

9.1 PBN Authorizations

Table 9.1-1 provides a summary of the authorizations held by PBN for current plant operations. Authorizations in this context include any permits, licenses, approvals, or other entitlements that would continue to be in place, as appropriate, through the proposed SLR operating term given their respective renewal schedules. Table 9.1-2 lists additional environmental authorizations and consultations related to the renewal of PBN Units 1 and 2 OLs.

Table 9.1-1 Environmental Authorizations for Current PBN Operations (Sheet 1 of 4)

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
EPA	Federal Resource Conservation and Recovery Act [42 USC 6912] Ch. 10.09 Wisconsin Statutes	Notification of Regulated Waste Activity	EPA ID Number: WID093422657	NA	Hazardous waste generation/transport.
NRC	Atomic Energy Act [10 CFR Part 49]	PBN License to Operate Unit 1	DPR-24	Renewed December 2005 Expires 10/5/2030	Operation of PBN Unit 1.
NRC	Atomic Energy Act [10 CFR Part 50]	PBN License to Operate Unit 2	DPR-27	Renewed December 2005 Expires 3/8/2033	Operation of PBN Unit 2.
NRC	10 CFR Part 72	General license for storage of spent fuel at power reactor sites	General Permit	NA	Storage of power reactor spent fuel and other associated radioactive materials in an ISFSI.
USDOT	[49 CFR Part 107, Subpart G]; 49 U.S.C. 5108	Registration	040920550023C	Issued 7/1/2020 Expires 6/30/2021	Hazardous material shipment.
USACE	Clean Water Act Section 404 [33 USC 1344]	Permit	MVP-2014-01045-SJW	Issued 10/22/2019 Expires 3/18/2022	Permit to perform bank stabilization activities on the shoreline of Lake Michigan at PBN.
State of Utah DEQ	R313-26 of the Utah Administrative Code	Generator Site Access Permit	0906005280	Issued 7/21/2020 Expires 7/26/2021	Authorizes waste generators, waste processors, and waste collectors to deliver radioactive wastes to a land disposal facility located in Utah.

Table 9.1-1 Environmental Authorizations for Current PBN Operations (Sheet 2 of 4)

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
TN Department of Environment and Conservation	Tennessee Code Annotated 68-202-206	License to ship radioactive material	T-WI002-L20	Issued 1/1/2020 Expires 12/31/2020	Shipment of radioactive material to processing facility in Tennessee.
WI Department of Commerce	Federal Resource Conservation Act [42 USC 6912], Ch. 101.09 Wisconsin Statutes	Underground Storage Tank Registration	Owner ID: 1114232 Site ID: 652382 Tank IDs: 285454, 764837, 764843	NA	Storage of flammable materials in underground tanks.
WI Department of Commerce	Ch. 101.09 Wisconsin Statutes	Aboveground Storage Tank Registration	Owner ID: 1114232 Site ID: 652382 Tank IDs: 206578, 206579, 206581, 206582, 206583, 206615, 206616, 206690, 455264, 455274, 1131794, 1131800, 1131801, 1131802, 1131803, 1131804, 1131805, 1131806, 1131807, 1325478, 1325484, 1370484, 1599013	NA	Storage of flammable materials in aboveground tanks.
WDNR	Ch. 29.614 Wisconsin Statutes	Scientific Collectors Permit	SCP-FM-2020-009	Issued 1/9/2020 Expires 12/31/2020 (Remains in effect pending state review of renewal application)	Collection of fish for scientific purposes.

Table 9.1-1 Environmental Authorizations for Current PBN Operations (Sheet 3 of 4)

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
WDNR	Section 30.12(3m) Wisconsin Statutes	Permit	IP-NE-2019-36-03112	Issued 10/23/2019 Expires 10/23/2024	Permit to install riprap on the banks of Lake Michigan at PBN.
WDNR	Clean Water Act [33 USC Section 1251 et seq.] Ch. 160 and 283 Wisconsin Statutes	Individual WPDES permit	WI-0000957-08-0	Issued 7/1/2016 Expires 6/30/2021	PBN discharges to Lake Michigan.
WDNR	Clean Water Act [33 USC Section 1251 et seq.] Ch. 283 Wisconsin Statutes	General WPDES industrial storm water discharge permit (Tier 2)	WI-S067857-4	Issued 6/15/2016 Expires 5/31/2021	Storm water runoff from industrial facilities.
WDNR	Federal Clean Air Act [42 USC 7661-7671] Ch. 285 Wisconsin Statutes, NR 407.09(4)(a) and 439.03(1)(c) Wisconsin Administrative Code	Renewed air pollution control operation permit, Air Operation Permit Compliance Certification	436034500-P32	Issued 11/19/2018 Expires 7/6/2022	Air emissions from gas turbines, boilers, generators, and fire pumps; certification that PBN complies with Wisconsin's administrative code.
WDNR	Ch. NR 809-810 Wisconsin Statutes	Registration	61469 60465 61745	May 1, 2022 February 1, 2021 November 1, 2021	Non-transient non-community water supply registration/ small water system (OTM/NN) operator certification.
WDNR	NR 149 Wisconsin Administrative Code	Registration/License	Laboratory ID: 436034500	Issued 7/6/2020 Expires 8/31/2021	Registers NEPB as a laboratory licensed to perform environmental sample analysis in support of covered environmental programs (Ch. NR149.02).
WDNR	Ch. 280 and 281 Wisconsin Statutes	Drinking water/groundwater wells	36-3-0017, Approval numbers: 52826, 68865, 52824, 71777, 01176	Issued 12/7/2011	Approval for high-capacity well with listing of previously approved wells.

Table 9.1-1 Environmental Authorizations for Current PBN Operations (Sheet 4 of 4)

Agency	Authority	Requirement	Number	Expiration Date	Authorized Activity
WDNR	281.346(5)(d) Wisconsin Statutes; Ch. NR 856.30 and 856.31 Wisconsin Administrative Code	Registration to withdrawal water in an amount averaging 100,000 gallons per day or more in any 30-day period from the Great Lakes Basin	10208	Issued 5/23/2013 Expires 5/23/2023	Groundwater withdrawal for use as potable, process, and cooling water.
WDNR	Ch. NR 114 Wisconsin Administrative Code	Authorization to operate a wastewater treatment plant	23750 18490 34859	Expires 7/1/2021 Expires 12/1/2020 Expires 5/1/2022	Wastewater treatment plant operating permit.
Manitowoc County	Manitowoc County Zoning Ordinance	Authorization to use property for an electric power plant with variance for building height	66-66	NA	Use of property for electric power plant.

Table 9.1-2 Environmental Authorizations and Consultations for PBN License Renewal (Sheet 1 of 2)

Agency	Authority	Requirement	Remarks
NRC	Atomic Energy Act [42 USC 2011 *et seq*.]	License Renewal	Applicant for federal license must submit an ER in support of license renewal application.
USFWS	Endangered Species Act Section 7 [16 USC 1536]	Consultation	Requires federal agency issuing a license to consult with the USFWS and NMFS if applicable, regarding federally protected species.
NMFS	Endangered Species Act Section 7 [16 USC 1536]	Consultation	Requires federal agency issuing a license to consult with the USFWS and NMFS if applicable, regarding federally protected species.
WDNR	Endangered Species Act Section 7 [16 USC 1536]	Consultation	Applicant may consult with state agency to support a timely and thorough review of potential impacts to threatened and endangered species and important habitats.
WI Department of Administration	Federal Coastal Zone Management Act [16 USC 1451 *et seq*.]	Certification	Requires applicant to provide certification to the federal agency issuing the license that license renewal would be consistent with the federally approved state coastal zone management program. Based on its review of the proposed activity, the state must concur with or object to the applicant's certification.
WDNR	Clean Water Act, Section 401 [33 USC 1341]	Certification or waiver	Requires state certification that proposed action would comply with CWA standards, however PBN qualifies for a waiver under NR299.01(2)(c) of Wisconsin Administrative Code.
WI Historical Society	National Historic Preservation Act, Section 106 [16 USC 470f]	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with SHPO.
Fort Belknap Indian Community of the Fort Belknap Reservation of Montana	National Historic Preservation Act, Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with tribal historic preservation officer.
Lac du Flambeau Band of Lake Superior Chippewa Indians of the Lac du Flambeau Reservation of Wisconsin	National Historic Preservation Act, Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with tribal historic preservation officer.
Little Traverse Bay Bands of Odawa Indians, Michigan	National Historic Preservation Act, Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with tribal historic preservation officer.

Table 9.1-2 Environmental Authorizations and Consultations for PBN License Renewal (Sheet 2 of 2)

Agency	Authority	Requirement	Remarks
Ottawa Tribe of Oklahoma	National Historic Preservation Act, Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with tribal historic preservation officer.
Menominee Indian Tribe of Wisconsin	National Historic Preservation Act, Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with tribal historic preservation officer.
Citizen Potawatomi Nation, Oklahoma	National Historic Preservation Act, Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with tribal historic preservation officer.
Forest County Potawatomi Community of Wisconsin	National Historic Preservation Act, Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with tribal historic preservation officer.
Miami Tribe of Oklahoma	National Historic Preservation Act, Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with tribal historic preservation officer.
Hannahville Indian Community, Michigan	National Historic Preservation Act, Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with tribal historic preservation officer.
Prairie Band Potawatomi Nation	National Historic Preservation Act, Section 106	Consultation	Requires federal agency issuing a license to consider cultural impacts and consult with tribal historic preservation officer.

9.2 Status of Compliance

PBN has established control measures in place to ensure compliance with the authorizations listed in Table 9.1-1, including monitoring, reporting, and operating within specified limits. PBN environmental compliance coordinators are primarily responsible for monitoring and ensuring that the site complies with its environmental permits and applicable regulations. Monitoring and sampling results associated with environmental programs are submitted to appropriate agencies as specified in the permits and/or governing regulations.

9.3 Notices of Violations

As discussed in Section 9.5.2.1, PBN received a notice of non-compliance in 2018 regarding air permits. NEPB took the necessary actions to return to compliance and apply for a revised permit. PBN was considered in compliance with the permit on November 30, 2018. Based on review of records over the 5-year period 2015–2019 of various environmental programs and permits that PBN is subject to and complies with, there have been no other federal (i.e., agencies other than the NRC), state, or local regulatory notices of violations issued to the facility.

9.4 Remediation Activities

As discussed in Section 3.6.4.2.1, there were no unplanned radioactive liquid or gaseous releases reported between 2015 and 2019. As presented in Section 3.6.4.2.2, one of 10 boreholes dug as part of cathodic protection installation had evidence of soil contamination. Results from the soil analysis revealed that there were 171 mg/kg diesel range organics and 44.9 mg/kg gasoline range organics present. However, no volatile organic compounds were detected. Excavation indicated that there was no active leakage and that the soil contamination was related to a minor historical leak or spill. The WDNR issued a "no further action" letter on March 20, 2019. There are no other current or ongoing remediation activities or investigations occurring at PBN.

9.5 Federal, State, and Local Regulatory Standards: Discussion of Compliance

9.5.1 Atomic Energy Act

9.5.1.1 Radioactive Waste

PBN has radioactive waste stream handling and shipping procedures. As a generator of both LLRW and spent fuel, PBN is subject to and complies with provisions and requirements of the Low-Level Radioactive Waste Policy Amendment Act of 1985 and the Nuclear Waste Policy Act of 1982, as subsequently amended.

9.5.2 Clean Air Act

9.5.2.1 Air Permit

PBN has a permit to operate oil-fired boilers, backup diesel generators, and backup electric generators (WDNR 2018a). PBN received a notice of non-compliance with permit 436034500-P30 condition I.ZZZ.7a(3)(f) for failing to limit the hours of operation of process P07 for non-emergencies to no more than 50 hours per year. PBN violated this condition by operating process P07 for 89.58 hours in 2017. PBN also violated condition I.E.1.a(1) of the same permit by using process P07 for 85.73 hours from October 16-20, 2017, to provide temporary power for planned maintenance of plant equipment, which is not part of the permitted activities. NEPB took the necessary actions to return to compliance with permit conditions, removing contaminated soil for disposal in a licensed landfill and testing for volatile organic compounds at the site of contamination. It also included applying for and obtaining operation permit revisions, resulting in issuance of permit 436034500-P32 in November 2018. PBN was considered in compliance with the permit as of November 30, 2018.

Operations of these air emission sources is maintained within the emission, opacity, fuel sulfur content, and fuel usage (as applicable) limits established in the station air permit issued by the WDNR. As required by the air permit, reports are submitted annually and semi-annually to the WDNR. PBN is in compliance with this permit.

9.5.2.2 Chemical Accident Prevention Provisions [40 CFR Part 68]

PBN is not subjected to the risk management plan requirements described in 40 CFR Part 68 because the amount of regulated chemicals present onsite do not exceed the threshold quantities specified in 40 CFR 68.130.

9.5.2.3 Stratospheric Ozone [40 CFR Part 82]

Under Title VI of the CAA, the EPA is responsible for several programs that protect the stratospheric ozone layer. Regulations promulgated by the EPA to protect the ozone layer are contained in 40 CFR Part 82. Refrigeration appliances and motor vehicle air conditioners are regulated under Sections 608 and 609 of the CAA, respectively. A number of service practices, refrigerant reclamation, technician certification, and other requirements are covered by these programs. PBN is in compliance with Section 608 of the CAA as amended in 1990 and the implementing regulations codified in these regulations. The program to manage stationary refrigeration appliances at PBN is described in NEPB procedures. Because motor vehicle air conditioners are not serviced onsite, Section 609 of the CAA is not applicable.

9.5.3 Clean Water Act

9.5.3.1 Water Quality (401) Certification

Federal CWA Section 401 requires applicants for a federal license to conduct an activity that might result in a discharge into navigable waters provide the licensing agency with either a waiver from the state or a certification from the state that the discharge will comply with applicable CWA requirements [33 USC 1341]. During the previous license renewal process, the previous PBN owner received clarification that the certification requirement is met by issuance of a WPDES permit (NMC 2004a). Wisconsin Administrative Code NR 299.01 (2)(c) sets as WDNR policy to waive the state water quality certifications required by the provisions of the Federal Water Pollution Control Act (the CWA amends the Act) for facilities regulated by WPDES permits. The waiver was applied to both the initial license renewal and power uprate applications and, in accordance with WDNR regulation, will apply to the application for SLR. PBN will comply with all regulatory requirements imposed by the WDNR and USACE as they relate to performing activities in federal jurisdictional waters.

9.5.3.2 WPDES Permit

WPDES permit No. WI-0000957-08-0 (Attachment B), issued by the WDNR, authorizes the discharge of once-through cooling water, process water, treated sanitary wastewater, and stormwater to state waters. This permit expires June 30, 2021. The application for renewal will include the results of the impingement and entrainment studies discussed in Section 3.7.7.1, in addition to the 316(b) §122.21(r)(2)-(13) submittal requirements in accordance with the rule's technical and schedule requirements.

WPDES permit regulation under Section 283.31(6) of the Wisconsin statutes requires existing facilities with cooling water intake structures to meet the requirements under §316(b) of the CWA. On October 14, 2014, a new final rule to establish new requirements for all existing facilities that withdraw > 2 mgd and use at least 25 percent of that water exclusively for cooling purposes became effective. The permit authorizes wastewater discharge to Lake Michigan and requires water quality condition monitoring.

As discussed in Section 3.6.1.2.1, there are 10 outfalls (3 external and 7 internal) identified in the WPDES permit. Monitoring results associated with these outfalls are submitted in discharge monitoring reports to the WDNR at the frequency specified in the permit. From 2015–2019, PBN reported exceedances in four monthly discharge monitoring reports as presented below.

- In April 2016, the weekly average and monthly limits for total suspended solids was exceeded. The presumed cause was material toxic to the microbial populations in the activated sludge system. Upon WDNR's guidance, PBN allowed the system to recover, re-establishing the proper microbial population. PBN also initiated added solids to the system, decreased flow rates, hauled wastewater offsite, and monitored the system on a daily basis.
- In April 2017, the weekly maximum 5-day biochemical oxygen demand limit was exceeded.
- In December 2018, an exceedance of the total residual halogen limit was caused by isolation of sodium bisulfite flow while service water chlorination was in progress. A procedural change was initiated as corrective action.

- In November 2019, wastewater effluent exceeded total suspended solids daily maximum and monthly average limits. Corrective actions taken included increased sampling frequency and investigation into finer mesh paper for filters.

There are no plant operations or modifications planned for the proposed SLR operating term that would alter the thermal discharge.

9.5.3.3 Industrial Stormwater Discharge

As discussed in Section 3.6.1.2.2, stormwater discharges associated with PBN industrial activities are controlled through a general stormwater permit, WPDES Permit No. WI-S067857-4, issued by the WDNR. PBN is also required to develop, maintain, and implement a SWPPP for the facility that identifies potential sources of pollution that would reasonably be expected to affect the quality of stormwater and identify the BMPs that will be used to prevent or reduce the pollutants in stormwater discharge (Attachment B). PBN is in compliance with the terms and conditions of the WPDES permit as it relates to the stormwater program.

9.5.3.4 Sanitary Wastewaters

As presented in Section 3.6.1.2.3, PBN is equipped with its own sewage treatment plant. Sanitary wastewater from the plant and administration building are collected in the sewage plant, where it is treated and discharged to an effluent sump pump station to the north of the lift stations. PBN had two sanitary sewage overflows, one in February 2017 and another in June 2019. The February 2017 overflow was due to an unscheduled bypass of 15–20 gallons of sanitary wastewater to the stormwater collection system. The June 2019 overflow was the result of a toilet flush valve which allowed water to leak by the seal. An estimated 30 gallons of gray water overflowed onto blacktop before reaching permeable soil. Sludge is removed periodically by a licensed septage hauler. Discharge of treated sanitary wastewater from PBN is regulated by PBN's WPDES Permit No. WI-0000957-08-0 (Attachment B).

Because sanitary wastewaters at PBN are collected in sewage lift stations at the plant and treated in a sewage treatment unit prior to disposal, PBN is required to employ or contract at least one licensed wastewater works operator for the sewage treatment facility. The license must be issued in accordance with Ch. NR 114 of the Wisconsin Administrative Code. PBN maintains onsite certified wastewater operators; therefore, the site is in compliance with this program.

9.5.3.5 Spill Prevention, Control, and Countermeasures

The EPA's Oil Pollution Prevention Rule became effective January 10, 1974, and was published under the authority of Section 311(i)(1)(C) of the Federal Water Pollution Control Act. The regulation has been published in 40 CFR Part 112, and facilities subject to the rule must prepare and implement an SPCC plan to prevent any discharge of oil into or upon navigable waters of the United States or adjoining shorelines. PBN is subject to this rule and has a written SPCC plan that identifies and describes the procedures, materials, equipment, and facilities utilized at the station to minimize the frequency and severity of oil spills to meet the requirements of this rule.

9.5.3.6 Reportable Spills [40 CFR Part 110]

PBN is subject to the reporting provisions of 40 CFR Part 110 as it relates to the discharge of oil in such quantities as may be harmful pursuant to Section 311(b)(4) of the Federal Water Pollution Control Act. Any discharge of oil in such quantities that may be harmful to the public health or welfare or the environment must be reported to the EPA's national response center. Based on a review of records over the previous 5 years (2015–2019), no releases at PBN have triggered this notification event.

9.5.3.7 Reportable Spills [Wisconsin Statute 292.11]

PBN is also subject to the reporting provisions of Wisconsin Statute 292.11 and Wisconsin Administrative Code Ch. NR 706. This reporting provision requires that any release of more than 1 gallon of gasoline or more than 5 gallons of a petroleum product other than gasoline that spills onto a pervious surface or runs off an impervious surface must be reported to the WDNR, the coordinator of emergency services of the locality that could reasonably be expected to be impacted, and appropriate federal authorities. Based on review of records over the previous 5 years (2015–2019), there have been no releases at PBN that have triggered this notification requirement.

9.5.3.8 Facility Response Plan

PBN is not subject to the facility response plan risk requirements described in 40 CFR 112.20 because the facility does not transfer oil over water to or from vessels and does not store oil in quantities greater than one million gallons.

9.5.3.9 Section 404 Permit

As presented in Section 3.6.1.2.4, no periodic maintenance dredging occurs on the PBN site. Additionally, no dredging activities or discharge are anticipated. PBN holds both a USACE permit (MVP-2014-01045-SJW) and WDNR permit (IP-NE-2019-36-03112) to install riprap for the purpose of bank stabilization along the shore of Lake Michigan. No other current operations at PBN require a Section 404 permit. The plant would comply with regulatory requirements imposed by the USACE as it relates to performing future activities in federal jurisdictional waters when appropriate.

9.5.4 Safe Drinking Water Act

As discussed in Section 3.6.3.2, potable water for PBN is supplied by onsite groundwater wells. Domestic-quality water for drinking and sanitary purposes is withdrawn from groundwater by five active domestic supply wells permitted by WDNR. As the operator of a non-transient non-community waterworks, PBN is subject to the Safe Drinking Water Act. State governments, such as Wisconsin's, are approved to implement these rules and drinking water standards for the EPA through waterworks regulations. Wisconsin has established regulations for drinking water standards and operation and maintenance of public water systems in Ch. NR 809 and 810 of the Wisconsin Administrative Code. PBN received one notice of non-compliance for late sampling of drinking water in November 2017. As an operator of a non-transient non-community water system, PBN is required to have a certified operator to manage the system. PBN maintains onsite certified water system operators. The site is in compliance with this program.

9.5.5 Endangered Species Act

Potential impacts on federally and state-listed species were considered in NEPB's review and analysis in Section 4.6, and it was concluded that none would likely be adversely affected as a result of the SLR.

Section 7 of the ESA requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of species that are listed, or proposed for listing, as endangered or threatened. Depending on the action involved, the ESA requires consultation with USFWS, and with the NMFS if marine or anadromous species could be affected. Although NEPB invited comment from the USFWS and NMFS (Attachment C) during the development of this ER, a more structured consultation process with these agencies may be initiated by the NRC per Section 7 of the ESA.

9.5.6 Migratory Bird Treaty Act

The MBTA makes it unlawful to pursue, hunt, take, capture, kill, or sell birds listed, and grants protection to any bird parts, including feathers, eggs, and nests. NEPB adheres to the MBTA, but does not currently hold any MBTA-related permits.

9.5.7 Bald and Golden Eagle Protection Act

The BGEPA prohibits the take, transport, sale, barter, trade, import and export, and possession of eagles, making it illegal for anyone to collect eagles and eagle, parts, nests, or eggs without a USFWS permit. Bald eagles are known to nest in the vicinity of PBN; therefore, consultation with the USFWS is conducted prior to new activities and maintenance activities to ensure compliance with the BGEPA. There are currently no BGEPA permitting requirements associated with PBN operations.

9.5.8 Magnuson-Stevens Fishery Conservation and Management Act

As discussed in Section 3.7.8.5, according to the EFH final amendment, potential EFH does not exist within the proposed action area.

9.5.9 Marine Mammal Protection Act

The Marine Mammal Protection Act prohibits, with certain exceptions, the "take" of marine mammals in U.S. waters and by U.S. citizens on the high seas, and the importation of marine mammals and marine mammal products into the United States. There are currently no Marine Mammal Protection Act permitting requirements associated with PBN operations.

9.5.10 Coastal Zone Management Act

The federal Coastal Zone Management Act (CZMA) [16 USC 1451 et seq.] imposes requirements on applicants for a federal license to conduct an activity that could affect a state's coastal zone. The CZMA requires the applicant to certify to the licensing agency that the proposed activity would be consistent with the state's federally approved coast zone management program [16 USC 1456(c)(3)(A)] and provide a copy to the state for concurrence. NOAA has promulgated implementing regulations indicating that the requirement is applicable to renewal of federal licenses for activities not previously reviewed by the state [15 CFR 930.51(b)(1)]. The regulation requires that the license applicant provides its certification to the federal licensing agency and a copy to the applicable state agency [15 CFR 930.57(a)].

The NRC's Office of Nuclear Reactor Regulation has issued guidance to staff regarding compliance with the CZMA. This guidance acknowledges that Wisconsin has an approved coastal zone management program (NRC 2013d). The coastlines of Lake Michigan and Lake Superior in Wisconsin are designated as coastal zones; therefore, PBN is located within the Wisconsin coastal zone.

PBN received a letter from the Wisconsin Department of Administration (WDA) in 2010 regarding the planned power uprate. The WDA determined that a federal consistency review was unnecessary. (NRC 2010b)

NEPB developed a CZMA consistency certification for the proposed action (Attachment F). The certification demonstrates the project is consistent to the maximum extent practicable with the enforceable policies of the Wisconsin Coastal Zone Management Program and will be conducted in a manner consistent with the program.

9.5.11 Wild and Scenic Rivers Act

Section 7(a) of the Wild and Scenic Rivers Act requires federal agencies to determine whether the operation of the project under a new license would invade the area or unreasonably diminish the scenic, recreational, and fish and wildlife values present in the designated river corridor. No waterbodies at or adjacent to PBN have been designated a wild and scenic river. (NWSRS 2020)

9.5.12 National Historic Preservation Act

Potential impacts on historic properties are discussed in Section 4.7.4.2. As previously presented in Section 3.8.6, cultural resources on the PBN site are protected by administrative procedures. The procedures ensure that cultural resources are protected from unauthorized removal and that, in the event ground disturbance is required in these areas, coordination with the Wisconsin Historical Society (serving as Wisconsin's SHPO) is conducted. The guidance protects known cultural resources as well as unknown cultural resources by establishing a process for all activities that require a federal permit or use federal funding, or have the potential to impact historic resources.

Section 106 of the NHPA [54 USC 306108] requires federal agencies having the authority to license any undertaking, prior to issuing the license, to consider the effect of the undertaking on historic properties and to afford the Advisory Council on Historic Preservation an opportunity to comment on the undertaking. Council regulations provide for establishing an agreement with any SHPO to substitute state review for council review [35 CFR 800.7]. Although not required of an applicant by federal law or NRC regulation, NEPB has chosen to invite comments by the SHPO. Attachment D includes a copy of NEPB correspondence with the SHPO regarding potential effects that the proposed PBN SLR might have on historic or cultural resources.

9.5.13 Resource Conservation and Recovery Act

9.5.13.1 Nonradioactive Waste

As a generator of hazardous and nonhazardous wastes, PBN is subject to and complies with the RCRA and specific WDNR regulations contained in Wisconsin Statute 291. PBN is classified as a small quantity generator of hazardous waste; therefore, hazardous waste routinely makes up only a small percentage of the total waste generated. As a generator of hazardous waste, PBN also maintains a hazardous waste generator identification number (Table 9.1-1). As presented in Section 3.6.4.2.2, one of 10 boreholes excavated for cathodic protection installation had evidence of soil contamination. Results indicated 171 mg/kg diesel range organics and 44.9 mg/kg gasoline range organics were present. No volatile organic compounds were detected. There was no indication of any active leakage; therefore, the discovery was related to a minor historical leak or spill. The WDNR issued a "no further action" letter on March 20, 2019.

For most hazardous waste records, the regulations require that records be retained for at least 3 years from the date the hazardous waste for which the record pertains is last shipped offsite. Records are maintained for 3 years in accordance with the NEPB industrial and hazardous waste management procedures.

9.5.13.2 Reportable Spills [40 CFR Part 262]

PBN is subject to the reporting provisions of 40 CFR 262.34(d)(5)(iv)(C) as it relates to a fire, explosion, or other release of hazardous waste, which could threaten human health outside the facility boundary or when the facility has knowledge that a spill has reached surface water. Any such events must be reported to the national response center. As presented in Section 3.6.4.2.1, between 2015 and 2019 there were no unplanned radioactive liquid or gaseous releases reported. As discussed in Section 3.6.4.2.2, one of 10 boreholes excavated for cathodic protection installation had evidence of soil contamination. Results indicated 171 milligrams per kilogram (mg/kg) diesel range organics and 44.9 mg/kg gasoline range organics. No VOCs were detected. There was no indication of any active leakage; therefore, the discovery was related to a minor historical leak or spill. The WDNR issued a "No Further Action" letter on March 20, 2019, following source removal and verification sampling results below the laboratory detection limits.

9.5.13.3 Mixed Waste

Radioactive materials are regulated by the NRC under the Atomic Energy Act of 1954, and hazardous waste is regulated by the EPA under the RCRA of 1976. Management of radioactive waste is discussed in Section 2.2.6. NEPB has developed guidance documents for managing its hazardous waste streams, including mixed waste. In addition, NEPB inspects its waste management areas for compliance with applicable regulations and permits. PBN's management of its waste streams is in compliance with applicable regulatory standards and has not resulted in any notices of violations for the 2015–2019 time frame. PBN will continue to store and dispose of hazardous and non-hazardous waste in appropriately permitted treatment and disposal facilities during the proposed SLR operating term.

9.5.13.4 Underground Storage Tanks [§62.1-44.34:19]

PBN has three underground storage tanks onsite. Two 35,000-gallon and one 14,000-gallon diesel tanks are maintained onsite. These tanks are registered with the state of Wisconsin and thereby subject to the regulation of industry, buildings, and safety under Wisconsin Statute 101.09, storage of flammable, combustible, and hazardous liquids. PBN is in compliance with these requirements.

9.5.13.5 Reportable Spills [§62.1-44.34:19]

PBN is subject to the reporting provisions of Wisconsin Administrative Code NR 706.11 as it relates to discovering the release of a regulated substance from an underground storage tank containing a hazardous substance. Any such events must be reported to the WDNR. There have been no releases at PBN that have triggered this notification from 2015–2019.

9.5.14 Pollution Prevention Act

In accordance with RCRA Section 3002(b) and 40 CFR 262.27, a small or large quantity generator must certify that there is a waste minimization program in place to reduce the volume and toxicity of the waste generated to the degree determined to be economically practical. PBN is meeting this requirement as procedural measures are in place to minimize hazardous waste generated to the maximum extent practical.

9.5.15 Federal Insecticide, Fungicide, and Rodenticide Act

Commercially approved herbicides such as Roundup® are applied by a licensed contractor on an as-needed basis to control vegetation. Pesticides are also applied inside buildings by a licensed contractor. Because only contractors who have obtained a license as specified in Wisconsin statutes 94.703, 94.704, and 94.705 can conduct pesticide/herbicide applications onsite, PBN is in compliance with the requirements of these acts.

9.5.16 Toxic Substances Control Act

The Toxic Substances Control Act of 1976 regulates PCBs [40 CFR Part 761] and asbestos [40 CFR Part 763], both of which may be present at PBN. NEPB procedure provides guidance for asbestos removal to ensure compliance with state and federal regulations. PBN is in compliance with the PCB and asbestos regulations applicable to the facility.

9.5.17 Hazardous Material Transportation Act

Because PBN ships hazardous materials regulated by the DOT offsite, the facility is subject to and complies with the applicable requirements of the Hazardous Materials Transportation Act described in Title 49 of the CFR, including the requirement to possess a current hazardous materials certificate of registration (Table 9.1-1).

9.5.18 Emergency Planning and Community Right-To-Know Act

9.5.18.1 Section 312 Reporting [40 CFR Part 370]

PBN is subject to and complies with Section 312 of the Emergency Planning and Community Right-to-Know Act that requires annual submittal of an emergency and hazardous chemical inventory report (Tier II) to the local emergency planning commission, the state emergency response committee, and the local fire department. This report typically includes, but is not limited to, chemicals such as sodium bisulfite, boric acid, carbon dioxide, diesel fuel, transformer oil/dielectric fluid, gasoline, hydrazine, hydrogen, lube oils, nitrogen, and sulfuric acid.

9.5.18.2 Section 313 [40 CFR Part 372]

Section 313 of the Emergency Planning and Community Right-to-Know Act requires facilities meeting regulatory requirements to complete a toxic chemical release inventory form annually for specified chemicals. The form must be submitted to the EPA and the State Emergency Response Commission every year, and covers releases to the environment and other waste management of toxic chemicals that occurred during the preceding calendar year. NEPB has been subject to toxic chemical release inventory reporting during the years (e.g., 2018) when the diesel generator was operated to demonstrate ability to provide power to the grid and not solely plant emergency support.

9.5.19 Comprehensive Environmental Response, Compensation, and Liability Act

PBN is subject to the hazardous substance release and reporting provisions of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as subsequently amended. Any release of reportable quantities of listed hazardous substances to the environment requires a notification to the EPA's National Response Center and the WDNR as appropriate and subsequent written follow-up. Based on a review of records over the 5-year period 2015–2019, there have been no releases at PBN that have triggered this notification requirement.

9.5.20 Farmland Protection Policy Act

The FPPA applies only to federal programs. The term "federal program" under this act does not include federal permitting or licensing for activities on private or non-federal lands. Therefore, because license renewal is considered a federal licensing activity and PBN is located on non-federal lands, the FPPA is not applicable.

9.5.21 Federal Aviation Act

Coordination with the Federal Aviation Administration (FAA) is required to ensure that the highest structures associated with a project do not impair the safety of aviation. Submission of a letter of notification (with accompanying maps and project description) to the FAA would result in a written response from the FAA certifying that no hazard exits or recommending project changes and/or the installation of warning devices such as lighting.

At PBN, the site elevation is dominated by the approximately 63-foot-high reactor containment buildings and the 148-foot-tall meteorological tower (NEE 2009; NRC 2005). No SLR-related construction activities have been identified; therefore, no new notifications to the FAA are required.

9.5.22 Occupational Safety and Health Act

OSHA governs the occupational safety and health of the construction workers and operations staff. PBN and its contractors comply with OSHA's requirements, as these are incorporated in the site's occupational health and safety practices.

9.5.23 State Water Withdrawal Reporting

In accordance with Wisconsin Statute 281.346(3) and Ch. NR 856 of the Wisconsin Administrative Code, the WDNR requires that all major water withdrawers keep accurate records of water withdrawals within their facilities and report such withdrawals to the state on an annual basis. PBN withdraws groundwater and surface water. Groundwater withdrawals are monitored and documented monthly. PBN is in compliance with these reporting requirements.

9.5.24 Manitowoc County Zoning Requirements

Development in Manitowoc County is governed by the Manitowoc County and Town of Two Creeks zoning ordinances. The PBN site and adjacent area are zoned as an "exclusive agriculture" district by Manitowoc County. A zoning permit with unlimited height variance was granted by Manitowoc County in 1966 (Manitowoc County 1966). The Town of Two Creeks, which uses the zoning map developed by Manitowoc County, lists the land use at the PBN site as industrial. According to Manitowoc County, any future development after May 21, 2019, must adhere to development standards. The zoning ordinances are necessary to insure the protection and well-being of neighboring areas. PBN is in compliance with these zoning ordinances.

9.6 Environmental Reviews

NEPB has procedural controls in place to ensure all environmentally sensitive areas at PBN, if present, are adequately protected during site operations and project planning. These controls, which encompass nonradiological environmental resource areas such as land use, air quality, surface water, and groundwater, terrestrial and aquatic ecology, historic and cultural resources, and waste management and pollution prevention, consist of the following:

- Appropriate local, state, and/or federal permits are obtained or modified as necessary.
- BMPs, including for stormwater, are implemented to protect wetlands, natural heritage areas, and sensitive ecosystems.
- Appropriate agencies are consulted on matters involving federally and state-listed threatened, endangered, and protected species; BMPs are implemented to minimize impacts to these species.
- Appropriate agencies are consulted on matters involving cultural resources and to ensure BMPs are implemented to minimize impacts to these resources.

In summary, NEPB's administrative controls ensure that appropriate local, state, and/or federal permits are obtained or modified as necessary, that cultural resources and threatened and endangered species are protected if present, and that other regulatory issues are adequately addressed as necessary.

9.7 Alternatives

The discussion of alternatives in the ER shall include a discussion of whether alternatives will comply with such applicable environmental quality standards and requirements [10 CFR 51.45(d)]. The natural gas combined cycle plant and solar PV array, new nuclear units, and hybrid plants of onshore wind, solar PV, and battery storage alternatives presented in Chapter 7 would be constructed and operated to comply with applicable environmental quality standards and requirements. While alternative generation would be developed and operated compliant with standards and requirements, additional environmental impacts associated with siting, construction, and operation would be addressed. Continued operation of PBN under regulatory compliance would not result in additional impacts.

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10.1 Figure References

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3.3-3	2014–2018 PBN Spring Wind Rose	
3.3-4	2014–2018 PBN Summer Wind Rose	
3.3-5	2014–2018 PBN Fall Wind Rose	
3.3-6	Non-Attainment and Maintenance Areas, 50-Mile Radius of PBN	EPA 2020; USCB 2020a; USGS 2020a
3.5-1	Physiographic Provinces	USCB 2020a; USGS 2020a; USGS 2020b
3.5-2	PBN Surficial Geology	ESRI 2020; USGS 2020c
3.5-3a	Cross Section Inset	AECOM 2008
3.5-3b	Cross Section	

No.	Figure Title	References
3.5-4	Distribution of Soils	USDA 2020a; USDA 2020b
3.5-5	Historic Earthquakes	ESRI 2020; USCB 2020a; USGS 2020d
3.6-1	Vicinity Hydrological Features	USCB 2020a; USGS 2020a
3.6-2	FEMA Flood Zones at PBN	FEMA 2020; USDA 2020a
3.6-3	WPDES Outfalls	
3.6-4	Average Condenser Intake Temperature	
3.6-5	Average Condenser Discharge Temperature	
3.6-6	Well Locations Onsite	USDA 2020a
3.6-7	Potentiometric Surface Map	AECOM 2017; USDA 2020a
3.6-8	Offsite Registered Water Wells within 2 Miles	WDNR 2020b; ESRI 2020
3.7-1	NWI Wetlands within a 6-Mile Radius of PBN	USCB 2020a; USDA 2020a; USFWS 2019
3.7-2	NWI Wetlands on the PBN Site	USDA 2020a; USFWS 2019
3.8-1	Government Land Office Survey Map, 1835	BLM 2020
3.8-2	Historic Map of Wisconsin, 1845	DRHMC 2020
3.8-3	Manitowoc County, Wisconsin, 1878	
3.8-4	Auto Road Map of Wisconsin, 1927	
3.8-5	Early Site Construction of PBN Site, 1967	
3.8-6	Construction Photograph of the PBN Site, August 1969	
3.8-7	Construction Photograph of PBN, August 1969	
3.8-8	Post-Construction Photograph of PBN, 1972	
3.11-1 through 3.11-20	Environmental Justice Minority Populations Figures	USCB 2020a; USCB 2020b; USGS 2020a

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Attachment A: NRC NEPA Issues for License Renewal

NRC NEPA Issues for License Renewal of Nuclear Power Plants

Point Beach Nuclear Plant Units 1 and 2 Environmental Report

NRC NEPA Issues for License Renewal of Nuclear Power Plants

NextEra Energy Point Beach (NEPB) has prepared this environmental report (ER) in accordance with the requirements of U.S. Nuclear Regulatory Commission (NRC) regulation 10 CFR 51.53. The NRC included in the regulation the list of 78 National Environmental Policy Act (NEPA) issues for license renewal of nuclear power plants that were identified in the 2013 GEIS (Appendix B to Subpart A of 10 CFR Part 51, Table B-1).

The following table lists the 78 issues from 10 CFR Part 51, Appendix B, Table B-1, and identifies the section in this ER in which NEPB addresses each issue.

Table A-1. Point Beach Nuclear Plant ER Cross-Reference of License Renewal NEPA Issues

No.	Issue[(a)]	Category	ER Section	GEIS Cross Reference (Section/Page)[(b)]
	Land Use			
1	Onsite land use	1	4.1.1	4.2.1.1/4-6
2	Offsite land use	1	4.1.2	4.2.1.1/4-7
3	Offsite land use in transmission line rights-of-way	1	4.0.1	4.2.1.1/4-6
	Visual Resources			
4	Aesthetic impacts	1	4.1.3	4.2.1.2/4-9
	Air Quality			
5	Air quality (all plants)	1	4.2.1	4.3.1.1/4-14
6	Air quality effects of transmission lines	1	4.2.2	4.3.1.1/4-14
	Noise			
7	Noise impacts	1	4.3	4.3.1.2/4-19
	Geologic Impacts			
8	Geology and soils	1	4.4	4.4/4-29
	Surface Water Resources			
9	Surface water use and quality (non-cooling system impacts)	1	4.5	4.5.1.1/4-30
10	Altered current patterns at intake and discharge structures	1	4.5	4.5.1.1/4-36
11	Altered salinity gradients	1	4.0.1	4.5.1.1/4-36
12	Altered thermal stratification of lakes	1	4.5	4.5.1.1/4-37
13	Scouring caused by discharged cooling water	1	4.5	4.5.1.1/4-38
14	Discharge of metals in cooling system effluent	1	4.5	4.5.1.1/4-38
15	Discharge of biocides, sanitary wastes, and minor chemical spills	1	4.5	4.5.1.1/4-39
16	Surface water use conflicts (plants with once-through cooling systems)	1	4.5	4.5.1.1/4-40
17	Surface water use conflicts (plants with cooling ponds, or cooling towers using makeup water from a river)	2	4.5.1	4.5.1.1/4-41
18	Effects of dredging on surface water quality	1	4.5	4.5.1.1/4-42
19	Temperature effects on sediment transport capacity	1	4.5	4.5.1.1/4-43

No.	Issue[a]	Category	ER Section	GEIS Cross Reference (Section/Page)[b]
	Groundwater Resources			
20	Groundwater contamination and use (non-cooling system impacts)	1	4.5	4.5.1.2/4-45
21	Groundwater use conflicts (plants that withdraw <100 gpm)	1	4.5	4.5.1.2/4-47
22	Groundwater use conflicts (plants that withdraw >100 gpm)	2	4.5.3	4.5.1.2/4-48
23	Groundwater use conflicts (plants with closed-cycle cooling systems that withdraw makeup water from a river)	2	4.5.2	4.5.1.2/4-48
24	Groundwater quality degradation resulting from water withdrawals	1	4.5	4.5.1.2/4-49
25	Groundwater quality degradation (plants with cooling ponds in salt marshes)	1	4.0.1	4.5.1.2/4-50
26	Groundwater quality degradation (plants with cooling ponds at inland sites)	2	4.5.4	4.5.1.2/4-51
27	Radionuclides released to groundwater	2	4.5.5	4.5.1.2/4-51
	Terrestrial Resources			
28	Effects on terrestrial resources (non-cooling system impacts)	2	4.6.5	4.6.1.1/4-59
29	Exposure of terrestrial organism to radionuclides	1	4.6	4.6.1.1/4-61
30	Cooling system impacts on terrestrial resources (plants with once-through cooling systems or cooling ponds)	1	4.6	4.6.1.1/4-64
31	Cooling tower impacts on vegetation (plants with cooling towers)	1	4.0.1	4.6.1.1/4-69
32	Bird collisions with plant structures and transmission lines	1	4.6	4.6.1.1/4-70
33	Water use conflicts with terrestrial resources (plants with cooling ponds or cooling towers using makeup water from a river)	2	4.6.4	4.6.1.1/4-75
34	Transmission line ROW management impacts on terrestrial resources	1	4.6	4.6.1.1/4-75
35	Electromagnetic fields on flora and fauna (plants, agricultural crops, honeybees, wildlife, livestock)	1	4.6	4.6.1.1/4-80
	Aquatic Resources			
36	Impingement and entrainment of aquatic organisms (plants with once-through cooling	2	4.6.1	4.6.1.2/4-87

No.	Issue[a]	Category	ER Section	GEIS Cross Reference (Section/Page)[b]
	systems or cooling ponds)			
37	Impingement and entrainment of aquatic organisms (plants with cooling towers)	1	4.0.1	4.6.1.2/4-92
38	Entrainment of phytoplankton and zooplankton (all plants)	1	4.6	4.6.1.2/4-93
39	Thermal impacts on aquatic organisms (plants with once-through cooling systems or cooling ponds)	2	4.6.2	4.6.1.2/4-94
40	Thermal impacts on aquatic organisms (plants with cooling towers)	1	4.0.1	4.6.1.2/4-96
41	Infrequently reported thermal impacts (all plants)	1	4.6	4.6.1.2/4-97
42	Effects of cooling water discharge on dissolved oxygen, gas supersaturation, and eutrophication	1	4.6	4.6.1.2/4-100
43	Effects of non-radiological contaminants on aquatic organisms	1	4.6	4.6.1.2/4-103
44	Exposure of aquatic organisms to radionuclides	1	4.6	4.6.1.2/4-105
45	Effect of dredging on aquatic organisms	1	4.6	4.6.1.2/4-107
46	Water use conflicts with aquatic resources (plants with cooling ponds or cooling towers using makeup water from a river)	2	4.6.3	4.6.1.2/4-109
47	Effects on aquatic resources (non-cooling system impacts)	1	4.6	4.6.1.2/4-110
48	Impacts of transmission line ROW management on aquatic resources	1	4.6	4.6.1.2/4-112
49	Losses from predation, parasitism, and disease among organisms exposed to sub-lethal stresses	1	4.6	4.6.1.2/4-110
	Special Status Species and Habitats			
50	Threatened, endangered, and protected species and essential fish habitat	2	4.6.6	4.6.1.3/4-115
	Historic and Cultural Resources			
51	Historic and cultural resources	2	4.7	4.7.1/4-122
	Socioeconomics			
52	Employment and income, recreation and tourism	1	4.8.1	4.8.1.1/4-127
53	Tax revenues	1	4.8.2	4.8.1.1/4-128
54	Community services and education	1	4.8.3	4.8.1.1/4-129
55	Population and housing	1	4.8.4	4.8.1.1/4-130
56	Transportation	1	4.8.5	4.8.1.1/4-131

No.	Issue[(a)]	Category	ER Section	GEIS Cross Reference (Section/Page)[(b)]
	Human Health			
57	Radiation exposures to the public	1	4.9	4.9.1.1.1/4-140
58	Radiation exposures to plant workers	1	4.9	4.9.1.1.1/4-136
59	Human health impacts from chemicals	1	4.9	4.9.1.1.2/4-147
60	Microbiological hazards to the public (plants that use cooling ponds, lake, or canals or that discharge to a river)[(c)]	2	4.9.1	4.9.1.1.3/4-149
61	Microbiological hazards to plant workers	1	4.9	4.9.1.1.3/4-149
62	Chronic effects of electromagnetic fields	UC	4.0.3	4.9.1.1.4/4-150
63	Physical occupational hazards	1	4.9	4.9.1.1.5/4-156
64	Electric shock hazards	2	4.9.2	4.9.1.1.5/4-156
	Postulated Accidents			
65	Design-basis accidents	1	4.15.1	4.9.1.2/4-158
66	Severe accidents	2	4.15.2	4.9.1.2/4-158
	Environmental Justice			
67	Minority and low-income populations	2	4.10.1	4.10.1/4-167
	Waste Management			
68	Low-level waste storage and disposal	1	4.11.1	4.11.1.1/4-171
69	Onsite storage of spent nuclear fuel	1	4.11.2	4.11.1.2/4-172
70	Offsite radiological impacts of spent nuclear fuel and high-level waste disposal	1	4.11.3	4.11.1.3/4-175
71	Mixed waste storage and disposal	1	4.11.4	4.11.1.4/4-178
72	Non-radioactive waste storage and disposal	1	4.11.5	4.11.1.5/4-179
	Cumulative Impacts			
73	Cumulative impacts	2	4.12	4.13/4-243
	Uranium Fuel Cycle			
74	Offsite radiological impacts–individual impacts from other than the disposal of spent fuel and high-level waste	1[(d)]	4.13.1	4.12.1.1/4-193
75	Offsite radiological impacts–collective impacts from other than the disposal of spent fuel and high-level waste	1	4.13.2	4.12.1.1/4-194
76	Non-radiological Impacts of the uranium fuel cycle	1	4.13.3	4.12.1.1/4-194
77	Transportation	1	4.13.4	4.12.1.1/4-196

No.	Issue[a]	Category	ER Section	GEIS Cross Reference (Section/Page)[b]
	Termination of Nuclear Power Plant Operations and Decommissioning			
78	Termination of plant operations and decommissioning	1	4.14	4.12.2.1/4-201

a. 10 CFR 51, Subpart A, Appendix A, Table B-1 (issue numbers added to facilitate discussion).

b. Generic Environmental Impact Statement for License Renewal of Nuclear Plants (NUREG-1437, Rev 1).

c. Wording from [10 CFR 51.53(c)(3)(ii)(G)].

d. SECY-14-0072 (July 21, 2014).

UC = uncategorized (categorization and impact finding definitions do not apply to the issue).

Attachment B: WPDES Permit

State of Wisconsin
DEPARTMENT OF NATURAL RESOURCES
101 South Webster Street
P.O. Box 7921
Madison, WI 53707-7921

Scott Walker, Governor
Cathy Stepp, Secretary
Telephone (608) 266-2621
FAX (608) 267-3579
TDD (608) 267-6897

Eric McCartney
Site Vice President
NextEra Energy Point Beach LLC
6610 Nuclear Road
Two Rivers, WI 54241

SUBJECT: WPDES Permit Reissuance No. WI-0000957-08-0
NextEra Energy Point Beach LLC, 6610 NUCLEAR ROAD

Dear Permittee:

Your Wisconsin Pollutant Discharge Elimination System (WPDES) Permit is enclosed. The conditions of the enclosed permit reissuance were determined using the permit application, information from your WPDES permit file, other information available to the Wisconsin Department of Natural Resources (hereafter Department) and applicable Wisconsin Administrative Codes. All discharges from this facility and actions or reports relating thereto shall be in accordance with the terms and conditions of the enclosed permit.

This enclosed permit requires you to submit monitoring results to the Department on a periodic basis. Monitoring forms, which must be submitted electronically, are available on the Department's web page. Go to the DNR Switchboard page at http://dnr.wi.gov/topic/switchboard/ to log in and access your monitoring forms. For your convenience, there is a 'Summary of Reports Due' at the end of the enclosed permit that shows a synopsis of the required reports and monitoring forms.

The Department has the authority under chs. 160 and 283, Wis. Stats., to establish effluent limitations, monitoring requirements, and other permit conditions for discharges to groundwater and surface waters of the State. The Department also has the authority to issue, reissue, modify, terminate, or revoke and reissue WPDES permits under ch. 283, Wis. Stats.

The enclosed permit contains water quality-based effluent limitations that are necessary to ensure the water quality standards for Lake Michigan are met. You may apply for a variance from the water quality standard used to derive the limitations pursuant to s. 283.15, Stats., by submitting an application to the Director of the Bureau of Water Quality, P.O. Box 7921, Madison, Wisconsin 53707 within 60 days of the date the permit was issued (see "Date Permit Signed/Issued" after the signature on the front page of the enclosed permit). This statute also allows the permittee to apply for a variance to the water quality standard when applying for reissuance of the permit. Subchapter III of ch. NR 200, Wis. Adm. Code, specifies the procedures that must be followed and the information that must be included when submitting an application for a variance.

To challenge the reasonableness of or necessity for any term or condition of the enclosed permit, s. 283.63, Stats., and ch. NR 203, Wis. Adm. Code, require that you file a verified petition for review with the Secretary of the Department of Natural Resources within 60 days of the date the permit was issued (see "Date Permit Signed/Issued" after the signature on the front page of the enclosed permit). For permit-related decisions that are not reviewable pursuant to s. 283.63, Stats., it may be possible for permittees or other persons to obtain an administrative review pursuant to s. 227.42, Stats., and s. NR 2.05(5), Wis. Adm. Code, or a judicial review pursuant to s. 227.52, Stats. If you choose to pursue one of these options, you should know that Wisconsin Statutes and Administrative Code establish time periods within which requests to review Department decisions must be filed.

Sincerely,

Sharon L. Gayan

Sharon L. Gayan, MPA

Water Quality Bureau – Director

Dated: June 30, 2016

cc: Legal Permit File
Cyndi Barr, WT/3
U.S. Fish and Wildlife Service (Electronic Copy via Email)
David Gerdman
EPA – Region 5 (Electronic Copy via Email)

WISCONSIN
DEPT. OF NATURAL RESOURCES

WPDES PERMIT

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

PERMIT TO DISCHARGE UNDER THE WISCONSIN POLLUTANT DISCHARGE ELIMINATION SYSTEM

NextEra Energy Point Beach LLC

is permitted, under the authority of Chapter 283, Wisconsin Statutes, to discharge from a facility located at
6610 NUCLEAR ROAD
TWO RIVERS, WISCONSIN 54241-9516
to
Lake Michigan

in accordance with the effluent limitations, monitoring requirements and other conditions set forth in this permit.

The permittee shall not discharge after the date of expiration. If the permittee wishes to continue to discharge after this expiration date an application shall be filed for reissuance of this permit, according to Chapter NR 200, Wis. Adm. Code, at least 180 days prior to the expiration date given below.

State of Wisconsin Department of Natural Resources
For the Secretary

By Sharon L. Gayan

Sharon L. Gayan, MPA
Water Quality Bureau – Director

June 30, 2016
Date Permit Signed/Issued

PERMIT TERM: EFFECTIVE DATE - July 01, 2016 **EXPIRATION DATE - June 30, 2021**

TABLE OF CONTENTS

1 Cooling Water Intake Requirements

1.1 Sampling Point(s)

Sampling Point Designation	
Sampling Point Number	**Sampling Point Location, WasteType/Sample Contents and Treatment Description (as applicable)**
701	Lake Michigan water intake structure for unit 1 and unit 2 condenser cooling water.

1.2 Cooling Water Intake Description

The permittee shall at all times properly operate and maintain all water intake facilities. The permittee shall give advance notice to the Department of any planned changes in the location, design, operation, or capacity of the intake structure. The permittee is authorized to use the cooling water intake system which consists of the following:

- The current configuration of the CWIS includes a crib with an acoustic deterrent system (ADS) located 1,750 ft offshore in approximately 22 ft of water.
- The offshore crib consists of two annular rings of 12 inch steel "H" piles driven into the lake bed, with an outside diameter of 110 ft and an inside chamber diameter of 60 ft. The annulus is filled with 3- to 12- ton limestone blocks. Water is drawn into the chamber through the plastic mesh grating located on the top of the crib, as well as through the interstitial spaces between the limestone blocks and through 27, 30-inch diameter, corrugated, galvanized steel pipes that penetrate the blocks in a ring 5 ft above the lakebed. Also, the crib is equipped with three 6.5-ft square concrete pipes near the lake bottom in the south half of the crib.
- The steel pipes are covered with $1^{3}/_{16}$-inch by 2-inch galvanized bar grating to prevent debris and large fish from entering the intake system.
- The concrete pipes are covered with a 1/4-square-inch grating that is hinged for lowering in the winter months (usually December 1 to March 1) to prevent the formation of frazil ice on the grate and the subsequent restriction of water flow.
- A high frequency ADS surrounds the crib in order to reduce alewife impingement. The acoustic array consists of 16 Integrated Projector Assemblies ("IPAs") uniformly spaced around the outer circumference of the Crib. The deterrent signal consists of high frequency broad band (122 – 128 kHz) pulses, 0.5 second in duration, at 1-second intervals.
- There is no emergency intake.

1.3 Water Intake BTA Determination

The cooling water intake, as described above in Subsection 1.2, represents interim BTA for minimizing adverse environmental impact in accordance with the requirements in s. 283.31(6), Wis. Stats., and section 316 (b) of the Clean Water Act.

Note: This is an interim BTA determination based on the Department's February 2, 2009 guidance for evaluating cooling water intake structures using best professional judgment. Because the current permit expired before the October 14, 2014 effective date of the new federal regulations for existing facilities, those requirements are not applicable until the next permit reissuance. Nevertheless, for informational purposes this permit includes references to the new federal regulations in 40 CFR Parts 122 and 125, and some of the requirements are included at the Department's discretion to begin implementation of the new rule in this permit.

1.4 Future BTA

BTA determinations for entrainment and impingement mortality at cooling water intake structures will be made in each permit reissuance, in accordance with 40 CFR 125.90-98. In subsequent permit reissuance applications, the permittee shall provide all the information required in 40 CFR 122.21(r). Exemptions from some application requirements are possible in accordance with 40 CFR 125.95(c) and 125.98(g), where information already submitted is sufficient. If desired, a request for reduced application material requirements must be submitted at least 2 years and 6 months prior to permit expiration. Past submittals and previously conducted studies may satisfy some or all of the application material requirements.

Note: The Department is in the process of promulgating ch. NR 111, Wis. Adm. Code, on cooling water intake structures. The objective of ch. NR 111, Wis. Adm. Code, is to incorporate federal requirements for cooling water intake structures into the state's administrative code. If ch. NR 111, Wis. Adm. Code, is promulgated prior to the expiration of this permit, the permittee may be subject to ch. NR 111, Wis. Adm. Code, application requirements for the next permit reissuance.

1.5 Monitoring

1.5.1 Biological Monitoring

This permit does not specify any studies needed as follow-up for the cooling water intake evaluation, or for the next permit reissuance application.

1.5.2 Compliance Monitoring Requirements

1.5.2.1 Impingement Mortality

The permittee shall monitor the deployment of the ADS once per week during periods of use when the cooling water intake is in operation.

1.5.2.2 Entrainment Mortality

This permit does not specify any monitoring.

1.5.2.3 Visual or Remote inspections

The permittee shall conduct a weekly visual inspection or employ a remote monitoring device during periods when the cooling water intake is in operation. The inspection frequency shall be weekly to ensure the intake is maintained and operated to function as designed.

1.5.3 Reporting Requirements

1.5.3.1 Annual Certification Statement and Report

Submit an annual certification statement signed by the authorized representative with information on the following:

(a) Water intake structure technologies are being maintained and operated as set forth in this permit, or a justification to allow a modification of the practices. Include a summary of the inspections required under paragraph 1.5.2.3.

(b) If there are substantial modifications to the operation of any unit that impacts the cooling water withdrawals or operation of the water intake structure, provide a summary of those changes.

(c) If the information contained in the previous year's annual certification is still applicable, the certification may simply state as such.

1.6 Intake Screen Discharges and Removed Substances

Floating debris and accumulated trash collected on the cooling water intake trash rack shall be removed and disposed of in a manner to prevent any pollutant from the material from entering the waters of the State pursuant to s. NR 205.07 (3) (a), Wis. Adm. Code. The permittee may discharge backwash from the traveling water screens and discharge to the discharge canal. The fish and debris are returned to the Lake via a 24-inch pipe to the Unit 2 discharge flume, 80 ft away. These backwashes may contain fine materials that originated from the intake water source (sand, silt, small vegetation or aquatic life).

1.7 Endangered Species Act

Nothing in this permit authorizes take for the purpose of a facility's compliance with the Endangered Species Act. Refer to 40 CFR 125.98 (b) (1) and (2).

2 In-Plant Requirements

2.1 Sampling Point(s)

Sampling Point Designation	
Sampling Point Number	**Sampling Point Location, WasteType/Sample Contents and Treatment Description (as applicable)**
101	Demineralizer regeneration neutralization tank discharge.
102	Unit 1 steam generator blowdown.
103	Unit 2 steam generator blowdown.
104	Sewage treatment plant effluent prior to combining with the low volume wastewater effluent and condenser cooling water discharge.
105	Low volume wastewater (wastewater effluent) consisting of the combined discharge of sanitary wastewater effluent, turbine hall sumps and floor drains, facade sumps, water treatment plant backwash, heating steam condensate, and potable water treatment system filter backwash and reverse osmosis reject wastewater.
106	Plant process water reverse osmosis reject wastewater.
107	Microfiltration unit backwash from the power plant's make-up water treatment system. This is a direct discharge to Outfall 002 if the TSS limits can be met. If the in-line turbidimeter indicates elevated TSS that would exceed limits, the backwash is routed to the vacuum fabric filters for treatment and is discharged from Sampling Point 105.

2.2 Monitoring Requirements and Limitations

The permittee shall comply with the following monitoring requirements and limitations.

2.2.1 Sampling Point 101 - Demineralizer Regeneration; 102- Blowdown Unit 1; 103-Blowdown Unit 2; 106- Plant Process Water RO Reject, and 107- Microfiltration Unit Backwash

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Monthly	Total Daily	
Suspended Solids, Total	Daily Max	100 mg/L	Monthly	Grab	
Suspended Solids, Total	Monthly Avg	30 mg/L	Monthly	Grab	
Oil & Grease (Hexane)	Daily Max	20 mg/L	Annual	Grab	
Oil & Grease (Hexane)	Monthly Avg	15 mg/L	Annual	Grab	

2.2.2 Sampling Point 104 - STP Effluent

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Weekly	Total Daily	
BOD_5, Total	Monthly Avg	30 mg/L	Weekly	24-Hr Comp	
BOD_5, Total	Weekly Avg	45 mg/L	Weekly	24-Hr Comp	
Suspended Solids, Total	Monthly Avg	30 mg/L	Weekly	24-Hr Comp	
Suspended Solids, Total	Weekly Avg	45 mg/L	Weekly	24-Hr Comp	
pH Field		su	Weekly	Grab	

2.2.3 Sampling Point 105 - Low Volume Wastewater Effluent

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Weekly	Total Daily	
Suspended Solids, Total	Daily Max	100 mg/L	Weekly	24-Hr Comp	
Suspended Solids, Total	Monthly Avg	30 mg/L	Weekly	24-Hr Comp	
Oil & Grease (Hexane)	Daily Max	20 mg/L	Monthly	Grab	
Oil & Grease (Hexane)	Monthly Avg	15 mg/L	Monthly	Grab	
pH Field		su	Weekly	Grab	

3 Surface Water Requirements

3.1 Sampling Point(s)

The discharge(s) shall be limited to the waste type(s) designated for the listed sampling point(s).

Sampling Point Designation	
Sampling Point Number	**Sampling Point Location, WasteType/Sample Contents and Treatment Description (as applicable)**
001	Unit 1 condenser cooling water discharge to Lake Michigan.
002	Unit 2 condenser cooling water discharge to Lake Michigan.
004	Deicing line for the water intake crib in Lake Michigan. The discharge consists of reversing the flow of one of the water intake pipes to return warm water to the water intake crib.
601	Lake Michigan water intake monitoring for background water quality data.

3.2 Monitoring Requirements and Effluent Limitations

The permittee shall comply with the following monitoring requirements and limitations.

3.2.1 Sampling Point (Outfall) 001 - Condenser Cooling Water; 002- Condenser Cooling Water

Monitoring Requirements and Effluent Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Daily	Total Daily	
Temperature Maximum		deg F	Daily	Continuous	
pH Field	Daily Max	9.0 su	Weekly	Grab	
pH Field	Daily Min	6.0 su	Weekly	Grab	
Temperature Average		deg F	Daily	Calculated	
Halogen, Total Residual as Cl2	Daily Max	38 µg/L	Daily	Grab	See Halogens footnote below
Acute WET		TU_a	See Listed Qtr(s)	24-Hr Flow Prop Comp	See WET Testing footnote below
Chronic WET		rTU_c	See Listed Qtr(s)	24-Hr Flow Prop Comp	See WET Testing footnote below
Additive - Water Treatment - Specify	Daily Max	0.071 mg/L	Daily	Grab	See EVAC footnote below
Phosphorus, Total		mg/L	Monthly	Grab	See schedule for additive review
Heat	Weekly Avg	8,273 MBTU/hr	Daily	Calculated	See heat load calculation footnote below

3.2.1.1 Halogens Reporting – As Total Residual Chlorine

One grab sample for total residual chlorine (actually total residual halogens of both chlorine and bromine) shall be collected during the period when the chlorine discharge of each chlorination event is the greatest. The discharge monitoring reported value shall be the maximum of the chlorination events for that day. A continuous monitor may be used to determine the greatest value and length of chlorine discharge as long as it duplicates the accuracy of a NR 219 approved method. The permittee shall use EPA test method 330.2, or 330.5, or other equivalent test method with a suitable level of detection. Monitoring is only required on days when chlorine is added to the cooling water (typically daily). Refer to Standard Requirement 5.3.6 for determining compliance with the effluent limit.

3.2.1.2 Whole Effluent Toxicity (WET) Testing

Primary Control Water: Lake Michigan

Instream Waste Concentration (IWC): 9%

Dilution series: At least five effluent concentrations and dual controls must be included in each test.

- **Acute:** 100, 50, 25, 12.5, 6.25% and any additional selected by the permittee.
- **Chronic:** 100, 30, 10, 3, 1% (if the IWC $\leq$30%) or 100, 75, 50, 25, 12.5% (if the IWC >30%) and any additional selected by the permittee.

WET Testing Frequency:

Tests are required during the following quarters. Only one of the outfalls needs to be monitored if both outfalls have the same characteristics.

- **Acute:** 2017 3rd quarter, 2019 2nd quarter, 2021 1st quarter
- **Chronic:** 2017 3rd quarter, 2019 2nd quarter, 2021 1st quarter

Testing: WET testing shall be performed during normal operating conditions. Permittees are not allowed to turn off or otherwise modify treatment systems, production processes, or change other operating or treatment conditions during WET tests.

Reporting: The permittee shall report test results on the Discharge Monitoring Report form, and also complete the "Whole Effluent Toxicity Test Report Form" (Section 6, "*State of Wisconsin Aquatic Life Toxicity Testing Methods Manual, 2nd Edition*"), for each test. The original, complete, signed version of the Whole Effluent Toxicity Test Report Form shall be sent to the Biomonitoring Coordinator, Bureau of Water Quality, 101 S. Webster St., P.O. Box 7921, Madison, WI 53707-7921, within 45 days of test completion. The Discharge Monitoring Report (DMR) form shall be submitted electronically by the required deadline.

Determination of Positive Results: An acute toxicity test shall be considered positive if the Toxic Unit - Acute (TU_a) is greater than 1.0 for either species. The TU_a shall be calculated as follows: If $LC_{50} \geq 100$, then $TU_a = 1.0$. If LC_{50} is < 100, then $TU_a = 100 \div LC_{50}$. A chronic toxicity test shall be considered positive if the Relative Toxic Unit - Chronic (rTU_c) is greater than 1.0 for either species. The rTU_c shall be calculated as follows: If $IC_{25} \geq IWC$, then $rTU_c = 1.0$. If $IC_{25} < IWC$, then $rTU_c = IWC \div IC_{25}$.

Additional Testing Requirements: Within 90 days of a test which showed positive results, the permittee shall submit the results of at least 2 retests to the Biomonitoring Coordinator on "Whole Effluent Toxicity Test Report Forms". The 90 day reporting period shall begin the day after the test which showed a positive result. The retests shall be completed using the same species and test methods specified for the original test (see the Standard Requirements section herein).

3.2.1.3 [Reserved]

3.2.1.4 [Reserved]

3.2.1.5 EVAC

EVAC may be used for macroinvertebrate control for the service water system, as approved March 7, 2000. Treatments typically occur once or twice a year during May through October. The outfall that receives the service water discharge shall be monitored during each zebra mussel treatment. The daily maximum effluent limit is 0.071 mg/L expressed in amine equivalents.

3.2.1.6 Polychlorinated Biphenyls

There shall be no discharge of polychlorinated biphenyl compounds such as those commonly used for transformer fluid.

3.2.1.7 Additives

The permittee shall maintain a log to record the usage of all cooling water treatment additives used on a monthly basis for the intake water. Refer to Standard Requirement 5.3.7 regarding changes to additive use.

3.2.1.8 [Reserved]

3.2.1.9 Heat Load Calculation

Heat discharged is calculated and reported each day based on measured flow and the increase in temperature of the cooling water. Flow is measured each day as total gallons/day. The temperature increase is measured each day between average incoming water temperature and average outgoing temperature. Compliance is based on the weekly average and is calculated by the Department Wastewater Discharge Monitoring Report.

3.2.2 Sampling Point (Outfall) 004 - Intake De-icing

Monitoring Requirements and Effluent Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Per Occurrence	Estimated	

3.2.3 Sampling Point 601 - Water Intake

Monitoring Requirements and Effluent Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Monthly	Total Daily	
Temperature Maximum		deg F	Daily	Continuous	
Temperature Average		deg F	Daily	Calculated	

4 Schedules

4.1 Water Treatment Additive Review

The permittee shall take the necessary actions to minimize the discharge of phosphorus. The water treatment additives used at the power plant that contain phosphorus are sources of additional phosphorus in the effluent.

Required Action	Due Date
Evaluate Additive Source Reduction Measures: The permittee shall evaluate potential phosphorus source reduction measures for those additives containing phosphorus that are currently in use. Evaluate for replacement with an additive that is phosphorus free, replacement with an additive with a reduced phosphorus concentration, and reduction in the additive dosage. The water treatment additive review may include: a. Literature available on comparable water treatment additives. b. Similar reviews conducted at other facilities. c. Pilot studies and monitoring. d. A plan for optimizing the additive dosage rates so the additives are the most effective without over dosing.	07/01/2017
Submit Additive Review Report: The permittee shall submit a report summarizing the findings of the water treatment additive review. The report shall include information on the following: a. Description of the scope of work performed in additive review process. b. Identification of feasible additive changes. A feasible change means it would reduce the amount of phosphorus discharged while still being effective in providing the additive's purpose. c. An explanation of why a change in additive is not feasible. d. A summary of any monitoring data related to the additive review. e. An estimate of the amount of phosphorus reduction possible with any feasible additive change. If a new water treatment additive is proposed, information on the additive must be submitted to the Department for approval in accordance with standard requirement 5.3.7. Refer to the link below to access the Department's program guidance for "Water Quality Review Procedures for Additives". http://dnr.wi.gov/topic/wastewater/Guidance.html	10/01/2017
Implement Source Reduction Measures: If a phosphorus source reduction is found to be feasible during the water treatment additive review it shall be implemented. Any change in the dosage of a currently used additive or request for a new additive approval shall be made by the due date.	02/01/2018

5 Standard Requirements

NR 205, Wisconsin Administrative Code (Conditions for Industrial Dischargers): The conditions in ss. NR 205.07(1) and NR 205.07(3), Wis. Adm. Code, are included by reference in this permit. The permittee shall comply with all of these requirements. Some of these requirements are outlined in the Standard Requirements section of this permit. Reqnirements not specifically outlined in the Standard Requirement section of this permit can be found in ss. NR 205.07(I) and NR 205.07(3).

5.1 Reporting and Monitoring Requirements

5.1.1 Monitoring Results

Monitoring results obtained during the previous month shall be summarized and reported on a Department Wastewater Discharge Monitoring Report. The report may require reporting of any or all of the information specified below under 'Recording of Results'. This report is to be returned to the Department no later than the date indicated on the form. A copy of the Wastewater Discharge Monitoring Report Form or an electronic file of the report shall be retained by the permittee.

Monitoring results shall be reported on an electronic discharge monitoring report (eDMR). The eDMR shall be certified electronically by a principal executive officer, a ranking elected official or other duly authorized representative. The 'eReport Certify' page certifies that the electronic report form is true, accurate and complete.

If the permittee monitors any pollutant more frequently than required by this permit, the results of such monitoring shall be included on the Wastewater Discharge Monitoring Report.

The permittee shall comply with all limits for each parameter regardless of monitoring frequency. For example, monthly, weekly, and/or daily limits shall be met even with monthly monitoring. The permittee may monitor more frequently than required for any parameter.

5.1.2 Sampling and Testing Procedures

Sampling and laboratory testing procedures shall be performed in accordance with Chapters NR 218 and NR 219, Wis. Adm. Code and shall be performed by a laboratory certified or registered in accordance with the requirements of ch. NR 149, Wis. Adm. Code. Groundwater sample collection and analysis shall be performed in accordance with ch. NR 140, Wis. Adm. Code. The analytical methodologies used shall enable the laboratory to quantitate all substances for which monitoring is required at levels below the effluent limitation. If the required level cannot be met by any of the methods available in NR 219, Wis. Adm. Code, then the method with the lowest limit of detection shall be selected. Additional test procedures may be specified in this permit.

5.1.3 Recording of Results

The permittee shall maintain records which provide the following information for each effluent measurement or sample taken:

- the date, exact place, method and time of sampling or measurements;
- the individual who performed the sampling or measurements;
- the date the analysis was performed;
- the individual who performed the analysis;
- the analytical techniques or methods used; and
- the results of the analysis.

5.1.4 Reporting of Monitoring Results

The permittee shall use the following conventions when reporting effluent monitoring results:

- Pollutant concentrations less than the limit of detection shall be reported as < (less than) the value of the limit of detection. For example, if a substance is not detected at a detection limit of 0.1 mg/L, report the pollutant concentration as < 0.1 mg/L.

- Pollutant concentrations equal to or greater than the limit of detection, but less than the limit of quantitation, shall be reported and the limit of quantitation shall be specified.

- For purposes of calculating NR 101 fees, the 2 mg/l lower reporting limits for BOD_5 and Total Suspended Solids shall be considered to be limits of quantitation

- For the purposes of reporting a calculated result, average or a mass discharge value, the permittee may substitute a 0 (zero) for any pollutant concentration that is less than the limit of detection. However, if the effluent limitation is less than the limit of detection, the department may substitute a value other than zero for results less than the limit of detection, after considering the number of monitoring results that are greater than the limit of detection and if warranted when applying appropriate statistical techniques.

5.1.5 Records Retention

The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by the permit, and records of all data used to complete the application for the permit for a period of at least 3 years from the date of the sample, measurement, report or application, except for sludge management forms and records, which shall be kept for a period of at least 5 years.

5.1.6 Other Information

Where the permittee becomes aware that it failed to submit any relevant facts in a permit application or submitted incorrect information in a permit application or in any report to the Department, it shall promptly submit such facts or correct information to the Department.

5.2 System Operating Requirements

5.2.1 Noncompliance Notification

- The permittee shall report the following types of noncompliance by a telephone call to the Department's regional office within 24 hours after becoming aware of the noncompliance;
  - any noncompliance which may endanger health or the environment;
  - any violation of an effluent limitation resulting from an unanticipated bypass;
  - any violation of an effluent limitation resulting from an upset; and
  - any violation of a maximum discharge limitation for any of the pollutants listed by the Department in the permit.

- A written report describing the noncompliance shall also be submitted to the Department's regional office within 5 days after the permittee becomes aware of the noncompliance. On a case-by-case basis, the Department may waive the requirement for submittal of a written report within 5 days and instruct the permittee to submit the written report with the next regularly scheduled monitoring report. In either case, the written report shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times; the steps taken or planned to reduce, eliminate and prevent reoccurrence of the noncompliance; and if the noncompliance has not been corrected, the length of time it is expected to continue.

- The permittee shall give advance notice to the Department of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

NOTE: Section 292.11(2)(a), Wisconsin Statutes, requires any person who possesses or controls a hazardous substauce or who causes the discharge of a hazardous substance to notify the Department of Natural Resources **immediately** of any discharge not authorized by the permit. The discharge of a hazardous substance that is not authorized by this permit or that violates this permit may be a hazardous substance spill. To report a hazardous substance spill, call DNR's 24-hour HOTLINE at **1-800-943-0003**.

5.2.2 Unscheduled Bypassing

Any unscheduled bypass or overflow of wastewater at the treatment works or from the collection system is prohibited, and the Department may take enforcement action against a permittee for such occurrences under s. 283.89, Wis. Stats., unless all of the following occur:

- The bypass was unavoidable to prevent loss of life, personal injury, or severe property damage.
- There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance.
- The permittee notifies the department of the unscheduled bypass or overflow. The permittee shall notify the department within 24 hours of initiation of the bypass or overflow occurrence by telephone, voicemail, fax or e-mail. Within 5 days of conclusion of the bypass or overflow occurrence, the permittee shall submit to the department in writing, all of the following information:
  - Reason the bypass or overflow occurred, or explanation of other contributing circumstances that resulted in the overflow event. If the overflow or bypass is associated with wet weather, provide data on the amount and duration of the rainfall or snow melt for each separate event.
  - Date the bypass or overflow occurred.
  - Location where the bypass or overflow occurred.
  - Duration of the bypass or overflow and estimated wastewater volume discharged.
  - Steps taken or the proposed corrective action planned to prevent similar future occurrences.
  - Any other information the permittee believes is relevant.

5.2.3 Scheduled Bypassing

Any construction or normal maintenance which results in a bypass of wastewater is prohibited unless authorized by the Department in writing. If the Department determines that there is significant public interest in the proposed action, the Department may schedule a public hearing or notice a proposal to approve the bypass. Each request shall specify the following minimum information:

- Proposed date of bypass.
- Estimated duration of the bypass.
- Alternatives to bypassing.
- Measures to mitigate environmental harm caused by the bypass.
- Estimated volume of the bypass.

5.2.4 Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control which are installed or used by the permittee to achieve compliance with the conditions of this permit. The wastewater treatment facility shall be under the direct supervision of a state certified operator as required in s. NR 108.06(2), Wis. Adm. Code. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training as required in ch. NR 114, Wis. Adm. Code, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of the permit.

5.2.5 Spill Reporting

The permittee shall notify the Department in accordance with ch. NR 706 (formerly NR 158), Wis. Adm. Code, in the event that a spill or accidental release of any material or substance results in the discharge of pollutants to the waters of the state at a rate or concentration greater than the effluent limitations established in this permit, or the spill or accidental release of the material is unregulated in this permit, unless the spill or release of pollutants has been reported to the Department in accordance with s. NR 205.07 (1)(s), Wis. Adm. Code.

5.2.6 Planned Changes

In accordance with ss. 283.31(4)(b) and 283.59, Stats., the permittee shall report to the Department any facility expansion, production increase or process modifications which will result in new, different or increased discharges of pollutants. The report shall either be a new permit application, or if the new discharge will not violate the effluent limitations of this permit, a written notice of the new, different or increased discharge. The notice shall contain a description of the new activities, an estimate of the new, different or increased discharge of pollutants and a description of the effect of the new or increased discharge on existing waste treatment facilities. Following receipt of this report, the Department may modify this permit to specify and limit any pollutants not previously regulated in the permit.

5.2.7 Duty to Halt or Reduce Activity

Upon failure or impairment of treatment facility operation, the permittee shall, to the extent necessary to maintain compliance with its permit, curtail production or wastewater discharges or both until the treatment facility operations are restored or an alternative method of treatment is provided.

5.3 Surface Water Requirements

5.3.1 Permittee-Determined Limit of Quantitation Incorporated into this Permit

For pollutants with water quality-based effluent limits below the Limit of Quantitation (LOQ) in this permit, the LOQ calculated by the permittee and reported on the Discharge Monitoring Reports (DMRs) is incorporated by reference into this permit. The LOQ shall be reported on the DMRs, shall be the lowest quantifiable level practicable, and shall be no greater than the minimum level (ML) specified in or approved under 40 CFR Part 136 for the pollutant at the time this permit was issued, unless this permit specifies a higher LOQ.

5.3.2 Appropriate Formulas for Effluent Calculations

The permittee shall use the following formulas for calculating effluent results to determine compliance with average concentration limits and mass limits and total load limits:

Weekly/Monthly/Six-Month/Annual Average Concentration = the sum of all daily results for that week/month/six-month/year, divided by the number of results during that time period.

Weekly Average Mass Discharge (lbs/day): Daily mass = daily concentration (mg/L) x daily flow (MGD) x 8.34, then average the daily mass values for the week.

Monthly Average Mass Discharge (lbs/day): Daily mass = daily concentration (mg/L) x daily flow (MGD) x 8.34, then average the daily mass values for the month.

Annual Average Mass Discharge (lbs/day): Daily mass = daily concentration (mg/L) x daily flow (MGD) x 8.34, then average the daily mass values for the entire year.

Total Monthly Discharge: = monthly average concentration (mg/L) x total flow for the month (MG/month) x 8.34.

Total Annual Discharge: = sum of total monthly discharges for the calendar year.

5.3.3 Effluent Temperature Requirements

Weekly Average Temperature – The permittee shall use the following formula for calculating effluent results to determine compliance with the weekly average temperature limit (as applicable): Weekly Average Temperature = the sum of all daily maximum results for that week divided by the number of daily maximum results during that time period.

Cold Shock Standard – Water temperatures of the discharge shall be controlled in a manner as to protect fish and aquatic life uses from the deleterious effects of cold shock. 'Cold Shock' means exposure of aquatic organisms to a rapid decrease in temperature and a sustained exposure to low temperature that induces abnormal behavior or physiological performance and may lead to death.

Rate of Temperature Change Standard – Temperature of a water of the state or discharge to a water of the state may not be artificially raised or lowered at such a rate that it causes detrimental health or reproductive effects to fish or aquatic life of the water of the state.

5.3.4 Energy Emergency Events

The Department will use enforcement discretion whenever there are exceedances of effluent temperature limitations for the electric generating facility during an energy emergency warning or when an energy emergency event has been declared under a Federal Energy Regulatory Commission order (Standard EOP-002, North American Electric Reliability Corporation).

5.3.5 Visible Foam or Floating Solids

There shall be no discharge of floating solids or visible foam in other than trace amounts.

5.3.6 Total Residual Halogen Requirements (When De-Halogenating Effluent)

Test methods for total residual chlorine, approved in ch. NR 219 - Table B, Wis. Adm. Code, normally achieve a limit of detection of about 20 to 50 micrograms per liter and a limit of quantitation of about 100 micrograms per liter. Reporting of test results and compliance with effluent limitations for chlorine residual and total residual halogens shall be as follows:

- Sample results which show no detectable levels are in compliance with the limit. These test results shall be reported on Wastewater Discharge Monitoring Report Forms as "< 100 µg/L". (Note: 0.1 mg/L converts to 100 µg/L)

- Samples showing detectable traces of chlorine are in compliance if measured at less than 100 µg/L, unless there is a consistent pattern of detectable values in this range. These values shall also be reported on Wastewater Discharge Monitoring Report Forms as "<100 µg/L." The facility operating staff shall record actual readings on logs maintained at the plant, shall take action to determine the reliability of detected results (such as re-sampling and/or calculating dosages), and shall adjust the chemical feed system if necessary to reduce the chances of detects.

- Samples showing detectable levels greater than 100 µg/L shall be considered as exceedances, and shall be reported as measured.

- To calculate average or mass discharge values, a "0" (zero) may be substituted for any test result less than 100 µg/L. Calculated values shall then be compared directly to the average or mass limitations to determine compliance.

5.3.7 Additives

In the event that the permittee wishes to commence use of a water treatment additive, or increase the usage of the additives greater than indicated in the permit application, the permittee must get a written approval from the Department prior to initiating such changes. This written approval shall provide authority to utilize the additives at the specific rates until the permit can be either reissued or modified in accordance with s. 283.53, Stats. Restrictions on the use of the additives may be included in the authorization letter.

5.3.8 Whole Effluent Toxicity (WET) Monitoring Requirements

In order to determine the potential impact of the discharge on aquatic organisms, static-renewal toxicity tests shall be performed on the effluent in accordance with the procedures specified in the *"State of Wisconsin Aquatic Life Toxicity Testing Methods Manual, 2nd Edition" (PUB-WT-797,* November 2004) as required by NR 219.04, Table A, Wis. Adm. Code). All of the WET tests required in this permit, including any required retests, shall be conducted on the *Ceriodaphnia dubia* and fathead minnow species. Receiving water samples shall not be collected from any point in contact with the permittee's mixing zone and every attempt shall be made to avoid contact with any other discharge's mixing zone.

5.3.9 Whole Effluent Toxicity (WET) Identification and Reduction

Within 60 days of a retest which showed positive results, the permittee shall submit a written report to the Biomonitoring Coordinator, Bureau of Watershed Management, 101 S. Webster St., PO Box 7921, Madison, WI 53707-7921, which details the following:

- A description of actions the permittee has taken or will take to remove toxicity and to prevent the recurrence of toxicity;

- A description of toxicity reduction evaluation (TRE) investigations that have been or will be done to identify potential sources of toxicity, including some or all of the following actions:

  (a) Evaluate the performance of the treatment system to identify deficiencies contributing to effluent toxicity (e.g., operational problems, chemical additives, incomplete treatment)
  (b) Identify the compound(s) causing toxicity
  (c) Trace the compound(s) causing toxicity to their sources (e.g., industrial, commercial, domestic)
  (d) Evaluate, select, and implement methods or technologies to control effluent toxicity (e.g., in-plant or pretreatment controls, source reduction or removal)

- Where corrective actions including a TRE have not been completed, an expeditious schedule under which corrective actions will be implemented;

- If no actions have been taken, the reason for not taking action.

The permittee may also request approval from the Department to postpone additional retests in order to investigate the source(s) of toxicity. Postponed retests must be completed after toxicity is believed to have been removed.

6 Summary of Reports Due

FOR INFORMATIONAL PURPOSES ONLY

Description	Date	Page
Water Treatment Additive Review -Evaluate Additive Source Reduction Measures	July 1, 2017	10
Water Treatment Additive Review -Submit Additive Review Report	October 1, 2017	10
Water Treatment Additive Review -Implement Source Reduction Measures	February 1, 2018	10

Report forms shall be submitted electronically in accordance with the reporting requirements herein. Any facility plans or plans and specifications for municipal, industrial, industrial pretreatment and non industrial wastewater systems shall be submitted to the Bureau of Water Quality, P.O. Box 7921, Madison, WI 53707-7921. All other submittals required by this permit shall be submitted to:
Northeast Region, 2984 Shawano Avenue, Green Bay, WI 54313-6727

WISCONSIN
DEPT. OF NATURAL RESOURCES

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

GENERAL PERMIT TO DISCHARGE UNDER THE WISCONSIN POLLUTANT DISCHARGE ELIMINATION SYSTEM WPDES PERMIT NO. WI-S067857-4

TIER 2 INDUSTRIAL FACILITIES

In compliance with the provisions of ch. 283, Wis. Stats., and ch. NR 216, Wis. Adm. Code, any **Tier 2** facility as defined in ch. NR 216, Wis. Adm. Code, and located in the State of Wisconsin, excluding initial coverage within Indian Country after September 30, 2001, that discharges

STORM WATER ASSOCIATED WITH INDUSTRIAL ACTIVITY

and meeting the applicability criteria in section 2 of this permit and that receives a letter from the Wisconsin Department of Natural Resources (Department) granting coverage under this permit, is authorized to discharge storm water to waters of the state provided that the discharge is in accordance with the conditions set forth in this permit.

This permit is issued by the Department and covers storm water discharges from the facility as of the **Start Date** of permit coverage to the permittee. For initial permit coverage, the Department will transmit a cover letter to the permittee stating that the facility is covered under this permit. Initial coverage under this permit will become effective at a facility beginning upon the **Start Date** specified by the Department in the cover letter. For an existing facility with permit coverage under a previously issued version of the Tier 2 general permit, coverage under this permit will become effective at the facility beginning upon the **Effective Date** below. For these facilities, the **Effective Date** is the **Start Date.**

State of Wisconsin Department of Natural Resources
For the Secretary

By ______________________ June 15, 2016
Mark D. Aquino, Director — Date
Office of Business Support and Science

PERMIT EFFECTIVE DATE: June 15, 2016 **PERMIT EXPIRATION DATE:** May 31, 2021

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1. APPLICATION REQUIREMENTS

1.1 Initial Permit Coverage The owner or operator of a Tier 2 industrial facility type listed in s. NR 216.21(2)(b), Wis. Adm. Code, and not previously covered under the Tier 2 general permit shall submit a complete Notice of Intent (NOI) to the Department to apply for coverage under an industrial storm water discharge permit in accordance with the time frames in s. NR 216.22(2), Wis. Adm. Code. Within 30 calendar days of receipt of the NOI, the Department will evaluate the information submitted in the NOI to determine whether the NOI is complete, whether additional information is needed for review, whether the facility will be covered under this permit or an individual permit, or whether coverage under a permit will be denied. Based upon this evaluation, unless notified to the contrary by the Department, within 30 calendar days of receipt of the NOI, the Department will transmit a cover letter to the owner or operator indicating the **Start Date** upon which permit coverage becomes effective at the facility with instructions on where to download the permit from the Department's Internet website. In the alternative, a hard copy of the permit will be mailed to the owner or operator of the facility upon request.

Note: The NOI form (Form 3400-163) and general permit are available for download from the Department's Internet website at: http://dnr.wi.gov/topic/stormwater/industrial/forms.html
If, for any reason, you are unable to access the permit over the Internet, please telephone the Department at (608) 267-7694 for assistance.

1.2 Existing Permit Coverage Unless the Department makes a determination for an individual WPDES permit under section 2.5.7, a Tier 2 industrial facility type listed in s. NR 216.21(2)(b), Wis. Adm. Code, with existing Tier 2 general permit coverage prior to the **Effective Date** of this permit is automatically covered under this permit as of the **Effective Date**. For these permittees, the **Effective Date** is the permittee's **Start Date.** The Department will notify the owner or operator of the facility's continued coverage under this permit with instructions on where to download the permit from the Department's Internet website. In the alternative, a hard copy of the permit will be mailed to the owner or operator of the facility upon request.

Note: The general permit is available for download from the Department's Internet website at: http://dnr.wi.gov/topic/stormwater/industrial/forms.html
If, for any reason, you are unable to access the permit over the Internet, please telephone the Department at (608) 267-7694 for assistance.

1.3 No Exposure Certification The owner or operator of a facility not currently covered under this permit that has submitted a Conditional No Exposure Certification to the Department in accordance with s. NR 216.21(3), Wis. Adm. Code, but that has been denied a No Exposure Exclusion by the Department shall apply for permit coverage in accordance with section 1.1 of this permit within 14-working days of being notified by the Department of the denial. The owner or operator of a facility that has previously been granted a No Exposure Exclusion by the Department but that has had that exclusion revoked shall apply for permit coverage in accordance with section 1.1 of this permit within 14-working days of being notified by the Department of the revocation.

1.4 Permit Coverage Transfers A permittee who will no longer control the permitted industrial facility may request that permit coverage be transferred to the person who will control the industrial facility. The transfer request shall be signed by both the permittee and the new owner or operator and sent via certified or registered mail to the Department contemporaneously with the transfer of control. The Department may require additional information including an NOI to be filed prior to transferring permit coverage. Coverage is not transferred until the Department sends notification of transfer approval to the new owner or operator. The transfer request shall contain the following information:

1.4.1 The name and address of the facility.

1.4.2 The Facility Identification Number.

1.4.3 The names of the persons involved in the transfer, their signatures, and date of signatures.

1.4.4 A description of any significant changes in the operation of the facility.

1.4.5 A statement of acknowledgement by the transferee that it will be the permittee of record and is responsible for compliance with the permit.

Note: Mail the request to transfer permit to the appropriate Department regional office or to the Department of Natural Resources, Storm Water Program – WT/3, Box 7921, Madison, WI 53707-7921.

1.5 Permit Coverage Terminations
If the permittee no longer claims coverage under this permit, the permittee shall submit a signed Notice of Termination to the Department in accordance with s. NR 216.32, Wis. Adm. Code.

Note: The NOT form (Form 3400-170) is available on the Department website at:
http://dnr.wi.gov/topic/stormwater/industrial/forms.html

2. PERMIT APPLICABILITY CRITERIA

2.1 Applicability This permit applies to point sources at facilities which discharge contaminated storm water associated with industrial activity to waters of the state, either directly or via a separate storm sewer system, originating from industrial facilities belonging to:

2.1.1 Manufacturing facilities described by the following SIC codes:

SIC	Description
20--	Food & Kindred Products
21--	Tobacco Products
22--	Textile Mill Products
23--	Apparel & Other Textile Products
2434	Wood Kitchen Cabinets
25--	Furniture & Fixtures
265-	Paperboard Containers & Boxes
267-	Misc. Converted Paper Products
27--	Printing, Publishing, & Allied Industries
283-	Drugs
285-	Paints & Allied Products
30--	Rubber & Misc. Plastics Products
31--	Leather & Leather Products
323-	Products of Purchased Glass
34--	Fabricated Metal Products
35--	Industrial & Commercial Machinery & Computer Equipment
36--	Electronic & Other Electrical Equipment & Components
37--	Transportation Equipment
38--	Instruments & Related Products
39--	Misc. Manufacturing Industries
4221	Farm Product Warehousing & Storage
4222	Refrigerated Warehousing & Storage
4225	General Warehousing & Storage

Note: Facilities in SIC codes 311-, 3441 and 373- are included in s. NR 216.21(2)(a) 1. as Tier 1 facilities.

2.1.2 Transportation facilities described by the following SIC codes that have vehicle maintenance shops, equipment cleaning operations, or airport de-icing operations. This only applies to those portions of these facilities that are either involved in vehicle maintenance including rehabilitation, mechanical repairs, painting, fueling, lubrication, and associated parking areas, or involved in cleaning operations, or de-icing operations, or that are listed as a pollution source area under s. NR 216.02(2)(d):

SIC	Description
40--	Railroad Transportation
41--	Local & Interurban Passenger Transit
42--	Trucking & Warehousing
43--	U.S. Postal Service

44--	Water Transportation
45--	Transportation by Air
5171	Petroleum Bulk Stations & Terminals

2.1.3 Facilities described by the following SIC codes, including active and inactive mining operations. This permit only applies where storm water runoff has come into contact with any overburden, raw material, intermediate product, finished product, by-product, or waste material.

SIC	Description
10--	Metal Mining
12--	Coal Mining
13--	Oil & Gas Extraction
14--	Non-metallic Minerals, except fuels

Note: An industry-specific general permit has been developed by the Department that regulates both process and storm water discharges associated non-metallic mining operations, SIC code 14--. While the Department intends to cover non-metallic mining operations under the industry-specific general permit, it may alternatively cover storm water discharges associated with non-metallic mining operations under this Tier 2 general permit. This permit does not apply to non-coal mining operations which have been released from applicable state or federal reclamation requirements after December 17, 1990; nor to coal mining operations released from the performance bond issued to the facility by the appropriate Surface Mining Control and Reclamation Act authority under 30 USC 1201 et seq. and 16 USC 470 et seq. Production, processing, or treatment operations or transmission facilities associated with oil and gas extraction are included only if there has been a discharge of storm water after November 16, 1987 containing a reportable quantity of a pollutant, or if a storm water discharge contributed to a violation of a water quality standard.

2.1.4 Facilities subject to storm water effluent limitation guidelines, new or existing source performance standards, or toxic pollutant effluent standards under 33 USC 1251, 1311, 1314 (b) and (c), 1316 (b) and (c), 1317 (b) and (c), 1326 (c), except for those facilities identified in paragraph A.(1) that do not have contaminated storm water.

2.1.5 Treatment works treating domestic sewage or any other sewage sludge or wastewater treatment device or system, used in the storage, treatment, recycling, and reclamation of municipal or domestic sewage, including land dedicated to the disposal of sewage sludge that are located within the confines of the facility, with a design flow of one million gallons per day or more, or required to have an approved pretreatment program. Not included are farm lands, domestic gardens or lands used for sludge management where sludge is beneficially reused and which are not physically located in the confines of the facility, or areas that are in compliance with Section 405 of the Clean Water Act under 33 USC s. 1345.

2.1.6 Hazardous waste treatment, storage, and disposal facilities, including those operating under interim status or a permit under Subtitle C of the Resource Conservation and Recovery Act (RCRA), 42 USC 6901 et seq.

2.1.7 Landfills, land application sites, and open dumps that receive or have received any industrial waste from any of the facilities identified in this section 2.1 of this permit, including those subject to regulation under subtitle D of RCRA, 42 USC 6901 et seq.

2.1.8 Steam electric power generating facilities, including coal handling sites but not including offsite transformer or electric substations.

2.1.9 Facilities described in SIC code 2951 for asphalt paving mixes and block, and facilities described in SIC codes 3271, 3272 and 3273 for cement products.

Note: In 1997, the North American Industry Classification System (NAICS) was developed as the standard for use by Federal agencies in classifying business establishments and has been adopted by Federal agencies to replace the SIC Code system. As a result, an industrial facility identified in sections 2.1.1 through 2.1.9 of this permit may have an NAICS Code assigned to it by a Federal agency, trade association, or other organization. If needed, the Department may use Federal data to convert the NAICS Code to the corresponding SIC Code for purposes of determining the applicability of this permit to the facility.

2.1.10 Facilities originally covered under a Tier 1 general permit, but subsequently covered under a Tier 2 general permit pursuant to s. NR 216.23(3), Wis. Adm. Code.

2.2 Authorized Discharges This permit authorizes storm water point source discharges to waters of the State from industrial activities identified in section 2.1 of this permit. This permit also authorizes the discharge of storm water commingled with flows contributed by process and non-process wastewater, provided those flows are regulated by other WPDES permits, if required.

2.3 Movement to Tier One Coverage In accordance with s. NR 216.23(4), Wis. Adm. Code, the Department may revoke coverage under this permit. In this case, the permittee shall reapply for Tier 1 general permit coverage.

2.4 Exclusions This permit does not apply to any of the following:

2.4.1 Diffused surface drainage or agricultural storm water discharges.

2.4.2 Non−storm water discharges.

2.4.3 Non−storm water discharges for which coverage under an individual or general WPDES permit is not required, including landscape irrigation, diverted stream flows, uncontaminated groundwater infiltration, uncontaminated pumped groundwater, discharges from potable water sources, foundation drains, air conditioning condensation, irrigation water, lawn watering, individual residential car washing, flows from riparian habitats and wetlands and fire fighting.

2.4.4 Inactive, closed or capped landfills that have no potential for contamination of storm water. The Department shall make a determination of contamination potential on a case−by−case basis.

2.4.5 Remedial action discharges or discharges authorized by a WPDES permit for discharging contaminated or uncontaminated groundwater.

2.4.6 Areas located on plant lands that are segregated from the industrial activities of the plant, such as office buildings and accompanying parking lots, if the drainage from the segregated areas is not mixed with contaminated storm water drainage.

2.4.7 Storm water discharges into a municipal combined sewer system.

Note: Areas where this exclusion may apply include portions of the City of Milwaukee, the City of Superior, and the Village of Shorewood.

2.4.8 Storm water discharges from an industrial facility for which the owner or operator has submitted a Conditional No Exposure Certification to the Department in accordance with s. NR 216.21(3), Wis. Adm. Code, provided that the Department concurs with the no exposure certification and the conditions under which a No Exposure Exclusion was granted remain in effect.

2.5 Discharges Not Covered by this Permit The following are not authorized under this permit:

2.5.1 Storm water discharges within Indian Country for which initial coverage under this permit is sought after September 30, 2001. Industrial storm water discharges within Indian Country from non-tribal lands that have state coverage under a general storm water permit prior to September 30, 2001, continue to be covered under this permit for purposes of state law.

Note: Indian County is defined under 18 USC §1151. Contact the Department at (608) 267-7694 for non-tribal storm water discharges within Indian Country to determine if state permit coverage from the Department is required.

2.5.2 Discharges of hazardous substances that are required to be reported under ch. NR 706, Wis. Adm. Code.

2.5.3 Storm water discharges that affect wetlands, unless the Department determines that the storm water discharges comply with the wetland water quality standards provisions in ch. NR 103, Wis. Adm. Code.

2.5.4 Storm water discharges that affect endangered and threatened resources, unless the Department determines that the storm water discharges comply with the endangered and threatened resource protection requirements of s. 29.604, Wis. Stats., and ch. NR 27, Wis. Adm. Code.

2.5.5 Storm water discharges that affect any historic property that is listed property, or on the inventory or on the list of locally designated historic places under s. 44.45, Wis. Stats., unless the Department determines that the storm water discharges will not have an adverse effect on any historic property pursuant to s. 44.40(3), Wis. Stats.

2.5.6 Storm water discharges from land disturbing construction activity affecting one acre or more of land that require storm water permit coverage under subch. III of NR 216, Wis. Adm. Code, for new construction , reconstruction, or expansion of an industrial facility.

Note: Storm water discharges from areas of bare soil due to the normal industrial operation of the facility are covered under this permit provided those areas are managed in accordance with section 3.3.2.8.2.

2.5.7 Facilities where the Department makes a determination, pursuant to s. 283.35(3), Wis. Stats. or s. NR 216.25(3), Wis. Adm. Code, that a storm water discharge is more appropriately covered under an individual WPDES permit. The Department may make this determination if one or more of the following conditions are met:

2.5.7.1 The storm water discharge is potentially a significant source of pollution and more appropriately regulated by an individual WPDES storm water discharge permit.

2.5.7.2 The facility is not in compliance with the terms and condition of this permit or Subchapter II of ch. NR 216, Wis. Adm. Code.

2.5.7.3 Numeric effluent limitations or standards are promulgated for a storm water discharge covered by this permit.

2.5.7.4 Storm water discharges that are regulated by permits containing storm water effluent limitations.

2.5.8 Storm water discharges in violation of the regulation of injection wells under ch. NR 815, Wis. Adm. Code.

Note: Information about the Department's injection well program may be found at: http://dnr.wi.gov/topic/wells/uiw.html

2.5.9 Discharges associated with activities subject to any of the federal effluent limitation guidelines listed in Table 1 below:

Table 1

Regulated Activity	**40 CFR Part/Subpart**
Discharges resulting from spray down or intentional wetting of logs at wet deck storage areas	Part 429, Subpart I
Runoff from phosphate fertilizer manufacturing facilities that comes into contact with any raw materials, finished product, by-products or waste products (SIC 2874)	Part 418, Subpart A
Runoff from asphalt emulsion facilities	Part 443, Subpart A
Runoff from material storage piles at cement manufacturing facilities	Part 411, Subpart C
Mine dewatering discharges at crushed stone, construction sand and gravel, or industrial sand mining facilities	Part 436, Subparts B, C, and D
Runoff from hazardous waste landfills	Part 445, Subpart A
Runoff from non-hazardous waste landfills	Part 445, Subpart B
Runoff from coal storage piles at steam electric generating facilities	Part 423
Runoff containing urea from airfield pavement deicing at existing and new primary airports with 1,000 or more annual non-propeller aircraft departures	Part 449

Note: The federal effluent limitations guidelines are available at the following website:
http://www.ecfr.gov/cgi-bin/text-idx?gp=&SID=b3d5d7e7e412cd63e5893ace05f30133&mc=true&tpl=/ecfrbrowse/Title40/40CIsubchapN.tpl
Discharges associated with activities subject to any of the federal effluent limitation guidelines listed in Table 1 require coverage under a separate WPDES general permit or individual permit. However, these industrial facilities still require coverage under this permit for discharges not subject to the federal effluent limitation guidelines listed in Table 1.

2.6 Water Quality Standards

2.6.1 This permit specifies the conditions under which storm water may be discharged to waters of the state for the purpose of achieving water quality standards contained in chs. NR 102 through 105, NR 140, and NR 207, Wis. Adm. Code. For the term of this permit, compliance with water quality standards will be addressed by adherence to general narrative-type storm water discharge limitations and implementation of a storm water pollution prevention plan.

2.6.2 This permit does not authorize storm water discharges that the Department, prior to authorization of coverage under this permit, determines will cause or have reasonable potential to cause or contribute to an excursion above any applicable water quality standard. Where such determinations have been made prior to authorization, the Department may notify the applicant that an individual permit application is necessary. However, the Department may authorize coverage under this permit where the storm water pollution prevention plan required under this permit will include appropriate controls and implementation procedures designed to bring the storm water discharge into compliance with water quality standards

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2.7 Outstanding and Exceptional Resource Waters

2.7.1 Storm water discharges from industrial facilities covered under a previously issued version of this permit shall comply with sections 2.7.2 through 2.7.5 as of the **Effective Date**. Storm water discharges from industrial facilities covered under this permit after the **Effective Date** shall comply with sections 2.7.2 through 2.7.5 as of the **Start Date** of coverage under this permit.

2.7.2 The permittee shall determine whether any part of its facility discharges storm water to an outstanding resource water (ORW) or exceptional resource water (ERW). ORWs and ERWs are listed in ss. NR 102.10 and 102.11, Wis. Adm. Code, respectively.

Note: A list of ORWs and ERWs may be found on the Department's Internet site at: http://dnr.wi.gov/topic/surfacewater/orwerw.html

2.7.3 The permittee may not establish a new storm water discharge of pollutants directly to an ORW or an ERW unless the discharge of pollutants is equal to or less than existing levels of pollutants immediately upstream of the discharge site. The storm water pollution prevention plan required under section 3 of this permit shall include practices designed to meet this requirement for new discharges.

2.7.3.1 "New storm water discharge" or "new discharge" means a storm water discharge that would first occur after the permittee's **Start Date** of coverage under this permit to a surface water to which the facility did not previously discharge storm water, and does not include an increase in a storm water discharge to a surface water to which the facility discharged on or before coverage under this permit.

2.7.4 The permittee may increase an existing storm water discharge directly to an ERW only if the increased discharge will not cause a significant lowering of water quality and the discharge is related to important economic or social development.

2.7.5 The permittee may increase an existing storm water discharge to an ORW only if the increased discharge of pollutants is equal to or less than the background levels of the pollutant upstream of the discharge and the discharge is related to important economic or social development.

2.8 Impaired Water Bodies and Total Maximum Daily Load Requirements

2.8.1 "Pollutant(s) of concern" means a pollutant that is contributing to the impairment of a water body.

2.8.2 By February 15th of each calendar year, the permittee shall perform an annual check to determine whether its facility discharges a pollutant of concern via storm water to an impaired water body listed in accordance with Section 303 (d) (1) of the Federal Clean Water Act, 33 USC §1313 (d) (1) (C), and the implementing regulation of the U.S. Environmental Protection Agency (USEPA), 40 CFR §130.7 (c) (1). Impaired waters are those listed as not meeting applicable surface water quality standards. The results of the annual check shall be documented with the Annual Facility Site Compliance Inspection required under section 4.3.1 of this permit.

Note: The list of Wisconsin impaired surface water bodies may be obtained by contacting the Department or by searching for keyword "impaired waters" on the Department's Internet site. The Department updates the list approximately every two years. The updated list is effective upon approval by the USEPA. The current list may be found on the Department's Internet site at: http://dnr.wi.gov/topic/impairedwaters/

2.8.3 A permittee that discharges a pollutant of concern via storm water to an impaired water body shall, within 180 days of the annual check that determines the facility discharges to an impaired water body, include a written section in the storm water pollution prevention plan that specifically identifies source area pollution prevention controls and storm water best management practices that will collectively be used to reduce, with the goal of eliminating, the storm water discharge of pollutant(s) of concern that contribute to the impairment of the water body and explain why these controls and practices were chosen as opposed to other alternatives. Changes identified in the storm water pollution prevention plan shall be implemented with the 180-day timeframe.

Note: For a permittee that discharges a pollutant of concern via storm water to an impaired water body, amending the storm water pollution prevention plan will be required after the initial annual check and if subsequent annual checks indicate additional pollutants of concern have been added, additional water bodies have been designated as impaired, or other relevant changes to the designation have occurred.

2.8.4 The permittee may not establish a new storm water discharge of a pollutant of concern to an impaired water body or significantly increase an existing discharge of a pollutant of concern to an impaired water body unless the new or increased discharge does not contribute to the receiving water impairment, or the discharge is consistent with a State and Federal approved total maximum daily load (TMDL) allocation for the impaired water body.

2.8.4.1 "New storm water discharge" or "new discharge" has the meaning given in section 2.7.3.1 of this permit.

2.8.5 By February 15th each calendar year, the permittee shall perform an annual check to determine whether its facility discharges a pollutant of concern via storm water to a water body included in a State and Federal approved TMDL. If so, the permittee shall assess whether any TMDL wasteload allocation for the facility's discharge is being met through the existing pollution prevention controls and storm water best management practices or whether additional controls or treatment are necessary and feasible. The assessment of the feasibility of additional controls or treatment shall focus on the ability to improve pollution prevention and treatment system effectiveness and the adequacy of implementation and maintenance of the additional controls or treatment. The results of the annual check shall be documented with the Annual Facility Site Compliance Inspection required under section 4.3.1 of this permit.

Note: State and Federal approved TMDLs can be identified by contacting the Department, or by searching for keyword " TMDL" on the Department Internet site. The current State and Federal approved Final TMDLs may be found on the Department's Internet site at: http://dnr.wi.gov/topic/tmdls/

2.8.6 Within 180 days of the annual check that determines the facility discharges to a TMDL allocated water body, a permittee that is included in a State and Federal approved TMDL shall submit to the Department a proposed implementation plan for the storm water discharge that meets the requirements of the State and Federal approved TMDL wasteload allocation for the facility. The proposed TMDL implementation plan shall specify any feasible pollution prevention and treatment improvements that could be made and specify any revisions or redesigns that could be implemented to increase the effectiveness of the permittee's storm water pollution prevention controls and treatment practices. The TMDL implementation plan shall also specify a time schedule for implementation of the improvements, revisions or redesigns necessary to meet the wasteload allocation for the facility. If a specific wasteload allocation has not been assigned to the facility under a TMDL, compliance with this permit shall be deemed to be in compliance with the TMDL.

2.9 Fish and Aquatic Life Waters

2.9.1 The permittee shall determine whether it will have a storm water discharge to a fish and aquatic life water as defined in s. NR 102.13, Wis. Adm. Code.

Note: Most receiving waters of the state are classified as a fish and aquatic life waters and this classification includes all surface waters of the state except ORWs, ERWs, Great Lakes system waters and variance water identified within ss. NR 104.05 through 104.10, Wis. Adm. Code. The Department may be consulted if the permittee is not certain of the classification.

2.9.2 The permittee may not establish a new storm water discharge of pollutants to a fish and aquatic life water if the discharge will result in the significant lowering of water quality of the fish and aquatic life water. Significant lowering of water quality is defined within ch. NR 207, Wis. Adm. Code.

2.9.2.1 "New storm water discharge" or "new discharge" has the meaning given in section 2.7.3.1 of this permit.

2.9.3 If the permittee's facility has an existing storm water discharge to a fish and aquatic life water, it may not increase the discharge of pollutants if the increased discharge would result in a significant lowering of water quality.

2.9.4 Any increased or new discharge of storm water authorized under this permit shall be related to important economic or social development.

2.10 Toxic Pollutants In accordance with s. NR 102.12 Wis. Adm. Code, a new discharge and increased discharge as defined in ch. NR 207, Wis. Adm. Code, of persistent, bioaccumulating toxic substances to the Great Lakes waters or their tributaries shall be avoided or limited to the maximum extent practicable. Any new or increased discharge of these substances is prohibited unless the permittee certifies that the new or increased discharge is necessary after utilization of best technology in process or control using waste minimization, pollution prevention, municipal pretreatment programs, material substitution or other means of commercially available technologies which have demonstrated capability for similar applications.

2.11 Minimum Source Area Control Requirements All permittees shall comply with the following minimum source area control requirements. The Storm Water Pollution Prevention Plan required under section 3 shall identify how each source area control requirement will be met. Source area controls shall be utilized to prevent storm water from becoming contaminated at the facility. Structural source area controls that are either proposed or in place at the facility shall be indicated on the facility drainage base map described in section 3.3.2.2 of this permit. The permittee shall:

2.11.1 Minimize exposure of pollutants associated with the potential sources of storm water contamination identified in section 3.3.2.4 of this permit.

2.11.2 Use good house-keeping measures such as sweeping, appropriate storage, and proper management of waste materials and dumpsters/compactors.

2.11.3 Maintain both structural and non-structural control measures, institute preventive maintenance for vehicles and equipment, and perform routine visual inspections.

2.11.4 Minimize the potential for leaks, spills, and other releases that may contaminate storm water, and institute spill prevention and response measures, including spill reporting described in section 6.5 of this permit.

2.11.5 Stabilize areas of bare soil with vegetation or through permanent land cover to control soil erosion, or when that is not possible, implement best management practices to meet the requirements of section 3.3.2.8.2 of this permit.

2.11.6 Cover or enclose salt storage piles so that neither precipitation nor storm water runoff can come into contact with the stored salt; or, for permittees that use brine and have salt storage piles on impervious curbed surfaces, install a means of diverting contaminated storm water to a brine treatment system for process use.

2.11.7 Train and raise awareness of employees as appropriate on storm water pollution prevention, the requirements of this permit, and their specific responsibilities in implementing any of the requirements, practices, or activities of this permit or the Storm Water Pollution Prevention Plan.

2.11.8 Evaluate the facility for the presence of non-storm water discharges as specified in section 4.2. of this permit.

Note: This permit does not cover non-storm water discharges. See section 2.3.

2.11.9 Minimize dust and off-site tracking of soil, raw materials, intermediate products, final products, or waste materials.

2.11.10 If applicable, use a combination of storm water contact control or containment, drainage controls, or diversions to control SARA Title III Section 313 "Water Priority Chemicals" (42 USC s. 11023 (c)) potentially discharged through the action of storm water runoff, leaching, or wind.

2.12 Compliance with Runoff Management Performance Standards The owner or operator of a facility subject to the performance standards in s. NR 151.12 or ss. NR 151.121 to 151.128, Wis. Adm. Code, shall describe in the Storm Water Pollution Prevention Plan the best management practices necessary to maintain compliance with the applicable performance standards in s. NR 151.12 or ss. NR 151.121 to 151.128, Wis. Adm. Code, for those areas that are described in s. NR 151.12(2) or s. NR 151.121(2), Wis. Adm. Code, respectively. Best management practices installed to meet the performance standards in s. NR 151.12 or s. NR 151.121 to 151.128, Wis. Adm. Code, shall be maintained to meet the treatment capability as originally designed.

2.13 Post-Construction Performance Standards for Landfills For landfills, post-construction storm water best management practices constructed after the effective date of this permit shall be in compliance with the performance standards in ss. NR 151.122 and NR 151.123, Wis. Adm. Code.

Note: The infiltration performance standard in s. NR 151.124, Wis. Adm. Code, does not apply to landfills.

3. STORM WATER POLLUTION PREVENTION PLAN

3.1 Storm Water Pollution Prevention Plan Required In accordance with s. NR 216.27, Wis. Adm. Code, and section 3.3 of this permit, the owner or operator of a facility requiring coverage under this permit shall prepare a Storm Water Pollution Prevention Plan (SWPPP) prior to applying for permit coverage under s. NR 216.22, Wis. Adm. Code.

3.2 Incorporation by Reference When plans are developed or activities conducted in accordance with other federal, state or local regulatory programs that meet the requirements of section 3.3.2 of this permit, the plans may be incorporated by the permittee into the SWPPP by reference.

3.3 Purpose and Content of a Storm Water Pollution Plan

3.3.1 Purpose of the Plan Any SWPPP prepared to comply with this permit shall do all of the following:

3.3.1.1 Identify sources of storm water and non-storm water contamination to the storm water drainage system.

3.3.1.2 Identify and prescribe appropriate "source area control" type best management practices designed to prevent storm water contamination from occurring.

3.3.1.3 Identify and prescribe "storm water treatment" type best management practices to reduce pollutants in contaminated storm water prior to discharge.

3.3.1.4 Prescribe actions needed either to bring non-storm water discharges under an appropriate WPDES permit or to remove these discharges from the storm drainage system.

3.3.1.5 Prescribe an implementation schedule so as to ensure that the storm water management actions prescribed in the SWPPP are carried out in a timely manner and evaluated on a regular basis.

3.3.2 Required Plan Content The SWPPP shall contain, at a minimum, the following items and provisions:

3.3.2.1 Pollution Prevention Individual The SWPPP shall identify by job title the specific individual who has primary responsibility for all aspects of SWPPP development and implementation and identify any other individuals concerned with SWPPP development or implementation, and their respective roles. The specific individual who has primary responsibility shall develop, evaluate, maintain and revise the SWPPP, and carry out the specific management actions identified in the SWPPP, including maintenance practices, monitoring activities, preparing and submitting reports, recordkeeping, and serving as facility contact for the Department.

3.3.2.2 Facility Site Description and Drainage Base Map The SWPPP shall contain a short summary of the major activities conducted at various locations throughout the facility. The SWPPP shall also include a facility drainage base map depicting all of the following:

3.3.2.2.1 How storm water drains on, through and from the facility to groundwater, surface water, or wetlands.

3.3.2.2.2 The facility property boundaries.

3.3.2.2.3 The storm drainage collection and disposal system including all surface and subsurface conveyances.

3.3.2.2.4 Any secondary containment structures.

3.3.2.2.5 The location of all outfalls that discharge channelized flow to groundwater, surface water or wetlands, including outfalls recognized as permitted outfalls under another WPDES permit, numbered for reference.

3.3.2.2.6 The drainage area boundary for each outfall.

3.3.2.2.7 The surface area in acres draining to each outfall, including the percentage that is impervious such as paved, roofed or highly compacted soil, and the percentage that is pervious such as grassy areas and woods.

3.3.2.2.8 Existing structural storm water controls.

3.3.2.2.9 The name and location of receiving waters.

3.3.2.2.10 The location of activities and materials that have the potential to contaminate storm water.

3.3.2.3 Summary of Existing Sampling Data or Observations The SWPPP shall summarize any results of available storm water sampling data or other observations that characterize the quality of storm water discharges or identifying sources of storm water contamination. Available data that characterizes the quality of storm water discharges under dry weather flow conditions shall also be included, except when such data has been or will be reported to the Department under another WPDES permit.

3.3.2.4 Potential Sources of Storm Water Contamination The SWPPP shall identify any significant pollutants or activities associated with the storm water pollution source areas identified in this permit. When possible, specific pollutants likely to be present in storm water as a result of contact with specific materials shall also be listed. The SWPPP shall identify all potential source areas of storm water contamination, including but not limited to:

3.3.2.4.1 Outdoor manufacturing areas.

3.3.2.4.2 Rooftops contaminated by industrial activity, exhaust vents, or a pollution control device.

3.3.2.4.3 Industrial plant yards.

3.3.2.4.4 Storage and maintenance areas for material handling equipment.

3.3.2.4.5 Immediate access roads and rail lines owned or operated by the permittee.

3.3.2.4.6 Material handling sites including storage, loading, unloading, transportation, or conveyance of any raw material, finished product, intermediate product and by−product or waste areas.

3.3.2.4.7 Storage areas (including tank farms) for raw materials, finished and intermediate products.

3.3.2.4.8 Disposal or application of wastewater.

3.3.2.4.9 Areas containing residual pollutants from past industrial activity.

3.3.2.4.10 Areas of significant soil erosion, including areas of bare soil.

3.3.2.4.11 Refuse sites.

3.3.2.4.12 Vehicle maintenance and cleaning areas.

3.3.2.4.13 Washing areas for equipment, vehicles, containers, or other items.

3.3.2.4.14 Shipping and receiving areas.

3.3.2.4.15 Manufacturing buildings.

3.3.2.4.16 Residual treatment, storage, and disposal sites.

3.3.2.4.17 Any other areas capable of contaminating storm water runoff.

3.3.2.5 Status of Non-Storm Water Discharges to the Storm Sewer The SWPPP shall identify all known contaminated and uncontaminated sources of non-storm water discharges to the storm sewer system or waters of the state and indicate which are covered by WPDES permits. The SWPPP shall contain the results of the non-storm water discharge monitoring required by s. NR 216.28, Wis. Adm. Code. If monitoring is not feasible due to the lack of suitable access to an appropriate monitoring location, the SWPPP shall include a statement that the monitoring could not be conducted and an explanation of the reasons why.

3.3.2.6 Source Area Control Best Management Practices The SWPPP shall rely, to the maximum extent practicable, on the use of source area control best management practices designed to prevent storm water from becoming contaminated at the facility. Source area control best management practices that are either proposed or in place at the facility shall be indicated on the facility drainage base map described in section 3.3.2.2 of this permit. The SWPPP shall provide for the use of the following source area control best management practices:

3.3.2.6.1 Activities to stabilize areas of bare soil with vegetation or through permanent land cover to control soil erosion.

3.3.2.6.2 Good house-keeping measures, preventive maintenance measures, visual inspections, spill prevention and response measures, and employee training and awareness.

3.3.2.6.3 Covering or enclosing salt storage piles so that neither precipitation nor storm water runoff can come into contact with the stored salt; or, for permittees that use brine and have salt storage piles on impervious curbed surfaces, a means of diverting contaminated storm water to a brine treatment system for process use.

3.3.2.6.4 Use of a combination of storm water contact control or containment, drainage controls, or diversions to control SARA Title III Section 313 "Water Priority Chemicals" (42 USC s. 11023 (c)) potentially discharged through the action of storm water runoff, leaching, or wind.

3.3.2.7 Residual Pollutants The SWPPP shall identify pollutants that are likely to contaminate storm water discharges to waters of the state following implementation of source area control best management practices. Past sampling data collected at the facility or at sufficiently similar outfalls at other facilities may be used in making this determination. At a minimum, the following pollutants shall be considered for their potential to contaminate storm water:

3.3.2.7.1 Any pollutant for which an effluent limitation is contained in any discharge permit issued to the permittee, for this facility, by the Department.

3.3.2.7.2 Any pollutant contained in a categorical effluent limitation or pre-treatment standard to which the facility is subject.

3.3.2.7.3 Any SARA Title III Section 313 "Water Priority Chemical" (42 USC s. 11023 (c)) for which the permittee, for this facility, has reporting requirements and which has the potential for contaminating storm water.

3.3.2.7.4 Any other toxic or hazardous pollutants from present or past activity at the site that remain in contact with precipitation or storm water and which could be discharged to the waters of the state, and which are not regulated by another environmental program.

3.3.2.7.5 Any of the following parameters which might be present in significant concentrations: Oil and grease, pH, total suspended solids, 5-day biological oxygen demand, and chemical oxygen demand.

3.3.2.8 Storm Water Treatment Best Management Practices When source area control best management practices are not practicable or are inadequate to control storm water pollution, or when the Department determines source area control best management practices are inadequate to achieve a water quality standard, the SWPPP shall prescribe appropriate storm water treatment practices as needed to reduce the pollutants in contaminated storm water prior to discharge to waters of the state. Proposed or existing storm water treatment practices shall be shown on the facility drainage basin map described in section 3.3.2.2 of this permit. The SWPPP shall provide for the following types of storm water treatment practices:

3.3.2.8.1 Storm water significantly contaminated with petroleum products shall be treated for oil and grease removal by an adequately sized, designed, and functioning wastewater treatment device. Coverage under a separate individual or general permit is required for discharges of storm water from oil/water treatment devices. Under s. 281.41, Wis. Stats., prior Department approval of plans for oil and grease removal devices may be required.

3.3.2.8.2 Storm water discharges contaminated by sediment eroding from areas of bare soil that cannot be stabilized by pavement, gravel, vegetation, or other permanent land cover shall be treated by best management practices designed, installed and maintained to achieve compliance with the construction site performance standards in s. NR 151.11(6m), Wis. Adm. Code, and in accordance with the Department's Construction Site Erosion and Sediment Control Technical Standards.

Note: The Construction Site Erosion and Sediment Control Technical Standards are available at the following Department website:
http://dnr.wi.gov/topic/stormwater/standards/const_standards.html

3.3.2.9 Facility Monitoring The SWPPP shall include provisions for complying with the monitoring requirements specified in s. NR 216.28, Wis. Adm. Code, and section 4 of this permit. The SWPPP shall include a checklist of inspections to be made during the annual facility site inspection required by s. NR 216.28(2), Wis. Adm. Code. The SWPPP shall also identify for each outfall the type of monitoring that will be conducted, such as non-storm discharge monitoring and storm water discharge quality inspections.

3.3.2.10 SWPPP Implementation Schedule The SWPPP shall include an implementation schedule for the requirements of this permit that meet the compliance timeframes set forth in this permit.

3.3.2.11 Certification and Signature The SWPPP and SWPPP summary shall be signed in accordance with s. NR 216.22(7), Wis. Adm. Code, and contain the following statement:

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations. "

3.4 Amending a SWPPP Unless an alternative timeframe is specified by the Department, the permittee shall amend the SWPPP within 30 days of the occurrence of any of the following circumstances:

3.4.1 When expansion, production increases, process modifications, changes in material handling or storage, or other activities are planned which will result in significant increases in the exposure of pollutants to storm water discharged either to waters of the state or to storm water treatment devices. The amendment shall contain a description of the new activities that contribute to the increased pollutant loading, planned source control activities that will be used to control pollutant loads, an estimate of the new or increased discharge of pollutants following treatment, and when appropriate, a description of the effect of the new or increased discharge on existing storm water treatment facilities.

3.4.2 The comprehensive annual facility site compliance inspection, quarterly visual inspection of storm water quality, or other information reveals that the provisions of the SWPPP are ineffective in controlling storm water pollutants discharged to waters of the state.

3.4.3 Upon written notice that the Department finds the SWPPP to be ineffective in achieving the conditions of this permit.

3.5 Storm Water Discharges to Outstanding and Exceptional Resource Waters If the permittee's industrial storm water will discharge to an outstanding resource water or exceptional resource water, the permittee shall include a written section in the SWPPP that discusses and identifies the management practices and control measures the permittee will implement to prevent the discharge of any pollutant(s) in excess of the background level within the water body. This section of the permittee's plan shall specifically identify control measures and practices that will collectively be used to prevent the discharge of pollutants in excess of the background level within the water body.

4. MONITORING REQUIREMENTS

4.1 Purpose Monitoring includes site inspections and non-storm water discharge assessments. The purpose of monitoring is to evaluate storm water outfalls for the presence of non-storm water discharges, and to evaluate the effectiveness of the permittee's pollution prevention activities in controlling contamination of storm water discharges.

4.2 Evaluation of Non-Storm Water Discharges

4.2.1 The permittee shall evaluate all storm water outfalls for non-storm water contributions to the storm drainage system for the duration of this permit. Any monitoring shall be representative of non-storm water discharges from the facility. Evaluations shall take place during dry periods, and may include either end of pipe screening or detailed testing of the storm sewer collection system. Either of the following monitoring procedures is acceptable:

4.2.1.1 A detailed testing of the storm sewer collection system may be performed. Acceptable testing methods include dye testing, smoke testing, or video camera observation. The Department may require a re-test after 5 years or a lesser period as deemed necessary by the Department.

4.2.1.2 End of pipe screening shall consist of visual observations made at least twice per year at each outfall of the storm sewer collection system. Instances of dry weather flow, stains, sludge, color, odor, or other indications of a non-storm water discharge shall be recorded.

4.2.2 In addition to maintaining results on-site at the facility, results of the non-storm water evaluations shall be included in the SWPPP summary required in section 5.1 of this permit and the Annual Facility Site Compliance Inspection report required in section 5.2 of this permit. Information reported shall include the date of testing, test method, outfall location, testing results, and potential significant sources of non-storm water discovered through testing. Upon discovering non-storm water flows that are not covered under another WPDES permit, the permittee shall either immediately seek coverage under another permit from the Department or eliminate the non-storm water flow.

4.2.3 Any permittee unable to evaluate an outfall for non-storm water discharges shall sign a statement certifying that this requirement could not be complied with, and include a copy of the statement in the SWPPP and the Annual Facility Site Compliance Inspection report. The statement shall be submitted to the Department within 30 days after the permittee determines that it is unable to evaluate an outfall.

4.3 Evaluation of Storm Water Discharges The permittee shall evaluate storm water outfalls for storm water contributions to the storm drainage system. Any monitoring shall be representative of storm water discharges from the facility.

4.3.1 Annual Facility Site Compliance Inspection Permittees shall perform and document the results of an Annual Facility Site Compliance Inspection (AFSCI). The AFSCI shall be adequate to verify that the site drainage conditions and potential pollution sources identified in the SWPPP remain accurate, and that the best management practices prescribed in the SWPPP are being implemented, properly operated and adequately maintained. Information reported shall include the inspection date, inspection personnel, scope of the inspection, major observations, and revisions needed in the SWPPP.

4.3.2 Quarterly Visual Monitoring Permittees shall perform and document quarterly visual inspections of storm water discharge quality at each storm water discharge outfall. Inspections shall be conducted within the first 30 minutes of discharge or as soon thereafter as practical, but not exceeding 60 minutes. The inspections shall include any observations of color, odor, turbidity, floating solids, foam, oil sheen, or other obvious indicators of storm water pollution. Information reported shall include the inspection date, inspection personnel, visual quality of the storm water discharge, and probable sources of any observed storm water contamination.

4.3.3 Monitoring Waivers The Department may waive specific monitoring requirements for the following reasons:

4.3.3.1 The permittee indicates that either an employee could not reasonably be present at the facility at the time of the snowmelt or runoff event, or that attempts to meet the monitoring requirement would endanger employee safety or well-being.

4.3.3.2 The permittee indicates that there were no snow melt or runoff events large enough to conduct a quarterly visual inspection at an outfall. A waiver is automatically granted for a quarter where the permittee sufficiently documents and retains records demonstrating that there were no snow melt or runoff events large enough to conduct a quarterly visual inspection at the facility during that quarter. Documentation and records used to qualify for an automatic waiver shall be submitted to the Department upon request.

4.3.3.3 The facility is inactive or remote facility (such as an inactive mining operation) where the permittee demonstrates that monitoring and inspection activities are impractical or unnecessary. At a minimum, the Department shall establish an alternative requirement that the permittee make site inspections by a qualified individual at least once in every 3-year period.

4.3.3.4 The permittee demonstrates to the Department's satisfaction that the sources of storm water contamination are outside of the permittee's property boundary and are not associated with the permittee's activities. The demonstration shall be presented in the SWPPP or AFSCI report and submitted to the Department for evaluation.

5. COMPLIANCE AND REPORTING REQUIREMENTS

5.1 SWPPP Compliance and Reporting Requirements

5.1.1 An owner or operator of a facility requiring coverage under this permit shall prepare a Storm Water Pollution Prevention Plan (SWPPP) prior to applying for permit coverage under s. NR 216.22, Wis. Adm. Code, and shall submit a SWPPP summary to the Department when applying for coverage under this permit For existing facilities that previously operated without required permit coverage and without a SWPPP as required, the owner or operator shall immediately develop a SWPPP and submit a SWPPP summary to the Department, and implement the SWPPP to achieve compliance with this permit in the shortest practicable time.

5.1.2 The SWPPP shall conform to the requirements specified in s. NR 216.27 (3), Wis. Adm. Code, and section 3.3 of this permit.

5.1.3 The SWPPP shall be kept at the facility and made available to the Department for inspection and copying upon request. If storm water discharges from the facility enter a municipal separate storm sewer system covered under a storm water permit pursuant to Subchapter I of ch. NR 216, Wis. Adm. Code, the SWPPP shall be made available to the owner or operator of the municipal separate storm sewer system for inspection and copying upon request.

5.1.4 The SWPPP summary shall be submitted to the Department on a form available from the Department.

Note: The SWPPP summary form is available for download from the Department's Internet website at: http://dnr.wi.gov/topic/stormwater/industrial/forms.html. If you are unable to access this form over the Internet, please contact the Department at (608) 267-7694 for assistance.

5.1.5 If the SWPPP summary is inadequate or incomplete, the Department shall notify the permittee, and may request a review of the entire SWPPP.

5.1.6 Unless an alternate implementation schedule is specified by the Department, the SWPPP shall be implemented in accordance with the implementation schedule developed under section 3.3.2.10 of this permit.

5.1.7 The permittee shall keep the SWPPP current and amend it as necessary to correct deficiencies in the original SWPPP. The permittee shall amend the SWPPP and notify the Department in the event of any facility operational changes that could result in additional significant storm water contamination.

5.2 Monitoring Compliance and Reporting Requirements

5.2.1 The permittee shall conduct the first Annual Facility Site Compliance Inspection (AFSCI) within 12 months of the **Start Date** of coverage under this general permit. Subsequent AFSCIs shall be conducted and AFSCI reports prepared by the permittee by the anniversary of the **Start Date** for each year of coverage under this permit. Reports shall be written on forms available from the Department and shall contain information from the AFSCI, the quarterly visual inspection, and the non-storm water evaluation. Copies of all of AFSCI reports, quarterly visual inspections and non-storm water monitoring reports shall be maintained on site at the facility and made available to the Department for inspection and copying upon request for the duration of permit coverage.

Note: The AFSCI Report form and the Quarterly Visual Inspection form are available for download from the Department's Internet website at: http://dnr.wi.gov/topic/stormwater/industrial/forms.html. If you are unable to access this form over the Internet, please contact the Department at (608) 267-7694 for assistance.

5.2.2 Quarterly visual inspections of storm water discharge quality shall be conducted by the permittee four times annually by the anniversary date of **Start Date** of coverage under the permit.

5.3 Discharges to Regulated Municipal Separate Storm Sewer Systems

5.3.1 Permittees regulated under this permit with storm water discharges and non-storm water discharges entering a municipal separate storm sewer system covered under a storm water permit pursuant to Subchapter I of ch. NR 216, Wis. Adm. Code, shall provide information on these discharges to the owner or operator of the municipal separate storm sewer system upon request. Information the permittee shall provide includes the area or sub-areas of the facility draining to the municipal separate storm sewer system, the nature of industrial activity and potential storm water contamination sources in the areas draining to the system, the nature and number of non-storm water discharges to the system, storm water best management practices employed at the facility and their effectiveness at pollutant removal, storm water monitoring data, and copies of the SWPPP and AFSCI reports.

5.3.2 Upon discovering a previously unknown non-storm water discharge to the municipal separate storm sewer system that is not authorized to discharge under a required WPDES permit or that is an illicit discharge as defined by s. NR 216.002(11), Wis. Adm. Code, the permittee shall immediately report the discharge to the owner or operator of the municipal separate storm sewer system.

5.3.3 The permittee shall immediately report spills or dumping of materials that enter the municipal separate storm sewer system to the owner or operator of the system.

5.3.4 In accordance with the owner or operator's established authority to control discharges to its municipal separate storm sewer system, the permittee shall assist the owner or operator of the system with detecting and eliminating illicit discharges to the system to the maximum extent practicable if the owner or operator finds that the source of an illicit discharge may originate from the permittee's facility.

6. GENERAL CONDITIONS The general conditions in s. NR 205.07(1), (3), and (5), Wis. Adm. Code, are hereby incorporated by reference into this permit, except for s. NR 205.07(1)(n) and(3)(b), Wis. Adm. Code. Under s. NR 205.08(9), Wis. Adm. Code, dischargers covered under a storm water general permit are not required to submit an application for reissuance unless directed to do so by the Department under s. NR 216.22(9), Wis. Adm. Code. The requirements for spill reporting are in section 6.5 below.

Note: Chapter NR 205 is available at the following website:
http://docs.legis.wisconsin.gov/code/admin_code/nr/200

6.1 Work near Surface Waters and Wetlands Activities performed in wetland areas, in floodplains, or near shorelands may require permits or approvals through applicable state law, state regulations, or county or local ordinances. Additionally, state permits and/or contracts required by chs. 30, 31 and 87, Wis. Stats. and s. 281.36, Wis. Stats. (or Wisconsin Administrative Code promulgated under these laws), and federal permits may be applicable.

6.2 Continuation of the Expired General Permit As provided in s. NR 205.08(9), Wis. Adm. Code, and s. 227.51, Wis. Stat., the terms and conditions of this general permit shall continue to apply until this general permit is reissued or revoked or until an individual permit is issued for the discharge to which the general permit applied.

6.3 Liabilities under Other Laws Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties to which the permittee is or may be subject under Section 311 of the federal Clean Water Act (33 USC s. 1321), any applicable federal, state, or local law or regulation under authority preserved by Section 510 of the Clean Water Act (33 USC s. 1370).

6.4 Severability The provisions of this permit are severable, and if any provisions of this permit or the application of any provision of this permit to any circumstance is held invalid the remainder of this permit shall not be affected thereby.

6.5 Spill Reporting The permittee shall notify the Department immediately of any release or spill of a hazardous substance to the environment in accordance with s. 292.11, Wis. Stats., and ch. NR 706, Wis. Adm. Code.

Note: The 24-hour toll free spills hotline number is (800) 943-0003. Information about hazardous substance spills is available from the Department's website at: http://dnr.wi.gov/topic/Spills/

6.6 Submitting Records Unless otherwise specified, any reports submitted to the Department of Natural Resources in accordance with this permit shall be submitted to the appropriate Department regional storm water contact or to Department of Natural Resources, Storm Water Program – WT/3, Box 7921, Madison, WI 53707-7921.

6.7 Enforcement Any violation of s. 283.33, Wis. Stats., ch. NR 216, Wis. Adm. Code, or this permit is enforceable under s. 283.89, Wis. Stats.

6.8 Permit Fee A storm water discharge permit fee shall be paid annually for each industrial facility covered under this permit. The permittee will be billed by the Department annually in May of each year and the fee is due by June 30 of each year in accordance with s. NR 216.30, Wis. Adm. Code. A permittee may be referred to the Wisconsin Department of Revenue for the collection of any unpaid storm water fee.

State of Wisconsin
DEPARTMENT OF NATURAL RESOURCES
101 South Webster Street
P.O. Box 7921
Madison, WI 53707-7921

Scott Walker, Governor
Cathy Stepp, Secretary
Telephone (608) 266-2621
FAX (608) 267-3579
TDD (608) 267-6897

WISCONSIN
DEPT. OF NATURAL RESOURCES

Eric McCartney
Site Vice President
NextEra Energy Point Beach LLC
6610 Nuclear Road
Two Rivers, WI 54241

SUBJECT: WPDES Permit Reissuance No. WI-0000957-08-0
NextEra Energy Point Beach LLC, 6610 NUCLEAR ROAD

Dear Permittee:

Your Wisconsin Pollutant Discharge Elimination System (WPDES) Permit is enclosed. The conditions of the enclosed permit reissuance were determined using the permit application, information from your WPDES permit file, other information available to the Wisconsin Department of Natural Resources (hereafter Department) and applicable Wisconsin Administrative Codes. All discharges from this facility and actions or reports relating thereto shall be in accordance with the terms and conditions of the enclosed permit.

This enclosed permit requires you to submit monitoring results to the Department on a periodic basis. Monitoring forms, which must be submitted electronically, are available on the Department's web page. Go to the DNR Switchboard page at http://dnr.wi.gov/topic/switchboard/ to log in and access your monitoring forms. For your convenience, there is a 'Summary of Reports Due' at the end of the enclosed permit that shows a synopsis of the required reports and monitoring forms.

The Department has the authority under chs. 160 and 283, Wis. Stats., to establish effluent limitations, monitoring requirements, and other permit conditions for discharges to groundwater and surface waters of the State. The Department also has the authority to issue, reissue, modify, terminate, or revoke and reissue WPDES permits under ch. 283, Wis. Stats.

The enclosed permit contains water quality-based effluent limitations that are necessary to ensure the water quality standards for Lake Michigan are met. You may apply for a variance from the water quality standard used to derive the limitations pursuant to s. 283.15, Stats., by submitting an application to the Director of the Bureau of Water Quality, P.O. Box 7921, Madison, Wisconsin 53707 within 60 days of the date the permit was issued (see "Date Permit Signed/Issued" after the signature on the front page of the enclosed permit). This statute also allows the permittee to apply for a variance to the water quality standard when applying for reissuance of the permit. Subchapter III of ch. NR 200, Wis. Adm. Code, specifies the procedures that must be followed and the information that must be included when submitting an application for a variance.

To challenge the reasonableness of or necessity for any term or condition of the enclosed permit, s. 283.63, Stats., and ch. NR 203, Wis. Adm. Code, require that you file a verified petition for review with the Secretary of the Department of Natural Resources within 60 days of the date the permit was issued (see "Date Permit Signed/Issued" after the signature on the front page of the enclosed permit). For permit-related decisions that are not reviewable pursuant to s. 283.63, Stats., it may be possible for permittees or other persons to obtain an administrative review pursuant to s. 227.42, Stats., and s. NR 2.05(5), Wis. Adm. Code, or a judicial review pursuant to s. 227.52, Stats. If you choose to pursue one of these options, you should know that Wisconsin Statutes and Administrative Code establish time periods within which requests to review Department decisions must be filed.

Sincerely,

Sharon L. Gayan

Sharon L. Gayan, MPA

Water Quality Bureau – Director

Dated: June 30, 2016

cc: Legal Permit File
Cyndi Barr, WT/3
U.S. Fish and Wildlife Service (Electronic Copy via Email)
David Gerdman
EPA – Region 5 (Electronic Copy via Email)

WISCONSIN
DEPT. OF NATURAL RESOURCES

WPDES PERMIT

STATE OF WISCONSIN
DEPARTMENT OF NATURAL RESOURCES

PERMIT TO DISCHARGE UNDER THE WISCONSIN POLLUTANT DISCHARGE ELIMINATION SYSTEM

NextEra Energy Point Beach LLC

is permitted, under the authority of Chapter 283, Wisconsin Statutes, to discharge from a facility located at
6610 NUCLEAR ROAD
TWO RIVERS, WISCONSIN 54241-9516
to
Lake Michigan

in accordance with the effluent limitations, monitoring requirements and other conditions set forth in this permit.

The permittee shall not discharge after the date of expiration. If the permittee wishes to continue to discharge after this expiration date an application shall be filed for reissuance of this permit, according to Chapter NR 200, Wis. Adm. Code, at least 180 days prior to the expiration date given below.

State of Wisconsin Department of Natural Resources
For the Secretary

By Sharon L. Gayan
Sharon L. Gayan, MPA
Water Quality Bureau – Director
June 30, 2016
Date Permit Signed/Issued

PERMIT TERM: EFFECTIVE DATE - July 01, 2016 **EXPIRATION DATE - June 30, 2021**

TABLE OF CONTENTS

1 Cooling Water Intake Requirements

1.1 Sampling Point(s)

Sampling Point Designation	
Sampling Point Number	Sampling Point Location, WasteType/Sample Contents and Treatment Description (as applicable)
701	Lake Michigan water intake structure for unit 1 and unit 2 condenser cooling water.

1.2 Cooling Water Intake Description

The permittee shall at all times properly operate and maintain all water intake facilities. The permittee shall give advance notice to the Department of any planned changes in the location, design, operation, or capacity of the intake structure. The permittee is authorized to use the cooling water intake system which consists of the following:

- The current configuration of the CWIS includes a crib with an acoustic deterrent system (ADS) located 1,750 ft offshore in approximately 22 ft of water.
- The offshore crib consists of two annular rings of 12 inch steel "H" piles driven into the lake bed, with an outside diameter of 110 ft and an inside chamber diameter of 60 ft. The annulus is filled with 3- to 12- ton limestone blocks. Water is drawn into the chamber through the plastic mesh grating located on the top of the crib, as well as through the interstitial spaces between the limestone blocks and through 27, 30-inch diameter, corrugated, galvanized steel pipes that penetrate the blocks in a ring 5 ft above the lakebed. Also, the crib is equipped with three 6.5-ft square concrete pipes near the lake bottom in the south half of the crib.
- The steel pipes are covered with $1^{3}/_{16}$-inch by 2-inch galvanized bar grating to prevent debris and large fish from entering the intake system.
- The concrete pipes are covered with a 1/4-square-inch grating that is hinged for lowering in the winter months (usually December 1 to March 1) to prevent the formation of frazil ice on the grate and the subsequent restriction of water flow.
- A high frequency ADS surrounds the crib in order to reduce alewife impingement. The acoustic array consists of 16 Integrated Projector Assemblies ("IPAs") uniformly spaced around the outer circumference of the Crib. The deterrent signal consists of high frequency broad band (122 – 128 kHz) pulses, 0.5 second in duration, at 1-second intervals.
- There is no emergency intake.

1.3 Water Intake BTA Determination

The cooling water intake, as described above in Subsection 1.2, represents interim BTA for minimizing adverse environmental impact in accordance with the requirements in s. 283.31(6), Wis. Stats., and section 316 (b) of the Clean Water Act.

Note: This is an interim BTA determination based on the Department's February 2, 2009 guidance for evaluating cooling water intake structures using best professional judgment. Because the current permit expired before the October 14, 2014 effective date of the new federal regulations for existing facilities, those requirements are not applicable until the next permit reissuance. Nevertheless, for informational purposes this permit includes references to the new federal regulations in 40 CFR Parts 122 and 125, and some of the requirements are included at the Department's discretion to begin implementation of the new rule in this permit.

1.4 Future BTA

BTA determinations for entrainment and impingement mortality at cooling water intake structures will be made in each permit reissuance, in accordance with 40 CFR 125.90-98. In subsequent permit reissuance applications, the permittee shall provide all the information required in 40 CFR 122.21(r). Exemptions from some application requirements are possible in accordance with 40 CFR 125.95(c) and 125.98(g), where information already submitted is sufficient. If desired, a request for reduced application material requirements must be submitted at least 2 years and 6 months prior to permit expiration. Past submittals and previously conducted studies may satisfy some or all of the application material requirements.

Note: The Department is in the process of promulgating ch. NR 111, Wis. Adm. Code, on cooling water intake structures. The objective of ch. NR 111, Wis. Adm. Code, is to incorporate federal requirements for cooling water intake structures into the state's administrative code. If ch. NR 111, Wis. Adm. Code, is promulgated prior to the expiration of this permit, the permittee may be subject to ch. NR 111, Wis. Adm. Code, application requirements for the next permit reissuance.

1.5 Monitoring

1.5.1 Biological Monitoring

This permit does not specify any studies needed as follow-up for the cooling water intake evaluation, or for the next permit reissuance application.

1.5.2 Compliance Monitoring Requirements

1.5.2.1 Impingement Mortality

The permittee shall monitor the deployment of the ADS once per week during periods of use when the cooling water intake is in operation.

1.5.2.2 Entrainment Mortality

This permit does not specify any monitoring.

1.5.2.3 Visual or Remote inspections

The permittee shall conduct a weekly visual inspection or employ a remote monitoring device during periods when the cooling water intake is in operation. The inspection frequency shall be weekly to ensure the intake is maintained and operated to function as designed.

1.5.3 Reporting Requirements

1.5.3.1 Annual Certification Statement and Report

Submit an annual certification statement signed by the authorized representative with information on the following:

(a) Water intake structure technologies are being maintained and operated as set forth in this permit, or a justification to allow a modification of the practices. Include a summary of the inspections required under paragraph 1.5.2.3.

(b) If there are substantial modifications to the operation of any unit that impacts the cooling water withdrawals or operation of the water intake structure, provide a summary of those changes.

(c) If the information contained in the previous year's annual certification is still applicable, the certification may simply state as such.

1.6 Intake Screen Discharges and Removed Substances

Floating debris and accumulated trash collected on the cooling water intake trash rack shall be removed and disposed of in a manner to prevent any pollutant from the material from entering the waters of the State pursuant to s. NR 205.07 (3) (a), Wis. Adm. Code. The permittee may discharge backwash from the traveling water screens and discharge to the discharge canal. The fish and debris are returned to the Lake via a 24-inch pipe to the Unit 2 discharge flume, 80 ft away. These backwashes may contain fine materials that originated from the intake water source (sand, silt, small vegetation or aquatic life).

1.7 Endangered Species Act

Nothing in this permit authorizes take for the purpose of a facility's compliance with the Endangered Species Act. Refer to 40 CFR 125.98 (b) (1) and (2).

2 In-Plant Requirements

2.1 Sampling Point(s)

Sampling Point Designation	
Sampling Point Number	**Sampling Point Location, WasteType/Sample Contents and Treatment Description (as applicable)**
101	Demineralizer regeneration neutralization tank discharge.
102	Unit 1 steam generator blowdown.
103	Unit 2 steam generator blowdown.
104	Sewage treatment plant effluent prior to combining with the low volume wastewater effluent and condenser cooling water discharge.
105	Low volume wastewater (wastewater effluent) consisting of the combined discharge of sanitary wastewater effluent, turbine hall sumps and floor drains, facade sumps, water treatment plant backwash, heating steam condensate, and potable water treatment system filter backwash and reverse osmosis reject wastewater.
106	Plant process water reverse osmosis reject wastewater.
107	Microfiltration unit backwash from the power plant's make-up water treatment system. This is a direct discharge to Outfall 002 if the TSS limits can be met. If the in-line turbidimeter indicates elevated TSS that would exceed limits, the backwash is routed to the vacuum fabric filters for treatment and is discharged from Sampling Point 105.

2.2 Monitoring Requirements and Limitations

The permittee shall comply with the following monitoring requirements and limitations.

2.2.1 Sampling Point 101 - Demineralizer Regeneration; 102- Blowdown Unit 1; 103- Blowdown Unit 2; 106- Plant Process Water RO Reject, and 107- Microfiltration Unit Backwash

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Monthly	Total Daily	
Suspended Solids, Total	Daily Max	100 mg/L	Monthly	Grab	
Suspended Solids, Total	Monthly Avg	30 mg/L	Monthly	Grab	
Oil & Grease (Hexane)	Daily Max	20 mg/L	Annual	Grab	
Oil & Grease (Hexane)	Monthly Avg	15 mg/L	Annual	Grab	

2.2.2 Sampling Point 104 - STP Effluent

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Weekly	Total Daily	
BOD_5, Total	Monthly Avg	30 mg/L	Weekly	24-Hr Comp	
BOD_5, Total	Weekly Avg	45 mg/L	Weekly	24-Hr Comp	
Suspended Solids, Total	Monthly Avg	30 mg/L	Weekly	24-Hr Comp	
Suspended Solids, Total	Weekly Avg	45 mg/L	Weekly	24-Hr Comp	
pH Field		su	Weekly	Grab	

2.2.3 Sampling Point 105 - Low Volume Wastewater Effluent

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Weekly	Total Daily	
Suspended Solids, Total	Daily Max	100 mg/L	Weekly	24-Hr Comp	
Suspended Solids, Total	Monthly Avg	30 mg/L	Weekly	24-Hr Comp	
Oil & Grease (Hexane)	Daily Max	20 mg/L	Monthly	Grab	
Oil & Grease (Hexane)	Monthly Avg	15 mg/L	Monthly	Grab	
pH Field		su	Weekly	Grab	

3 Surface Water Requirements

3.1 Sampling Point(s)

The discharge(s) shall be limited to the waste type(s) designated for the listed sampling point(s).

Sampling Point Designation	
Sampling Point Number	**Sampling Point Location, WasteType/Sample Contents and Treatment Description (as applicable)**
001	Unit 1 condenser cooling water discharge to Lake Michigan.
002	Unit 2 condenser cooling water discharge to Lake Michigan.
004	Deicing line for the water intake crib in Lake Michigan. The discharge consists of reversing the flow of one of the water intake pipes to return warm water to the water intake crib.
601	Lake Michigan water intake monitoring for background water quality data.

3.2 Monitoring Requirements and Effluent Limitations

The permittee shall comply with the following monitoring requirements and limitations.

3.2.1 Sampling Point (Outfall) 001 - Condenser Cooling Water; 002- Condenser Cooling Water

Monitoring Requirements and Effluent Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Daily	Total Daily	
Temperature Maximum		deg F	Daily	Continuous	
pH Field	Daily Max	9.0 su	Weekly	Grab	
pH Field	Daily Min	6.0 su	Weekly	Grab	
Temperature Average		deg F	Daily	Calculated	
Halogen, Total Residual as Cl2	Daily Max	38 µg/L	Daily	Grab	See Halogens footnote below
Acute WET		TU_a	See Listed Qtr(s)	24-Hr Flow Prop Comp	See WET Testing footnote below
Chronic WET		rTU_c	See Listed Qtr(s)	24-Hr Flow Prop Comp	See WET Testing footnote below
Additive - Water Treatment - Specify	Daily Max	0.071 mg/L	Daily	Grab	See EVAC footnote below
Phosphorus, Total		mg/L	Monthly	Grab	See schedule for additive review
Heat	Weekly Avg	8,273 MBTU/hr	Daily	Calculated	See heat load calculation footnote below

3.2.1.1 Halogens Reporting – As Total Residual Chlorine

One grab sample for total residual chlorine (actually total residual halogens of both chlorine and bromine) shall be collected during the period when the chlorine discharge of each chlorination event is the greatest. The discharge monitoring reported value shall be the maximum of the chlorination events for that day. A continuous monitor may be used to determine the greatest value and length of chlorine discharge as long as it duplicates the accuracy of a NR 219 approved method. The permittee shall use EPA test method 330.2, or 330.5, or other equivalent test method with a suitable level of detection. Monitoring is only required on days when chlorine is added to the cooling water (typically daily). Refer to Standard Requirement 5.3.6 for determining compliance with the effluent limit.

3.2.1.2 Whole Effluent Toxicity (WET) Testing

Primary Control Water: Lake Michigan

Instream Waste Concentration (IWC): 9%

Dilution series: At least five effluent concentrations and dual controls must be included in each test.

- **Acute:** 100, 50, 25, 12.5, 6.25% and any additional selected by the permittee.
- **Chronic:** 100, 30, 10, 3, 1% (if the IWC $\leq$30%) or 100, 75, 50, 25, 12.5% (if the IWC >30%) and any additional selected by the permittee.

WET Testing Frequency:

Tests are required during the following quarters. Only one of the outfalls needs to be monitored if both outfalls have the same characteristics.

- **Acute:** 2017 3rd quarter, 2019 2nd quarter, 2021 1st quarter
- **Chronic:** 2017 3rd quarter, 2019 2nd quarter, 2021 1st quarter

Testing: WET testing shall be performed during normal operating conditions. Permittees are not allowed to turn off or otherwise modify treatment systems, production processes, or change other operating or treatment conditions during WET tests.

Reporting: The permittee shall report test results on the Discharge Monitoring Report form, and also complete the "Whole Effluent Toxicity Test Report Form" (Section 6, "*State of Wisconsin Aquatic Life Toxicity Testing Methods Manual, 2nd Edition*"), for each test. The original, complete, signed version of the Whole Effluent Toxicity Test Report Form shall be sent to the Biomonitoring Coordinator, Bureau of Water Quality, 101 S. Webster St., P.O. Box 7921, Madison, WI 53707-7921, within 45 days of test completion. The Discharge Monitoring Report (DMR) form shall be submitted electronically by the required deadline.

Determination of Positive Results: An acute toxicity test shall be considered positive if the Toxic Unit - Acute (TU_a) is greater than 1.0 for either species. The TU_a shall be calculated as follows: If $LC_{50} \geq 100$, then $TU_a = 1.0$. If LC_{50} is < 100, then $TU_a = 100 \div LC_{50}$. A chronic toxicity test shall be considered positive if the Relative Toxic Unit - Chronic (rTU_c) is greater than 1.0 for either species. The rTU_c shall be calculated as follows: If $IC_{25} \geq IWC$, then $rTU_c = 1.0$. If $IC_{25} < IWC$, then $rTU_c = IWC \div IC_{25}$.

Additional Testing Requirements: Within 90 days of a test which showed positive results, the permittee shall submit the results of at least 2 retests to the Biomonitoring Coordinator on "Whole Effluent Toxicity Test Report Forms". The 90 day reporting period shall begin the day after the test which showed a positive result. The retests shall be completed using the same species and test methods specified for the original test (see the Standard Requirements section herein).

3.2.1.3 [Reserved]

3.2.1.4 [Reserved]

3.2.1.5 EVAC

EVAC may be used for macroinvertebrate control for the service water system, as approved March 7, 2000. Treatments typically occur once or twice a year during May through October. The outfall that receives the service water discharge shall be monitored during each zebra mussel treatment. The daily maximum effluent limit is 0.071 mg/L expressed in amine equivalents.

3.2.1.6 Polychlorinated Biphenyls

There shall be no discharge of polychlorinated biphenyl compounds such as those commonly used for transformer fluid.

3.2.1.7 Additives

The permittee shall maintain a log to record the usage of all cooling water treatment additives used on a monthly basis for the intake water. Refer to Standard Requirement 5.3.7 regarding changes to additive use.

3.2.1.8 [Reserved]

3.2.1.9 Heat Load Calculation

Heat discharged is calculated and reported each day based on measured flow and the increase in temperature of the cooling water. Flow is measured each day as total gallons/day. The temperature increase is measured each day between average incoming water temperature and average outgoing temperature. Compliance is based on the weekly average and is calculated by the Department Wastewater Discharge Monitoring Report.

3.2.2 Sampling Point (Outfall) 004 - Intake De-icing

Monitoring Requirements and Effluent Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Per Occurrence	Estimated	

3.2.3 Sampling Point 601 - Water Intake

Monitoring Requirements and Effluent Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Monthly	Total Daily	
Temperature Maximum		deg F	Daily	Continuous	
Temperature Average		deg F	Daily	Calculated	

4 Schedules

4.1 Water Treatment Additive Review

The permittee shall take the necessary actions to minimize the discharge of phosphorus. The water treatment additives used at the power plant that contain phosphorus are sources of additional phosphorus in the effluent.

Required Action	Due Date
Evaluate Additive Source Reduction Measures: The permittee shall evaluate potential phosphorus source reduction measures for those additives containing phosphorus that are currently in use. Evaluate for replacement with an additive that is phosphorus free, replacement with an additive with a reduced phosphorus concentration, and reduction in the additive dosage. The water treatment additive review may include: a. Literature available on comparable water treatment additives. b. Similar reviews conducted at other facilities. c. Pilot studies and monitoring. d. A plan for optimizing the additive dosage rates so the additives are the most effective without over dosing.	07/01/2017
Submit Additive Review Report: The permittee shall submit a report summarizing the findings of the water treatment additive review. The report shall include information on the following: a. Description of the scope of work performed in additive review process. b. Identification of feasible additive changes. A feasible change means it would reduce the amount of phosphorus discharged while still being effective in providing the additive's purpose. c. An explanation of why a change in additive is not feasible. d. A summary of any monitoring data related to the additive review. e. An estimate of the amount of phosphorus reduction possible with any feasible additive change. If a new water treatment additive is proposed, information on the additive must be submitted to the Department for approval in accordance with standard requirement 5.3.7. Refer to the link below to access the Department's program guidance for "Water Quality Review Procedures for Additives". http://dnr.wi.gov/topic/wastewater/Guidance.html	10/01/2017
Implement Source Reduction Measures: If a phosphorus source reduction is found to be feasible during the water treatment additive review it shall be implemented. Any change in the dosage of a currently used additive or request for a new additive approval shall be made by the due date.	02/01/2018

5 Standard Requirements

NR 205, Wisconsin Administrative Code (Conditions for Industrial Dischargers): The conditions in ss. NR 205.07(1) and NR 205.07(3), Wis. Adm. Code, are included by reference in this permit. The permittee shall comply with all of these requirements. Some of these requirements are outlined in the Standard Requirements section of this permit. Reqnirements not specifically outlined in the Standard Requirement section of this permit can be found in ss. NR 205.07(I) and NR 205.07(3).

5.1 Reporting and Monitoring Requirements

5.1.1 Monitoring Results

Monitoring results obtained during the previous month shall be summarized and reported on a Department Wastewater Discharge Monitoring Report. The report may require reporting of any or all of the information specified below under 'Recording of Results'. This report is to be returned to the Department no later than the date indicated on the form. A copy of the Wastewater Discharge Monitoring Report Form or an electronic file of the report shall be retained by the permittee.

Monitoring results shall be reported on an electronic discharge monitoring report (eDMR). The eDMR shall be certified electronically by a principal executive officer, a ranking elected official or other duly authorized representative. The 'eReport Certify' page certifies that the electronic report form is true, accurate and complete.

If the permittee monitors any pollutant more frequently than required by this permit, the results of such monitoring shall be included on the Wastewater Discharge Monitoring Report.

The permittee shall comply with all limits for each parameter regardless of monitoring frequency. For example, monthly, weekly, and/or daily limits shall be met even with monthly monitoring. The permittee may monitor more frequently than required for any parameter.

5.1.2 Sampling and Testing Procedures

Sampling and laboratory testing procedures shall be performed in accordance with Chapters NR 218 and NR 219, Wis. Adm. Code and shall be performed by a laboratory certified or registered in accordance with the requirements of ch. NR 149, Wis. Adm. Code. Groundwater sample collection and analysis shall be performed in accordance with ch. NR 140, Wis. Adm. Code. The analytical methodologies used shall enable the laboratory to quantitate all substances for which monitoring is required at levels below the effluent limitation. If the required level cannot be met by any of the methods available in NR 219, Wis. Adm. Code, then the method with the lowest limit of detection shall be selected. Additional test procedures may be specified in this permit.

5.1.3 Recording of Results

The permittee shall maintain records which provide the following information for each effluent measurement or sample taken:

- the date, exact place, method and time of sampling or measurements;
- the individual who performed the sampling or measurements;
- the date the analysis was performed;
- the individual who performed the analysis;
- the analytical techniques or methods used; and
- the results of the analysis.

5.1.4 Reporting of Monitoring Results

The permittee shall use the following conventions when reporting effluent monitoring results:

- Pollutant concentrations less than the limit of detection shall be reported as < (less than) the value of the limit of detection. For example, if a substance is not detected at a detection limit of 0.1 mg/L, report the pollutant concentration as < 0.1 mg/L.

- Pollutant concentrations equal to or greater than the limit of detection, but less than the limit of quantitation, shall be reported and the limit of quantitation shall be specified.

- For purposes of calculating NR 101 fees, the 2 mg/l lower reporting limits for BOD_5 and Total Suspended Solids shall be considered to be limits of quantitation

- For the purposes of reporting a calculated result, average or a mass discharge value, the permittee may substitute a 0 (zero) for any pollutant concentration that is less than the limit of detection. However, if the effluent limitation is less than the limit of detection, the department may substitute a value other than zero for results less than the limit of detection, after considering the number of monitoring results that are greater than the limit of detection and if warranted when applying appropriate statistical techniques.

5.1.5 Records Retention

The permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by the permit, and records of all data used to complete the application for the permit for a period of at least 3 years from the date of the sample, measurement, report or application, except for sludge management forms and records, which shall be kept for a period of at least 5 years.

5.1.6 Other Information

Where the permittee becomes aware that it failed to submit any relevant facts in a permit application or submitted incorrect information in a permit application or in any report to the Department, it shall promptly submit such facts or correct information to the Department.

5.2 System Operating Requirements

5.2.1 Noncompliance Notification

- The permittee shall report the following types of noncompliance by a telephone call to the Department's regional office within 24 hours after becoming aware of the noncompliance;
  - any noncompliance which may endanger health or the environment;
  - any violation of an effluent limitation resulting from an unanticipated bypass;
  - any violation of an effluent limitation resulting from an upset; and
  - any violation of a maximum discharge limitation for any of the pollutants listed by the Department in the permit.

- A written report describing the noncompliance shall also be submitted to the Department's regional office within 5 days after the permittee becomes aware of the noncompliance. On a case-by-case basis, the Department may waive the requirement for submittal of a written report within 5 days and instruct the permittee to submit the written report with the next regularly scheduled monitoring report. In either case, the written report shall contain a description of the noncompliance and its cause; the period of noncompliance, including exact dates and times; the steps taken or planned to reduce, eliminate and prevent reoccurrence of the noncompliance; and if the noncompliance has not been corrected, the length of time it is expected to continue.

- The permittee shall give advance notice to the Department of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

NOTE: Section 292.11(2)(a), Wisconsin Statutes, requires any person who possesses or controls a hazardous substauce or who causes the discharge of a hazardous substance to notify the Department of Natural Resources **immediately** of any discharge not authorized by the permit. The discharge of a hazardous substance that is not authorized by this permit or that violates this permit may be a hazardous substance spill. To report a hazardous substance spill, call DNR's 24-hour HOTLINE at **1-800-943-0003**.

5.2.2 Unscheduled Bypassing

Any unscheduled bypass or overflow of wastewater at the treatment works or from the collection system is prohibited, and the Department may take enforcement action against a permittee for such occurrences under s. 283.89, Wis. Stats., unless all of the following occur:

- The bypass was unavoidable to prevent loss of life, personal injury, or severe property damage.
- There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance.
- The permittee notifies the department of the unscheduled bypass or overflow. The permittee shall notify the department within 24 hours of initiation of the bypass or overflow occurrence by telephone, voicemail, fax or e-mail. Within 5 days of conclusion of the bypass or overflow occurrence, the permittee shall submit to the department in writing, all of the following information:
  - Reason the bypass or overflow occurred, or explanation of other contributing circumstances that resulted in the overflow event. If the overflow or bypass is associated with wet weather, provide data on the amount and duration of the rainfall or snow melt for each separate event.
  - Date the bypass or overflow occurred.
  - Location where the bypass or overflow occurred.
  - Duration of the bypass or overflow and estimated wastewater volume discharged.
  - Steps taken or the proposed corrective action planned to prevent similar future occurrences.
  - Any other information the permittee believes is relevant.

5.2.3 Scheduled Bypassing

Any construction or normal maintenance which results in a bypass of wastewater is prohibited unless authorized by the Department in writing. If the Department determines that there is significant public interest in the proposed action, the Department may schedule a public hearing or notice a proposal to approve the bypass. Each request shall specify the following minimum information:

- Proposed date of bypass.
- Estimated duration of the bypass.
- Alternatives to bypassing.
- Measures to mitigate environmental harm caused by the bypass.
- Estimated volume of the bypass.

5.2.4 Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control which are installed or used by the permittee to achieve compliance with the conditions of this permit. The wastewater treatment facility shall be under the direct supervision of a state certified operator as required in s. NR 108.06(2), Wis. Adm. Code. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training as required in ch. NR 114, Wis. Adm. Code, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems only when necessary to achieve compliance with the conditions of the permit.

5.2.5 Spill Reporting

The permittee shall notify the Department in accordance with ch. NR 706 (formerly NR 158), Wis. Adm. Code, in the event that a spill or accidental release of any material or substance results in the discharge of pollutants to the waters of the state at a rate or concentration greater than the effluent limitations established in this permit, or the spill or accidental release of the material is unregulated in this permit, unless the spill or release of pollutants has been reported to the Department in accordance with s. NR 205.07 (1)(s), Wis. Adm. Code.

5.2.6 Planned Changes

In accordance with ss. 283.31(4)(b) and 283.59, Stats., the permittee shall report to the Department any facility expansion, production increase or process modifications which will result in new, different or increased discharges of pollutants. The report shall either be a new permit application, or if the new discharge will not violate the effluent limitations of this permit, a written notice of the new, different or increased discharge. The notice shall contain a description of the new activities, an estimate of the new, different or increased discharge of pollutants and a description of the effect of the new or increased discharge on existing waste treatment facilities. Following receipt of this report, the Department may modify this permit to specify and limit any pollutants not previously regulated in the permit.

5.2.7 Duty to Halt or Reduce Activity

Upon failure or impairment of treatment facility operation, the permittee shall, to the extent necessary to maintain compliance with its permit, curtail production or wastewater discharges or both until the treatment facility operations are restored or an alternative method of treatment is provided.

5.3 Surface Water Requirements

5.3.1 Permittee-Determined Limit of Quantitation Incorporated into this Permit

For pollutants with water quality-based effluent limits below the Limit of Quantitation (LOQ) in this permit, the LOQ calculated by the permittee and reported on the Discharge Monitoring Reports (DMRs) is incorporated by reference into this permit. The LOQ shall be reported on the DMRs, shall be the lowest quantifiable level practicable, and shall be no greater than the minimum level (ML) specified in or approved under 40 CFR Part 136 for the pollutant at the time this permit was issued, unless this permit specifies a higher LOQ.

5.3.2 Appropriate Formulas for Effluent Calculations

The permittee shall use the following formulas for calculating effluent results to determine compliance with average concentration limits and mass limits and total load limits:

Weekly/Monthly/Six-Month/Annual Average Concentration = the sum of all daily results for that week/month/six-month/year, divided by the number of results during that time period.

Weekly Average Mass Discharge (lbs/day): Daily mass = daily concentration (mg/L) x daily flow (MGD) x 8.34, then average the daily mass values for the week.

Monthly Average Mass Discharge (lbs/day): Daily mass = daily concentration (mg/L) x daily flow (MGD) x 8.34, then average the daily mass values for the month.

Annual Average Mass Discharge (lbs/day): Daily mass = daily concentration (mg/L) x daily flow (MGD) x 8.34, then average the daily mass values for the entire year.

Total Monthly Discharge: = monthly average concentration (mg/L) x total flow for the month (MG/month) x 8.34.

Total Annual Discharge: = sum of total monthly discharges for the calendar year.

5.3.3 Effluent Temperature Requirements

Weekly Average Temperature – The permittee shall use the following formula for calculating effluent results to determine compliance with the weekly average temperature limit (as applicable): Weekly Average Temperature = the sum of all daily maximum results for that week divided by the number of daily maximum results during that time period.

Cold Shock Standard – Water temperatures of the discharge shall be controlled in a manner as to protect fish and aquatic life uses from the deleterious effects of cold shock. 'Cold Shock' means exposure of aquatic organisms to a rapid decrease in temperature and a sustained exposure to low temperature that induces abnormal behavior or physiological performance and may lead to death.

Rate of Temperature Change Standard – Temperature of a water of the state or discharge to a water of the state may not be artificially raised or lowered at such a rate that it causes detrimental health or reproductive effects to fish or aquatic life of the water of the state.

5.3.4 Energy Emergency Events

The Department will use enforcement discretion whenever there are exceedances of effluent temperature limitations for the electric generating facility during an energy emergency warning or when an energy emergency event has been declared under a Federal Energy Regulatory Commission order (Standard EOP-002, North American Electric Reliability Corporation).

5.3.5 Visible Foam or Floating Solids

There shall be no discharge of floating solids or visible foam in other than trace amounts.

5.3.6 Total Residual Halogen Requirements (When De-Halogenating Effluent)

Test methods for total residual chlorine, approved in ch. NR 219 - Table B, Wis. Adm. Code, normally achieve a limit of detection of about 20 to 50 micrograms per liter and a limit of quantitation of about 100 micrograms per liter. Reporting of test results and compliance with effluent limitations for chlorine residual and total residual halogens shall be as follows:

- Sample results which show no detectable levels are in compliance with the limit. These test results shall be reported on Wastewater Discharge Monitoring Report Forms as "< 100 µg/L". (Note: 0.1 mg/L converts to 100 µg/L)

- Samples showing detectable traces of chlorine are in compliance if measured at less than 100 µg/L, unless there is a consistent pattern of detectable values in this range. These values shall also be reported on Wastewater Discharge Monitoring Report Forms as "<100 µg/L." The facility operating staff shall record actual readings on logs maintained at the plant, shall take action to determine the reliability of detected results (such as re-sampling and/or calculating dosages), and shall adjust the chemical feed system if necessary to reduce the chances of detects.

- Samples showing detectable levels greater than 100 µg/L shall be considered as exceedances, and shall be reported as measured.

- To calculate average or mass discharge values, a "0" (zero) may be substituted for any test result less than 100 µg/L. Calculated values shall then be compared directly to the average or mass limitations to determine compliance.

5.3.7 Additives

In the event that the permittee wishes to commence use of a water treatment additive, or increase the usage of the additives greater than indicated in the permit application, the permittee must get a written approval from the Department prior to initiating such changes. This written approval shall provide authority to utilize the additives at the specific rates until the permit can be either reissued or modified in accordance with s. 283.53, Stats. Restrictions on the use of the additives may be included in the authorization letter.

5.3.8 Whole Effluent Toxicity (WET) Monitoring Requirements

In order to determine the potential impact of the discharge on aquatic organisms, static-renewal toxicity tests shall be performed on the effluent in accordance with the procedures specified in the *"State of Wisconsin Aquatic Life Toxicity Testing Methods Manual, 2nd Edition" (PUB-WT-797,* November 2004) as required by NR 219.04, Table A, Wis. Adm. Code). All of the WET tests required in this permit, including any required retests, shall be conducted on the *Ceriodaphnia dubia* and fathead minnow species. Receiving water samples shall not be collected from any point in contact with the permittee's mixing zone and every attempt shall be made to avoid contact with any other discharge's mixing zone.

5.3.9 Whole Effluent Toxicity (WET) Identification and Reduction

Within 60 days of a retest which showed positive results, the permittee shall submit a written report to the Biomonitoring Coordinator, Bureau of Watershed Management, 101 S. Webster St., PO Box 7921, Madison, WI 53707-7921, which details the following:

- A description of actions the permittee has taken or will take to remove toxicity and to prevent the recurrence of toxicity;

- A description of toxicity reduction evaluation (TRE) investigations that have been or will be done to identify potential sources of toxicity, including some or all of the following actions:

  (a) Evaluate the performance of the treatment system to identify deficiencies contributing to effluent toxicity (e.g., operational problems, chemical additives, incomplete treatment)
  (b) Identify the compound(s) causing toxicity
  (c) Trace the compound(s) causing toxicity to their sources (e.g., industrial, commercial, domestic)
  (d) Evaluate, select, and implement methods or technologies to control effluent toxicity (e.g., in-plant or pretreatment controls, source reduction or removal)

- Where corrective actions including a TRE have not been completed, an expeditious schedule under which corrective actions will be implemented;

- If no actions have been taken, the reason for not taking action.

The permittee may also request approval from the Department to postpone additional retests in order to investigate the source(s) of toxicity. Postponed retests must be completed after toxicity is believed to have been removed.

6 Summary of Reports Due

FOR INFORMATIONAL PURPOSES ONLY

Description	Date	Page
Water Treatment Additive Review -Evaluate Additive Source Reduction Measures	July 1, 2017	10
Water Treatment Additive Review -Submit Additive Review Report	October 1, 2017	10
Water Treatment Additive Review -Implement Source Reduction Measures	February 1, 2018	10

Report forms shall be submitted electronically in accordance with the reporting requirements herein. Any facility plans or plans and specifications for municipal, industrial, industrial pretreatment and non industrial wastewater systems shall be submitted to the Bureau of Water Quality, P.O. Box 7921, Madison, WI 53707-7921. All other submittals required by this permit shall be submitted to:
Northeast Region, 2984 Shawano Avenue, Green Bay, WI 54313-6727

Permit Fact Sheet

1 General Information

Permit Number:	WI-0000957-08-0
Permittee Name:	NextEra Energy - Point Beach Nuclear Power Plant
Address:	6610 Nuclear Road
City/State/Zip:	Two Rivers WI 54241
Discharge Location:	Shore of Lake Michigan
Receiving Water:	Lake Michigan
StreamFlow ($Q_{7,10}$):	N/A
Stream Classification:	Great Lakes, Cold Water Community

2 Facility Description

The Point Beach Nuclear Power Plant (PBNP) consists of two nuclear powered steam supply units which drive two turbine generators rated at 630 megawatts each. An annual average flow of 780 million gallons per day of wastewater is discharged into Lake Michigan. It consists primarily of once through noncontact cooling water from generating units 1 and 2. Combined with the cooling water discharge are other wastewater sources including intake water screen backwash, miscellaneous equipment cooling, steam generator blowdown, primary coolant letdown, reverse osmosis reject water, floor drains, fire protection water, and sanitary wastewater effluent. Where categorical standards apply, the wastewater is regulated through a sample point. In addition, there are two outfalls for the condenser cooling water and an outfall for a deicing line for the water intake crib.

Sample Point Designation		
Sample Point Number	**Discharge Flow, Units, and Averaging Period**	**Sample Point Location, WasteType/sample Contents and Treatment Description (as applicable)**
001	840.6 MGD max. annual avg., combined with outfall 002 (2006)	Unit 1 condenser cooling water discharge to Lake Michigan.
002	840.6 MGD max. annual avg., combined with outfall 001 (2007)	Unit 2 condenser cooling water discharge to Lake Michigan.
004	Discharges during winter months maximum of 200,000 gpm	Deicing line for the water intake crib in Lake Michigan. The discharge consists of reversing the flow of one of the water intake pipes to return warm water to the water intake crib.
009		Discharge of potable water used for temporary cooling during a condenser unit outage.
101	35,000 gpd annual avg (2007-2008)	Demineralizer regeneration neutralization tank discharge.
102	86,000 gpd annual avg (2007-2008)	Unit 1 steam generator blowdown.
103	142,000 gpd annual avg (2007-	Unit 2 steam generator blowdown.

Sample Point Designation		
Sample Point Number	**Discharge Flow, Units, and Averaging Period**	**Sample Point Location, WasteType/sample Contents and Treatment Description (as applicable)**
	2008)	
104	6,000 gpd annual avg (2007-2008)	Sewage treatment plant effluent prior to combining with the low volume wastewater effluent and condenser cooling water discharge.
105	133,000 gpd annual avg (2007-2008)	Low volume wastewater (wastewater effluent) consisting of the combined discharge of sanitary wastewater effluent, turbine hall sumps and floor drains, facade sumps, water treatment plant backwash, heating steam condensate, and potable water treatment system filter backwash and reverse osmosis reject wastewater.
106	69,000 gpd annual avg (2007-2008)	Plant process water reverse osmosis reject wastewater.
107	52,000 gpd annual avg	Microfiltration unit backwash from the power plant's make-up water treatment system. This is a direct discharge to Outfall 002 if the TSS limits can be met. If the in-line turbidimeter indicates elevated TSS that would exceed limits, the backwash is routed to the vacuum fabric filters for treatment and is discharged from Sampling Point 105.

3 Cooling Water Intake Structure

§ 316(b) of the Clean Water Act requires that the location, design, construction, and capacity of the cooling water intake structure reflect the best technology available (BTA) for minimizing adverse environmental impact. From December 2005 to November 2006, PBNP conducted a study to quantify the number of aquatic organisms impinged and entrained by the intake structure. A report was submitted to the Department which included the results of the study along with an evaluation of various technology options that could reduce impingement mortalities and entrainment (IM&E). Currently, U.S. EPA has no criteria for the Department to make a BTA determination. Until such criteria are published, the Department will not make a BTA determination nor impose IM&E reduction requirements. The proposed permit includes a "reopener" provision whereby, after U.S. EPA publishes requirements for implementing § 316(b), the permit may be modified to incorporate those requirements.

4 Inplant - Proposed Monitoring and Limitations

4.1 Sample Point Number: 101- Demineralizer Regeneration; 102- Blowdown Unit 1; 103- Blowdown Unit 2; 106- Plant Process Water RO Reject, and 107- Microfiltration Unit Backwash

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Monthly	Total Daily	
Suspended Solids, Total	Daily Max	100 mg/L	Monthly	Grab	
Suspended Solids, Total	Monthly Avg	30 mg/L	Monthly	Grab	
Oil & Grease (Hexane)	Daily Max	20 mg/L	Annual	Grab	
Oil & Grease (Hexane)	Monthly Avg	15 mg/L	Annual	Grab	

4.1.1 Changes from Previous Permit:

No changes.

4.1.2 Explanation of Limits and Monitoring Requirements

These low volume wastewater sources are subject to the categorical limits contained in ch. NR 290, Wis. Adm. Code. These technology based limits apply to the effluent at the sampling point prior to combining with the condenser cooling water.

4.2 Sample Point Number: 104- STP Effluent

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Weekly	Total Daily	
BOD5, Total	Monthly Avg	30 mg/L	Weekly	24-Hr Comp	
BOD5, Total	Weekly Avg	45 mg/L	Weekly	24-Hr Comp	
Suspended Solids, Total	Monthly Avg	30 mg/L	Weekly	24-Hr Comp	
Suspended Solids, Total	Weekly Avg	45 mg/L	Weekly	24-Hr Comp	
pH Field		su	Weekly	Grab	

4.2.1 Changes from Previous Permit:

No changes.

4.2.2 Explanation of Limits and Monitoring Requirements

The small on-site sanitary wastewater treatment system is subject to secondary treatment standards similar to a typical municipal wastewater treatment plant. These technology based limits apply to the effluent at the sampling point prior to combining with the condenser cooling water.

4.3 Sample Point Number: 105- Low Volume Wastewater Effluent

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Weekly	Total Daily	
Suspended Solids, Total	Daily Max	100 mg/L	Weekly	24-Hr Comp	
Suspended Solids, Total	Monthly Avg	30 mg/L	Weekly	24-Hr Comp	
Oil & Grease (Hexane)	Daily Max	20 mg/L	Monthly	Grab	
Oil & Grease (Hexane)	Monthly Avg	15 mg/L	Monthly	Grab	
pH Field		su	Weekly	Grab	

4.3.1 Changes from Previous Permit:

No changes.

4.3.2 Explanation of Limits and Monitoring Requirements

These low volume wastewater sources are subject to the categorical limits contained in ch. NR 290, Wis. Adm. Code. These technology based limits apply to the effluent at the sampling point prior to combining with the condenser cooling water

5 Surface Water - Proposed Monitoring and Limitations

5.1 Sample Point Numbers: 001 and 002 - Condenser Cooling Water

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Daily	Total Daily	
Temperature Maximum		deg F	Daily	Continuous	
pH Field	Daily Max	9.0 su	Weekly	Grab	
pH Field	Daily Min	6.0 su	Weekly	Grab	
Chlorine, Total Residual	Daily Max	38 ug/L	Daily	Grab	See Halogens footnote below
Acute WET		TUa	See Listed Qtr(s)	24-Hr Flow Prop Comp	See WET Testing footnote below
Chronic WET		rTUc	See Listed Qtr(s)	24-Hr Flow Prop Comp	See WET Testing footnote below
Mercury, Total Recoverable		ng/L	Quarterly	Grab	See Mercury footnotes below
Additive Water Treatment - Specify	Daily Max	0.071 mg/L	Daily	Grab	See EVAC footnote below
Phosphorus, Total		mg/L	Monthly	Grab	

5.1.1 Changes from Previous Permit

- The current permit's allowance of annual reporting of daily temperatures has been dropped. The new permit requires reporting of daily maximum temperatures on monthly discharge monitoring reports (DMRs),
- Mercury monitoring is a new permit requirement. The new permit also requires the implementation of a Mercury Pollutant Minimization Program along with the submittal of annual status reports.
- The new permit requires monthly phosphorus monitoring.

5.1.2 Explanation of Limits and Monitoring Requirements

As of early 2012, PBNP increased its power generating capacity from 540 MW to 630 MW for each generating unit. This so-called "uprating" resulted in no substantial increase in cooling water flow rate, but did result in a 3.6°F increase in discharge temperature. PBNP submitted a document dated August 2008, titled Evaluation of the Thermal Effects Due to a Planned Extended Power Uprate in order to comply with section 5.2.6 of the permit, and ss. 283.31(4)(b) and 283.59, Stats. The Department has reviewed the document and determined that the increased discharge temperature does not harm the biological indigenous community (BIC), nor did the previous discharge temperature harm the BIC. Refer to Attachment B (which also references Attachment E) for details. Since the uprate occurred so recently, and in order to validate the projected temperature increase, it is prudent to review temperature data on a monthly basis rather than at the end of the year.

As of November 15, 2010, the Great Lake Water Quality Initiative (GLI) regulation has phased out the mixing zone for calculating effluent limits for biological chemicals of concern (BCCs). Mercury is a BCC. As a consequence to the GLI, the effluent limitation for Mercury would be equal to the wildlife criteria, 1.3 ng/L. It is likely that the Mercury effluent concentration at PBNP would exceed this value. PBNP has requested an exception to the mixing zone phase out. The Department has granted the exception with the stipulation that PBNP undertake a Mercury Pollutant Minimization Program (PMP). Refer to Attachment C for details.

Refer to pages 9 and 10 of the August 29, 2011 Water Quality-Based Effluent Limitations memo (Attachment D) for an explanation of the phosphorus monitoring requirement.

The daily maximum concentration of 0.017 mg/L for the additive EVAC was carried over from the current permit, and stems from a March 7, 2000 Department approval.

Refer to page 13 of the August 29, 2011 Water Quality-Based Effluent Limitations memo (Attachment D) for an explanation of the WET testing requirements. Because both outfalls are similar, only one needs to be monitored.

Categorical Limits

The outfalls are subject to the categorical limits for pH and total residual chlorine contained in ch. NR 290, Wis. Adm. Code. Note, however, that the permit uses the word "halogen" in place of "chlorine". PBNP uses a combination of bromine and hypochlorite as a biocide for service water and condenser cooling water. Bromine is assumed to have the same toxicity as chlorine. For this reason, the word substitution in the new permit is appropriate.

5.2 Sample Point 004- Intake De-icing

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Per Occurrence	Estimated	

5.2.1 Changes from Previous Permit

No changes.

5.2.2 Explanation of Limits and Monitoring Requirements

Estimated flow monitoring provides information on when the deicing line is used.

5.3 Sample Point Number: 009- Temporary Cooling Water

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		gpd	Daily	Estimated	

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Temperature		deg F	Daily	Grab	

5.3.1 Changes from Previous Permit

Discharge of potable water used for temporary cooling during a condenser unit outage.

5.1 601- Water Intake

Monitoring Requirements and Limitations					
Parameter	**Limit Type**	**Limit and Units**	**Sample Frequency**	**Sample Type**	**Notes**
Flow Rate		MGD	Monthly	Total Daily	
Temperature		deg F	Daily	Continuous	

5.1.1 Changes from Previous Permit

Lake Michigan water intake monitoring for background water quality data

6 Sludge Land Application - Sample Point Number: 005

The existing permit has an outfall for the land application of sludge from the sanitary treatment system. PBNP no longer land applies sludge. Therefore, the proposed new permit has eliminated this outfall (005).

7 Compliance Schedules

7.1 Mercury Pollutant Minimization Program

Required Action	Date Due
Mercury Pollutant Minimization Program (PMP) submittal: The permittee shall submit a mercury PMP for Department review.	10/01/2013
Submit First Annual Status Report: The permittee shall submit to the Department the first annual status report which discusses the results of the mercury mass balance across the plant.	12/01/2013
Submit Second Annual Status Report: The permittee shall submit to the Department the second annual status report which discusses the results of the mercury mass balance across the plant.	12/01/14
Submit Third Annual Status Report: The permittee shall submit to the Department the third annual status report which discusses the results of the mercury mass balance across the plant. Note:If any of the annual status reports demonstrate that the mass of mercury leaving the plant as effluent exceeds the mass of mercury entering the plant via the intake structure, the permittee shall	12/01/15

submit a new mercury PMP.	
Submit New Mercury PMP: If necessary, submit for Department approval a new mercury PMP that conforms to the requirements of s. NR 106.145(7), subparagraphs (d), (f), and (g), Wis. Admin. Code. Note: If the permittee wishes to apply for an alternative mercury effluent limitation, that application is due with the application for permit reissuance by 6 months prior to permit expiration. The permittee should submit or reference the latest PMP plan or more recent developments as part of that application.	03/01/16

7.2 Explanation of Compliance Schedules

The Department's August 6, 2012 letter to NextEra – Point Beach (Attachment C) discusses the requirement for a Mercury Minimization Plan. The submittal of a mercury balance in the three annual status reports will validate the permittee's assertion that the Point Beach plant is not adding mercury to the environment. If any of the three annual reports indicate that mercury is being added, a new mercury PMP must be submitted, with an emphasis on identification of sources.

8 Attachments:

Attachment A: Substantial Compliance Determination

Attachment B: Department Determination of Compliance with § 316(a) of the Clean Water Act

Attachment C: Mixing Zone Phase-out Exception letter

Attachment D: Water Quality-Based Effluent Limitations memo

Attachment E: Addendum to the Temperature and Arsenic Water Quality Effluent Limitations memo

9 Proposed Expiration Date:

September 30, 2017

Prepared By: Dan Joyce Wastewater Engineer – retired

Steve Jaeger Wastewater Engineer

Date: 8/30/12

Substantial Compliance Determination

Permittee Name: NextEra Energy Point Beach LLC		Permit Number: 0000957-08-0
	Compliance?	Comments
Discharge Limits	Yes	
Sampling/testing requirements	Yes	
Groundwater standards	Yes	
Reporting requirements	Yes	
Compliance schedules	Yes	
Management plan	Yes	
Other:	Yes	
Enforcement Considerations		
In substantial compliance?	Yes Comments: Signature: Daniel Joyce Date: 8/9/12 Concurrence: Date:	

CORRESPONDENCE / MEMORANDUM **State of Wisconsin**

DATE: August 29, 2012

TO: Steve Jaeger - CO

FROM: Amanda Minks - CO

SUBJECT: Approval of the alternative effluent temperature limit for the Point Beach Nuclear Plant (WI-0000957)

The Point Beach Nuclear Plant (PBNP) is an existing facility pursuant to s. NR 106.71(3), Wis. Adm. Code, and discharges heat and other pollutants to Lake Michigan north of Two Rivers, Wisconsin. In order to protect fish and aquatic life in Lake Michigan, temperature limits were calculated for PBNP pursuant to ch. NR 106- Subchapter V, Wis. Adm. Code (see 8/22/2012 Addendum to the Temperature and Arsenic Water Quality-Based Effluent Limitations for NextEra Energy Point Beach, LLC). This evaluation determined that temperature limits are triggered by PBNP for all months given the protocols specified in Subchapter V. In accordance with Ch. NR 106 - Subchapter VI, 40 CFR Part 125, and Section 316(a) of the federal Clean Water Act, PBNP requested alternative effluent limitations (AEL) for temperature based on a demonstration that the calculated effluent temperature limits are more stringent than necessary to protect fish and aquatic life.

This demonstration entitled *"Point Beach Nuclear Plant Evaluation of the Thermal Effects Due to a Planned Extended Power Uprate"* was prepared by EA Engineering, Science, and Technology and submitted to the Department May 11, 2009. There were three main conclusions made in this report:

1. The historic heat load of 7,094 MBTU/hr discharged from PBNP did not cause appreciable harm to the balanced, indigenous community of shellfish, fish, and wildlife in and on Lake Michigan.
2. The thermal plume resulting from the current heat load of 8,273 MBTU/hr increased the areal extent of the thermal plume but the elevated temperatures are still confined to the upper 6 feet of the water column except in the immediate vicinity of the discharge.
3. The current heat load will assure the protection and propagation of the representative, important species.

In order to demonstrate a lack of appreciable harm, this study:

1. Referenced a previous 316(a) demonstration submitted by PBNP in October, 1975 (Point Beach Nuclear Plant – Demonstration for a thermal standard variance, WEPCO, 1975), which was approved by the Department June 30, 1976.
2. Presented summaries of other 316(a) demonstrations from other power plants discharging to Lake Michigan
3. Presented new modeling analysis to show the extent of the thermal plume
4. Updated their biological analysis to account for changes in Lake Michigan biota.

No further action was taken by the Department to validate the 1975 316(a) demonstration in this decision-making process.

Additional biological data was submitted in the 2009 alternative effluent limit report to compare the current biological condition of the receiving water to the biological monitoring results submitted from the previously approved study. After review, the Department has concluded that the 2009 biological monitoring data was collected using protocols consistent with 316(b) guidance, and agrees that the main discrepancies in the 1978 and 2009 reports are more likely the result of lake-wide fish population trends, and are less likely to be the result of the thermal plume.

The 2009 alternative effluent limit demonstration presented results from hydrodynamic modeling to predict the extent of the thermal plume resulting from the increased thermal discharge. A three-dimensional thermal model of the PBNP discharge was developed using the Environmental Fluid Dynamic Computer Code developed at the Virginia Institute of Marine Science and revised by EPA and Tetra Tech. The model was validated with measured plumes from 1973.

Size and direction of the PBNP plume is affected by the magnitude and direction of the Lake Michigan along-shore current. Model predictions were run with currents of 0.1 ft/sec, 0.2 ft/sec and 0.3 ft/sec. Water temperatures along the shore of Lake Michigan vary naturally due to wind and upwelling events. The modeling performed shows the increase due to the heated discharge from the PBNP.

For the summer model predictions with along-shore currents of 0.2 ft/sec, the area of water elevated more than 1°C increased by 28% to 1170 acres, extending approximately 1.8 miles down shore and a maximum of 1.5 miles offshore. The area of the 2°C contour increased 24% to 390 acres and the area of the 5°C contour increased 41% to 44 acres or roughly a circle with a diameter of 1900 feet.

The plume for the faster 0.3 ft/sec along-shore currents affected smaller areas but extended further down shore. The model predictions with along-shore currents of 0.1 ft/sec produced larger areas but were directed more offshore. Differences in along-shore current velocity have a greater effect on the areas of the 1°C and 2°C temperature increases than the areas of larger temperature increases.

The representative important species list used in this report included gizzard shad, channel catfish, common carp, spottail shiner, yellow perch, burbot, alewife, mottled sculpin, lake trout, lake whitefish, bloater, and rainbow smelt. This report also discussed several invertebrates including *Diporeia*, *Mysis*, and *Gammarus* in addition to these fish species. This list of representative important species was approved by Steve Hogler, WDNR fisheries biologist, on August 14, 2012. The Department also confirms the upper lethal and avoidance temperature ranges are reasonable compared to peer-reviewed studies used by the Department when deriving the thermal water quality standards for surface waters. After reviewing the available temperature data and the temperature preferences of the representative important species, there appears to be portions of the mixing zone that will not be suitable for all life stages of these species. Although the discharge plume may cause some negative impacts to the fish community of the immediate area or to the localized ecology of the area, the Department has concluded that the thermal plume created at 8,273 MBTU/hr will cause minimal impacts to the fish and invertebrate communities on the representative important species list.

In conclusion, the Department agrees that the discharge at the maximum heat load of 8,273 MBTU/hr is protective of the balanced, indigenous community of shellfish, fish, and wildlife in and on Lake Michigan and that no temperature limit is needed. Other factors such as threatened and endangered species and cumulative impacts from other thermal and pollutant mixing zones, were considered as part of this decision, but determined to not be applicable to this demonstration. This decision will be re-evaluated by the Department upon permit reissuance. Additional data should be submitted with the next permit application to continue to justify an alternative effluent limit to the Department.

If there are any questions or comments, please contact Amanda Minks at (608) 264-9223.

Sincerely,

Amanda Minks

Amanda Minks
Water Quality Standards Specialist

CC: Kelley O'Connor- NER
Tom Mugan- WT/3
Mike Lemcke- WT/3
Bob Masnado- WT/3

State of Wisconsin
DEPARTMENT OF NATURAL RESOURCES
101 S. Webster Street
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Cathy Stepp, Secretary
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WISCONSIN
DEPT. OF NATURAL RESOURCES

August 6, 2012

Larry Meyer, Site Vice President
NextEra Energy Point Beach Nuclear Plant
6610 Nuclear Road
Two Rivers, WI 54241

Subject: Mixing Zone Phase-out Exception for Mercury – Point Beach Nuclear Power Plant

Dear Mr. Meyer:

NextEra Energy has requested continued application of a mixing zone for outfalls 001 and 002 of the Point Beach Nuclear Power Plant (PBNP) for calculating effluent limitations for mercury beyond November 15, 2010 under the exception for technical and economic considerations to the mixing zone phase-out for bioaccumulating chemicals of concern (BCC's) at 40 CFR, Part 132, Appendix F, Procedure 3 C. 6.

In consideration of the requirements contained at the above reference, the Wisconsin Department of Natural Resources (WDNR) determines that:

- PBNP is in compliance with all applicable requirements of Clean Water Act sections 118, 301, 302, 303, 304, 306, 307, 401, and 402, including existing categorical effluent limitations and water quality based effluent limitations (WQBELs).
- The previous owner of PBNP, We Energies, conducted an investigation in 2004 to explain why mercury effluent concentrations were higher than intake/background concentrations. The investigation determined that there were no identifiable additions of mercury as a result of plant operation, after a reagent containing mercury iodide was discontinued in 2003. The investigation concluded that background/intake mercury was being concentrated by the makeup water treatment system, which is to say that reject streams, such as softener regenerant, were contributing to the higher mercury concentrations going to the wastewell. The new owner, NextEra, has stated that it has not introduced any processes or chemicals that could add mercury to the environment. NextEra believes, as did the previous owner, that the plant is concentrating the incoming mercury.
- NextEra will accept a new permit requirement for implementing a mercury pollutant minimization plan (PMP) that meets the requirements of s. 106.145(7), Wis. Adm. Code. The PMP shall, in essence, consist of a mass balance of mercury across the plant. The intent is to demonstrate that the mass of mercury coming into the plant via the water intake is essentially equal to the aggregate mass of mercury leaving the plant via the effluent discharges from outfalls 001 and 002 and any solids or sludges leaving the plant; and furthermore that the mass of the mercury leaving the plant via outfalls 001 and 002 is no greater than the mass of the mercury coming into the plant via the water intake.
- WDNR believes that the finding at s. 106.145(1)(a), sufficiently demonstrates that controls beyond a PMP would result in unreasonable economic effects because controls to remove mercury using wastewater treatment technology are not feasible or cost-effective.
- PBNP discharges directly to Lake Michigan. Under s. NR 106.06(4)(b)2, WQBELs are calculated using a mixing or dilution calculation of one part effluent to ten parts receiving water. The WQBEL for mercury using this procedure is 9.32 ng/L (monthly average). The mean effluent concentration is 0.7

ng/L, which is less than 1/5th of the calculated monthly average. Therefore, a mercury limit is not required.

- There has not previously been a mercury effluent limitation in PBNP's permit, and therefore the requirements for mercury in PBNP's proposed permit are no less strict than requirements prior to November 13, 2000 (the date of the aforementioned federal regulation).
- The size of the mixing zone is defined by the 10 to 1 dilution ratio. There are no regulatory requirements nor does data and information exist to allow WDNR to make a scientifically and valid determination of an alternative size of the mixing zone that could be attained with current available and economically feasible technology.
- By definition, the water quality criteria are met at the edge of the mixing zone.
- There is currently no applicable TMDL for mercury in Lake Michigan as data indicate that the concentration of mercury in Lake Michigan meets all applicable water quality criteria. Other actions to reduce releases of mercury include rules to control emissions from utility boilers and proposed mercury product legislation. It should be noted that PBNP has no boiler emissions because it is a nuclear plant.
- This mixing zone and resulting WQBELs meet the requirements at 40 CFR, Part 132, Appendix F, Procedure 3 D., including that the actions will not jeopardize the continued existence of endangered or threatened species. The requirements for authorizing the above mixing zone exception and the circumstances under which it is being granted is essentially the same as those for granting a variance to water quality standards. WDNR has analyzed the potential impacts to endangered and threatened species as part of its variance process. That analysis concluded that approval of mercury variances, with more stringent permit requirements for PMPs, is unlikely to adversely affect bald eagles or other listed species that occur within the State of Wisconsin.

In consideration of the foregoing determinations, WDNR grants a mixing zone exception to NextEra Energy's Point Beach Nuclear Plant due to technical and economic considerations.

The granting of this exception shall apply only to the 5-year permit term of the proposed WPDES permit. NextEra will need to make a similar request and DNR will need to make a similar determination for a further continuation of a mixing zone, if those actions become appropriate for the next permit term.

Sincerely,

Daniel J. Joyce
Wastewater Engineer
Water Quality Bureau

CORRESPONDENCE / MEMORANDUM ______________________ **State of Wisconsin**

DATE: August 29, 2011 FILE REF: 3200

TO: Paul Luebke– WT/3

FROM: Mike Lemcke- WT/3 Diane Figiel for ML

SUBJECT: Water Quality-Based Effluent Limitations for NextEra– Energy Point Beach, LLC
WPDES Permit No. WI-0000957

This is in response to your request for an evaluation of water quality-based effluent limitations for toxic substances using chs. NR 102, 105, 106, and 207 of the Wisconsin Administrative Code (where applicable), for the discharge from the Point Beach Nuclear Power Plant, in Manitowoc County to Lake Michigan. This plant is located in the "East Twin River Watershed" (TK 02) in the Twin-Door-Kewaunee River Basin. The evaluation of the permit recommendations is discussed in more detail in the attached report.

No changes are recommended in any permit limitations for the "conventional" pollutants, which in this case include BOD_5, Total Suspended Solids, pH, and Oil & Grease.

Based on our review, the following recommendations are made on a chemical-specific and water-quality basis:

Outfalls 001 & 002 - Condenser Cooling Water

Parameter	Daily Maximum	Daily Minimum	Weekly Average	Monthly Avearge	Monitoring Only
pH	9.0 s.u.	6.0 s.u.			
Chlorine, Total Residual	Variable*				
Additive Water Treatment - EVAC	0.071 mg/L				
Temperature					
August			70°F		
September			65°F		
October			56°F		
Phosphorus					X
Arsenic**				2.2 ug/L	

*The Residual Chlorine is limited to a daily make of 200 μg/L if chlorine is added for 160 minutes per day or less, or 38 μg/L if chlorine is added for more than 160 minutes per day.
** Arsenic monthly limit is subject to drop if after the first year of the permit term, NextEra demonstrates arsenic concentrations in the effluent are below the recommended limit.

Although not explicitly addressed in this evaluation, continuation of the current in-plant limitations on the individual process wastewater streams prior to blending for Total Suspended Solids and Oil & Grease, based on categorical standards, is also recommended.

Along with the chemical-specific and water quality based recommendations mentioned above, the need for acute and chronic whole effluent toxicity testing is also evaluated for the discharge from NextEra–Point Beach Nuclear Power Plant. Following the guidance provided in the Department's July 1, 2008 *Whole Effluent Toxicity Program Guidance Document - Revision #8*, acute and chronic whole effluent toxicity test batteries are recommended three times throughout the 5-year permit term. The chronic testing shall be performed using a dilution series of 100, 30, 10, 3, 1%.

Please consult the attached report for details regarding the above recommendations. If there are any questions or comments, please contact Amy Schmidt by telephone at (608) 266-3906, or by e-mail at amy.schmidt@wisconsin.gov.

Attachment (2) – Narrative & Complete Thermal Tables

PREPARED BY: Amy Schmidt, Wastewater Engineer

APPROVED BY: Diane Figiel date: 8/29/11
Diane Figiel, Water Resources Engineer

cc: David Gerdman, Basin Engineer – NER/Green Bay
Kelley O'Connor, Lakeshore Team Leader – NER/Green Bay (cover memo only)
Amy Schmidt – WT/3

Water Quality-Based Effluent Limitations for
NextEra– Energy Point Beach, LLC
WPDES Permit No. WI-0000957

Prepared by:
Amy Schmidt

Facility Description: NextEra– Energy Point Beach, LLC, hereinafter simply NextEra, operates the Point Beach Nuclear Power Plant which consists of two nuclear powered steam supply units which drive two turbine generators rated at 630 megawatts each. The wastewater consists primarily of once through noncontact cooling water from generating units. Treated effluent is discharged to Lake Michigan. The outfalls are located in the NW ¼ of Section 24, T21N-R24E, Town of Two Creeks in Manitowoc County. This power plant is located in the "East Twin River Watershed" (TK02) in the Twin-Door-Kewaunee River Basin.

Existing Permit Limitations:

Sample Points: 101, 102, 103, 106, & 107

Parameter	Daily Maximum	Monthly Average
TSS	100 mg/L	30 mg/L
Oil & Grease (Hexane)	20 mg/L	15 mg/L

Sample Point 104

Parameter	Weekly Average	Monthly Average
BOD5, Total	45 mg/L	30 mg/L
TSS	45 mg/L	30 mg/L

Sample Point 105

Parameter	Daily Maximum	Monthly Average
TSS	100 mg/L	30 mg/L
Oil & Grease (Hexane)	20 mg/L	15 mg/L

Outfalls: 001 & 002

Parameter	Daily Maximum	Daily Minimum	Monitoring Only
pH	9.0 s.u.	6.0 s.u.	
Chlorine, Total Residual	320 lbs/day		
Temperature			X
Additive Water Treatment - EVAC	0.071 mg/L		

Receiving Water Information:

- Name: Lake Michigan
- Classification: Great Lakes System, cold water community, public water supply
- Flow: Lake classification with 10 to 1 dilution ratio to effluent
- Hardness = 130 mg/L as $CaCO_3$
- Source of background concentration data: Data for several metal substances shown in the tables below has been obtained from Lake Michigan approximately 7 miles off Milwaukee. The background Mercury concentration is the mean o the intake data. Intake data is considered for several substances in the following discussion. Where no data is available, a background concentration of zero is assumed.
- Multiple dischargers: There are a number of dischargers in this watershed. None are considered significant to this evaluation.

Effluent Information:

Outfalls 001 & 002 – Condenser Cooling Water

- Flow: The following actual flow data was reported on the application for permit reissuance.
  Annual average = 840.6 MGD (Million Gallons per Day)
  Peak daily = 1008 MGD
  Peak monthly = 994.7 MGD
- Hardness = 176.5 mg/L as $CaCO_3$ (geometric mean of data from the permit application)
- Acute dilution factor used: 1

Sample Point 105 – Low Volume Wastewater In-plant Location

- Flow: The following actual flow data was reported on the application for permit reissuance.
  Annual average = 0.14266 MGD (Million Gallons per Day)
  Peak daily = 0.317 MGD
  Peak monthly = 0.181 MGD
- Hardness = 180.4 mg/L as $CaCO_3$ (geometric mean of data from the permit application)
- Acute dilution factor used: 1

- Effluent Characterization: This facility is categorized as a Primary Industry, so the permit application required sample analyses for Volatile Organics and Acid Extractable Compounds. A total of 18 samples for Mercury were submitted as part of ss. NR 106.145(9) and (10), Wisconsin Administrative Code. The results of the Mercury monitoring are tabulated immediately below.
- Water Source: Virtually all of the water discharged is withdrawn from Lake Michigan.

	Mercury [ng/L]									
Sample Date	Intake A	Intake B	Average	Outfall 001 A	Outfall 002 A	Outfall 002 B	Average	Sample Point A	Sample Point B	Average
05/05/2004	0.38	0.36	**0.37 (<0.10)**	-	0.4	0.39	**0.395 (<0.10)**	13.6	12.2	**12.9 (<0.10)**
05/21/2004	0.33	0.34	**0.335 (<0.10)**	-	0.4	0.41	**0.405 (<0.10)**	10.5	11.4	**10.95 (<0.10)**
09/23/2008	-	-	-	-	**<0.14 (<0.14)**	-	-	**14 (<0.14)**	-	-
10/21/2008	-	-	-	-	**2.5 (<0.14)**	-	-	**14 (<0.14)**	-	-
11/25/2008	-	-	-	-	**1.2 (<0.14)**	-	-	**4 (<0.14)**	-	-
03/24/2009	**0.79 (<0.14)**	-	-	-	-	-	-	-		
05/04/2009	-	-	-	**0.28 (<0.14)**	**0.24 (<0.14)**	-	-	**0.47 (<0.14)**	-	-
05/04/2009	-	-	-	**0.32 (<0.12)**	**0.29 (<0.12)**	-	-	**12.3 (<0.12)**	-	-

Effluent Limitations for Toxic Substances: The following tables list the water quality-based effluent limitations for this discharge along with the results of testing effluent samples. In these tables some of the numerical values appear in exponential notation. Following the tables, permit recommendations are made where appropriate, based on a comparison between the effluent concentrations and the calculated limits pursuant to ss. NR 106.04 and 106.05.

Outfalls 001 & 002 – Condenser Cooling Water

DAILY MAXIMUM LIMITS based on ACUTE TOXICITY CRITERIA: (µg/L, except for Chlorides which is in mg/L)

SUBSTANCE	REF. HARD. or pH	ATC	MAX. EFFL. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	1-day MAX. CONC.
-	-	-	-	-	-	-
Chlorine		19.03	38.06	7.61	<0.016	
Arsenic		339.8	679.60	135.92	1	
Cadmium	176.5	8.36	16.72	3.34	<0.12	
Chromium (+3)	176.5	2871.39	5742.78	1148.56	0.17	
Chromium (+6)		16.02	32.04	6.41	<0.0025	
Copper	176.5	26.52	53.04	10.61	<6.0	
Lead	176.5	185.13	370.26	74.05	<0.12	
Mercury		0.83	1.66	0.332	7.03E-04	2.5E-03
Nickel	176.5	736.66	1473.32	294.66	<6.0	

Zinc	176.5	197.84	395.68	79.14	<6.0
Cyanide		22.36	44.72	8.94	<0.017
Chlorides (mg/L)		757	1514	303	10

In the past permit, there was a daily maximum chlorine limitation of 38 ug/L when discharged for more than 160 minutes per day and 200 ug/L daily maximum for discharges under 160 minutes per day (categorical limit from ch. NR 290). The ch. NR 105 criteria for chlorine have not changed since the current permit was issued, so no changes are recommended in the chlorine limits at the two Outfalls.

WEEKLY AVERAGE LIMITS based on CHRONIC TOXICITY CRITERIA: (µg/L, except for Chlorides which is in mg/L)

RECEIVING WATER "FLOW" = 15596.472 cfs

SUBSTANCE	REF. HARD. or pH	CTC	MEAN BACK-GRD.	WEEKLY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
-	-	-	-	-	-	-
Chlorine		7.28		80.08	16.02	<0.016
Arsenic		148		1628.00	325.60	1
Cadmium	130	3.03		33.33	6.67	<0.12
Chromium (+3)	130	106.87		1175.57	235.11	0.17
Chromium (+6)		10.98		120.78	24.16	<0.0025
Copper	130	12.96	0.44	138.16	27.63	<6.0
Lead	130	36.09		396.99	79.40	<0.12
Mercury		0.44	4.98E-04	4.84	0.968	7.03E-04
Nickel	130	65.17		716.87	143.37	<6.0
Selenium		5		55.00	11.00	0.64
Zinc	130	151.42		1665.62	333.12	<6.0
Cyanide		5.22		57.42	11.48	<0.017
Chlorides (mg/L)		395		4345	869	10

No effluent limitations are recommended based on chronic toxicity to aquatic organisms.

MONTHLY AVERAGE LIMITS based on WILDLIFE CRITERIA: (µg/L)

RECEIVING WATER "FLOW" = 15596.472 cfs

SUBSTANCE		WC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
-	-	-	-	-	-	-
Mercury		1.30E-03	4.98E-04	9.32E-03	1.86E-03	7.03E-04

At this time, the mercury concentrations do not exceed 1/5 of the monthly limit and so no limitations are recommended. It should be noted that with a mixing zone phase out as required under the GLI the limit would be equal to criteria, 1.3 ng/L. Under this scenario an exemption to the mixing zone phase could be requested or an alternative mercury effluent limitation (AMEL) is allowed by s. NR 106.145(4). For this, the permitee would need to submit an application for an AMEL which includes the submittal of a pollutant minimization plan. As specified in s. NR 106.145(5), an alternative limitation would equal the

1-day p99 of the effluent data and should be expressed as a daily maximum concentration. This will not be addressed further until ch. NR 106 is revised to reflect the phase out.

No other effluent limitations are recommended based on toxicity to wildlife.

MONTHLY AVERAGE LIMITS based on HUMAN THRESHOLD CRITERIA: (μg/L)

RECEIVING WATER "FLOW" = 15596.472 cfs

SUBSTANCE	HTC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Antimony	5.6		62	12	0.31
Cadmium	4.4		48	10	<0.12
Chromium, total	100		1100	220	0.17
Chromium (+6)	83.5		919	184	<0.0025
Lead	10		110	22	<0.12
Mercury	1.50E-03	4.98E-04	1.15E-02	2.30E-03	7.03E-04
Nickel	100		1100	220	<6.0
Selenium	50		550	110	0.64
Silver	140		1540	308	<0.12
Cyanide	138.6		1525	305	<0.17

See the discussion regarding Mercury above. No other effluent limits are recommended based on Human Threshold Criteria.

MONTHLY AVERAGE LIMITS based on HUMAN CANCER CRITERIA: (μg/L)

RECEIVING WATER "FLOW" = 15596.472 cfs

SUBSTANCE	HCC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Arsenic	0.2		2.20	0.44	1
Beryllium	0.054		0.59	0.12	<0.12

The cumulative cancer risk is considered, as follows.

DETECTED CARCINOGEN	HCC-BASED EFFLUENT LIMIT	MEAN EFFL. CONC.	EFFL. CONC./ LIMIT
Arsenic	2.2	1	0.455
TOTAL	(must be < 1)	=	0.455

This computation assumes that the incremental risk of each carcinogen is additive. Since the sum of the effluent concentrations divided by the its respective effluent limitation, is less than 1, limits do not need to be adjusted for cumulative cancer risk. However, the effluent Arsenic concentration exceeds 1/5 of the effluent limit, thus a monthly limit of 2.2 ug/L needs to be put into affect for Arsenic. There are two different ways to approach this limit due to the fact that is is such a low limit. First, since the plant does condenser cooling, if the intake arsenic is found to be higher than that of the value detected at Outfall 001 & 002, than the limit does not need to be included. Second, a monitoring schedule can be established in order to gather sufficient data to determine the necessity of an arsenic limit. For the basis of this WQBEL, a monthly average limit of 2.2 ug/L is recommended. However, if after the first year NextEra is able to demonstrate the arsenic concentrations within the effluent are below this calculated limit, the limit can be dropped.

MONTHLY AVERAGE LIMITS based on TASTE & ODOR CRITERIA: (μg/L)

SUBSTANCE	TOC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
-	-	-	-	-	-
Copper	1000	0.44	10996	2199	<6.0
Zinc	5000		55000	11000	<6.0
Phenol	300		3300	660	<0.00126

No effluent limitations are recommended based upon Taste & Odor Criteria.

Sample Point 105 – Low Volume Wastewater In-Plant Location

DAILY MAXIMUM LIMITS based on ACUTE TOXICITY CRITERIA: (μg/L, except for Chlorides which is in mg/L)

SUBSTANCE	REF. HARD. or pH	ATC	MAX. EFFL. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.	1-day MAX. CONC.
-	-	-	-	-	-	-
Chlorine		19.03	38.06	7.61	<0.016	
Arsenic		339.8	679.60	135.92	<0.12	
Cadmium	180.4	8.57	17.14	3.43	<0.12	
Chromium (+3)	180.4	2923.25	5846.50	1169.30	<0.12	
Chromium (+6)		16.02	32.04	6.41	<0.0025	
Copper	180.4	27.07	54.14	10.83	7.85	
Lead	180.4	189.08	378.16	75.63	1.8	
Mercury		0.83	1.66	0.332	1.02E-02	1.70E-02
Nickel	180.4	750.41	1500.82	300.16	<6.0	
Zinc	180.4	201.66	403.32	80.66	12	
Cyanide		22.36	44.72	8.94	<0.017	
Pentachlorophenol	7.75	18.45	36.90	7.38	<0.770	
Chlorides (mg/L)		757	1514	303	10	

No effluent limitations are recommended based on acute toxicity to aquatic organisms.

WEEKLY AVERAGE LIMITS based on CHRONIC TOXICITY CRITERIA: (µg/L, except for Chlorides which is in mg/L)

RECEIVING WATER "FLOW" = 4.904843 cfs

SUBSTANCE	REF. HARD. or pH	CTC	MEAN BACK-GRD.	WEEKLY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Chlorine		7.28		80.08	16.02	<0.016
Arsenic		148		1628.00	325.60	<0.12
Cadmium	130	3.03		33.33	6.67	<0.12
Chromium (+3)	130	106.87		1175.57	235.11	<0.12
Chromium (+6)		10.98		120.78	24.16	<0.0025
Copper	130	12.96	0.44	138.16	27.63	7.85
Lead	130	36.09		396.99	79.40	1.8
Mercury		0.44	4.98E-04	4.84	0.968	1.02E-02
Nickel	130	65.17		716.87	143.37	<6.0
Selenium		5		55.00	11.00	0.19
Zinc	130	151.42		1665.62	333.12	12
Cyanide		5.22		57.42	11.48	<0.017
Pentachlorophenol	8.2	22.14		243.54	48.71	<0.770
Chlorides		395		4345	869	10

No effluent limitations are recommended based on chronic toxicity to aquatic organisms.

MONTHLY AVERAGE LIMITS based on WILDLIFE CRITERIA: (µg/L)

RECEIVING WATER "FLOW" = 4.904843 cfs

SUBSTANCE	WC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Mercury	1.30E-03	4.98E-04	9.32E-03	1.86E-03	1.02E-02

See the discussion regarding Mercury below. No other effluent limitations are recommended based on toxicity to wildlife.

MONTHLY AVERAGE LIMITS based on HUMAN THRESHOLD CRITERIA: (µg/L)

RECEIVING WATER "FLOW" = 4.904843 cfs

SUBSTANCE	HTC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Antimony	5.6		62	12	0.12
Cadmium	4.4		48	10	<0.12
Chromium, total	100		1100	220	<0.12
Chromium (+6)	83.5		919	184	<0.0025
Lead	10		110	22	1.8

Mercury	0.0015	4.98E-04	0.0115	2.30E-03	1.02E-02
Nickel	100		1100	220	<6.0
Selenium	50		550	110	0.19
Silver	140		1540	308	<0.12
Cyanide	138.6		1525	305	<0.17
Acrolein	3.4		37	7	<5.0
Benzene	5		55	11	<0.20
Chlorobenzene	100		1100	220	<0.20
1,2-Dichloroethylene (cis)	70		770	154	<0.50
1,2-Dichloroethylene (trans)	100		1100	220	<0.50
Dichloropropenes	8.2		90	18	<0.50
Ethylbenzene	401		4411	882	<0.50
Methylene Chloride	5		55	11	<1.0
Toluene	1000		11000	2200	<0.50
1,1,1-Trichloroethane	200		2200	440	<0.50
2,4-Dichlorophenol	58		638	128	<0.770
2,4-Dimethylphenol	430		4730	946	<7.90
Dinitrophenols	55		605	121	<0.720
1,2-Dichlorobenzene	273		3003	601	<0.20
1,3-Dichlorobenzene	710		7810	1562	<0.20
2,4,5-Trichlorophenol	830		9130	1826	<0.670

See the discussion regarding Mercury below. No other effluent limits are recommended based on Human Threshold Criteria.

MONTHLY AVERAGE LIMITS based on HUMAN CANCER CRITERIA: (μg/L)

RECEIVING WATER "FLOW" = 4.904843 cfs

SUBSTANCE	HCC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Arsenic	0.2		2.20	0.44	<0.12
Beryllium	0.054		0.59	0.12	<0.12
Acrylonitrile	0.45		4.95	0.99	<5.0
Benzene	5		55	11	<0.20
Bromoform	53		583	117	<0.20
Carbon Tetrachloride	2.1		23.10	4.62	<0.50
Chloroform	53		583	117	<0.20
Dichlorobromomethane	53		583	117	<0.20
1,2-Dichloroethane	3.8		41.80	8.36	<0.50
Methyl Bromide	53		583	117	<0.50
Methyl Chloride	53		583	117	<0.30
Methylene Chloride	5		55	11	<1.0
1,1,2,2-Tetrachloroethane	1.6		17.60	3.52	<0.20
Tetrachloroethylene	4.6		51	10	<0.50
1,1,2-Trichloroethane	6		66	13	<0.25
Trichloroethylene	5		55	11	<0.20

Vinyl Chloride	0.18		1.98	0.40	<0.20
2,4,6-Trichlorophenol	24		264	53	<0.690
1,4-Dichlorobenzene	12		132	26	<0.50
1,3-Dichloropropene	3.4		37.40	7.48	<0.25

No effluent limits are needed based upon Human Cancer Criteria.

MONTHLY AVERAGE LIMITS based on TASTE & ODOR CRITERIA: (μg/L)

SUBSTANCE	TOC	MEAN BACK-GRD.	MO'LY AVE. LIMIT	1/5 OF EFFL. LIMIT	MEAN EFFL. CONC.
Copper	1000	0.44	10996	2199	7.85
Zinc	5000		55000	11000	12
Chlorobenzene	20		220	44	<0.20
2-Chlorophenol	0.1		1.10	0.22	<0.770
2,4-Dichlorophenol	0.3		3.30	0.66	<0.770
2,4-Dimethylphenol	400		4400	880	<7.90
P-Chloro-M-Cresol	3000		33000	6600	<0.510
Pentachlorophenol	30		330	66	<0.770
Phenol	300		3300	660	<0.390
2,4,5-Trichlorophenol	1		11.00	2.20	<0.670
2,4,6-Trichlorophenol	2		22.00	4.40	<0.690

No effluent limitations are recommended based upon Taste & Odor Criteria.

Mercury: In accordance with s. NR 106.145(2), the need for effluent limitations for Mercury must be based on a minimum of twelve sample results collected over a two-year period. Clearly, available data does not meet this minimum requirement. However, the Mercury concentrations at Sample Point 105, an internal sample point would seem to exceed the water quality criterion, though at the actual Outfalls 001 and 002, the Mercury levels will not exceed the limit and so overall, Mercury levels should not exceed the monthly average and there would be no need for effluent limits. Monitoring is recommended in order to provide insight on to Mercury concentrations within the plant.

Phosphorus: Wisconsin Administrative Code, ch. NR 217, requires industrial wastewater dischargers that discharge greater than 60 pounds of Total Phosphorus per month to comply with a Monthly Average limit of 1.0 mg/L, expressed as a rolling 12-month average, or an approved Alternative Concentration limit. The application for permit reissuance included four effluent sample results reported at less than the level of detection (<0.10 mg/L). Consequently it appears unlikely that greater than 60 pounds of phosphorus are discharged per month.

However, revisions to the administrative rules for phosphorus discharges took effect on December 1, 2010. For Lake Michigan (in the East Twin River Watershed) the new rules specify a water quality criterion (WQC) of 7 ug/L for phosphorus. Median phosphorus concentrations (Cs) in the Lake is 25 ug/L (5 results for samples collected at various locations in Lake Michigan) exceeding the WQC of 7 ug/L, and indicates the lake has no assimilative capacity for phosphorus loading above the WQC. For this type of situation NR 217.13(3) specifies the WQBEL for phosphorus be set equal to 7 ug/L and a mass limit for phosphorus is also required.

The new phosphorus rules also allow for EPA approved Total Maximum Daily Loading (TMDL) models to be used to establish mass limits in the form of phosphorus allocations for the various discharges within a watershed. Until the time at which this model is available, we will be using an interim limit of 0.6 mg/L for Great Lakes waters (s. NR 217.13(4)).

However, s. NR 217.04(1)(a)2 specifies that, "Outfalls consisting of noncontact cooling water without phosphorus containing additives may not be included in the calculation of the cumulative total of phosphorus discharged from the facility." In this instance, it is possible that the sheer volume of water used for cooling dilutes the "process" effluent to such a degree that the effluent concentration is effectively masked. The data provided with the application for Outfall 001 stated the results were found to be less than the level of detection (<0.10 mg/L). The only minor source of phosphorus is at Sample Point 105, which had four detected results of 1.1, 1.7, 0.27, and 0.14 mg/L. Even though these detects trigger a phosphorus limit, it would be implemented at Outfall 001 and 002, which have levels of phosphorus below detection; however monitoring should be included in the reissued permit.

Ammonia- Nitrogen: The most stringent limitation calculated with the revised criteria would be a daily maximum limitation of 1.8 mg/L based on an effluent pH of 9.0 standard units. The application for permit reissuance included four effluent sample results for Ammonia Nitrogen. The results were all less than the level of detection (<0.10 mg/L). Based on examination of the list of additives, minimal amounts of Ammonia are introduced into the effluent. No effluent limitations for Ammonia Nitrogen are recommended.

Thermal: New surface water quality standards for temperature took effect on October 1, 2010. These new regulations are detailed in Chapter NR 102 (Subchapter II – Water Quality Standards for Temperature) and NR 106 (Subchapter V – Effluent Limitations for Temperature) of the Wisconsin Administrative Code.

In accordance with s. NR 106.53(2)(b), the highest daily maximum flow rate for a calendar month is used to determine the acute (daily maximum) effluent limitation. In accordance with s. NR 106.53(2)(c), the highest 7-day rolling average flow rate for a calendar month is used to determine the sub-lethal (weekly average) effluent limitation. These values were based off of actual flow reported from January 2004 to March 2011.

For facilities that discharge to great lakes waters, temperature limits are calculated in accordance with s. NR 106.55(7). The Point Beach discharges, Outfall 001 and 002 are considered Great Lakes shore discharge with a mixing zone of 3,125,000 squared feet. The following table summarized the values used in calculating temperature limitations that are site-specific. Ta, ambient temperature, and the water quality criteria are in accordance with ss. NR 102.25 to 27.

Month	Water Quality Criteria		
	Ta (default) (°F)	Sub-Lethal WQC (°F)	Acute WQC (°F)
JAN	34	43	69
FEB	33	47	69
MAR	35	52	69

APR	39	58	70
MAY	44	64	71
JUN	48	69	72
JUL	53	71	73
AUG	56	69	73
SEP	53	64	73
OCT	48	55	72
NOV	42	47	70
DEC	36	44	69

These values, in combination with the effluent flow data for each of the outfalls result in the following limitations. Following the Wisconsin Administrative Code for reasonable potential (ss. NR 106.56(2) and (3)), the recommended limits are in red, which is when the effluent temperature exceeds the calculated limit. For the entire spreadsheet please see attachment 2.

	Outfall 001				Outfall 002			
	Representative Highest Monthly Effluent Temperature		**Calculated Effluent Limit**		Representative Highest Monthly Effluent Temperature		**Calculated Effluent Limit**	
Month	Weekly Average (°F)	Daily Maximum (°F)	**Weekly Average Effluent Limitation** (°F)	**Daily Maximum Effluent Limitation** (°F)	Weekly Average (°F)	Daily Maximum (°F)	**Weekly Average Effluent Limitation** (°F)	**Daily Maximum Effluent Limitation** (°F)
JAN	~~39~~	~~42~~	44	75	~~41~~	~~42~~	44	75
FEB	~~39~~	~~41~~	49	74	~~39~~	~~42~~	49	75
MAR	~~42~~ *	~~44~~	54	72	~~41~~ *	~~43~~	54	72
APR	~~48~~	~~51~~	60	73	~~45~~	~~49~~	60	73
MAY	~~50~~	~~62~~	66	73	~~51~~	~~53~~	66	73
JUN	~~58~~	~~71~~	71	74	~~58~~	~~70~~	71	74
JUL	~~59~~	~~69~~	73	75	~~60~~	~~69~~	73	75
AUG	~~70~~	~~73~~	70	75	~~71~~	~~72~~	70	75
SEP	~~70~~	~~72~~	65	75	~~70~~	~~72~~	65	75
OCT	~~58~~	~~61~~	56	74	~~57~~	~~61~~	56	74
NOV	~~45~~	~~52~~	47	73	~~47~~	~~52~~	47	73
DEC	~~40~~	~~43~~	45	72	~~40~~	~~43~~	45	72

Additives: The application for permit reissuance indicates that 3 biocide and 22 water quality conditioners are used. Nine of those water quality conditioners and two of those biocides are used less frequently than once in any four-day period. These additives are not evaluated individually. Rather, their use will be considered collectively in the evaluation of the need for Whole Effluent Toxicity testing.

Whole Effluent Toxicity (WET) Evaluation: WET testing is used to measure, predict, and control the discharge of toxic materials that may be harmful to aquatic life. In WET tests, organisms are exposed to a series of effluent concentrations for a given time. Acute tests predict the concentration that causes lethality of aquatic organisms during a 48 to 96-hour exposure. Chronic tests predict the concentration that interferes with the growth or reproduction of test organisms during a seven-day exposure.

* Effluent temperatures shown in table above are incorrect.
Refer to tables attached to the end of this memo for correct values.
Paul W. Luebke 3/1/2012

According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Wis. Adm. Code), the default acute dilution series is: 6.25, 12.5, 25, 50 & 100%, and the default chronic dilution series is 100, 30, 10, 3 & 1%. The permittee or Department staff may choose other dilution series, but alternate dilution series must be specified in the WPDES permit. For guidance on selecting an alternate dilution series, see Chapter 2.11 of the WET Guidance Document.

According to the *State of Wisconsin Aquatic Life Toxicity Testing Methods Manual* (s. NR 219.04, Wis. Adm. Code) receiving water must be used as the dilution water and primary control in WET tests, unless the use of another dilution water is approved by the Department prior to use. The dilution water used in WET tests conducted on outfall 001 shall be a grab sample collected from the Fox River, upstream or out of the influence of the mixing zone and any other known discharge. Collection of river water (Lake Winnebago water) from the intake for the Neenah Waterworks is suggested. The receiving water location must be specified in the WPDES permit.

Below is a tabulation of all available WET data form NextEra for outfall 001.

Date Initiated	Acute Results LC_{50}				Chronic Results IC_{25}			
	C. dubia	Fathead minnow	Pass or Fail ?	Use in RPF ?	*C. dubia*	Fathead Minnow	Pass or Fail ?	Use in RPF ?
04/08/2003	>100	>100	Pass	Yes		>100		No
09/13/2005	>100	>100	Pass	Yes	>100	>100	Pass	Yes
06/05/2007	>100	>100	Pass	Yes	>100	>100	Pass	Yes
03/24/2009	>100	>100	Pass	Yes	>100	100	Pass	Yes

RPF = Reasonable Potential Factor

Efforts have been made to insure that decisions about WET monitoring and limits have been made based on representative data. Data which is thought to no longer be representative of the discharge being evaluated have not been included in RPF calculations. The table above shows the tests used in RPF calculations. It should also be noted that the Instream Waste Concentration used in the current permit is 9%.

The WET Checklist has been developed to assist DNR staff when deciding whether WET limits and monitoring are needed. As toxicity potential increases, more points accumulate and more monitoring is needed to insure that toxicity is not occurring. The Checklist recommends acute and chronic WET limits (as needed) based on the Reasonable Potential Factor (RPF), as required by s. NR 106.08, Wis. Adm. Code, and monitoring frequencies based on points accumulated during the Checklist analysis. The completed WET Checklist and monitoring recommendations are summarized in the table below. (For more on the RPF and WET Checklist, see Chapter 1.3 of the WET Guidance Document, at: http://www.dnr.state.wi.us/org/water/wm/ww/biomon/biomon.htm).

WHOLE EFFLUENT TOXICITY (WET) CHECKLIST SUMMARY

	ACUTE	CHRONIC
1. INSTREAM WASTE CONCENTRATION	1A. Not Applicable **TOTAL POINTS = 0**	1B. IWC = 9% **TOTAL POINTS = 0**
2. HISTORICAL DATA	2A. 4 tests used in RPF, all passed; RPF = 0 **TOTAL POINTS = 0**	2B. 3 tests used in RPF, all passed; RPF = 0 **TOTAL POINTS = 0**
3. EFFLUENT VARIABILITY	3A.Little variability, no violations or upsets, consistent WWTF operations **TOTAL POINTS = 0**	3B. Same as Acute **TOTAL POINTS = 0**
4. STREAM CLASSIFICATION	4A. Cold Water, Public Water Supply, in Great Lakes (FFAL) **TOTAL POINTS = 5**	4B. Same as Acute **TOTAL POINTS = 5**
5. CHEMICAL SPECIFIC DATA	5A. No limits based on ATC; Chloride, As & Hg, detected **TOTAL POINTS = 3**	5B. No limits based on CTC; Chloride, Cr, As & Hg detected, plus 1 Additional Compound of Concern (ACC) detected. **TOTAL POINTS = 5**
6. ADDITIVES	6A. 3 Biocide and 22 Water Quality Conditioners added **TOTAL POINTS = 20**	6B. Same as Acute **TOTAL POINTS = 20**
7. DISCHARGE CATEGORY	7A.Steam electric power generation Contact Cooling Water **TOTAL POINTS = 5**	7B. Same as Acute **TOTAL POINTS = 5**
8. WASTEWATER TREATMENT	8A. Secondary Treatment provided **TOTAL POINTS = 0**	8B. Same as Acute **TOTAL POINTS = 0**
9. DOWNSTREAM IMPACTS	9A. None attributable to discharge **TOTAL POINTS = 0**	9B. Same as Acute **TOTAL POINTS = 0**
TOTAL POINTS	33	35

Based on historical WET data and RPF calculations (as required in s. NR 106.08, Wis. Adm. Code), neither an acute nor a chronic WET limit is required. Based upon the point totals generated by the WET Checklist, other information given above, and Chapter 1.3 of the WET Guidance Document, acute and chronic WET testing is recommended three times in the reissued permit. With the points generated by Chronic, yearly testing is actually recommended; however, since one point less would only have three tests and 20 points are due to additives, only three tests in the reissued permit are recommended for Chronic WET. Tests should be done in rotating quarters, in order to collect seasonal information about this discharge.

Outfall 001 – Complete Thermal Tables

Month	Water Quality Criteria			Representative Highest Effluent Flow Rate (Qe)					Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit	
	Ta (default)	Sub-Lethal WQC	Acute WQC	7-day Rolling Average (Qesl)	Daily Maximum Flow Rate (Qea)	B	e^{-a} (for SL-WQBEL)	e^{-a} (for A-WQBEL)	Weekly Average	Daily Maximum	Weekly Average Effluent Limitation	Daily Maximum Effluent Limitation
	(°F)	(°F)	(°F)	(mgd)	(mgd)				(°F)	(°F)	(°F)	(°F)
JAN	34	43	69	282.20	282.20	0.405	0.858	0.858	39	42	44	75
FEB	33	47	69	291.10	317.800	0.405	0.862	0.873	39	41	49	74
MAR	35	52	69	490.47	495.400	0.405	0.916	0.916	42	44	54	72
APR	39	58	70	504.00	504.000	0.405	0.918	0.918	48	51	60	73
MAY	44	64	71	503.03	504.000	0.405	0.918	0.918	50	62	66	73
JUN	48	69	72	504.00	504.000	0.405	0.918	0.918	58	71	71	74
JUL	53	71	73	501.19	504.000	0.405	0.917	0.918	59	69	73	75
AUG	56	69	73	489.60	489.600	0.405	0.915	0.915	70	73	70	75
SEP	53	64	73	489.60	489.600	0.405	0.915	0.915	70	72	65	75
OCT	48	55	72	497.57	504.000	0.405	0.917	0.918	58	61	56	74
NOV	42	47	70	504.00	504.000	0.405	0.918	0.918	45	52	47	73
DEC	36	44	69	425.40	489.600	0.405	0.903	0.915	40	43	45	72

Outfall 002

Month	Water Quality Criteria			Representative Highest Effluent Flow Rate (Qe)					Representative Highest Monthly Effluent Temperature		Calculated Effluent Limit	
	Ta (default)	Sub-Lethal WQC	Acute WQC	7-day Rolling Average (Qesl)	Daily Maximum Flow Rate (Qea)	B	e^{-a} (for SL-WQBEL)	e^{-a} (for A-WQBEL)	Weekly Average	Daily Maximum	Weekly Average Effluent Limitation	Daily Maximum Effluent Limitation
	(°F)	(°F)	(°F)	(mgd)	(mgd)				(°F)	(°F)	(°F)	(°F)
JAN	34	43	69	282.20	282.20	0.405	0.858	0.858	41	42	44	75
FEB	33	47	69	282.20	282.200	0.405	0.858	0.858	39	42	49	75
MAR	35	52	69	488.51	495.400	0.405	0.915	0.916	41	43	54	72
APR	39	58	70	504.00	504.000	0.405	0.918	0.918	45	49	60	73
MAY	44	64	71	504.00	504.000	0.405	0.918	0.918	51	53	66	73
JUN	48	69	72	495.40	495.400	0.405	0.916	0.916	58	70	71	74
JUL	53	71	73	489.60	489.600	0.405	0.915	0.915	60	69	73	75
AUG	56	69	73	489.60	489.600	0.405	0.915	0.915	71	72	70	75
SEP	53	64	73	502.51	504.000	0.405	0.918	0.918	70	72	65	75
OCT	48	55	72	504.00	504.000	0.405	0.918	0.918	57	61	56	74
NOV	42	47	70	504.00	504.000	0.405	0.918	0.918	47	52	47	73
DEC	36	44	69	425.40	489.600	0.405	0.903	0.915	40	43	45	72

* Refer to note on page 11.
PWL 3/1/2012

Temperature limits for receiving waters without unidirectional flow
(calculation using default ambient temperature data)

Facility: Next Era - Point Beach
Outfall(s): Outfall 001
Date Prepared: 09/09/2011
Design Flow (Qe): mgd

Data Range
Start: 01/01/09
End: 07/30/11

Lake Type: Lake Michigan waters - North
Discharge Type: Great Lakes shore discharge

Maximum area of mixing zone allowed (coefficient "A"): 3,125,000 ft^2

Month	Water Quality Criteria			Representative Highest Effluent Flow Rate (Qe)					Representative Highest Monthly Effluent Temperature		**Calculated Effluent Limit**	
	Ta (default) (°F)	Sub-Lethal WQC (°F)	Acute WQC (°F)	7-day Rolling Average (Qesl) (mgd)	Daily Maximum Flow Rate (Qea) (mgd)	B	e^{-a} (for SL-WQBEL)	e^{-a} (for A-WQBEL)	Weekly Average (°F)	Daily Maximum (°F)	**Weekly Average Effluent Limitation (°F)**	**Daily Maximum Effluent Limitation (°F)**
JAN	34	43	69	291.90	291.90	0.405	0.862	0.862	74	77	44	75
FEB	33	47	69	291.90	291.900	0.405	0.862	0.862	74	77	49	75
MAR	35	52	69	317.16	324.100	0.405	0.873	0.875	73	76	54	74
APR	39	58	70	489.60	489.600	0.405	0.915	0.915	76	81	60	73
MAY	44	64	71	523.40	523.400	0.405	0.921	0.921	83	85	66	73
JUN	48	69	72	499.30	499.300	0.405	0.917	0.917	80	94	71	74
JUL	53	71	73	500.53	505.100	0.405	0.917	0.918	87	93	73	75
AUG	56	69	73	499.30	499.300	0.405	0.917	0.917	89	93	70	75
SEP	53	64	73	499.37	499.800	0.405	0.917	0.917	90	93	65	75
OCT	48	55	72	504.00	504.000	0.405	0.918	0.918	82	91	56	74
NOV	42	47	70	504.00	504.000	0.405	0.918	0.918	68	77	47	73
DEC	36	44	69	489.69	499.300	0.405	0.915	0.917	74	77	45	72

Temperature limits for receiving waters without unidirectional flow
(calculation using default ambient temperature data)

Facility: Next Era - Point Beach
Outfall(s): Outfall 002
Date Prepared: 09/09/2011
Design Flow (Qe): mgd

Data Range
Start: 01/01/09
End: 07/30/11

Lake Type: Lake Michigan waters - North
Discharge Type: Great Lakes shore discharge

Maximum area of mixing zone allowed (coefficient "A"): 3,125,000 ft^2

Month	Water Quality Criteria			Representative Highest Effluent Flow Rate (Qe)					Representative Highest Monthly Effluent Temperature		**Calculated Effluent Limit**	
	Ta (default) (°F)	Sub-Lethal WQC (°F)	Acute WQC (°F)	7-day Rolling Average (Qesl) (mgd)	Daily Maximum Flow Rate (Qea) (mgd)	B	e^{-a} (for SL-WQBEL)	e^{-a} (for A-WQBEL)	Weekly Average (°F)	Daily Maximum (°F)	**Weekly Average Effluent Limitation (°F)**	**Daily Maximum Effluent Limitation (°F)**
JAN	34	43	69	291.90	291.90	0.405	0.862	0.862	83	85	44	75
FEB	33	47	69	291.90	291.900	0.405	0.862	0.862	82	85	49	75
MAR	35	52	69	297.76	304.700	0.405	0.865	0.868	81	86	55	74
APR	39	58	70	495.40	495.400	0.405	0.916	0.916	80	84	60	73
MAY	44	64	71	494.20	495.400	0.405	0.916	0.916	77	86	66	73
JUN	48	69	72	499.30	499.300	0.405	0.917	0.917	86	100	71	74
JUL	53	71	73	499.30	499.300	0.405	0.917	0.917	89	93	73	75
AUG	56	69	73	499.30	499.300	0.405	0.917	0.917	90	94	70	75
SEP	53	64	73	499.37	499.800	0.405	0.917	0.917	98	100	65	75
OCT	48	55	72	499.40	500.000	0.405	0.917	0.917	87	93	56	74
NOV	42	47	70	499.30	499.300	0.405	0.917	0.917	64	68	47	73
DEC	36	44	69	489.60	499.300	0.405	0.915	0.917	81	102	45	72

CORRESPONDENCE/MEMORANDUM

State of Wisconsin

DATE: August 22, 2012 FILE REF: 3200

TO: Steve Jaeger – WY/3

FROM: Diane Figiel – WY/3

SUJECT: Addendum to the Temperature and Arsenic Water Quality-Based Effluent Limitations for NextEra Energy Point Beach, LLC (WPDES Permit No. WI-0000957)

This is a revision to the August 29, 2011 water quality based effluent memo for NextEra Energy Point Beach for temperature and arsenic.

The August 29, 2011 memo included temperature limits for outfalls 001 and 002 individually. The limits are recalculated using the combined flow given the fact that the mixing zones overlap for the two outfalls. Effluent limitations calculated using the procedures in ch. NR 106 subchapter V, s. NR 106.55(7) and the reasonable potential procedures in ss. NR 106.56(2) and (3) are provided in the attached tables. The maximum reported effluent temperature for the two outfalls in used in the reasonable potential evaluation. In the previous evaluation the average effluent temperature was incorrectly used where the maximum values should have been. The facility may request alternative effluent limitations for temperature under subsection VI of ch. NR 106.

Also the previous memo recommended a monthly average arsenic limit of 2.2 ug/L based on one data point at 1.0 ug/L. The facility collected 12 additional samples between July 16 and Aug 2 which resulted in a 30 day p99 of 1.05 ug/L. The limit is not needed in the reissued permit since the 30 day p99 is less than the calculated monthly average limit.

Temperature limits for receiving waters without unidirectional flow
(calculation using default ambient temperature data)

Facility:	Nextera Energy Point Beach	**Data Range**		**Lake Type:**	Lake Michigan waters - North	
Outfall(s):	Combined 001 and 002	**Start:**	01/01/09	**Discharge Type:**	Great Lakes shore discharge	
Date Prepared:	08/14/2012	**End:**	06/30/12	**Maximum area of mixing zone allowed (coefficient "A"):**	3,125,000	ft^2
Design Flow (Qe):		mgd				

Month	Water Quality Criteria			Representative Highest Effluent Flow Rate (Qe)					Representative Highest Monthly Effluent Temperature*		**Calculated Effluent Limit**	
	Ta (default) (°F)	Sub-Lethal WQC (°F)	Acute WQC (°F)	7-day Rolling Average (Qesl) (mgd)	Daily Maximum Flow Rate (Qea) (mgd)	B	e^{-a} (for SL-WQBEL)	e^{-a} (for A-WQBEL)	Weekly Average (°F)	Daily Maximum (°F)	**Weekly Average Effluent Limitation (°F)**	**Daily Maximum Effluent Limitation (°F)**
JAN	34	43	69	583.80	583.80	0.405	0.929	0.929	83	85	44	72
FEB	33	47	69	583.80	583.800	0.405	0.929	0.929	83	85	48	72
MAR	35	52	69	583.80	583.800	0.405	0.929	0.929	87	92	53	72
APR	39	58	70	998.60	998.600	0.405	0.958	0.958	86	91	59	71
MAY	44	64	71	998.60	998.600	0.405	0.958	0.958	83	86	65	72
JUN	48	69	72	998.60	998.600	0.405	0.958	0.958	86	100	70	73
JUL	53	71	73	998.60	998.600	0.405	0.958	0.958	89	93	72	74
AUG	56	69	73	998.60	998.600	0.405	0.958	0.958	96	97	70	74
SEP	53	64	73	998.60	998.600	0.405	0.958	0.958	98	100	64	74
OCT	48	55	72	998.60	998.600	0.405	0.958	0.958	87	93	55	73
NOV	42	47	70	998.60	998.600	0.405	0.958	0.958	68	77	47	71
DEC	36	44	69	979.20	998.600	0.405	0.957	0.958	82	102	44	70

*maximum temperature reported from outfall 001 and 002

Attachment C: Threatened and Endangered Species Consultations

November 10, 2020 PBNFWS-20-0053

Peter Fasbender
U.S. Fish and Wildlife Service
Ecological Service Field Office
2661 Scott Tower Drive
New Franken, WI 54229

RE: NextEra Energy Point Beach, LLC – Point Beach Nuclear Plant Units 1 and 2 Subsequent License Renewal

Dear Mr. Fasbender:

NextEra Energy Point Beach, LLC (NEPB) is preparing an application for renewing the operating licenses for Point Beach Nuclear Plant Units 1 and 2 (PBN) for an additional 20 years (see Table 1). As part of the license renewal process, the U.S. Nuclear Regulatory Commission (NRC) may request an informal or formal consultation with your agency pursuant to Section 7 of the ESA. It is our intent by this letter to introduce you to the project, to make available any data you need to ensure an efficient and effective consultation process, and to request the following:

- Confirmation from you on the identified list of listed species, and
- Confirmation from you on our impact assessment that due to the continued operation of PBN, absence of ground disturbing activities and no refurbishment, there will be no anticipated impacts to listed species (or candidates proposed for listing) and important plant and animal habitats within the station's environs.

Table 1. PBN Licensing Dates

PBN Unit	License Expiration Date	Extended License Expiration Date
Unit 1	October 5, 2030	October 5, 2050
Unit 2	March 8, 2033	March 8, 2053

As part of the renewal process, the NRC requires that the license renewal application include an environmental report (ER) that assesses the impacts from continued operation and any refurbishment undertaken to enable the continued operation of the units. The ER addresses the potential impact on species listed or proposed for listing as threatened or endangered in accordance with the Endangered Species Act (ESA), and important plant and animal habitats as defined by the ESA and essential fish habitat as identified under the Magnuson-Stevens Fishery Conservation and Management Act.

To facilitate our assessment and a smooth consultation by the NRC, we are seeking input from you regarding the effects that license renewal activities may have on listed species (or candidates proposed for listing) and important plant and animal habitats within the plant's environs and any questions or additional information necessary for the consultation process. Figures depicting the PBN site and the vicinity within a 6-mile radius are attached, and a brief discussion of the plant and its operations during the extended period of operation is provided below.

PBN is located on the western shore of Lake Michigan in Manitowoc County, WI, approximately 15 miles north-northeast of Manitowoc, WI. In accordance with NRC regulations, transmission lines within the scope of the license renewal are those located within the PBN site boundary.

Species potentially occurring near the PBN site, or within Manitowoc and Kewaunee counties (counties occurring in a 6-mile radius of the site) that are currently federally listed (or proposed for listing) as threatened or endangered are included in the attached Table 2.

During the license renewal term, NEPB proposes to continue operating the units as currently operated and based on aging management studies does not expect that refurbishment, construction, ground disturbing activities or physical changes will be needed for the license renewal.

NEPB does not anticipate operation of PBN to adversely affect the environmental resources.

As stated earlier, this letter seeks your input on our proposed continued operation of PBN on listed species and important habitats within the surrounding area of the plant. We appreciate your notifying us of your comments and any information you believe NEPB should consider as part of this license renewal process. Your response is kindly requested within 45 days of receiving this letter. NEPB plans to include this letter in the ER.

Should you or your staff have any questions or comments, please contact William Maher at (561) 691-2291 / William.Maher@fpl.com.

Sincerely,

William D. Maher
Senior Licensing Director

Attachments:

Table 2. Protected Species Potentially Occurring in the PBN Vicinity
Figure 1. PBN Site
Figure 2. PBN 6-mile Vicinity

Table 2. Protected Species Potentially Occurring in **the PBN Vicinity**

Common Name	Scientific Name	Legal Status
Bald Eagle	*Haliaeetus leucocephalus*	BGEPA
Rufa Red Knot	*Calidris canutus rufa*	FT
Northern Long-Eared Bat	*Myotis septentrionalis*	FT
Rusty Patch Bumble Bee	*Bombus affinis*	FE
Hine's Emerald Dragonfly	*Somatochlora hineana*	FE
Piping Plover	*Charadrius melodus*	FT
Pitcher's Thistle	*Cirsium pitcheri*	FT

BGEPA = Bald and Golden Eagle Protection Act; FE = federally endangered;
FT = federally threatened

Figure 1. PBN Site

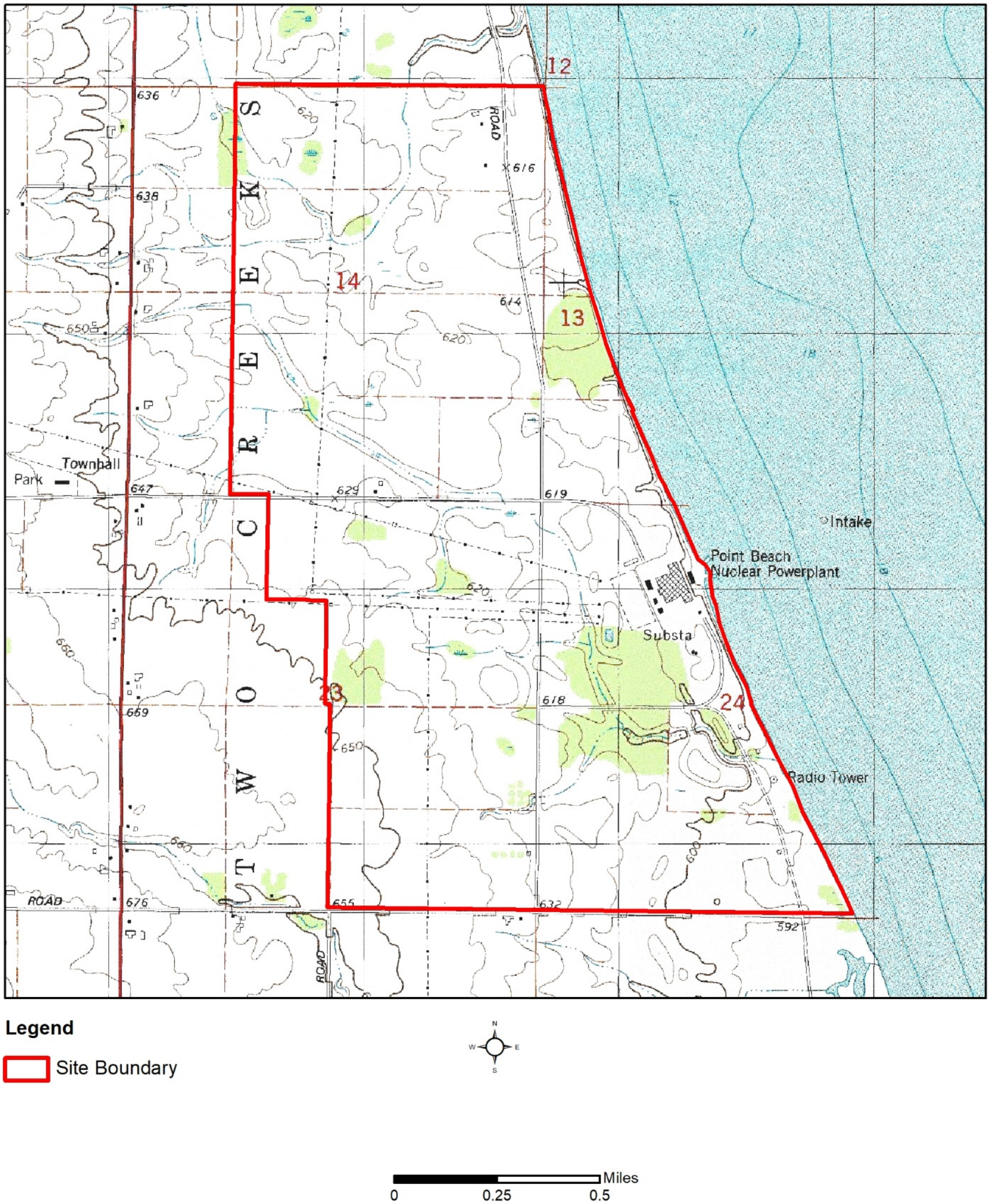
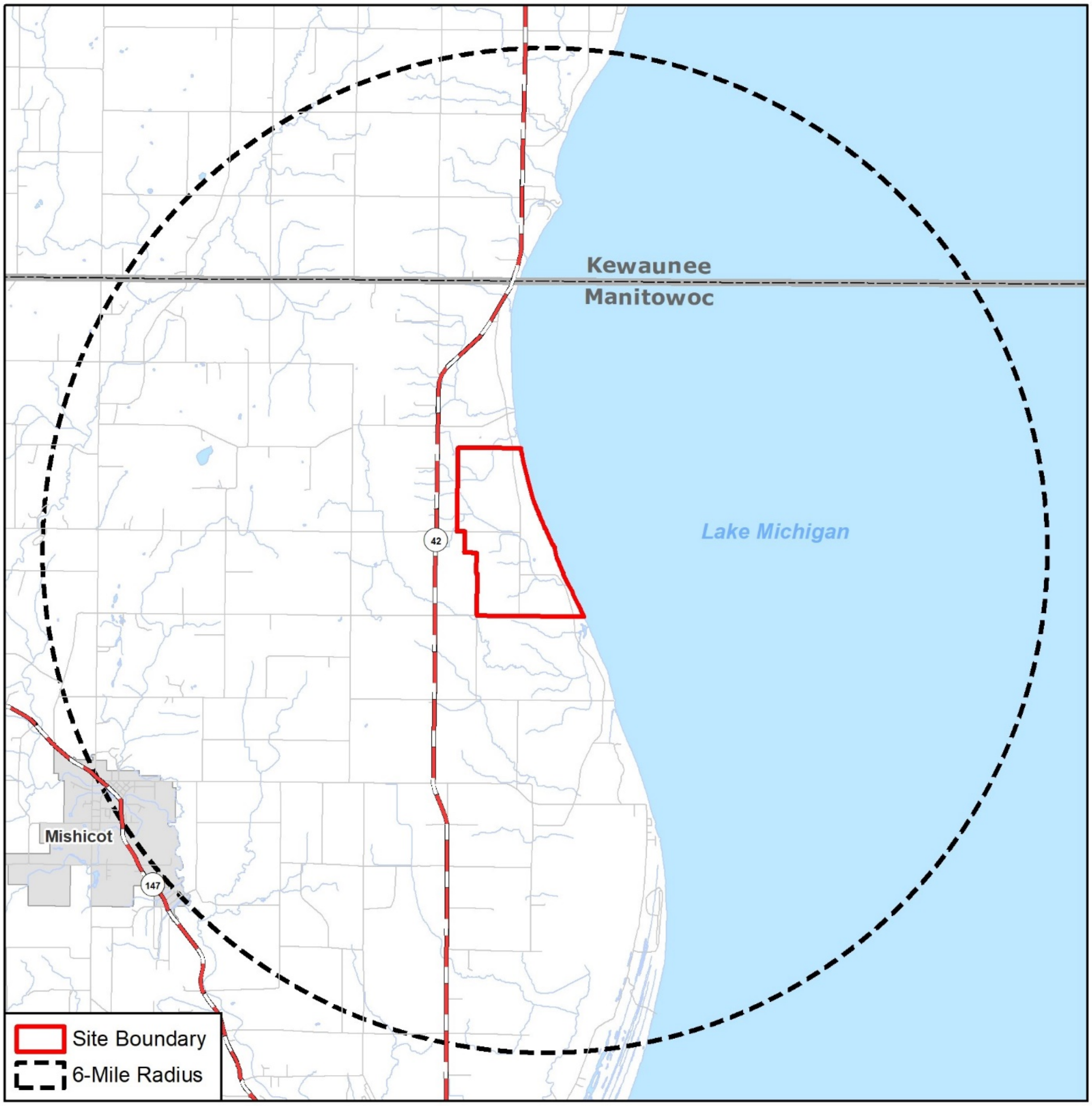


Figure 2. PBN 6-mile Vicinity



November 10, 2020 PBNWFW-20-0051

Jean Romback-Bartels
WI DNR. Fish, Wildlife & Parks Division
Green Bay Service Center
2984 Shawano Ave.
Green Bay, WI 54313-6727

RE: NextEra Energy Point Beach, LLC – Point Beach Nuclear Plant Units 1 and 2 Subsequent License Renewal

Dear Ms. Romback-Bartels:

NextEra Energy Point Beach, LLC (NEPB) is preparing an application for renewing the operating licenses for Point Beach Nuclear Plant Units 1 and 2 (PBN) for an additional 20 years (see Table 1). As part of the license renewal process, the U.S. Nuclear Regulatory Commission (NRC) may request an informal or formal consultation with your agency. It is our intent by this letter to introduce you to the project, to make available any data you need to ensure an efficient and effective consultation process, and to request the following:

- Confirmation from you on the identified list of listed species, and
- Confirmation from you on our impact assessment that due to the continued operation of PBN, absence of ground disturbing activities and no refurbishment, there will be no anticipated impacts to listed species (or candidates proposed for listing) and important plant and animal habitats within the station's environs.

Table 1. PBN Licensing Dates

PBN Unit	License Expiration Date	Extended License Expiration Date
Unit 1	October 5, 2030	October 5, 2050
Unit 2	March 8, 2033	March 8, 2053

As part of the renewal process, the NRC requires that the license renewal application include an environmental report (ER) that assesses the impacts from continued operation and any refurbishment undertaken to enable the continued operation of the units. The ER addresses the potential impact on species listed or proposed for listing as threatened or endangered in accordance with the Endangered Species Act (ESA), and important plant and animal habitats as defined by the ESA and essential fish habitat as identified under the Magnuson-Stevens Fishery Conservation and Management Act.

This letter seeks input from the Wisconsin Department of Natural Resources Fish, Wildlife & Parks Division regarding the effects that license renewal activities may have on listed species (or candidates proposed for listing) and important plant and animal habitats within the plant's environs and any questions or additional information necessary for the consultation process. Figures depicting the plant site and the vicinity within a 6-mile radius of the plant are attached, and a brief discussion of the plant and its operations during the extended period of operation is provided below.

PBN is located on the western shore of Lake Michigan in Manitowoc County, WI, approximately 15 miles north-northeast of Manitowoc, WI. In accordance with NRC regulations, transmission lines within the scope of the license renewal are those located within the PBN site boundary.

Species potentially occurring near the PBN site, or within Manitowoc and Kewaunee counties (counties occurring in a 6-mile radius of the site) that are currently federal or state listed (or proposed for listing) as threatened or endangered are included in the attached Table 2. A similar request is being submitted to the USFWS regarding federal endangered and threatened species listed within the PBN vicinity.

During the license renewal term, NEPB proposes to continue operating the units as currently operated and based on aging management studies does not expect that refurbishment, construction, ground disturbing activities or physical changes will be needed for the license renewal.

NEPB does not anticipate operation of PBN to adversely affect environmental resources.

As stated earlier, this letter seeks your input on our proposed continued operation of PBN on listed species and important habitats within the surrounding area of the plant. We appreciate your notifying us of your comments and any information you believe NEPB should consider in the preparation of the ER. Your response is kindly requested within 45 days of receiving this letter. NEPB plans to include this letter in the ER.

Should you or your staff have any questions or comments, please contact William Maher at (561) 691-2291 / William.Maher@fpl.com.

Sincerely,

William D. Maher
Senior Licensing Director

Attachments:

Table 2. Protected Species Potentially Occurring in the PBN Vicinity
Figure 1. PBN Site
Figure 2. PBN 6-mile Vicinity

Table 2. Protected Species Potentially Occurring in the PBN Vicinity

Common Name	Scientific Name	Legal Status
Birds		
Bald Eagle	*Haliaeetus leucocephalus*	BGEPA
Peregrine Falcon	*Falco peregrinus*	SE
Red-Shouldered Hawk	*Buteo lineatus*	ST
Black Tern	*Empidonax virescens*	SE
Caspian tern	*Hydroprogne caspia*	SE
Henslow's Sparrow	*Ammodramus henslowii*	ST
Cerulean Warbler	*Setophaga cerulea*	ST
Hooded Warbler	*Setophaga citrina*	ST
Upland sandpiper	*Bartramia longicauda*	ST
Acadian flycatchers	*Empidonax virescens*	ST
Mammals		
Northern Long-Eared Bat	*Myotis septentrionalis*	FT
Tri-Colored Bat	*Perimyotis subflavus subflavus*	ST
Big Brown Bat	*Eptesicus fuscus*	ST
Little Brown Bat	*Myotis lucifugus*	ST
Fish		
Redfin Shiner	*Lythrurus umbratilis*	ST
Longear Sunfish	*Lepomis megalotis*	ST
Pugnose Shiner	*Notropis anogenus*	ST
Mollusks		
Slippershell Mussel	*Alasmidonta viridis*	ST
Monkeyface Mussel	*Theliderma metanevra*	ST
Ellipse Mussel	*Venustaconcha ellipsiformis*	ST
Cherrystone Drop	*Hendersonia occulta*	ST
Reptiles		
Blanchard's Cricket Frog	*Acris blanchardi*	SE
Insects		
Hine's Emerald Dragonfly	*Somatochlora hineana*	FE
Rusty Patch Bumble Bee	*Bombus affinis*	FE
Hairy-Hecked Tiger Beetle	*Cicindela hirticollis hirticollis*	SE
Vascular Plants		
Pitcher's Thistle	*Cirsium pitcheri*	FT
Hubricht's Vertigo (Midwest Pleistocene vertigos)	*Vertigo hubrichti*	SE
Prairie Sandreed	*Calamovilfa longifolia* var. *magna*	ST
Fairyslipper Orchid	*Calypso bulbosa*	ST
Shore Sedge	*Carex lenticularis*	ST
Streambank Wheatgrass (thickspike)	*Elymus lanceolatus ssp. Psammophilus*	ST

Table 2. Protected Species Potentially Occurring in **the PBN Vicinity**

Common Name	Scientific Name	Legal Status
Clustered Broomrape	*Orobanche fasciculata*	ST
Shore Buttercup	*Ranunculus cymbalaria*	ST
Heartleaf Willow	*Salix cordata*	ST
Sticky Tofieldia	*Triantha glutinosa*	ST
Snow Trillium	*Trillium nivale*	ST
Harbinger of Spring	*Erigenia bulbosa*	SE
Forked Aster	*Eurybia furcata*	ST

BGEPA = Bald and Golden Eagle Protection Act; FE= federally endangered; FT = federally threatened; SE= state endangered; ST = state threatened

Figure 1. PBN Site

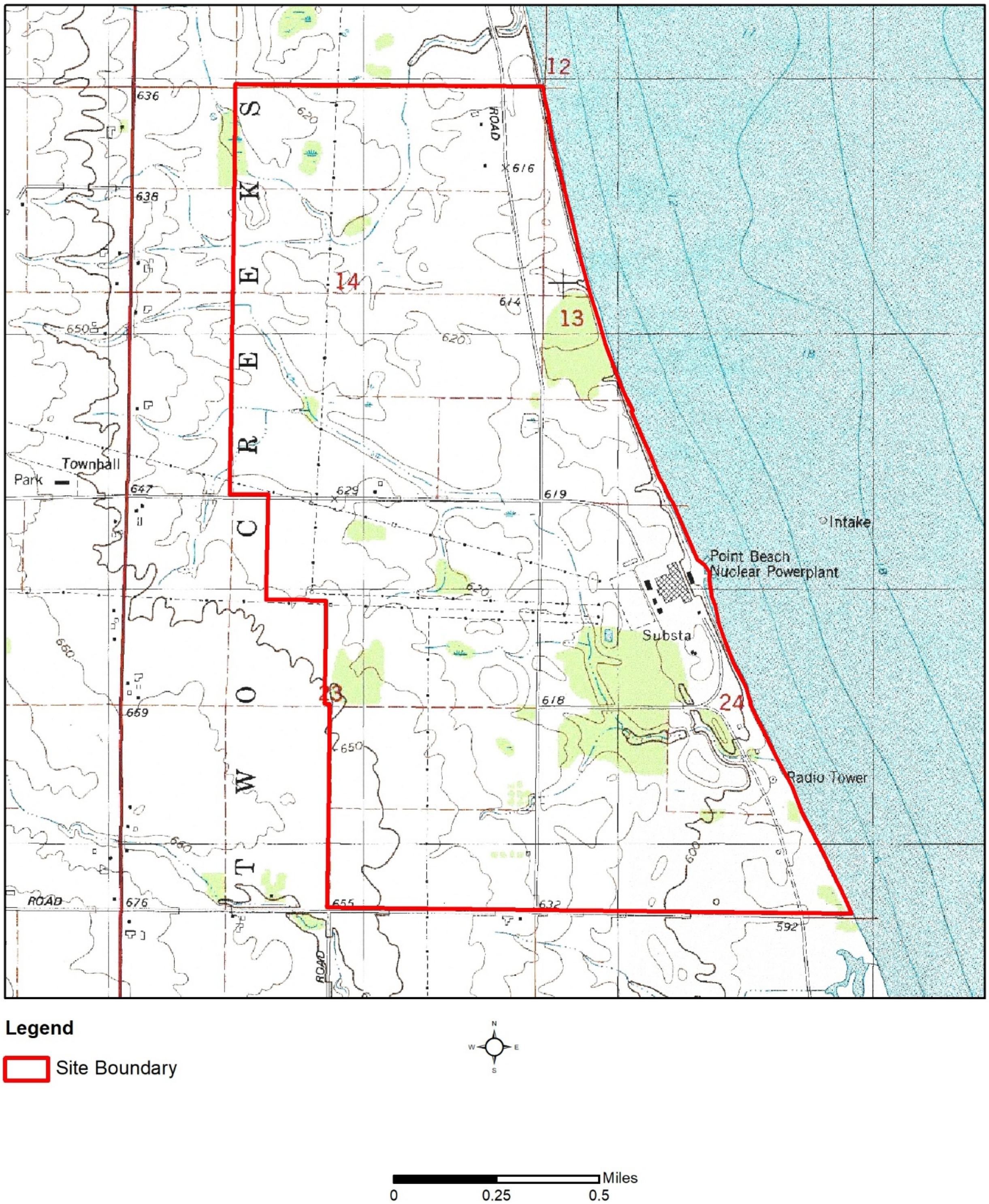
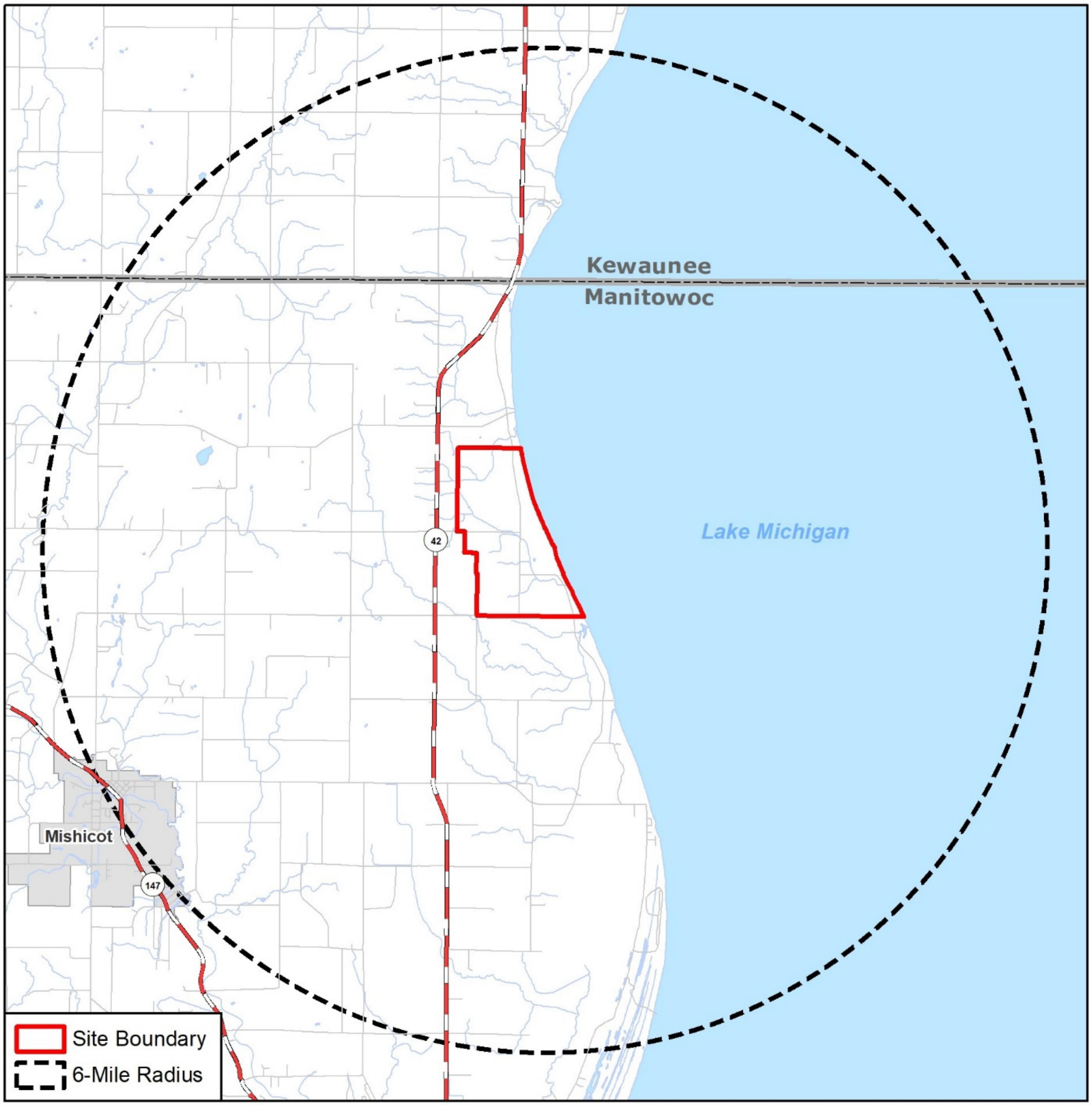


Figure 2. PBN 6-mile Vicinity



Attachment D: Cultural Resources Consultations

November 10, 2020

«Prefix» «First_Name» «Last_Name» «Suffix»
«Title»
«Tribe»
«Mailing_Address»
«City», «State» «Zip»

RE: NextEra Energy Point Beach, LLC – Point Beach Nuclear Plant Units 1 and 2 Subsequent License Renewal Project

Dear «First_Name»,

NextEra Energy Point Beach, LLC (NEPB) is preparing an application for the U.S. Nuclear Regulatory Commission (NRC) for renewing the operating licenses for Point Beach Nuclear Plant Units 1 and 2 (PBN) for an additional 20 years (see Table 1). This process is known as a "subsequent license" and as part of that process the NRC requires the license renewal application include an environmental report (ER) that assesses the impacts from continued operation and any refurbishment undertaken to enable the continued operation of the units. The ER addresses the potential to impact historic and cultural resources including tribal cultural resources on or near the PBN site. Also, as part of the subsequent license renewal process, NRC **may** request a consultation with your tribe in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended (Public Law 89-665; 54 U.S.C. 300101 et seq.), and implemented by the Advisory Council on Historic Preservation regulations (36 CFR 800).

Table 1. PBN Licensing Dates

PBN Unit	Initial License Expiration Date	Current License Expiration Date	Extended License Expiration Date
Unit 1	October 5, 2000	October 5, 2030	October 5, 2050
Unit 2	March 8, 2003	March 8, 2033	March 8, 2053

Consistent with NextEra's policy to reach out to Tribes in the area of its projects, I wanted to provide you with information about the project, make available any data you need to ensure an efficient and effective consultation process, and request input from you regarding tribal cultural resources within the plant's surrounding area.

Figures depicting the plant site and the vicinity within a 6-mile radius of the plant are enclosed, and a brief discussion of the plant and its operations during the extended period of operation is provided below.

PBN is located on the western shore of Lake Michigan in Manitowoc County, approximately 15 miles north-northeast of Manitowoc, WI. In accordance with NRC regulations transmission lines within the scope of the subsequent license renewal are those located within the PBN site boundary. PBN was constructed from 1967 to 1972 with Unit 1 achieving initial operation in December 1970 and Unit 2 following in October 1972. In 2005, PBN received approval for its first license renewal resulting in the current license expiration date seen in Table 1.

During the subsequent license renewal term, NEPB proposes to continue operating the units as currently operated and based on aging management studies **does not expect that refurbishment, construction, ground disturbing activities, or physical changes will be needed.** Protection of known cultural resources on the PBN site is managed by the Archaeological, Cultural, & Historic Resources section of the PBN procedures manual. NEPB does not anticipate operation of PBN to adversely affect the environment or any cultural or historic resources.

Although construction of the existing PBN facility itself may have impacted any archaeological resources that may have been located within its footprint, much of the surrounding area remains largely undisturbed. A cultural resources survey of the property was not required prior to the construction of PBN, but five recorded surveys were conducted at various stages of expansion and licensing between 1993 through 2018. These surveys have covered approximately 972 acres of the of the 1,260-acre PBN property. There are no National Register of Historic Places (NRHP)-eligible cultural resources confirmed within the 1,260-acre PBN property. The June 2004 survey identified findings, which included 15 isolates and one prehistoric archaeological site. PBN has committed to avoiding previously identified sites within the 1,260-acre property.

In preparation for the subsequent license renewal application, PBN conducted a literature review of the Wisconsin Historic Preservation Database to identify previously recorded sites within a 6-mile radius. The results of the 2020 literature review are presented in Table 2.

I hope this information has been helpful to you. Please let me know if you have any comments, questions, or have information you believe NEPB should consider as part of the license renewal application process. Your response is kindly requested within 45 days of receiving this letter. NEPB plans to include this letter in the ER. I can be reached at (561) 304-5168 or via email at Ronald.Burris@NextEraEnergy.com.

Regards,

Ronald F. Burris II

Ronald F. Burris II
Sr Project Manager, Tribal Relations

Attachments:
Table 2. Archaeological Sites Inventory Entries within a 6-mile Radius of PBN
Figure 1. PBN Site
Figure 2. PBN 6-mile Vicinity

Table 2. Archaeological Sites Inventory Entries within a 6-Mile Radius of PBN

Code #	Name	Site Type	Cultural Affiliation
47-KE-0086	Chas. Olson	Campsite/village	Middle Archaic
47-MN-0397	Pathfinder (1869)[(a)]	Shipwreck	Historic Euro-American
47-MN-0063	O'Neil 1	Campsite/village	Unknown Prehistoric
47-MN-0234	School Forest 4	Campsite/village	Unknown Prehistoric
47-MN-0233	School Forest 3	Campsite/village	Unknown Prehistoric
47-MN-0065	School Forest 2	Campsite/village	Unknown Prehistoric
47-MN-0064	School Forest 1	Campsite/village	Unknown Prehistoric
47-MN-0213	Stephen Elliott Farm	Campsite/village	Unknown Prehistoric
47-MN-0069	West Shore Sportmen's Club	Campsite/village	Unknown Prehistoric
47-MN-0068	Schmidt I	Campsite/village	Unknown Prehistoric
47-MN-0214	Henry Short Farm	Campsite/village	Unknown Prehistoric
47-MN-0212	Charles Leclair	Campsite/village	Unknown Prehistoric
47-MN-0410	Continental (1882)	Shipwreck	Historic Euro-American
47-KE-0010	Prucha	Campsite/village	Unknown Prehistoric
47-MN-0415	Murray	Lithic scatter	Unknown Prehistoric
47-MN-0185	William Schroeder Farm	Isolated finds	Unknown Prehistoric
47-MN-0266	Jean Vieau's Landing Place	Trading/fur post	Historic Euro-American
47-MN-0168	V. Hallada Farm	Campsite/village	Unknown Prehistoric
47-MN-0170	Jonathan Paarman Farm	Campsite/village	Middle Archaic
47-MN-0186	N. McMillan Farm	Isolated finds	Archaic

Code #	Name	Site Type	Cultural Affiliation
47-MN-0268	Frasch-Schroeder Farm	Campsite/village	Unknown Prehistoric
47-MN-0114	Thomas Zahorik Farm	Campsite/village	Late Archaic; Middle Archaic
47-MN-0169	Louis Abbet Farm	Campsite/village	Archaic
47-MN-0292	Joseph Strauf Farm	Campsite/village	Unknown
47-MN-0446	MN10 Isolate	Isolated finds	Unknown Prehistoric
47-MN-0447	MN11 Isolate	Isolated finds	Unknown Prehistoric
47-MN-0448	MN12 Isolate	Isolated finds	Unknown Prehistoric
47-MN-0449	MN13 Isolate	Isolated finds	Unknown Prehistoric
47-MN-0450	MN14 Isolate	Isolated finds	Unknown Prehistoric
47-MN-0453	MN17	HCM concentration	Historic Euro-American
47-KE-0098	K74	Isolated finds	Late Archaic; Middle Woodland
47-KE-0100	K78	Isolated finds	Late Archaic; Middle Woodland
47-MN-0460	Manitowoc School Forest	Isolated finds	Unknown Prehistoric
47-MN-0038	Chandelle's Village	Campsite/village; cemetery/burial; corn hills/garden beds	Historic Indian
47-MN-0486	Two Creeks Pier	Cemetery/burial	Unknown Prehistoric
47-MN-0500	Frank Biface	Isolated finds	Unknown Prehistoric

a. NRHP eligible.

Figure 1. PBN Site

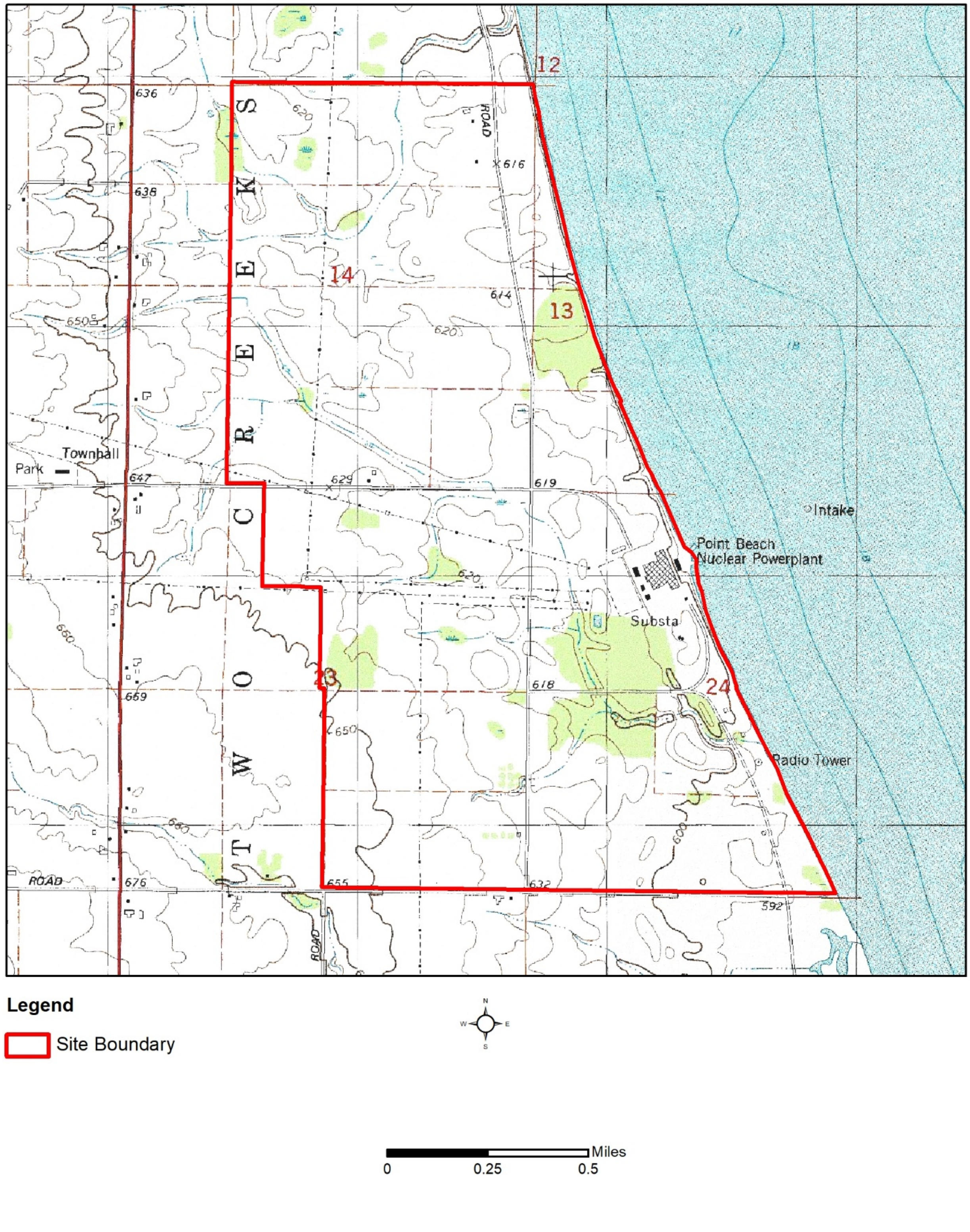
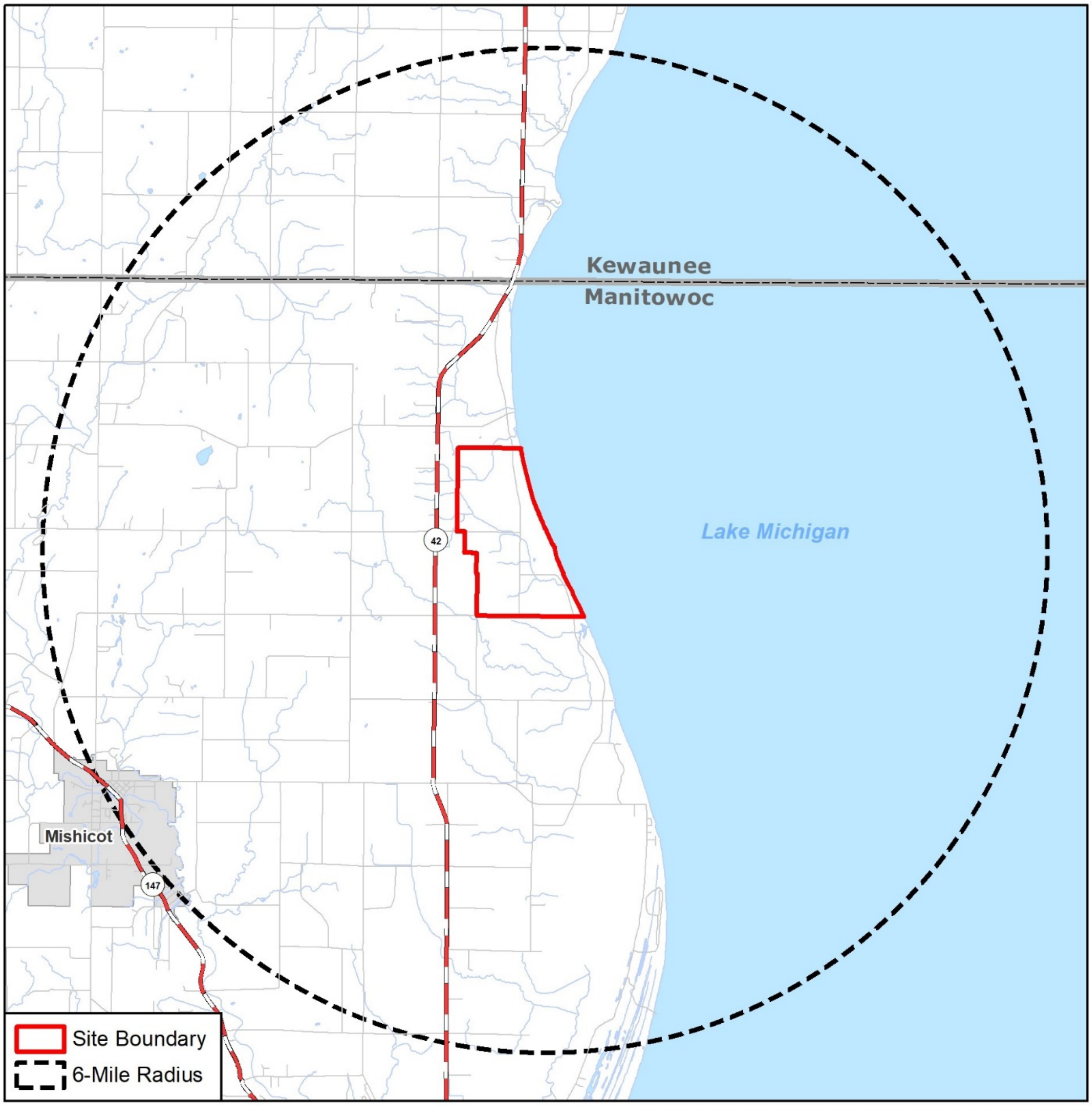


Figure 2. PBN 6-mile Vicinity



November 10, 2020 PBNWHS-20-0055

Daina Penkiunas
State Historic Preservation Officer
Wisconsin Historical Society
816 State Street
Madison, WI 53706

RE: NextEra Energy Point Beach, LLC – Point Beach Nuclear Plant Units 1 and 2 Subsequent License Renewal

Dear Ms. Penkiunas:

NextEra Energy Point Beach, LLC (NEPB) is preparing an application for renewing the operating licenses for Point Beach Nuclear Plant Units 1 and 2 (PBN) for an additional 20 years (see Table 1). As part of the renewal process, the U.S. Nuclear Regulatory Commission (NRC) requires that the license renewal application include an environmental report (ER) that assesses the potential impacts from continued operation and any refurbishment undertaken to enable the continued operation of the units. The ER addresses the potential to impact historic and cultural resources including tribal cultural resources on or near the PBN site. Also, as part of the renewal process, the NRC may request a consultation in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended (Public Law 89-665; 54 U.S.C. 300101 et seq.), and the federal Advisory Council on Historic Preservation regulations (36 CFR 800) with Wisconsin Historical Society (WHS) regarding the license renewal.

It is our intent by this letter to introduce you to the project, to make available any data you need to ensure an efficient and effective consultation process, and request the following:

- Confirmation from your office on the list of identified cultural resources, including Tribal cultural resources (summarized below); and
- Confirmation from your office on the assessment that PBN structures, pending no anticipated changes to use or design, will not require additional evaluations as part of license renewal process.

Figures depicting the plant site and the vicinity within a 6-mile radius of the plant are attached, and a brief discussion of the plant and its operations during the extended period of operation is provided below.

Table 1. PBN Licensing Dates

PBN Unit	Current License Expiration Date	Extended License Expiration Date
Unit 1	October 5, 2030	October 5, 2050
Unit 2	March 8, 2033	March 8, 2053

PBN is located on the western shore of Lake Michigan in Manitowoc County, approximately 15 miles north-northeast of Manitowoc, WI. In accordance with NRC regulations, transmission lines within the scope of the license renewal are those located within the PBN site boundary.

There have been five previous cultural resources surveys within the 1,260-acre PBN property. The most recent survey was conducted in 2018. There are no National Register of Historic Places (NRHP)-eligible cultural resources confirmed within the 1,260-acre PBN property. The June 2004 survey identified findings, which included 15 isolates, one prehistoric archaeological site, and three historic archaeological sites. The cultural resources within a 6-mile radius of PBN identified from a 2020 search of the Wisconsin Historic Preservation Database are presented in Tables 2 and 3. There is one NRHP-listed structure, the Rawley Point Light Station, within the 6-mile radius of PBN that is not listed on the Wisconsin Historic Preservation Database and is not included in Table 3.

During the license renewal term, NEPB proposes to continue operating the units as currently operated and based on aging management studies does not expect that refurbishment, construction, ground disturbing activities or physical changes to the generating facility will be needed for the license renewal. Any ground-disturbing activities would be maintenance related and governed by site procedures. Protection of known cultural resources on the PBN site is managed by the Archaeological, Cultural, & Historic Resources section of the PBN procedures manual .

NEPB does not anticipate operation of PBN to adversely affect environment or any cultural or historic resources.

As stated above, this letter requests your input on the potential for our proposed continued operation of PBN to affect historic properties, including tribal cultural resources, within the surrounding area of the plant. We appreciate your notifying us of your comments and any information you believe should be considered by the NRC. Your response is kindly requested within 45 days of receiving this letter.

Should you or your staff have any questions or comments, please contact Richard Estabrook at (561) 691-3054 / Richard.Estabrook@nexteraenergy.com.

Sincerely,

Richard W. Estabrook
Project Manager/Archaeologist

Attachments:

Table 2. Archaeological Sites Inventory Entries within a 6-Mile Radius of PBN
Table 3. Architecture and History Inventory Entries within a 6-Mile Radius of PBN
Figure 1. PBN Site
Figure 2. PBN 6-mile Vicinity

Table 2. Archaeological Sites Inventory Entries within a 6-Mile Radius of PBN

Code #	Name	Site Type	Cultural Affiliation	Distance (mi) from PBN[(a)]
47-KE-0086	Chas. Olson	Campsite/village	Middle Archaic	5.33
47-MN-0397	Pathfinder (1869)[(b)]	Shipwreck	Historic Euro-American	2.50
47-MN-0063	O'Neil 1	Campsite/village	Unknown Prehistoric	2.79
47-MN-0234	School Forest 4	Campsite/village	Unknown Prehistoric	2.92
47-MN-0233	School Forest 3	Campsite/village	Unknown Prehistoric	2.93
47-MN-0065	School Forest 2	Campsite/village	Unknown Prehistoric	2.99
47-MN-0064	School Forest 1	Campsite/village	Unknown Prehistoric	3.05
47-MN-0213	Stephen Elliott Farm	Campsite/village	Unknown Prehistoric	2.98
47-MN-0069	West Shore Sportmen's Club	Campsite/village	Unknown Prehistoric	3.62
47-MN-0068	Schmidt I	Campsite/village	Unknown Prehistoric	3.95
47-MN-0214	Henry Short Farm	Campsite/village	Unknown Prehistoric	3.51
47-MN-0212	Charles Leclair	Campsite/village	Unknown Prehistoric	3.66
47-MN-0410	Continental (1882)	Shipwreck	Historic Euro-American	3.47

47-KE-0010	Prucha	Campsite/village	Unknown Prehistoric	3.50
47-MN-0415	Murray	Lithic scatter	Unknown Prehistoric	2.65
47-MN-0185	William Schroeder Farm	Isolated finds	Unknown Prehistoric	1.44
47-MN-0266	Jean Vieau’s Landing Place	Trading/fur post	Historic Euro-American	1.51
47-MN-0168	V. Hallada Farm	Campsite/village	Unknown Prehistoric	2.23
47-MN-0170	Jonathan Paarman Farm	Campsite/village	Middle Archaic	3.71
47-MN-0186	N. McMillan Farm	Isolated finds	Archaic	0.87
47-MN-0268	Frasch-Schroeder Farm	Campsite/village	Unknown Prehistoric	1.93
47-MN-0114	Thomas Zahorik Farm	Campsite/village	Late Archaic; Middle Archaic	5.23
47-MN-0169	Louis Abbet Farm	Campsite/village	Archaic	4.55
47-MN-0292	Joseph Strauf Farm	Campsite/village	Unknown	4.34
47-MN-0446	MN10 Isolate	Isolated finds	Unknown Prehistoric	1.57
47-MN-0447	MN11 Isolate	Isolated finds	Unknown Prehistoric	1.26
47-MN-0448	MN12 Isolate	Isolated finds	Unknown Prehistoric	1.26
47-MN-0449	MN13 Isolate	Isolated finds	Unknown Prehistoric	1.36
47-MN-0450	MN14 Isolate	Isolated finds	Unknown Prehistoric	1.30

47-MN-0453	MN17	HCM concentration	Historic Euro-American	1.36
47-KE-0098	K74	Isolated finds	Late Archaic; Middle Woodland	4.09
47-KE-0100	K78	Isolated finds	Late Archaic; Middle Woodland	4.03
47-MN-0460	Manitowoc School Forest	Isolated finds	Unknown Prehistoric	3.01
47-MN-0038	Chandelle's Village	Campsite/village; cemetery/burial; corn hills/garden beds	Historic Indian	4.96
47-MN-0486	Two Creeks Pier	Cemetery/burial	Unknown Prehistoric	1.60
47-MN-0500	Frank Biface	Isolated finds	Unknown Prehistoric	1.81

a. Distances are approximate and based on the PBN center point and ASI location data.

b. NRHP eligible.

Table 3. Architecture and History Inventory Entries within a 6-Mile Radius of PBN

AHI #	Historical Name	Historical Use	Style	Distance (mi) from PBN[(a)]
65260	Point Beach Nuclear Power Plant	power plant	Astylistic utilitarian building	0.0
65242	N/A	barn	N/A (unknown or not a building)	5.76
65248	N/A	pony truss bridge	Side gabled	5.98
65256	N/A	Agricultural – outbuilding	N/A	5.34
65257	N/A	barn	N/A	3.92
65258	N/A	barn	Gabled ell	3.66
65259	N/A	house	Other vernacular	3.60
65971	Twin Elder School; School District No. 2	elementary, middle, junior high, or high	Other vernacular	1.56
65972	N/A	house	Astylistic utilitarian building	5.09
65384	N/A	mill	Italianate	5.83
65385	N/A	retail building	Gothic revival	5.75
65386	N/A	church	Queen Anne	5.93
65984	N/A	house	Front gabled	5.71
65990	N/A	retail building	Commercial vernacular	5.75
26259	W R Forst Hotel	retail building	Boomtown	5.34
26260	N/A	retail building	Italianate	5.32

26261	N/A	house	Astylistic utilitarian building	5.13
26262	Edward Albertson Octagonal Barn	centric barn	Boomtown	3.55
32874	N/A	retail building	Cross gabled	5.32
32876	N/A	house	Other vernacular	5.13
65987	N/A	barn	Boomtown	5.75
65985	N/A[(b)]	retail building	Neogothic revival	5.79
65387	St. Peter's Evangelical Lutheran Church	church	N/A	5.68
230040	Mishicot School[(b)]	elementary, middle, junior high, or high	Romanesque revival	5.66
233465	Mishicot Graded School	elementary, middle, junior high, or high	N/A (unknown or not a building)	5.71

a. Distances are approximate and based on the PBN center point and AHI location data.

b. Potentially NRHP eligible.

Figure 1. PBN Site

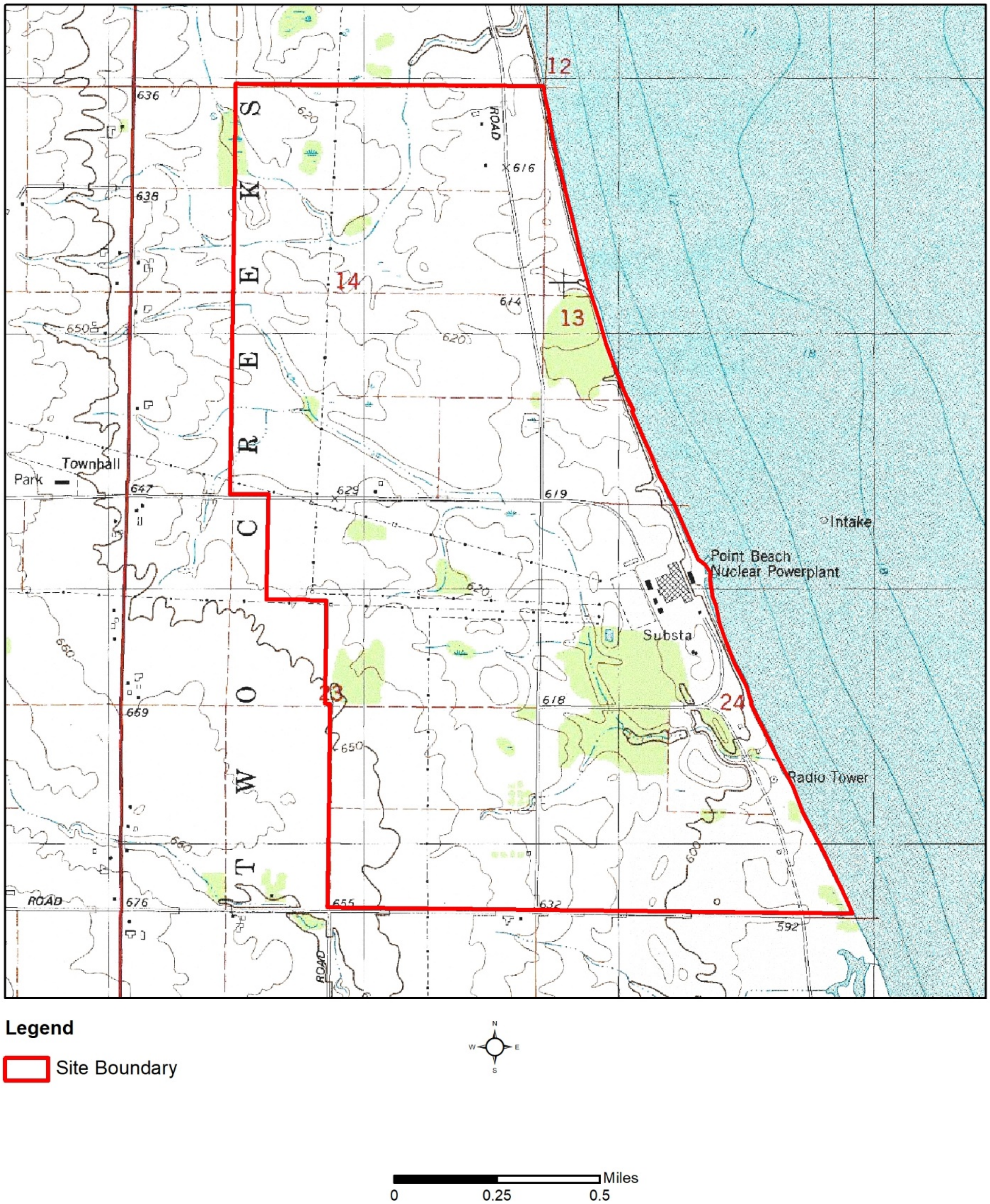
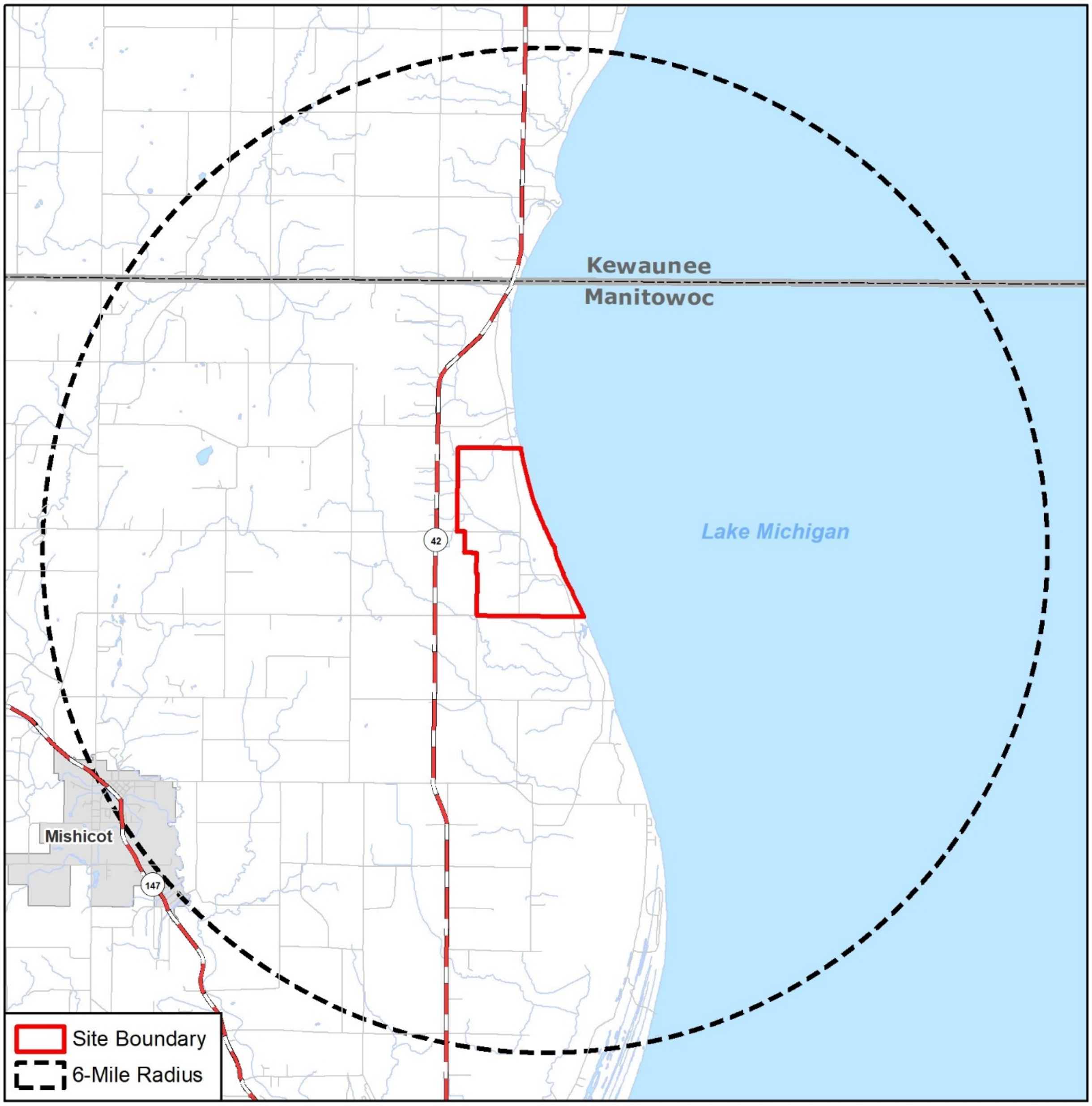


Figure 2. PBN 6-mile Vicinity



Federal Register Tribe Name	First_Name	Last_Name	Title
Arapaho Tribe of the Wind River Reservation, Wyoming [Northern Arapaho]	Ben	Ridgley	Tribal Historic Preservation Officer
Assiniboine & Sioux Tribes of the Fort Peck Indian Reservation, MT	Dyan	Youpee	Tribal Historic Preservation Officer
Bad River Band of Lake Superior Tribe of Chippewa Indians	Edith	Leoso	Tribal Historic Preservation Officer
Cheyenne River Sioux Tribe of the Cheyenne River Reservation, SD	Steve	Vance	Tribal Historic Preservation Officer
Citizen Potawatomi Nation	Kelli	Mosteller	Tribal Historic Preservation Officer
Flandreau Santee Sioux Tribe of South Dakota	Garrie	Kills A Hundred	Tribal Historic Preservation Officer
Forest County Potawatomi Community, Wisconsin	Michael	LaRonge	Tribal Historic Preservation Officer
Fort Belknap Indian Community of the Fort Belknap Reservation of Montana	Michael	Black Wolf	Tribal Historic Preservation Officer
Grand Traverse Band of Ottawa & Chippewa Indians, Michigan	Kirsten	Bisson	Museum Curator and Archivist
Hannahville Indian Community, Michigan	Earl	Meshigaud	Director of Culture, Language, and History
Ho-Chunk Nation of Wisconsin	William	Quackenbush	Tribal Historic Preservation Officer
Lac Courte Oreilles Band of Lake Superior Chippewa Indians of Wisconsin	Brian	Bisonette	Tribal Historic Preservation Officer
Lac du Flambeau Band of Lake Superior Chippewa Indians of the Lac du Flambeau Reservation of Wisconsin	Melinda	Young	Tribal Historic Preservation Officer
Lac Vieux Desert Band of Lake Superior Chippewa Indians of MI	Daisy	McGeshick	Tribal Historic Preservation Officer
Little River Band of Ottawa Indians, Michigan	Jonnie	Sam	Director, Historic Preservation
Little Traverse Bay Bands of Odawa Indians, Michigan	Melissa	Wiatrolik	Tribal Historic Preservation Officer
Lower Brule Sioux Tribe of the Lower Brule Reservation, SD	Clair	Green	Director, Cultural Resources Office
Lower Sioux Indian Community in the State of Minnesota	Cheyanne	St. John	Tribal Historic Preservation Officer
Match-e-be-nash-she-wish Band of Pottawatomi Indians of Michigan	Lakota	Pochedley	Tribal Historic Preservation Officer
Menominee Indian Tribe of Wisconsin	David	Grignon	Tribal Historic Preservation Officer
Miami Tribe of Oklahoma	Dianne	Hunter	Tribal Historic Preservation Officer
Minnesota Chippewa Tribe - Bois Forte Band (Nett Lake)	Jaylen	Strong	Tribal Historic Preservation Officer
Minnesota Chippewa Tribe - Fond du Lac Band	Jill	Hoppe	Tribal Historic Preservation Officer
Minnesota Chippewa Tribe - Grand Portage Band	Jared	Swader	Tribal Historic Preservation Officer
Minnesota Chippewa Tribe - Leech Lake Band	Amy	Burnette	Tribal Historic Preservation Officer
Minnesota Chippewa Tribe - Mille Lacs Band	Natalie	Weyaus	Tribal Historic Preservation Officer
Minnesota Chippewa Tribe - White Earth Band	Jaime	Arsenault	Tribal Historic Preservation Officer
Nottawaseppi Huron Band of the Potawatomi, MI	Douglas	Taylor	Tribal Historic Preservation Officer
Oneida Nation [Wisconsin]	Stacie	Cutbank	Tribal Historic Preservation Officer
Ottawa Tribe of Oklahoma	Rhonda	Dixon-Hayworth	Tribal Historic Preservation Officer
Pokagon Band of Potawatomi Indians, Michigan & Indiana	Matthew	Bussler	Tribal Historic Preservation Officer
Prairie Band of Potawatomi Nation	Joseph	Rupnick	Chairperson
Prairie Island Indian Community in the State of MN	Noah	White	Tribal Historic Preservation Officer
Red Cliff Band of Lake Superior Chippewa Indians of Wisconsin	Marvin	DeFoe	Tribal Historic Preservation Officer
Red Lake Band of Chippewa Indians, Minnesota	Kade	Ferris	Tribal Historic Preservation Officer
Rosebud Sioux Tribe of the Rosebud Indian Reservation, SD	Ione	Quigley	Tribal Historic Preservation Officer
Sac & Fox Tribe of the Mississippi in Iowa	Johnathan	Buffalo	Historic Preservation Director
Sac and Fox Nation, Oklahoma	Sandra	Massey	Historic Preservation Officer
Saginaw Chippewa Indian Tribe of Michigan	Marcella	Johnson	Tribal Historic Preservation Officer
Santee Sioux Nation, Nebraska	Ellen	Roberts	Tribal Historic Preservation Officer
Sault Ste. Marie Tribe of Chippewa Indians, Michigan	Colleen	Medicine	Cultural Repatriation Specialist
Shakopee Mdewakanton Sioux Community of Minnesota	Leonard	Wabasha	Tribal Historic Preservation Officer
Sisseton-Wahpeton Oyate of the Lake Traverse Reservation, SD	Dianne	Desrosiers	Tribal Historic Preservation Officer
Sokaogon Chippewa Community, Wisconsin	Adam	Van Zile	Tribal Historic Preservation Officer
Spirit Lake Tribe, North Dakota	Erich	Longie	Tribal Historic Preservation Officer
St. Croix Chippewa Indians of Wisconsin	Wanda	McFaggen	Tribal Historic Preservation Officer
Standing Rock Sioux Tribe of North & South Dakota	Jon	Eagle	Tribal Historic Preservation Officer
Stockbridge Munsee Community, Wisconsin	Nathan	Allison	Tribal Historic Preservation Officer
Turtle Mountain Band of Chippewa Indians of North Dakota	Jeffrey	Desjarlais	Tribal Historic Preservation Officer
Upper Sioux Community, Minnesota	Samantha	Odegard	Tribal Historic Preservation Officer
Winnebago Tribe of Nebraska	Sunshine	Thomas-Bear	Tribal Historic Preservation Officer
Yankton Sioux Tribe of South Dakota	Kip	Spotted Eagle	Tribal Historic Preservation Officer

Attachment E: Other Consultations

November 10, 2020 PBNDPH-20-0052

Mark Werner
Division of Public Health
Wisconsin Department of Health Services
1 West Wilson Street
Madison, WI 53703

RE: NextEra Energy Point Beach, LLC – Point Beach Nuclear Plant Units 1 and 2 Subsequent License Renewal

Dear Mr. Werner:

NextEra Energy Point Beach, LLC (NEPB) is seeking a license renewal (see Table 1) from the U.S. Nuclear Regulatory Commission (NRC) for the Point Beach Nuclear Plant Units 1 and 2 (PBN), which has a thermal discharge to Lake Michigan. As part of the license renewal process, the NRC may request a formal or informal consultation with your agency.

Table 1. PBN Licensing Dates

PBN Unit	Current License Expiration Date	Extended License Expiration Date
Unit 1	October 5, 2030	October 5, 2050
Unit 2	March 8, 2033	March 8, 2053

The NRC requires a license renewal applicant to assess public health impacts resulting from thermophilic organisms. It is our intent by this letter to introduce you to the project, to make available any data you need to ensure an efficient and effective consultation process, and request input from the Wisconsin Department of Health Services Division of Public Health (DPH) regarding:

- Identify any questions or additional information needs DPH may have regarding our thermophilic organism impact assessment summarized below.
- Requesting confirmation from DPH that continued operation of PBN will create no potential public health hazards from pathogenic microorganisms due to PBN discharge-related warming of Lake Michigan.

Information concerning this request, specific microorganisms of concern, and PBN's thermal discharge are presented below. A figure depicting the station site and the vicinity within a 6-mile radius is attached.

As part of the renewal process, the NRC requires that the license renewal application include an environmental report (ER) that assesses the impacts from continued operation and any refurbishment undertaken to enable the continued operation of the units. One of the environmental impact topics is the potential public health hazard associated with microorganisms. Information to be considered by the applicant in evaluating impacts includes thermal discharge temperature; thermal characteristics of the receiving water bodies; thermal conditions for the enhancement of the thermophilic microorganisms; and potential impacts to public health. NEPB's ER concludes that that the public human health risk posed by PBN's capacity to enhance thermophilic microorganisms is small.

Microorganisms of Concern

- Free-living amoebae of the genera *Naegleria* (*Naegleria fowleri*) and *Acanthamoeba*
- *Legionella spp.*
- Enteric pathogens *Salmonella spp*., *Shigella spp.*, and *Pseudomonas aeruginosa*
- Thermophilic fungi

Information to Support Consultation on Thermophilic Microorganisms

Naegleria spp. is ubiquitous in nature and thrives in heated water bodies at temperatures ranging from 95-106°F or higher is rarely found in water cooler than 95°F, and infection rarely occurs in water temperatures of 95°F or less. Infections occur when *N. fowleri* penetrates the nasal tissue through direct contact with water in warm lakes, rivers, or hot springs and migrates to the brain tissues. There have been only 145 cases of primary amebic meningoencephalitis, the infection caused by *N. fowleri*, in the United States with no cases occurring in Wisconsin from 1962–2018. The exposure route of concern would be emersion (e.g., swimming) in water contaminated with a sufficient population of microorganism for human infection.

Exposure to *Legionella spp*. from power plant operations is generally an occupational health concern rather than a public health concern. Occupational exposure is associated with tasks where worker could dislodge biofilms, where *Legionella* are often concentrated, such as during the cleaning of condenser tubes and cooling towers. PBN does not have cooling towers and condenser cleaning is accomplished by contracted to qualified vendors that specialize in condenser cleaning.

Other human pathogens mentioned above have infection routes of contact with infected persons or contaminated water, food, soil, or other contaminated material. The exposure route of concern would be contact with contaminated water (i.e., containing a population of microorganisms sufficient for human infection). The pathogens can grow at a range of temperatures, but as human pathogens, have an optimal growth temperature around the human body temperature. There were no reported cases of infection from waterborne *Salmonella* spp. in the United States in 2018. There were three infection cases from waterborne pathogens in untreated recreational water in Wisconsin in 2013-2014, which occurred from *Escherichia coli* in a reservoir setting.

PBN's wastewater discharge permit issued by the Wisconsin Department of Natural Resources limits the waste heat that PBN can reject to Lake Michigan and requires reporting of intake and discharge temperatures. The wastewater discharge exits the plant via two steel piling troughs extending in opposite directions (30-degree angle from the plant centerline) approximately 200 feet out into Lake Michigan. The average August discharge temperatures for years 2014–2018 were 82.2°F, 75.6°F, 84.8°F, 87.7°F, and 84. °F 0 and the highest average daily discharge temperature for August 2019 was 88.8°F. The momentum of the discharge velocity is sufficient to create a high degree of mixing with the lake surface water in the immediate vicinity. Lake Michigan along PBN is a security zone where entry is prohibited pursuant to USCG/Homeland Security regulation (Navigation and Navigable Waters) 33 CFR 165.916(a)(2).

The nearest public beach areas to PBN are Two Creeks County Park approximately 1 mile north and Point Beach Campground at Point Beach State Forest approximately 4 miles south.

As stated earlier, this letter seeks your input on potential public health impacts associated with the microorganisms of concern as they relate to the proposed continued operation of PBN. Your response is kindly requested within 45 days of receiving this letter.

Should you or your staff have any questions or comments, please contact William Maher at (561) 691-2291 / William.Maher@fpl.com.

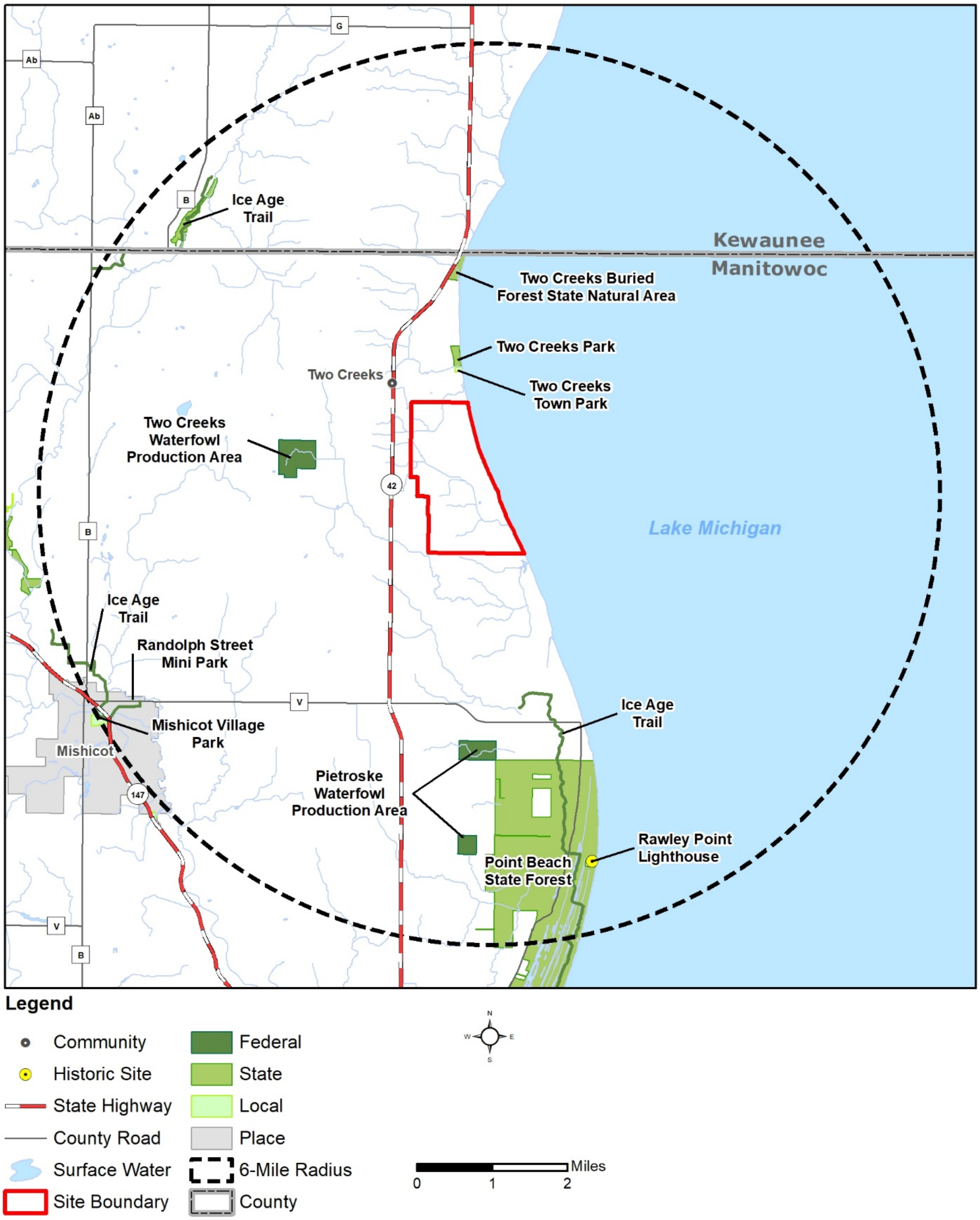
Sincerely,

William D. Maher
Senior Licensing Director

Attachment:

Figure 1. PBN 6-mile Vicinity

Figure 1. PBN 6-mile Vicinity



Attachment F: Coastal Zone Management Act Certification

November 10, 2020 PBNDOA-20-0054

Kathleen Angel
Federal Consistency and Coastal Coordinator
Wisconsin Coastal Management Program
Wisconsin Department of Administration
P.O. Box 8944
Madison, WI 53708-8944

RE: NextEra Energy Point Beach, LLC – Point Beach Nuclear Plant Units 1 and 2 Subsequent License Renewal

Dear Ms. Angel:

NextEra Energy Point Beach, LLC (NEPB) is preparing an application for renewing the operating licenses for Point Beach Nuclear Plant Units 1 and 2 (PBN) for an additional 20 years (see Table 1). The purpose of this letter is to initiate the process to obtain the Coastal Management Council's concurrence on this consistency certification.

Table 1. PBN Licensing Dates

PBN Unit	Current License Expiration Date	Extended License Expiration Date
Unit 1	October 5, 2030	October 5, 2050
Unit 2	March 8, 2033	March 8, 2053

NEPB expects PBN operations during the license renewal term to be a continuation of current operations with no changes that would affect Wisconsin's coastal zone. Continued operations do not involve substantially different coastal effects from those activities previously reviewed by the State of Wisconsin. The proposed continued operation of PBN complies with the policies of the Wisconsin Coastal Management Program (WCMP) and will continue to be conducted in a manner consistent with such policies.

As part of the renewal process, the NRC requires that the license renewal application include an environmental report (ER) that assesses the impacts from continued operation and any refurbishment undertaken to enable the continued operation of the units. The ER addresses the potential impact on coastal uses and resources within the coastal zone adjacent to PBN on Lake Michigan. The focus of the WCMP is on new "direct and significant" uses and proposed activities that have significant environmental impacts. NEPB submits that PBN's continued operation would not involve new uses of the coastal zone and PBN operates in compliance with Wisconsin regulations and permits including but not limited to its Wisconsin Department of Natural Resources (WDNR)-issued permits governing wastewater and stormwater discharges. The studies that have been performed and submitted to WDNR, as well as the information provided in the ER, demonstrate that there are no substantially different coastal effects from PBN's existing operations. Further, NEPB does not anticipate operation of PBN to adversely affect environment or the coastal zone adjacent to PBN.

PBNP, located in Manitowoc County, is within the Wisconsin coastal zone and is located on the western shore of Lake Michigan in Manitowoc County, WI, approximately 15 miles north-northeast of Manitowoc, WI. Figures depicting the plant site and the vicinity within a 6-mile radius of the plant are attached.

As stated earlier, this letter seeks the Coastal Management Council's concurrence on this consistency certification. We appreciate your notifying us of your comments and any information you believe should be considered by the NRC. Your response is kindly requested within 45 days of receiving this letter.

Should you or your staff have any questions or comments, please contact William Maher at (561) 691-2291 / William.Maher@fpl.com.

Sincerely,

William D. Maher
Senior Licensing Director

Attachments:

Figure 1. PBN Site
Figure 2. PBN 6-mile Vicinity

Figure 1. PBN Site

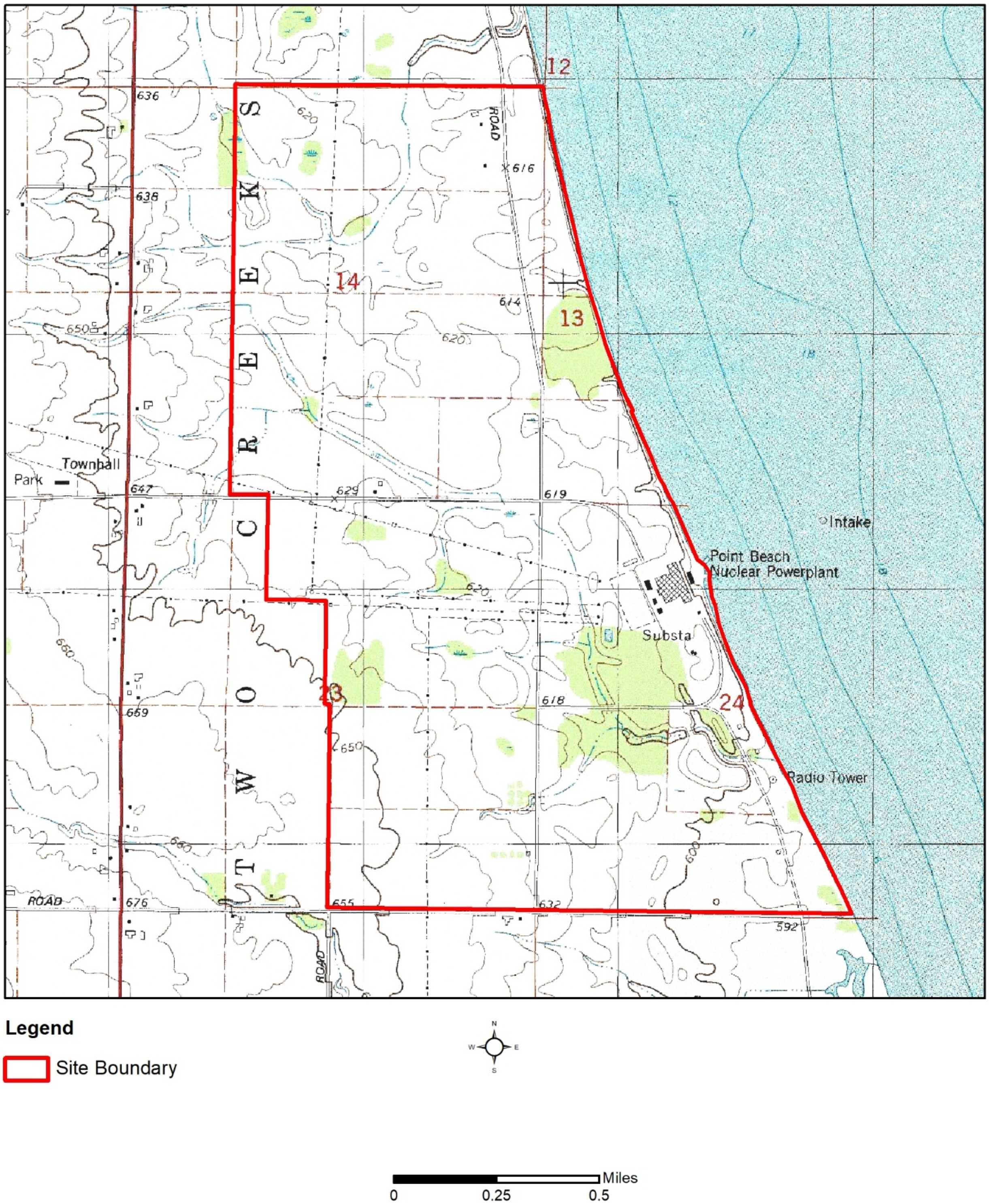


Figure 2. PBN 6-mile Vicinity