Applicant's Environmental Report – Operating License Renewal Stage

Monticello Nuclear Generating Plant

Nuclear Management Company

Docket No. 50-263

License No. DPR-22

March 2005

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ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
AADT	average annual daily traffic counts
AEC	U.S. Atomic Energy Commission
BNSF	Burlington Northern-Sante Fe
BWR	boiling water reactor
CEQ	Council on Environmental Quality
CFR	*Code of Federal Regulations*
cfs	cubic feet per second
CIP	Conservation Implementation Plan
CNS	Constellation Nuclear Services, Inc.
CO	carbon monoxide
CON	Certificate of Need
CT	combustion turbine
CWA	(Federal) Clean Water Act
CWIS	cooling-water intake structures
DOE	U.S. Department of Energy
DSM	Demand Side Management
EAM	Equivalent Adult Model
EIA	Energy Information Agency
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
EPRI	Electric Power Research Institute
ER	environmental report
FERC	Federal Energy Regulatory Commission
FES	Final Environmental Statement
FWS	U.S. Fish and Wildlife Service
GEIS	*Generic Environmental Impact Statement for License Renewal of Nuclear Plants*
General Electric	General Electric Company
gpd	gallons per day
gpm	gallons per minute

ACRONYMS AND ABBREVIATIONS (CONTINUED)

GRE	Great River Energy
GWh	gigawatt-hours
HRSG	heat recovery steam generator
IGCC	Integrated gasification combined cycle
ISFSI	Independent Spent Fuel Storage Installation
ISO	Independent System Operator
kV	kilovolt
LOS	level of service
MAPP	Mid-Continent Area Power Pool
MDC	Minnesota Department of Commerce
MEQB	Minnesota Environmental Quality Board
mgd	million gallons per day
MISO	Midwest Independent System Operator
MMBtu	million British thermal units
MNDNR	Minnesota Department of Natural Resources
MNDT	Minnesota Department of Transportation
MNGP	Monticello Nuclear Generating Plant
MPCA	Minnesota Pollution Control agency
MPUC	Minnesota Public Utilities Commission
MSA	Metropolitan Statistical Area
msl	mean sea level
MSP	Minneapolis-St. Paul International Airport
MW	megawatt
MWe	megawatt-electric
MWh	megawatt-hours
NA	not applicable
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Council
NESC®	National Electrical Safety Code®
NMC	Nuclear Management Company, LLC
NMFS	National Marine Fisheries Service

ACRONYMS AND ABBREVIATIONS (CONTINUED)

NOx	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPPOSA	Nuclear Power Plant Operating Service Agreement
NRC	U.S. Nuclear Regulatory Commission
NRHP	National Register of Historic Places
NSP	Northern States Power Company
NWIS	National Water Information System
psi	pounds per square inch
REMP	Radiological Environmental Monitoring Program
RIMS II	Regional Input-Output Modeling System
rm	river mile
ROPE	Reservoir Operating Plan Evaluation
ROW	right(s)-of-way
RTO	Regional Transmission Operator
Sherco	Sherburne County Generating Plant
SHPO	State Historic Preservation Officer
SO_2	sulfur dioxide
SO_x	sulfur oxides
TCMA	Twin Cities Metropolitan Area
U.S.	United States
USAR	Updated Safety Analysis Report
USC	United States Code
USGS	U.S. Geological Survey
Xcel Energy	Xcel Energy Inc.

1.0 PURPOSE OF AND NEED FOR ACTION

1.1 INTRODUCTION AND BACKGROUND

NRC

"Each application must include a supplement to the environmental report that complies with the requirements of Subpart A of 10 CFR Part 51." 10 CFR 54.23

"…The purpose and need for the proposed action (renewal of an operating license) is to provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by State, utility, and, where authorized, Federal (other than NRC) decisionmakers…" (NRC 1996a, Section 1.3; NRC 1996b, Page 28472).

"...The NRC's NEPA decision standard for license renewal would require the NRC to determine whether the environmental impacts of license renewal are so great that preserving the option of license renewal for future decisionmakers would be unreasonable." (NRC 1996b, 28471)

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. Nuclear Management Company, LLC (NMC), operates Monticello Nuclear Generating Plant (MNGP) pursuant to NRC Operating License DPR-22 (NRC 2000a). The current license expires September 8, 2010 (NRC 1987). NMC has prepared this Environmental Report (ER) in conjunction with its application to NRC to renew the MNGP operating license, as provided by the following NRC regulations:

- 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 Regulations for Domestic Licensing and Related Regulatory Functions, Section 51.53, Post-Construction Environmental Reports, Subsection 51.53(c), Operating License Renewal Stage [10 CFR 51.53(c)]

These regulations provide for an operating license renewal period for up to 20 years beyond the initial 40-year license term.

1.2 STATEMENT OF PURPOSE AND NEED

NMC adopts for this ER the following NRC general definition of purpose and need for the proposed action, as stated in NRC's *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS), NUREG-1437 (NRC 1996a, Section 1.3; NRC 1996b, page 28472):

> The purpose and need for the proposed action (renewal of an operating license) is to provide an option that allows for power generation capability beyond the term of a current nuclear power plant operating license to meet future system generating needs, as such needs may be determined by State, utility, and, where authorized, Federal (other than NRC) decisionmakers.

The proposed action would provide NMC the option to operate MNGP for up to an additional 20 years beyond the current 40-year operating license term, i.e., until September 8, 2030.

1.3 ENVIRONMENTAL REPORT SCOPE AND METHODOLOGY

NRC regulations for domestic licensing of nuclear power plants require environmental review of applications to renew operating licenses. NRC regulation 10 CFR 51.53(c) requires that an applicant for license renewal submit with its application a separate document entitled, *Applicant's Environmental Report - Operating License Renewal Stage*. This appendix to the MNGP License Renewal Application fulfills that requirement. In determining what information to include in the MNGP ER, NMC relied on NRC regulations and the following supporting documents which provide additional insight into the regulatory requirements:

- NRC supplemental information in the *Federal Register* (NRC 1996b; NRC 1996c; NRC 1996d; NRC 1999a)
- The *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) (NRC 1996a; NRC 1999b)
- *Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant Operating Licenses* (NRC 1996e)
- *Public Comments on the Proposed 10 CFR Part 51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response* (NRC 1996f)

NMC also obtained general guidance regarding format and content of the ER from the following NRC documents:

- Supplement 1 to NRC Regulatory Guide 4.2, *Preparation of Supplemental Environmental Reports for Applications to Renew Nuclear Power Plant Operating Licenses* (NRC 2000b)
- Supplement 1 to NUREG-1555, *Standard Review Plans for Environmental Reviews for Nuclear Power Plants (Operating License Renewal)* (NRC 1999c)

NMC developed Table 1.3-1 to verify conformance with regulatory requirements. Table 1.3-1 indicates where the ER addresses each requirement of 10 CFR 51.53(c). Additionally, key excerpts from applicable regulations and supporting documents preface each responsive section of the ER.

1.4 MNGP LICENSEE AND OWNERSHIP

MNGP is owned by Northern States Power Company (NSP) which is a wholly owned utility operating subsidiary of Xcel Energy Inc. (Xcel Energy). As the plant's owner, NSP has the exclusive right to the energy generated by MNGP. NMC operates and maintains MNGP on behalf of NSP. NSP is licensed by NRC to own MNGP, while NMC is licensed by NRC to use and operate the facility.

Nuclear Power Plant Operating Service Agreement (NPPOSA) between Xcel Energy Inc. and Nuclear Management Company, LLC establishes NMC as the sole operator of MNGP and defines the owner-operator relationship (NSP 1999). NMC and its employees are obligated to comply with all corporate policies listed in Exhibit D of the NPPOSA, including Xcel Energy's Code of Conduct and Environmental Policy. NPPOSA provides for owner services and assistance to NMC for safe, economic, and efficient operation of MNGP. Implementation of the NPPOSA agreement is achieved by continuance of functional relationships among owner/operator organizations regarding environmental matters. These functional relationships provide for close coordination among corporate and plant staff for efficient and effective environmental management (Xcel 2004).

TABLE 1.3-1
ENVIRONMENTAL REPORT RESPONSES TO LICENSE RENEWAL ENVIRONMENTAL REGULATORY REQUIREMENTS

Regulatory Requirement		Responsive Environmental Report Section(s)
10 CFR 51.53(c)(1)		Entire Document
10 CFR 51.53(c)(2), Sentences 1 and 2	3.0	The Proposed Action
10 CFR 51.53(c)(2), Sentence 3	7.3	Environmental Impacts of Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(1)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(2)	6.3	Unavoidable Adverse Impacts
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(3)	7.0 8.0	Alternatives to the Proposed Action Comparison of Environmental Impact of License Renewal with the Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(4)	6.5	Short-Term Use Versus Long-Term Productivity of the Environment
10 CFR 51.53(c)(2) and 10 CFR 51.45(b)(5)	6.4	Irreversible or Irretrievable Resource Commitments
10 CFR 51.53(c)(2) and 10 CFR 51.45(c)	4.0 6.2 7.3 8.0	Environmental Consequences of the Proposed Action and Mitigating Actions Mitigation Environmental Impacts of Alternatives Comparison of Environmental Impact of License Renewal with the Alternatives
10 CFR 51.53(c)(2) and 10 CFR 51.45(d)	9.0	Status of Compliance
10 CFR 51.53(c)(2) and 10 CFR 51.45(e)	4.0 6.3	Environmental Consequences of the Proposed Action and Mitigating Actions Unavoidable Adverse Impacts
10 CFR 51.53(c)(3)(ii)(A)	4.2	Surface Water and Groundwater Use Conflicts
10 CFR 51.53(c)(3)(ii)(B)	4.3 4.4 4.5	Entrainment of Fish and Shellfish in Early Life Stages Impingement of Fish and Shellfish Heat Shock
10 CFR 51.53(c)(3)(ii)(C)	4.1	Background
10 CFR 51.53(c)(3)(ii)(D)	4.1	Background
10 CFR 51.53(c)(3)(ii)(E)	4.6 4.7	Impacts of Refurbishment on Terrestrial Resources Threatened or Endangered Species
10 CFR 51.53(c)(3)(ii)(F)	4.8	Air Quality During Refurbishment (Nonattainment Areas)
10 CFR 51.53(c)(3)(ii)(G)	4.9	Impact on Public Health of Microbiological Organisms

TABLE 1.3-1 (CONTINUED)
ENVIRONMENTAL REPORT RESPONSES TO LICENSE RENEWAL ENVIRONMENTAL REGULATORY REQUIREMENTS

Regulatory Requirement	Responsive Environmental Report Section(s)	
10 CFR 51.53(c)(3)(ii)(H)	4.10	Electromagnetic Fields – Acute Effects
10 CFR 51.53(c)(3)(ii)(I)	4.11	Housing Impacts
	4.12	Public Utilities: Public Water Supply Availability
	4.13	Education Impacts from Refurbishment
	4.14	Offsite Land Use
10 CFR 51.53(c)(3)(ii)(J)	4.15	Transportation
10 CFR 51.53(c)(3)(ii)(K)	4.16	Historic and Archaeological Resources
10 CFR 51.53(c)(3)(ii)(L)	4.17	Severe Accident Mitigation Alternatives
10 CFR 51.53(c)(3)(iii)	4.0	Environmental Consequences of the Proposed Action and Mitigating Actions
	6.2	Mitigation
10 CFR 51.53(c)(3)(iv)	5.0	Assessment of New and Significant Information
10 CFR 51, Appendix B to Subpart A, Table B-1, Footnote 6	2.5.3	Minority and Low-Income Populations

CFR = Code of Federal Regulations

1.5 REFERENCES

Note to reader: This list of references identifies web pages and associated URLs where reference data was obtained. Some of these web pages may likely no longer be available or their URL addresses may have changed. NMC has maintained hard copies of the information and data obtained from the referenced web pages.

NRC (U.S. Nuclear Regulatory Commission). 1987. "Northern States Power Company; Docket NO. 50-263; Monticello Nuclear Generating Plant; Amendment to Facility Operating License." Amendment 53. November 19.

NRC (U.S. Nuclear Regulatory Commission). 1996a. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants*. NUREG-1437. Office of Nuclear Regulatory Research. Washington, D.C. May.

NRC (U.S. Nuclear Regulatory Commission). 1996b. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses." *Federal Register*. Vol. 61, No. 109. (June 5, 1996): 28467-97.

NRC (U.S. Nuclear Regulatory Commission). 1996c. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Correction." *Federal Register*. Vol. 61, No. 147. (July 30, 1996): 39555-6.

NRC (U.S. Nuclear Regulatory Commission). 1996d. "Environmental Review for Renewal of Nuclear Power Plant Operating Licenses." *Federal Register*. Vol. 61, No. 244. (December 18, 1996): 66537-54.

NRC (U.S. Nuclear Regulatory Commission). 1996e. *Regulatory Analysis for Amendments to Regulations for the Environmental Review for Renewal of Nuclear Power Plant* Operating *Licenses*. NUREG-1440. Office of Nuclear Regulatory Research. Washington, D.C. May.

NRC (U.S. Nuclear Regulatory Commission). 1996f. *Public Comments on the Proposed 10 CFR* Part *51 Rule for Renewal of Nuclear Power Plant Operating Licenses and Supporting Documents: Review of Concerns and NRC Staff Response*. NUREG-1529. Office of Nuclear Regulatory Research. Washington, D.C. May.

NRC (U.S. Nuclear Regulatory Commission). 1999a. "Changes to Requirements for Environmental Review for Renewal of Nuclear Power Plant Operating Licenses; Final Rules." *Federal Register*. Vol. 64, No. 171. (September 3, 1999): 48496-507.

NRC (U.S. Nuclear Regulatory Commission). 1999b. *Generic Environmental Impact Statement for License Renewal of Nuclear Plants.* Section 6.3*,* "Transportation," and Table 9-1, "Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants." NUREG-1437, Vol. 1, Addendum 1. Office of Nuclear Reactor Regulation. Washington, D.C. August.

NRC (U.S. Nuclear Regulatory Commission). 1999c. *Standard Review Plans for Environmental Reviews for Nuclear Power Plants (Operating License Renewal)*. NUREG-1555, Supplement 1. Office of Nuclear Reactor Regulation. Washington, D.C. October.

NRC (U.S. Nuclear Regulatory Commission). 2000a. "Northern States Power Company Nuclear Management Company, LLC; Docket NO. 50-263; Monticello Nuclear Generating Plant, Unit NO. 1; Facility Operating License." Amendment 110. August 7.

NRC (U.S. Nuclear Regulatory Commission). 2000b. *Preparation of Supplemental Environmental Reports for Applications to Renew Nuclear Power Plant Operating Licenses*. Supplement 1 to Regulatory Guide 4.2. Office of Nuclear Regulatory Research. Washington, D.C. September.

NSP (Northern States Power Company). 1999. "Nuclear Power Plant Operating Services Agreement between Northern States Power Company and Nuclear Management Company, LLC for the Monticello Nuclear Generating Plant." November 24.

Xcel (Xcel Energy Inc.). 2004. "Xcel Energy Code of Conduct (Uniform Policy)." February 25.

2.0 SITE AND ENVIRONMENTAL INTERFACES

2.1 GENERAL SITE DESCRIPTION

Monticello Nuclear Generating Plant (MNGP; shown in the photo below) is located in the City of Monticello, Wright County, Minnesota, on the southern bank of the Mississippi River (NMC 2003, Section 2.2). Major features within the MNGP region (i.e., within 50 and 6 miles) are illustrated in Figures 2.1-1 and 2.1-2, respectively. Figure 2.1-3 shows the MNGP site and its immediate environs. General regional, vicinity, and site features are highlighted in the following subsections. Nuclear Management Company, LLC (NMC) discusses characteristics of particular interest to this Environmental Report (ER) in Section 2.2 through 2.10.

2.1.1 REGIONAL FEATURES AND GENERAL FEATURES IN THE 6-MILE SITE VICINITY

Although the plant is located in the City of Monticello, the land use in the region is primarily agricultural (NMC 2003, Section 2.2). The nearest large city is St. Cloud, 22 miles to the northwest and upstream of the MNGP site. The Twin Cities area of Minneapolis, St. Paul, and their surrounding suburbs, is approximately 30 miles to the southeast and downstream of the site. This is the largest urban area within 50 miles of

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the site exerting a strong influence on the region as the surrounding cities and townships respond to the Twin City area's demands for suburban development (NMC 2003, Section 2.2).

The MNGP site is located in a region dominated by rivers, streams, and lakes. Figure 2.1-1 highlights some of the numerous public recreational and natural areas located within 50 miles of the MNGP site. Federal properties include 35 acres owned by the National Park Service in the Mississippi National River and Recreation Area, which extends in a narrow corridor along the River from Dayton to Hastings, Minnesota, and three federal wildlife refuges (FWS 2004a; NPS 2004). The nearest refuge is the Sherburne National Wildlife Refuge located approximately 9 miles to the northeast of the MNGP site (AEC 1972, II.D.4; FWS 2004a;). State properties include three state parks. Lake Maria State Park is the nearest to the MNGP site located approximately 6 miles to the west-southwest (AEC 1972, II.D.4; MNDNR 2004a). Additional state properties include three state forests; eighteen state Scientific and Natural Areas; and numerous state wildlife management areas (MNDNR 2004b,c,d,e). The closest state forest to the plant site is Sand Dunes State Forest located approximately 9 miles to the northeast. The Kelly-meyer State Wildlife Management Area is located less than 5 miles to the southeast of the site. Other public recreation areas within 10 miles of the MNGP site include three Wright County properties and one Sherburne County property. In Wright County, Montissippi County Park, Harry Larson County Forest, and Marcus Zumbreunnen County Park offer picnic grounds, trails for hiking and cross-country skiing, and public access for fishing. Montissippi County Park is also the nearest point of public access to the River from the MNGP site. This access point provides year-round fishing opportunities due to its close proximity to the warm water discharge from the plant. In Sherburne County, the Oak Savanna Land Preserve near Becker provides for day use activities such as hiking, biking, horseback riding, cross country skiing, snowshoeing, and dog sledding. Grams Regional Park, acquired in 2002 by Sherburne County, is located along Fremont Lake near the City of Zimmerman. The Park is in the early development stages and has some hiking trails (Sherburne Co. 2004a).

2.1.2 MNGP SITE FEATURES

Access to the MNGP site is provided by a site road connecting to Wright County Road 75, which parallels Interstate 94 in the vicinity of the site. Interstate 94 runs in a northwesterly direction from Minneapolis. Figures 2.1-1 and 2.1-2 illustrate the site location and features with 50 and 6 miles respectively. Figure 2.1-3 shows the site boundary in relation to the power block. The exclusion zone for the plant is set as the owner controlled fenced area as shown on Figure 2.1-3 satisfying the definition as specified at 10 CFR 100.3 (NMC 2003, Section 2.2).

The site consists of approximately 2,150 acres with roughly two miles of frontage on the north and south banks of the Mississippi River in Wright and Sherburne Counties. The majority of the acreage is located on the southern side of the River with approximately

450 acres on the northern side of the River. Approximately 50 acres are occupied by the plant and its supporting facilities (NMC 2003, Section 2.2; NSP 1971, Section II.A.2). The remaining acres are undeveloped with approximately 174 acres leased by local farmers for growing row crops and 144 acres are under lease for recreational use. Recreational use includes the lease of 120 acres to the Big Oaks Campground that is available for use by NMC and Xcel Energy employees and their families; 9 acres to Wright County Flyers Model Airplane Club; and 15 acres between the Training Center and Interstate 94 to the City of Monticello for athletic fields. Approximately 26 acres southeast of the power block make up the former MNGP Ecological Research Station which consisted of a series of canals and a laboratory building. The U.S. Environmental Protection Agency (EPA) originally leased the property from Northern States Power Company[1] (NSP) in 1970 and developed the facility for conducting field temperature studies on fish and other organisms with exposure to warm water discharges from MNGP. Through a cooperative agreement with the University of Minnesota, the lease was transferred from EPA to the University. The University's lease expired in 1996, and the facility has subsequently been closed and the canal area has been leveled off.

Transmission lines and corridors are prominent features on and near the MNGP site. Five Xcel Energy transmission lines emanate from the Monticello substation through three separate corridors: Sherburne County line corridor; St. Cloud line corridor; and a common corridor for the Elm Creek, Lake Pulaski, and Hassan lines. These transmission corridors are owned and maintained by Xcel Energy. Section 3.1.4 of this ER describes the power transmission systems in detail.

From a hydrologic perspective, MNGP site lies on the outwash plain of the Mississippi River. A glacial moraine, containing numerous lakes and swampy areas, bounds this outwash plain. Surface drainage from the moraine combines with that from the area's terraces and swales and flows in a southeastern direction into the River (AEC 1972, Section II.D).

Natural surface drainage of the MNGP site is generally to the southwest at an approximate 2 to 3 percent grade away from the River with surface runoff tending to collect at the southend of the terrace. Mississippi River tributaries close to the site are Silver Creek, five miles to the northwest, and Otter Creek, three miles to the southeast. The Elk River flows roughly parallel to the Mississippi River four miles to the north and converges with it 15 miles downstream of the MNGP site (AEC 1972, Section II.D). River use in the vicinity of the MNGP site is primarily recreational and includes fishing, boating, canoeing, water skiing, and sail boating.

The land cover of the MNGP site is predominated by formerly cultivated fields in various stages of ecological succession with remnant climax hardwood forest in isolated

[1] Northern States Power is a wholly owned operating subsidiary of Xcel Energy Inc.

pockets along the River and on the larger islands and some actively cultivated fields (AEC 1972, Section II.E.1).

The Sherburne County Generating Plant (Sherco) exhaust stacks are visible from the MNGP site. Sherco, a coal-fired plant also owned by Xcel Energy, is the closest industrial facility on the Mississippi River. Over 4,500 acres comprise the Sherco site, the majority of which are leased for agricultural purposes.

2.2 HYDROLOGY

2.2.1 UPPER MISSISSIPPI RIVER BASIN

The Mississippi River, with its source located in the north woods of Minnesota in Itasca State Park is the longest and largest river in North America. The River flows 3,705 kilometers (2,302 miles) from its source, Lake Itasca, draining through all or part of 31 states. Eventually, the Mississippi River reaches the Gulf of Mexico after it meanders through the sub-tropical Louisiana Delta. The River and the forests and wetlands along its banks support various diverse ecosystems. Over 400 species of wildlife including forty percent of the nation's duck, goose, swan and wading bird populations depend upon the Mississippi River for a migration corridor. For reference purposes, the United States Geological Survey (USGS) has broken the Mississippi River into six sub-basins known as the Upper Mississippi River, Lower Mississippi River, Arkansas Red-White River, Ohio River, Missouri River, and Tennessee River Subbasins (EPA 2004a).

The Upper Mississippi River Subbasin includes portions of Minnesota, Wisconsin, Iowa, Illinois, and Missouri (EPA 2004a). Within the State of Minnesota this subbasin includes 7 major drainage basins: Upper Mississippi River, St. Croix River, Minnesota River, Lower Mississippi River, Missouri River, Des Moines River and Cedar River Drainage Basins (MPCA 2004). Each individual drainage basin is comprised of smaller units corresponding to the drainage of a tributary or lake system, otherwise known as watersheds. MNGP is located in the Upper Mississippi River Drainage Basin, which extends from the headwaters at Lake Itasca to Lock and Dam Number 2 near Hastings, Minnesota (MPCA 2004). Most specifically, MNGP is found within the Clearwater-Elk watershed in the Upper Mississippi River Drainage Basin, Upper Mississippi River Sub-Basin. The Clearwater-Elk watershed includes land in both Sherburne County and Wright County and encompasses all water bodies within its boundaries (EPA 2004b). A series of dams exist between Lake Itasca and the Saint Anthony Falls Lock and Dam on the Mississippi River. However, lock systems for these dams are not in place on this area of the River, because it is not used for commercial navigational purposes (USGS 2004a).

Near MNGP, the Mississippi River is a broad turbulent stream with a boulder substrate. Rapids occur frequently as the River drops 10 feet from 1.5 miles upstream to 1.5 miles downstream from the plant. The Minnesota Department of Natural Resources (MNDNR) classifies the portion of the River adjacent to the plant as suitable for aquatic recreation, including fishing and swimming, as well as for protection as a drinking water source. Mississippi River tributaries close to the plant are Silver Creek, 5 miles upstream, and Otter Creek, 3 miles downstream. The Elk River flows parallel to the Mississippi River along a line 4 miles northeast of the plant, entering the Mississippi River 15 miles downstream at river mile (RM) 884.8 (ACE 2004a). The Mississippi

River flow continues to increase downstream with additional tributaries entering including the Crow River at RM 879.6, the Minnesota River at RM 844.0, and the St. Croix River at RM 811.3 (ACE 2004a). The Upper Saint Anthony Lock and Dam is located at Mississippi RM 853.8, 46 miles downstream of the MNGP site. Downstream of this location, Mississippi River elevations and flows are regulated by a series of locks and dams (ACE 2004a).

2.2.1.1 Headwater Reservoirs

Upstream from the MNGP site in north-central Minnesota, Mississippi River flows are impacted by six primary headwater reservoirs (Mississippi Headwaters reservoirs). The reservoirs were created by a series of dams and control structures, initially designed to augment the Mississippi River flows for navigation. The dams creating the six reservoirs were built between 1884 and 1912 (ACE 2004b).

General regulations governing the operation of the Mississippi Headwaters dams were first established by the War Department in 1889 and were formally modified in 1931, 1935, 1936, 1944 and 1988. The regulations deal primarily with the control of water levels in the six reservoirs and include a normal summer band and operating limits (Spading 2004, page 2-3). The summer band represents the range of water levels that are the most beneficial to a majority of users during the summer months. The summer band was established as a result of an investigation of desirable summer water levels through public consultation in the late 1920's and early 1930's. Several modifications to summer band parameters have occurred in more recent years. Currently, the range of water elevations for the summer band does not exceed 0.5 feet.

The Ordinary Operating Limits for the Headwater reservoirs were adopted through public consultation in the 1930's and 1940's. In general, the limits range from a normal winter drawdown level to an upper elevation above which erosion begins to accelerate in a particular reservoir. These limits are meant to be a range of elevations residents might expect to experience during a year as an 'ordinary' annual cycle. The reservoir water levels are lowered every winter to create room for flood control storage in the spring. The drawdown begins in the fall, usually in September or early October and concludes prior to the spring breakup. The drawdown is targeted for completion by February 15-28. The actual drawdown elevation in any given year is adjusted as the extent of the snowpack reveals itself over the course of a winter. The final drawdown elevation can be higher, or in some cases lower, than the 'normal' drawdown target (Spading 2004).

The regulations issued between 1931 and 1944 also contain required average annual flows from the reservoirs. The cumulative required federal minimum average annual flow is 400 cubic feet per second (cfs) based on the sum of the minimum required flow from Lakes Pokegama, Sandy, Cross, and Gull (Spading 2004, Table 1). The MNDNR has low-flow guidelines to maintain a minimum instantaneous flow of 270 cfs whenever

the same four reservoirs are above a specified elevation. However, the state guideline is secondary to maintaining the federal operating limits (Spading 2004, page 5).

The U.S. Army Corps of Engineers and the U.S. Forest Service are currently performing a joint long-range Reservoir Operating Plan Evaluation (ROPE). The primary purpose of the study is to evaluate alternative plans for each of the existing reservoirs and to improve system-wide operations of the Mississippi Headwaters reservoirs. Possible outcomes of the study could include changes in winter drawdown, a more natural flow release for downstream river reaches, and changes in flood control (ACE 2004b).

2.2.1.2 United States Geological Survey Gaging Stations

USGS gaging stations are located both upstream and downstream of the MNGP site listed as follows:

USGS Station	River Mile	Drainage Area (mi^2)	Available Record
St. Cloud (5270700)	926.3	13,320	1988-2002
Elk River (5275500)	884.6	14,500	1915-1956
Anoka (5288500)	864.8	19,100	1931-2002

The daily flow data observed at various stations near the MNGP site were obtained from the USGS National Water Information System (NWIS) web page (USGS 2004b). The USGS flow data were extrapolated to the MNGP site using drainage area scaling to provide a continuous record of daily historical flows. MNGP site flows were scaled from the gage at Elk River from data available for the period prior to 1956. For the period following 1988, site flows were scaled from data available from the gage at St. Cloud. In the interval between 1956 and 1988, flows were scaled from data available from the gage at Anoka. The drainage area scaling took into account two major tributaries: the Elk River and the Crow River. The Elk River at Big Lake (Station #5275000) has a drainage area of 599 square miles. The confluence of the Elk River with the Mississippi is 2,500 feet upstream of the Mississippi River gage at Elk River. The Crow River at Rockford (Station #5280000) has a drainage area of 2,640 square miles and enters the Mississippi River between the Elk River and Anoka gaging stations.

The MNGP site is located at RM 900. Interpolating drainage area between St. Cloud and Elk River, while accounting for the 599-square mile area associated with the Elk River tributary, results in a drainage area for the MNGP site of 13,700 square miles.

Site flows (Q_{site}) were determined using the following relationships:

Prior to 1956 Q_{site} = 0.9855 (Flow Elk River – Elk River Tributary)
1956-1988 Q_{site} = 0.8638 (Flow Anoka – Elk River Trib. – Crow River Trib.)
1988-2002 Q_{site} = 1.0285 (Flow St. Cloud)

Frequency distributions of Mississippi River flows scaled from USGS data to the MNGP site are provided in Tables 2.2-1 and 2.2-2. Table 2.2-1 provides the 31-year historical period from 1940 to 1970, prior to the operation of MNGP, and Table 2.2-2 provides the 31-year period from 1971 to 2001. Examination of the two tables indicates the annual average flow increased from 6,209 cfs to 7,217 cfs between the two 31-year periods.

2.2.1.3 Mississippi River Flow Statistics

Using data generated for the MNGP site scaled from USGS data taken at the St. Cloud and Elk River gages as discussed above, monthly average flows for the 1971 to 2001 historical period are provided in Table 2.2-3. Table 2.2-3 also includes the monthly minimum and maximum flows for the 31-year period. The monthly minimum, maximum, and mean flows for 1971-2001 are displayed in Figure 2.2-1. The maximum monthly average flow of 30,561 cfs occurred in April 2001 and the minimum monthly average flow of 853 cfs occurred in September 1976.

Daily Mississippi River flows recorded at the MNGP site by NSP were obtained from 1984 to 2003. Comparisons made between these flows and USGS flows scaled to the site were very favorable. In April 2001, the historical maximum monthly flow recorded at the site of 30,845 cfs, was within 1 percent of the 30,561 cfs scaled USGS flow. The second lowest monthly average flow in Table 2.2-3 for the 1971-2001 period was 880 cfs in July 1988. The July 1988 monthly average flow recorded at MNGP was 867 cfs.

Minimum seven-day average Mississippi River flows for a range of recurrence intervals are provided in the following table using data similarly generated. The flows were calculated using the standard Log-Pearson procedure.

Minimum 7-Day Average Flows (cfs)

Recurrence Interval	1940-1970	1971-2001	1940-2001
2-year	2,251	2,708	2,455
5-year	1,636	1,735	1,666
10-year	1,366	1,294	1,318
25-year	1,117	900	1,000
50-year	976	692	826

A common low-flow statistic is the 7Q10, a number denoting the minimum 7-day average flow with a 10-year recurrence interval at any given site on a river. The 7Q10 flow at the MNGP site decreased slightly from 1,366 cfs during the 1940-1970 period to 1,294 cfs during the 1971-2001 period. The 7Q10 for the longer 1940-2001 historical period is 1,318 cfs. Using MNGP data, a 7Q10 flow was calculated for the 1990 to 2003 period, which contained no missing data. The resulting 7Q10 flow of 1,934 cfs was significantly higher than the 1,318 cfs flow in the above table for the longer 1940-2001

period. However, a 7Q10 calculated using 1990-2001 scaled USGS data resulted in a value of 1,966 cfs, very similar to the result using site data.

The stage-discharge relationship used for MNGP location to calculate Mississippi River flows is illustrated in Table 2.2-4. This table provides river surface elevation in 0.1-foot intervals over a flow range extending up to 61,335 cfs.

2.2.1.4 Consumptive Surface Water Use

The MNDNR maintains an online database of water allocation permits. This database includes surface water and ground water type of use permits, and provides reported surface water usage for years 1988-2002 (MNDNR 2004f). The database was searched for Mississippi River water withdrawals for 14 counties upstream of the St. Croix River confluence. This point was chosen because the flow characteristics of the Mississippi River do not change appreciably from that in the vicinity of MNGP until the addition of the Minnesota and St. Croix Rivers. The 14-county area includes the Mississippi headwaters to Lake Itasca and the Twin Cities Metropolitan Area (TCMA), which includes major users that share the River surface water resource with MNGP. The results of this search were summarized by type of water use in three categories: industrial and municipal, agricultural, and power plants. The results of this analysis are provided in Tables 2.2-5 to 2.2-7.

A summary of the water allocation permits for industrial and municipal usage within the 14-county area is provided for the years 1994 to 2002 in Table 2.2-5. Within the 14-county area, there were a total of 13 permits (10 for industrial usage and 3 for municipal usage). Total Mississippi River withdrawals for industrial/municipal usage in 2002 amounted to 49,039 million gallons (208 cfs). In 2002, the largest user was the City of Minneapolis with 23,431 million gallons (47.8 percent of total) and the second largest user was the City of St. Paul with 12,200 million gallons (24.9 percent of total). Also in 2002, the 10 industrial permits used a total of 13,409 million gallons (27.3 percent of the total) (see Table 2.2-5). The net impact of water withdrawals from the Mississippi River is largely due to consumptive use, since a significant portion of the water is returned to the River by municipal wastewater treatment plants and similar discharges. For the following discussion, industrial/municipal consumptive use is assumed to be 15 percent on the basis of USGS water use statistics for the Upper Mississippi River region (Solley, Pierce, and Perlman 1998). Based on an estimated consumptive use of 15 percent, the annual average industrial/municipal withdrawals in the year 2002 results in a consumptive use of 31.2 cfs. Estimated annual industrial/municipal consumptive use estimates for the years 1994 to 2002 are provided at the bottom of Table 2.2-5 and displayed in Figure 2.2-2 (1990-2002). On this basis, industrial/municipal consumptive use during this 9-year period has varied from a low of 31.2 cfs in 2002 to a high of 35.3 cfs in 1998 (see Table 2.2-5). The majority of the industrial/municipal consumptive use is associated with the TCMA. The Minneapolis municipal intake is at RM 858.6, approximately 41 miles downstream of the MNGP site (ACE 2004a).

A summary of the water allocation permits for agricultural usage is provided in Table 2.2-6 for the years 1992 to 2002. A search of the MNDNR database for agricultural use permits granted in the 14 counties upstream of the St. Croix River confluence identified 105 permits. The search included both the Mississippi River and its tributaries. The agricultural water usage for river withdrawals is summarized in Table 2.2-6 by county. Aitkin County, upstream of the MNGP site near the Mississippi headwaters, had the highest agricultural water use of all 14 counties, consuming 589 of the 811 million gallon total usage in 2002. The total agricultural usage from the 14-county area is summarized at the bottom of Table 2.2-6 (1992-2002) and displayed in Figure 2.2-2 (1990-2002). The total agricultural usage of Mississippi River water has generally declined from a high of 1,579 million gallons (6.7 cfs) in 1992 to a low of 793 million gallons (3.4 cfs) in 2001 (see Table 2.2-6). The consumptive use of agricultural withdrawals is difficult to define since a portion of the water is returned to the environment by way of surface water runoff or ground water recharge. However, 100 percent consumptive use is assumed as a conservative estimator for purposes of this discussion.

A summary of the water allocation permits for power generation from 1992 to 2002 is provided in Table 2.2-7. Within the 14 counties upstream of the St. Croix River confluence, water allocation permits were identified for 7 power plants, 6 on the Mississippi River and 1 on the Minnesota River (see Table 2.2-8). Xcel Energy estimates consumptive use (surface water) at facilities using primarily once through cooling is 1 percent and that the average annual consumptive use at MNGP is 2 percent and at Sherco 90 percent for its closed cycle system. Based on these estimates, the total river water withdrawals at the 6 power plants were converted to consumptive use and provided in Table 2.2-7 (1992-2002) and displayed in Figure 2.2-2 (1990-2002).

The Metropolitan Council serving Minneapolis, St. Paul and seven surrounding counties performed a Projected Water Demand Study for the TCMA (Metropolitan Council 2001). This study forecasted increased water demand for the TCMA from 2000 to 2040. In 2000, the total water demand for residential, commercial, industrial, and other uses (excluding power production) was 464.3 million gallons per day (mgd). In 2040, water usage is forecasted to increase by 21.5 percent (100 mgd) to 564.5 mgd (Metropolitan Council 2001, pages iii, 11, 24). However, the forecasted water demand for power generation between 2000 and 2040 did not change. Currently, the TCMA obtains approximately 28 percent of its water demand from the Mississippi River, 57.4 percent from municipal groundwater wells, and 14.6 percent from private groundwater wells. Regarding the ability of the current water resources to meet future needs, the report states, “It is generally accepted that available water resources are sufficient to supply the increased demand” (Metropolitan Council 2001). In addition, the report indicates additional groundwater resources would be sought in areas currently being served by wells. It further states that in the event of an increased demand, division between percentages drawn from river and groundwater sources will remain similar. The current

28 percent Mississippi River usage represents 28 mgd of the total forecasted increase (100 mgd) through 2040 to come from the River. As previously discussed, the consumptive loss from industrial/municipal water use is assumed to be 15 percent. Thus, the consumptive loss from the 28 mgd forecasted increase in river withdraws would be 4.2 mgd (6.5 cfs).

The forecasted 21.5 percent increase in water demand between 2000 and 2040 for the TCMA is a conservative estimate for use in other areas in the region. The estimated industrial/municipal consumptive loss for the year 2000, the base year for the TCMA study, for a 14-county area upstream of the St. Croix River confluence was 34.9 cfs in Table 2.2-5. This loss rate was the highest during the 1999-2002 period. Seventy percent of the usage for the year 2000 in Table 2.2-5 were associated with municipal withdraws for the Twin Cities. Table 2.2-5 also includes industrial users that would have been included in the study by the Metropolitan Council. Applying the 21.5 percent demand increase for the year 2040 to the 34.9 cfs consumptive loss for the year 2000, results in a forecasted river loss of 42.4 cfs. This is a 7.5 cfs increase in consumptive loss from the Mississippi River between the years 2000 and 2040 for industrial/municipal usage.

2.2.2 ALLUVIAL AQUIFERS

Abundant quantities of groundwater of a quality suitable for domestic use are available from the unconsolidated sediments of the Mississippi River Valley and the underlying sandstone in the MNGP vicinity. The unconsolidated sediments overlying the sandstone consist of material left during the retreat of the Wisconsinian glaciation, less than 1,000,000 years ago. The unconsolidated glacial till material forms moraines, glacial outwash plains, and till plains around the MNGP site, and the depth of the materials vary from 55 to 122 feet thick (NSP 1971).

In general, the sand and gravel outwash deposited by glacial melt-water is highly permeable. The alluvial deposits are of Holocene age and consist of silt, sand, and gravel. These deposits generally are finer-grained and are less permeable than the glacial outwash deposits. The outwash and alluvial deposits are hydrologically connected and are a highly productive reservoir of groundwater.

The hydraulic conductivity of Mississippi River sediments (i.e., the capability of the sediment material to transmit water) was estimated to range from 27.4 feet per day to 2,740 feet per day based on laboratory tests of soil and rock extracted from exploration borings taken at the MNGP site. The USGS performed aquifer tests and collected samples at various locations in a 960-square-mile area of central Minnesota during a study of the Sand Plains in Benton, Sherburne, Stearns, and Wright Counties. The resulting hydraulic conductivities ranged from 30 to 660 feet per day and the specific yield for the unconfined aquifer ranged from 0.01 to 0.32 with an average value of 0.17. The aquifer test nearest to the MNGP site was a well 4 miles to the northwest. The hydraulic conductivity at this location was 420 feet per day and the specific yield was

0.29. A hydraulic conductivity of 274 feet per day, which falls in the middle of the laboratory range established for unconsolidated material at MNGP, and is consistent with values obtained by the USGS, was used for calculating the transmissivity of the surficial aquifer at the MNGP site.

Shallow wells in outwash and alluvial deposits supply water for many farms and residences in the surrounding countryside. The water usually is generally very mineral rich containing calcium, magnesium, and bicarbonates, with small amounts of sodium, potassium, sulfates, and chlorides. Shallow groundwater movement is controlled primarily by the Mississippi River and its tributaries.

2.2.3 DEEP AQUIFERS

The principal deep groundwater aquifer in the region of MNGP site occurs in the underlying Precambrian/Cambrian sandstone, known as the Mount Simon-Hinckley aquifer. The sandstone is supported by underlying bedrock of deeply weathered granite. The granite bedrock surface is irregular, slopes generally to the east or southeast, is non-porous, and has poor water-bearing capacity in relation to that of the overlying sandstone and unconsolidated sediments. Groundwater movement in the granitic rocks is extremely slow. In certain areas within the MNGP site the sandstone has been completely eroded, leaving weathered granitic rocks in contact with the overlying upper unconsolidated glacial sediments. The sandstone overlying the bedrock varies in thickness from 10 to 25 feet at the site and thickens toward the east (NSP 1971, Section F). The hydraulic conductivity of the sandstone is approximately 10 feet per day according to laboratory tests conducted on rock extracted from the exploration test borings.

The underlying geologic stratigraphy at the MNGP site is illustrated by the geologic descriptions in the boring logs for three of the onsite wells, described below.

Depth below Ground Level (ft)

Layer	Well 1	Well 2	Well-Admn Bldg
Surficial Deposits	0-60	0-65	0-80
Sandstone	60-80	65-82	
Shale/Sandstone	80-90	82-86	
Granite	90	86	
Uncased Interval	63-93	65-86	70-80

In the site vicinity, the general direction of deep groundwater flow is to the southeast. The regional hydrologic gradient, therefore, broadly parallels the trend of the topography and the principal surface drainage (NSP 1971, Section G).

2.2.4 GROUNDWATER LEVEL

Exploration borings drilled at the site in 1966 indicated that the groundwater level was approximately 909 feet mean sea level (msl) at the location of the reactor building. The elevation of the Mississippi River was approximately 907 feet msl at the time. Based on the water levels in the exploratory borings, the depth to groundwater varied from approximately 1 to 30 feet below the ground surface. The variability is due primarily to changes in topography. The water table in the site vicinity is relatively flat with a slight gradient sloping generally towards the River. The shallow groundwater flow direction toward the River might reverse during periods of high river stage, and the potential exists for these conditions to occur for a limited period of time. However, the area with the potential to be impacted by such a reversal in the MNGP site vicinity is likely limited.

In accordance with well water appropriations permit requirements, MNGP staff measured weekly groundwater elevations at two on-site wells during five months (January, March, July, August, October) each year from 1967 to 1994. This groundwater elevation data are provided in Table 2.2-9 for the 1990 to 1995 period. Table 2.2-9 includes both the measured weekly values and calculated monthly average values. The monthly average groundwater elevation at the two wells and the monthly average Mississippi River elevation are illustrated in Figure 2.2-3 for the 1993 to 1995 period. Groundwater elevations were typically 2 feet higher than river elevations, particularly during the summer and fall. In March of both 1994 and 1995, during the spring freshet, river elevations were similar to well elevations (see Figure 2.2-3 and Table 2.2-9).

2.2.5 CONSUMPTIVE GROUNDWATER USE

The MNDNR online database (MNDNR 2004f) was searched for ground water withdrawals in Wright County, and results of this search are summarized in Table 2.2-10. In addition to the permit for 2 wells on the MNGP site, there were 7 permits representing 10 wells within a 2-mile radius of the site and 10 permits representing 20 wells between 2 and 5 miles from the site. Within a 2-mile radius, total groundwater usage varied between 117.6 million gallons in 2001 and 70.6 million gallons in 2002. These volumes represent 63 percent and 38 percent, respectively, of the total allocated pumping from these wells. Six of the 7 permits within in a 2-mile radius were for crop irrigation, representing 95 percent of the total 2001 pumping. The largest user within a 2-5 mile radius of the site was the City of Monticello, pumping 514 million gallons in 2001 and 450.1 million gallons in 2002. These pumping volumes represented 77.2 percent and 83.8 percent of the total 2-5 mile pumping in these two years, respectively (see Table 2.2-10).

2.3 BIOLOGICAL RESOURCES

2.3.1 AQUATIC AND RIPARIAN ECOLOGICAL COMMUNITIES

2.3.1.1 Aquatic Ecological Communities

The Upper Mississippi River near the MNGP site supports a variety of plant and animal species that are typical of free-flowing, upper Midwestern rivers. The major primary producers, or plant groups, present are periphyton (attached algae), phytoplankton (floating algae), and macrophytes, which are larger flowering plants, either rooted or floating. Near the site, periphyton are the most important primary producer. Their ability to attach to underwater substrates allows these organisms to function in the higher velocity waters near MNGP. Although present in the area, neither phytoplankton nor macrophytes are prominent, because they are not well adapted to the relatively turbulent currents in the area (Amish et al. 1978, pages 44 and 48). Lower trophic level animal groups present in the River include zooplankton and benthic invertebrates. Although some zooplankton species are present in the area, they are not a prominent component of the ecosystem, because few zooplankton species are well-adapted to flowing water. In contrast, the benthic invertebrate community—comprising a great variety of insects, crustaceans, molluscs, and others—constitute a prominent faunal feature of the Mississippi River near MNGP, as is typical in any flowing water system (Hynes 1970, page 112). The Mississippi River also supports a diverse array of fish species, which are integral to ecosystem functioning. These fish communities also support significant recreational fishing activities in the vicinity of the MNGP site.

It is important to note that the energy base that supports the aquatic ecosystem in the Mississippi River near the MNGP site is derived in no small part from terrestrial primary production. Tree leaves and other terrestrial vegetative material wash into streams providing nutrients and also food for many benthic invertebrates. In some streams, over one half of the energy base in the systems comes from terrestrial origins (Hynes 1970, pages 432-433).

A brief description of the biotic groups in the River is provided in the following subsections.

Primary Producers

Amish et al. (1978) summarized studies of periphyton near the MNGP site conducted from 1968 to 1976. A total of 149 algal taxa were recorded, most of which were diatoms. Diatoms are single-celled algae with often ornate, silica-based cell walls. They often form a large portion of a periphyton community. Based on the prior studies, the diatom *Gomphonema olivaceum* dominated the winter community. That species was also present in spring, as were *Diatoma vulgare*, *Synedra ulna*, and *Navicula gracilis.* Peak periphyton production occurred during summer, and included diatoms as well as species of blue green algae. The fall community was again dominated by diatoms with *Cocconeis placentula* and *Cocconeis pediculus* being most common.

Periphyton cell densities varied from year to year, and among seasons. Species composition was reported to be similar between preoperational and operational years of MNGP (Amish et al. 1978, Section 4.3.2.2).

As noted, floating phytoplankton are not commonly occurring in flowing water systems. Amish et al. (1978, page 44) pointed out that most "phytoplankton" in fast-flowing streams originate from backwaters and from scouring of the periphyton community. Moyle (1940) described summer phytoplankton communities in the Upper Mississippi River. Several distinct communities were described, two of which were dominated by blue-green algae genera such as *Anabaena* and *Microcystis*. A third distinct community was dominated by the diatoms *Navicula* and *Surirella*. Amish et al. (1978, page 46) cited an earlier study that attributed 18 to 40 percent of the primary productivity in the River near the MNGP site to phytoplankton. Although this is a significant proportion of overall primary productivity, its likely origin was scoured portions of the periphyton community.

Aquatic vascular plants are also important in energy flow, primary productivity, and substrate stabilization of some streams. Moyle (1940) surveyed the Upper Mississippi River between Minneapolis and Crosby, which is inclusive of the MNGP site. Moyle reported 81 species of macrophytes, of which only 15 were common. Most common were American wildcelery (*Vallisneria americana*), American pondweed (*Potamogeton americanus*), and sago pondweed (*Potamogeton pectinatus*). However, specific macrophyte studies near the MNGP site in the late 1960s to 1970 recorded only three species: water moss (*Fontinalis antipyretica*), American pondweed, and sago pondweed. Although not a macrophyte by definition, the macroscopic green alga *Cladophora glomerata* was reported as important in the area. The low abundance of macrophytes was attributed to the high current velocity and shifting sand and gravel substrates in the area (Amish et al. 1978, pages 48, 49, 51).

Lower Trophic Level Fauna

Lower trophic level fauna include zooplankton and benthic (or bottom dwelling) invertebrates. Zooplankton populations are not a prominent feature of flowing systems, particularly higher gradient systems like the Mississippi River near the MNGP site. However, zooplankton communities that do exist in flowing streams tend to be dominated by microscopic, single-celled protozoans and rotifers, with few crustaceans. This was confirmed in earlier studies of the Upper Mississippi River where the dominant zooplankter was the rotifer *Keratella cochlearis* (Amish et al. 1978, pages 49-50). Overall, their contribution to energy flow in streams is negligible, although fish larvae may feed on them to some extent.

Moyle (1940) published the first comprehensive survey of benthic invertebrates in the Upper Mississippi River. Numerous samples were collected between Minneapolis and Crosby, and over 100 taxa were recorded. The most abundant groups were aquatic earthworms (oligochaetes); insect larvae (mayflies, beetles, caddisflies, midges, and

blackflies); snails; and fingernail clams. Five species of true clams (freshwater mussels, family Unionidae) were also collected (Amish et al. 1978, pages 51 and 52). Bottom fauna densities were notably higher in shallow weed beds compared to bare gravel areas. Moyle (1940, Section V) concluded that the benthic invertebrate fauna is the main source of food supply for fish.

Several benthic community studies were initiated in 1968 by staff and students of St. Cloud State College, now St. Cloud State University. These studies, summarized by Amish et al. (1978, pages 51-52), focused on areas up- and downstream of the MNGP site. Results of these studies confirmed Moyle's (1940, Section V) observation that benthic invertebrates were more abundant in shallow weed beds. However, shallow weed bed habitat was limited in the study area. In addition to population density studies, drifting of benthic invertebrates was also studied. Drifting is an important community phenomenon that permits recolonization of downstream areas, primarily by the insect groups caddisflies, mayflies, and true flies. Drifting organisms are also highly vulnerable to predation by fish. In one study, millions of drifting invertebrates were estimated to have passed a sampling point in one 24-hour period (Amish et al. 1978, page 54).

The Upper Mississippi River once supported a substantial mussel fishery. The larger mussels of the family Unionidae were harvested in the early 1900s for the button industry. Button blanks were stamped out of the thick mussel shells. By the early 1930s, many mussel beds were fished out, and the industry went into decline. There was a resurgence in the fishery in the 1950s for harvesting shell to use as seed in the cultured pearl industry. The larger operations appeared to be in the Iowa area of the River (FWS 2003, page 3). Moyle (1940, Section VIII) reported that the mainstem Upper Mississippi River upstream of St. Anthony Falls had not been heavily fished because of the small size and thinness of shells of available commercial species. Moyle reported five species of Unionidae from his 1930 survey: *Actinonaias carinata, Anodonta grandis plana, Ligumia recta, Lampsilis siliquoidea,* and *Lampsilis ventricosa* (Amish et al. 1978, page 51). *L. recta* is now listed as a State Species of Special Concern according to the MNDNR but does not have a record of occurrence in the vicinity of MNGP (MNDNR 2004g; Hoffmann 2004).

Another freshwater mussel that has generated much attention in the region is the zebra mussel, *Dreissena polymorpha.* This is a native European species that was introduced in North America via ship ballast water. In 1988, the first zebra mussel was discovered in Indian Harbor, Gary, Indiana. It has since spread to all of the Great Lakes, as well as the Mississippi, Illinois, and many other rivers. Zebra mussels have a direct impact upon river and lake ecosystems once they are introduced. Individual adult zebra mussels are capable of filtering up to one liter of water per day in order to feed. Consequently, large numbers of phytoplankton and zooplankton are removed from the water column. This occurrence has a positive secondary impact, causing light transmissivity to increase, which allows submerged aquatic vegetation to become more

established in deeper waters. However, this may also cause a decrease in fish populations dependent on phytoplankton and zooplankton as a food source.

The zebra mussel is harmful to both the environment and man-made facilities. Zebra mussels displace native clams and unionid mussels by interfering with their feeding, growth, reproduction, and respiration. It can out compete, and even destroy native mussels by attaching to their shells. Hundreds or thousands of zebra mussels may attach to a single large unionid. Zebra mussels also have a high reproductive potential, allowing the organism to colonize an area and eliminate native species in two to three years (Schloesser, Nalepa and MacKie 1996). Another indirect impact zebra mussels can have is an increase of bioconcentrated contaminants in fish that feed extensively on zebra mussels.

Zebra mussels are notorious for colonizing and clogging water intakes. Currently, zebra mussels are not found above St. Anthony Falls in the Mississippi River. However, they have been found in a lake and small stream in Crow Wing County in the Upper Mississippi River watershed (MNDNR 2004h). Consequently, the Upper Mississippi watershed and the area of the River in the vicinity of the MNGP site are vulnerable to invasion.

Fish Community

The fish fauna of the Upper Mississippi River system have been well described. By 1940, 52 species had been recorded in the River. Moyle (1940, Section VII) collected 44 of these species in his 1939 survey. Fishes reported as abundant in the mainstem Mississippi River included shorthead redhorse (formerly known as northern redhorse) (*Moxostoma macrolepidotum*), common carp (*Cyprinus carpio*), several species of minnow, three bullhead (catfish) species (*Ameiurus sp.*), and game fish such as smallmouth bass (*Micropterus dolomieu*), yellow perch (*Perca flavescens*), and walleye (*Stizostedion vitreum*). Moyle (1940) considered the absence of some species [e.g., channel catfish (*Ictalurus punctatus*), quillback (*Carpiodes cyprinus*), gizzard shad (*Dorosoma cepedianum*), sturgeon (*Acipenser fulvescens*), and paddlefish (*Polyodon spathula*)] to be noteworthy, and attributed this to the blockage of the River at St. Anthony Falls in Minneapolis.

Prior to the start up of MNGP, Dr. Alfred Hopwood and students of St. Cloud State College began fisheries surveys near the MNGP site in 1968 and continued after MNGP operations began through 1974. Amish et al. (1978, page 55) summarized these studies along with similar 1975 and 1976 surveys conducted by NSP. Electrofishing and seining were primary collection techniques utilized in the studies while drift netting was only done in 1976 for fish eggs and larvae. Electrofishing catches were dominated (78 percent) by common carp and shorthead redhorse. Silver redhorse (*Moxostoma anisurum*), white sucker (*Catostomus commersoni*), smallmouth bass, black crappie (*Pomoxis nigromaculatus*), and walleye were most abundant of the remaining species (Amish et al. 1978, page 76). The majority of species caught through seining before

and after start up of MNGP included minnows, i.e., spotfin shiner (*Cyprinella spiloptera*), bigmouth shiner (*Notropis dorsalis*), sand shiner (*Notropis stramineus*), and bluntnose minnow (*Pimephales notatus*). The 1976 drift net study yielded 18 taxa of fish in young life stages. Suckers (primarily redhorse) made up 52 percent of the total collection, and logperch (*Percina caprodes*) constituted 21 percent. Peak abundances of drifting young were recorded in late May and mid-June (Amish et al. 1978, pages 79, 94, and 99).

The electrofishing and seining studies began by NSP in 1975 and 1976 have continued annually, and provide an unbroken record of the fish community near the MNGP site for nearly 30 years (see Table 2.3-1). NSP's 1998-1999 biennial reports for the electrofishing and seining surveys (NSP 1999a, Table 2; NSP 1999b, Tables 5 and 6) include a review of all of the foregoing annual surveys. Overall, the composition of fish communities is not significantly different from those communities present when MNGP began operation. Electrofishing catches are still dominated by common carp, shorthead redhorse, and silver redhorse, with lesser numbers of smallmouth bass and northern hogsuckers (*Hypentelium nigricans*). Similarly, spotfin shiner, bigmouth shiner, sand shiner, and bluntnose minnow continue to dominate the seine catches. In both electrofishing and seine programs combined, 49 species have been reported since the NSP surveys began in the mid-1970s.

Since Moyle's (1940) survey, many additional fish species have been documented in the Upper Mississippi River. Hatch and Schmidt (2004, pages 68-72) documented the presence of 77 species in this portion of the River. The construction of the St. Anthony Falls Lock and Dam in 1963 effectively removed this barrier to fish movement. Species previously restricted to the area downstream of the falls, e.g., channel catfish, flathead catfish, gizzard shad, northern hogsucker, golden redhorse (*Moxostoma erythrurum*), and white crappie (*Pomoxis annularis*), are now found upstream of St. Anthony Falls. However, there remains today an impediment to upstream movement of fish in the form of Coon Rapids Dam, located approximately 12 miles upstream of St. Anthony Falls. In their discussion of the distribution of fishes in Minnesota, Hatch et al. (2003, page 2) inferred that Coon Raids Dam impeded upstream movement. The authors indicated that it was nearly 15 years from the opening of the lock at St. Anthony Falls before a new species (northern hogsucker) was documented upstream of Coon Rapids Dam. Hatch et al. (2003, page 8) surmised that the hogsucker circumvented Coon Rapids Dam during flood conditions as early as 1965. Consequently, although the Coon Rapids Dam represents an impediment to upstream movement of fish, there will be times and conditions that may enable fish to move upstream of the dam.

Amish et al. (1978, pages 105-109) summarized the sport fishery in the vicinity of the MNGP site in the early 1970s. A creel survey was conducted at six sites in a 6-kilometer reach between the MNGP site and the City of Monticello. Fishing effort increased from 2,570 fishing hours in 1972 to 1976 when nearly 6,000 fishing hours were estimated. Primary species caught varied among survey years; catches included carp, northern pike (*Esox lucius*), black bullhead (*Ameiurus melas*), black crappie, and

smallmouth bass. Over the six survey years, 1975 produced the greatest harvest in the study area. A total of 2,370 fish weighing 523 kg were taken during this time period. Black crappie and smallmouth bass formed the bulk of the 1975 harvest. Sport fishing continues to be a popular activity in the study area, and the area is actively managed by MNDNR. For example, Altena (2000) described a survey of smallmouth bass in the River between the St. Cloud Dam and Dayton, Minnesota, which is inclusive of MNGP. This study was designed to evaluate experimental regulations for the harvest of smallmouth bass. Catch rates of larger smallmouth bass were lower than previous surveys. However, an abundance of young-of-the-year smallmouth bass was observed (Altena 2000).

2.3.1.2 Riparian Habitats

Riparian zones are narrow areas along the shores of water courses that function as transition zones between aquatic and terrestrial environments (Montgomery 1996, page 1). These areas have hydrologic and vegetative characteristics that distinguish them from upland terrestrial habitats. Although the riparian areas are small in relation to nearby terrestrial habitats, these areas do provide a number of very important ecological functions. They supply food, cover, migration routes, habitat connectors, and water for a diversity of wildlife. Riparian zones protect the adjacent aquatic environments by stabilizing stream banks (vegetative rooting) and removing excess nutrients, pollutants, and sediment from surface water runoff.

As indicated by U.S. Geological Survey topographic maps and photographs, much of the riparian zone on the south side of the Mississippi River in the vicinity of the site and the City of Monticello is intensively developed (USGS 1991a, 1991b). The more rural areas along this segment of the River consist of active farmland with little or no presence of natural riparian communities. A review of USGS sources, maps produced as part of the National Wetland Inventory, and biological survey information developed by the MNDNR (Delaney and Epp 1993; DOI 1991; Hoffmann 2004), suggests that many of the tracts of natural vegetation in or near the riparian zone occur on upland areas. These upland areas would not be drastically affected by changes in flow or river surface elevation. The tracts of particular note include several MNDNR-recognized dry to dry mesic Oak Woodland-Brushland and dry Oak Forest natural communities that border the River at and downstream from the site (Delaney and Epp 1993; Hoffmann 2004). Riparian wetland communities, which reflect the result of the river hydrologic regime, are not extensive in the site vicinity, but do occur on river islands and, generally in small isolated tracts, along or near the river channel in the floodplain (DOI 1991; Delaney and EPP 1993; Hoffmann 2004).

River islands in the immediate MNGP site area consists of Cedar Island and Oxbow Island (see Figure 2.1-3). Both of these islands are mapped primarily as uplands by FWS; however, the forest communities that occupy nearly the entire area of these islands, Silver Maple- (Virginia Creeper) Floodplain Forest on Cedar Island and Willow

Swamp bordered by Floodplain Forest on Oxbow Island, are MNDNR-recognized natural communities (DOI 1991). Silver maple (*Acer saccharinum*) generally predominates in floodplain forests in the area. A variety of willow species (*Salix sp.*), often with red-osier dogwood (*Cornus stolonifera*), predominate in Willow Swamps in the area (Delaney and Epp 1993; Hoffmann 2004). Other river islands within approximately 10 miles downstream include:

- a group of small islands along the City of Monticello, typed as unconsolidated bottom and shore with some areas of saturated scrub-shrub and forest;
- an island grouping approximately 2 miles downstream from the City of Monticello, typed mostly as uplands with seasonally flooded forested wetland and unconsolidated shore on the island periphery; and
- an island approximately 4 miles downstream from the City of Monticello typed as seasonally flooded forested and scrub-shrub with some unconsolidated shore (DOI 1991).

Vegetation cover of the latter island, associated with the Mississippi Islands State Natural Area, is an MNDNR-recognized Floodplain Forest community such as that noted above on the periphery of Oxbow Island (Delaney and Epp 1993; Hoffmann 2004).

Wetland areas mapped by FWS of note on and near the river channel in the immediate MNGP site vicinity include:

- a seasonally flooded emergent wetland that occupies approximately 20 acres along the north shore of the River immediately west of Oxbow Island;
- an area (approximately 10 acres) of saturated forest/scrub-shrub with some seasonally flooded emergent vegetation near the south bank of the River in the eastern part of the MNGP site;
- an MNDNR-recognized Floodplain Forest community on the north side of the River along the eastern MNGP site boundary; and
- a relatively large (approximately 40-acre) wetland tract, mostly temporarily flooded forest/scrub-shrub, which lies on the south side of the River approximately 1/4 mile from the southeastern site boundary. Several other smaller wetlands assigned these or similar wetland classifications are indicated by FWS as occurring within 10 miles downstream from the MNGP site (DOI 1991).

2.3.2 CRITICAL AND IMPORTANT TERRESTRIAL HABITATS

2.3.2.1 Regional Setting

As described in Section 2.1 of this ER, the MNGP site has roughly two miles of shoreline on the north and south banks of the Mississippi River in Wright and Sherburne Counties. Although MNGP is located on the edge of the city of Monticello, the land use

in the region is primarily agricultural. Vegetation in the city of Monticello area was originally identified as supporting a climax deciduous forest. Remnants of the native climax hardwood forest of maple (*Acer* spp.), basswood (*Tilia americana*), elm (*Ulmus* spp.), oak (*Quercus* spp.), and hackberry (*Celtis occidentalis*) exist on the larger river islands and in small isolated pockets along the river banks (AEC 1972, page II-15).

Prior to European settlement, the southern sections of the Upper Mississippi River Basin where MNGP and the transmission corridors of interest are located were a mix of prairie, wetland prairie, Oak Woodland and Brushland, and the Maple-Basswood Forest (MPCA 2000). In 1974, Francis J. Marschner interpreted the original vegetation of Minnesota using Public Land Survey records from 1853 through 1856 (MCBS 1998). The original vegetation of Sherburne County in the general vicinity of the MNGP site and the Monticello to Coon Creek corridor was predominately oak openings and barrens which could be characterized by scattered trees and groves of scrubby oaks with some brush and thickets. This was interpersed with grasslands of dry prairie, wet prairies, marshes, and sloughs in the central part of the county. In the eastern part of the county, the oak openings and barrens were broken by small areas of aspen-oak woodlands. The conifer bogs and swamps were dominated by tamarack (*Larix laricina*). The aspen-oak woodlands were dominated by stands of small aspen (*Populus tremula*) with scattered oaks and a few elms, ash (*Fraxinus* spp.), and basswood (Delaney and Epp 1993; MCBS 1998). Original vegetation in Anoka County in the general vicinity of the transmission corridor of concern was similar to that of Sherburne County, though there were no dry or wet prairies (Delaney and Epp 1994). Original vegetation of Wright County and Hennepin Counties in the general vicinity of the MNGP site and the Monticello to Parkers Lake corridor was an upland decidious forest dominated by oak, basswood, maple, and elm (Big Woods) interspersed with some grasslands of wet prairie, marshes, and sloughs and some brushlands of oak openings and barrens similar to those in Sherburne County (MCBS 1998). Extensive farming in the area resulted in the removal of a large portion of this forest, with Wright County now having only 14 percent forest cover and Sherburne County 19 percent (Sherburne Co. 1992, page 16; Wright Co. 1988, page 46). The forest that remains has endured grazing and logging over the years and is; therefore, much changed from the original climax forest (AEC 1972, page II-15).

2.3.2.2 MNGP Site

Flora and fauna of the site are typical of the upland and wetland communities found along this stretch of the Mississippi. For the most part, facilities in use at MNGP are located on previously cultivated areas. Existing vegetation in these areas consists of early successional forbs and grasses. Upland forests on site are predominantly northern pin oak (*Quercus ellipsoidalis*), green ash (*Fraxinus pennsylvanica*), basswood, and prickly ash (*Zanthosxylum americanum*). Species composition of the forested wetlands on the northeast bank of the River and the river islands include American elm (*Ulmus americana*), box elder (*Acer negundo*), silver maple, cottonwood

(*Populus deltoides*), and black willow (*Salix nigra*) (MCBS 1998). Approximately 100 acres of the site property on the Wright County side of the River was planted with pines after completion of plant construction (AEC 1972, page II-15). AEC noted that this attempt to introduce conifers in a climax hardwood area may not be completely successful. Remnants of this effort exist on site south of the owner controlled area.

Information on the local ecology was derived from studies done at NSP's Sherburne County Generating Plant (Sherco) site approximately 5 miles upstream from MNGP prior to 1972, as well as the annual reports of the Sherco Environmental Monitoring and Ecological Studies Program between 1974 and 1984. NMC believes the sites are sufficiently similar to permit valid comparison. NMC also used Department of Interior Wetlands Inventory information derived from 1980 aerial imagery and current MNDNR County Biological Survey data (Delaney and Epp 1993; Delaney and Epp 1994; DOI 1991; MCBS 1998).

NMC discusses the occurrence of threatened and endangered species in the vicinity of MNGP and the associated transmission corridors in Section 2.3.3; other fauna are discussed in this section. Fauna identified in the Final Environmental Statement for MNGP as typical of the area included white-tailed deer (*Odocoileus virginianus)*, red fox (*Vulpes vulpes*), raccoon (*Procyon lotor*), red and grey squirrel (*Tamiasciurus hudsonicus* and *Sciurus carolinensis*), short-tailed shrew (*Blarina brevicauda*), southern red-backed and meadow voles (*Clethrionomys gapperi* and *Microtus pennsylvanicus*), various species of mice (*Peromyscus spp*.), pocket gopher (*Geomys bursarius*), white-tailed jack rabbit (*Lepus townsendii*), beaver (*Castor canadensis*), and muskrat (*Ondatra zibethicus*) (AEC 1972, pages II-15 and 17). Additional species identified through the Sherco Environmental Monitoring and Ecological Studies Program were gray fox (*Urocyon cinereoargenteus*), coyote (*Canis latrans*), fox squirrel (*Sciurus niger*), chipmunk (*Tamias striatus*), mink (*Mustela vison*), weasel (*Mustela frenata, erminea, and nivalis*), woodchuck (*Marmota monax*), and striped skunk (*Mephitis mephitis*).

The 1984 annual report of the Sherco Environmental Monitoring and Ecological Studies Program identified 99 avian species over a 10-year period during the breeding season along three road transects and in the floodplain area near MNGP. The most abundant species observed were mourning dove (*Zenaida macroura*), cliff swallow (*Petrochelidon pyrrhonota*), barn swallow (*Hirundo rustica*), robin (*Turdus migratorius*), starling (*Sturnus vulgaris*), vesper sparrow (*Pooecetes gramineus*), red-winged blackbird (*Agelaius phoeniceus*), grackle (*Quiscalus quiscula*), goldfinch (*Carduelis tristis*), and house sparrow (*Passer domesticus*). The most commonly hunted game species in the vicinity of MNGP were ruffed grouse (*Bonasa umbellus*), grey partridge (*Perdix perdix*), and pheasant (*Phasianus colchicus*). Waterfowl including Canada Geese (*Branta canadensis*), mallards (*Anas platyrhynchos*), and wood ducks (*Aix sponsa*) utilize the river shoreline for nesting and loafing. Other bird species present are grassland/woodland transition species such as meadowlark (*Sturnella magna* and

neglecta), robin, blue jay (*Cyanocitta cristata*), eastern bluebird (*Sialia sialis*), flicker (*Colaptes auratus*), red-tailed hawk (*Buteo jamaicensis*), and kestrel (*Falco sparverius*).

There are no federally designated critical terrestrial habitats for endangered species in the vicinity of MNGP or along the transmission corridor (FWS 2004b). Through the Minnesota County Biological Survey, MNDNR identifies significant natural areas and collects and interprets ecological data including the distribution of rare plants, native plant communities, and animals throughout the state. This information is maintained in the Division of Ecological Service's Natural Heritage database (MNDNR 2004i). Several of these MNDNR designated significant native plant communities exist on the MNGP site and either on or in the vicinity of the transmission corridor, as discussed below (Hoffmann 2004).

MNDNR has identified the following native plant communities as occurring on MNGP; Floodplain Forest, Silver Maple-Virginia Creeper Floodplain Forest, Bur Oak Woodland, Oak Woodland-Brushland, Willow Swamp, Dry Oak Savanna, and Dry Prairie. The Silver Maple-Virginia Creeper Floodplain Forest and Floodplain Forest types occur on the larger river islands. The Willow Swamp type occurs on Oxbow Island and on the MNGP site. The Floodplain Forest type occurs on the northeast bank of the River (Hoffmann 2004). The Floodplain Forest types are generally dominated by silver maple with bur oak (*Quercus macrocarpa*) and green ash (*Fraxinus pennsylvanica*) as associates. The Floodplain Forest has a fairly open understory where woody climbers such as virginia creeper (*Parthenocissus quinquefolia*) may occur in light gaps and along open channels overgrowing trees and contributing to the canopy (Delaney and Epp 1993; MNDNR 1993, page 55). The Willow Swamp type is dominated by shrubby willows (*Salix gracilis*, *S. bebbiana*, and *S. discolor*) and often with red-osier dogwood (Delaney and Epp 1993; MNDNR 1993, page 65). Two patches of Oak Woodland Brushland occur adjacent to the River on the Sherburne County side of the property to the east and west of the power block (Hoffmann 2004). This community is typified by a dry to dry-mesic woodland with a patchy canopy dominated by bur oak or northern pin oak and a pronounced shrub layer dominated by American hazel (*Corylus americana*), red rasberry (*Rubus strigosus*), blackberry (*Rubus alleghaniensis*), smooth sumac (*Rhus glabra*), prickly ash, or red cedar (*Juniperus virginiana*) (Delaney and Epp 1993). An area of Dry Oak Savanna Sand and Gravel occurs on the Sherburne County side of the property, on the first terrace north of the River. This community is typified by scattered open-grown bur oaks or northern pin oaks; a shrub layer of american hazels, chokecherries (*Prunus virginiana*), and juneberries (*Amelanchier spp*.); and a ground layer dominated by grasses and forbs (Hoffmann 2004; Delaney and Epp 1993; MNDNR 1993, pages 34 and 35).

On the portion of the MNGP site in Wright County, patches of the Bur Oak-Pin Oak Woodland community occur south and west of the power block extending from the riverbank south below I-94 (Hoffmann 2004). This community has historically been found in areas protected from fire. Hazelnuts, chokecherries, gray-bark dogwoods

(*Cornus foemina*), and *Rubus* spp. are common in the understory. Bur oaks and pin oaks form the canopy (MNDNR 1993, pages 31 and 32). An area of Dry Sand-Gravel Prairie occurs to the west of the power block on the narrow sloping area between the railroad right-of-way and the Mississippi River. The area consists of scattered prairie and savanna remnants (Hoffmann 2004). Dry prairies are typified by dry to mesic herbaceous communities dominated by grasses and sedges with common species of big bluestem (*Andropogon gerardii*), indian grass (*Sorghastrum nutans*), porcupine grass (*Stipa spartea*), little blue stem (*Schizachyrium scoparium*), side-oats grama (*Bouteloua curtipendula*), prairie june-grass (*Koeleria macrantha*), and sunloving sedge (*Carex heliophila*). The Dry Oak Savanna areas are dominated by a canopy of bur oak and pin oaks (MNDNR 1993, pages 47; Hoffmann 2004).

There are no wetlands onsite that are designated as protected under Minnesota Statute 103G.005, subd. 15 (MNDNR 1983, 1984, 2004j). However, the U.S. Fish and Wildlife Service (FWS) National Wetland Inventory indicates that these onsite wetlands exist for the most part along the River and on the river islands as saturated to seasonally flooded patches of scrub-shrub and deciduous forest and as patches of emergent vegetation along the shoreline (DOI 1991).

2.3.2.3 Transmission Corridors

The 345-kV transmission corridor extending from the Monticello Substation to the Elm Creek and Parkers Lake Substations traverses Wright County and terminates in Hennepin County. The 345-kV corridor extending from the Monticello Substation to the Sherburne County and Coon Creek Substations originates in Wright County, traverses Sherburne County, and terminates in Anoka County (see Figure 3.1-2) (NSP 1971, page II-29). Major portions of both corridors pass through rural areas, utilizing railroad rights-of-way and highways where possible (NSP 1971, page II-30a).

Both Sherburne and Wright Counties, including areas traversed by the transmission corridors are still predominately rural in nature (Sherburne Co. 1992, page 21; Wright Co. 1988, pages 46 and 47). In Wright County, the area traversed by the corridor is predominately cultivated fields with scattered forests and some wetlands (Wright Co. 1988, page 47). In Sherburne County, the area traversed by the corridor is mix of agriculture, rural residential, scattered forests and wetlands (Sherburne Co. 2004b; Terra*Server* 2004). Both Anoka and Hennepin Counties have experienced significant losses of undeveloped land primarily to residential development over the last 30 years, with decreases of approximately 25 and 37 percent respectively (Metropolitan Council 2004). Review of USGS topographic maps revised in 1993 revealed the expansion of residential development in these two counties, including the vicinity of the transmission corridors in the communities of Andover, Ramsey, and Coon Rapids in Anoka County and the communities of Maple Grove and Plymouth in Hennepin County (USGS 1993). Land use along the transmission corridor in Anoka and Hennepin Counties is

predominately a mix of urban and rural residential with scattered forests and wetlands (Terra*Server* 2004; USGS 1993).

Table 2.3-2 lists the native plant communities identified by MNDNR as occurring on or adjacent to the transmission corridor and biodiversity significance rating as assigned by MNDNR if applicable. The majority of transmission corridors are adjacent to the areas where native plant communities occur and do not traverse them.

2.3.3 THREATENED AND ENDANGERED SPECIES

The FWS has designated 13 species known to occur in Minnesota as threatened or endangered at the federal level and four species known to occur in the state as candidates for such listing (FWS 2004c). However, only one of these species, the bald eagle (*Haliaeetus leucocephalus)* is indicated by MNDNR as occurring on or in the vicinity of transmission lines of interest to this ER. Similarly, threatened and endangered species have been designated at the state level under programs administered by the MNDNR as implemented by Minnesota Rule 6134.0150. Three bird species, one reptile species, one insect species, and one plant species designated as endangered or threatened at the state level in Minnesota have been documented by MNDNR as occurring in the vicinity of MNGP or the transmission corridors of interest. Pertinent information related to the status of these species is provided in the following sections (see Table 2.3-3).

2.3.3.1 Fauna

The bald eagle, listed as federally threatened, is known to occur in the vicinity of the MNGP site. Originally listed as endangered by the FWS in 1967, the bald eagle was down-listed to threatened in 1995, and was proposed for delisting in 1999 (Texas 2004; Hoffmann 2004). Several factors aided in the recovery of this species including a national ban on DDT and other organochlorine pesticides by the EPA in mid 1970's and the reduced use of lead shot for waterfowl hunting (Nebraska 2001). These efforts have considerably benefited bald eagle populations in the State of Minnesota. The state's first bald eagle survey in 1973 found 115 active nests; by 1995 the survey found over 600. In 2000, MNDNR surveyed over 1,300 known breeding areas and identified 681 occupied nests in the state, 76.5 percent of which included young. The 2000 survey documents the continuing recovery of the species. In comparing the early survey results with year 2000 data, MNDNR concluded that Minnesota's bald eagle population is growing at a slower but healthy level (MNDNR 2004k). Bald eagles are typically found near forested rivers and lakes where there is ready access to preferred nest sites and food. Preferred nesting habitat includes tall trees or cliffs. Bald eagles primarily prey on fish and ducks (MNDNR 2004l; NGS 1987, page 184). Bald eagles are known to nest in the vicinity of the MNGP site. One nest is known to exist on Cedar Island, upstream from the power block (see Figure 2.1-3); however, recent use of this nest and nesting success has not been confirmed.

Three bird species listed as threatened by the State of Minnesota are known to occur either on or in the vicinity of MNGP and associated transmission corriodors of interest: peregrine falcon (*Falco peregrinus*), loggerhead shrike (*Lanius ludovicianus*), and trumpeter swan (*Cygnus buccinator*) (Hoffmann 2004; MNDNR 2004m). Though peregrine falcon populations were greatly reduced in the 1950's and 60's by the effects of pesticide poisoning, reintroduction programs are having success in Minnesota. Peregrine falcons prefer open wetlands where there is access to nesting sites on cliffs, such as those along the Mississippi River Valley and Lake Superior. This species also demands a ready supply of prey such as ducks, shorebirds, and seabirds. However, they have proven to be adaptable. MNDNR reported that in 2003, 25 pairs successfully raised 48 young at traditional cliff sites and new man-made habitats which include power plant stacks, skyscraper balconies and rooftops, and bridges (MNDNR 2004n). With the installation of a nest box on the MNGP Off Gas Stack in 1992, peregrine falcons have been successfully nesting at the site since 1995. Since 1993, peregrine falcons have also been successfully nesting at the Sherco site, which is five miles upstream from MNGP. In 2003, four young were banded at the MNGP and three young were banded at Sherco sites.

Loggerhead shrikes are known to occur on and in the vicinity of MNGP and are documented in several areas along the transmission corridor in Anoka and Sherburne Counties. Preferring open country and dry upland prairie with hedgerows, shrubs, and small trees, the birds can also be found around planted shelterbelts of trees, old orchards, pastures, cemeteries, grassy roadsides, and farmsteads. The scattered trees, shrubs, and fencerows in these areas provide places for the shrikes to hunt and rest. Power lines are used as perches from which to hunt as well. Red cedar, hawthorn (*Crataegus spp.*) and plum (*Prunus americana*) trees are often used for nesting (Hoffmann 2004; MNDNR 1996).

In recent years, wintering trumpeter swans have been observed in increasing numbers on the Mississippi River downstream from MNGP. The swans in this area are drawn to the open water in the winter months, which results from MNGP's discharge of warm water to the River, and to food supplied by a local resident at the City of Monticello's Mississippi Drive Park (MCC 2004). Having disappeared from Minnesota in 1880's, the trumpeter swan has been successfully restored to the state with recent MNDNR and FWS surveys showing more than 75 nesting pairs and nearly 900 year round residents (MNDNR 2004o, 2004p).

One reptile species, the Blanding's turtle (*Emydoidea blandingii*) is listed by the State of Minnesota as a threatened species and is documented by MNDNR as occurring in the vicinity of the transmission corridors in Anoka and Sherburne Counties (see Table 2.3-3). In Sherburne County, the transmission corridor passes through two areas classified by MNDNR as "known concentration areas" of Blanding's turtles. There are fifteen such areas across the state (Hoffmann 2004). The turtles require both wetland and upland habitats to complete their life cycle. In Minnesota, the turtles are primarily

marsh and pond inhabitants. Calm, shallow water bodies with mud bottoms and abundant aquatic vegetation, such as cattails, and water lilies are preferred, though extensive marshes bordering rivers are also suitable habitat for the turtles. Nesting occurs in open (grassy and brushy) sandy uplands (MNDNR 2001).

One insect species, the Uncas skipper (*Hesperia uncas*), a state-listed endangered species, is documented by MNDNR as occurring in the vicinity of the transmission corridor in Sherburne County (Hoffmann 2004). Preferred habitat for the Uncas skipper includes short-grass prairie and open woodlands. Adults feed on flower nectar, and the plant hosts for the caterpillar stage are blue grama grass (*Bouteloua gracilis*) and needlegrass (*Stipa sp.*) (USGS 2004c). Though found in many areas of the western North America, where arid environments are common, the Uncas skipper is listed as endangered in Minnesota because of habitat scarcity. With fire no longer a natural part of the regional ecosystem, forestation of former savanna has occurred and reduced the available habitat (Hoff 2000).

2.3.3.2 Flora

Tall nut-rush (*Scleria triglomerata)* is a state-listed endangered species documented by MNDNR as occurring in the vicinity of the transmission corridor in Anoka County where the corridor passes through Bunker Hills Regional Park. Tall nut-rush can be found in dry or moist sandy ground and tolerates open to shaded light conditions. It is found in prairies and in the borders of marshes (Hoffmann 2004). Common or indicator plant associates in dry sand prairie habitats include bluejoint grass, cordgrass, rush, sedges, twig-rush, and shrubby cinquefoil. In wet-mesic prairie habitats common or indicator plant associates include big bluestem, little blue stem, cord grass, prairie dropseed, and bee-balm (MSU 2004).

2.4 METEOROLOGY AND AIR QUALITY

The MNGP site is located in central Minnesota on the southern bank of the Mississippi River. The prevailing climate is characterized as a marked continental type with wide seasonal variations in temperature, relatively light winter precipitation, normally ample summer rainfall, and a general tendency to extremes in all climatic features. Relative humidity in the MNGP area is moderate, averaging 71 percent for the year with little seasonal variation. The greatest amount of precipitation comes during the months of May through September in the form of thunderstorms, averaging 17 to 18 inches or more than 70 percent of the annual rainfall total. Annual snowfall averages 42.2 and 42.4 inches for the Twin Cities and St. Cloud respectively, with extremes ranging from a low of 6 inches to a high of 88 inches. March typically receives the greatest average monthly snowfall. Monthly average temperatures range from 12°F in January to 72°F in July, with extremes ranging from negative 38°F in January to 107°F in July (NMC 2003, Section 2.3).

Wind speeds at the MNGP site and throughout the Twin Cities and St. Cloud areas exhibit similar trends, with the strongest winds occurring in the early spring and the lightest in late summer. Extreme conditions leading to poor dispersion and stagnation are rare in the MNGP area. Diffusion climatology comparisons with other similar locations indicate that the site is typical of the North-Central United States with the inversion frequency expected to be 30 to 40 percent of the year (NMC 2003, Section 2.3.4). Severe weather, though not common, occasionally occurs at the MNGP site. The site is located on the northern edge of the region of maximum tornado frequency in the United States. Eighteen tornados were reported in Wright County and six were reported in Sherburne County between January 1950 and April 2004. Using data from the Minneapolis-St. Paul and St. Cloud area, it is expected that the site may hypothetically experience an average of 36 thunderstorms annually. The maximum reported wind speed associated with the passage of a storm is 92 miles per hour (NCDC 2004; NMC 2003, Section 2.3.4).

MNGP is located in an area designated by the National Ambient Air Quality Standards as being in attainment for all criteria pollutants. The nearest area of nonattainment is the Milwaukee metropolitan area including Kenosha, Milwaukee, Ozaukee, Racine, Washington, and Waukesha Counties in Wisconsin. The area is in nonattainment with the eight hour ozone standard (EPA 2004c).

2.5 DEMOGRAPHY

In this section, NMC describes demographic characteristics of the area within 50 miles of MNGP. NMC uses 2000 U.S. Census data for the population classification determination presented in Section 2.5.1 and the determination of minority populations in Section 2.5.3.

2.5.1 GENERAL DEMOGRAPHY

NRC's *Generic Environmental Impact Statement for License Renewal of Nuclear Plants* (GEIS) presents a population classification method using degrees of "sparseness" and "proximity" to characterize the remoteness of the area surrounding a site. Sparseness measures population density and city size within 20 miles of a site; proximity measures population density and city size within 50 miles (NRC 1996, Section C.1.4). NRC's model for categorizing population by sparseness and proximity measures, as presented in the GEIS, is shown below:

	Category	
Sparseness		
Most sparse	1.	Fewer 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 fewer 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
Proximity		
Not in close proximity	1.	No city with 100,000 or more persons and fewer 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 fewer than 190 persons per square mile within 50 miles
In close proximity	4.	Greater than 190 persons per square mile within 50 miles

Source: NRC 1996.

NRC uses the following matrix to rank the population category as low, medium, or high:

Sparseness \ Proximity	1	2	3	4
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 Medium High

Source: NRC 1996, page C-6.

NMC used U.S. Census Bureau Year 2000 data and geographic information system software (ArcView®) to determine demographic characteristics in the MNGP vicinity at the block group level. The block groups, as defined by the Census Bureau are the next lower level in census geographic hierarchy below census tracts. NMC estimated 166,860 persons live within 20 miles of MNGP, which equals a population density of 133 persons per square mile. The area within a 20-mile radius of MNGP falls into Category 4 of NRC's GEIS sparseness classification (greater than or equal to 120 persons per square mile within 20 miles). There are an estimated 2,740,995 persons living within 50 miles of MNGP. This equates to a population density of 349 persons per square mile within 50 miles. The area within a 50-mile radius of MNGP falls into Category 4 (one or more cities with 100,000 or more persons and greater than 190 persons per square mile within 50 miles) of the GEIS proximity classification. According to NRC's GEIS sparseness and proximity matrix, the area's sparseness Category 4 and proximity Category 4 indicate that MNGP is in a high population area.

All or parts of 21 counties in Minnesota lie within the 50-mile radius of MNGP (see Figure 2.1-1). There are two Metropolitan Statistical Areas (MSAs) located at least partially within a 50-mile radius of MNGP. The Minneapolis-St. Paul-Bloomington, Minnesota-Wisconsin MSA, which lies partially within a 50-mile radius of the plant, includes eleven Minnesota Counties: Anoka, Carver, Chisago, Dakota, Hennepin, Isanti, Ramsey, Scott, Sherburne, Washington, and Wright. This MSA also includes two Wisconsin Counties: Pierce and St. Croix. This MSA is the 16th most populated MSA with an estimated Year 2000 Census population of 2,968,806 persons. The St. Cloud, Minnesota MSA is entirely within MNGP's 50-mile radius and includes both Benton and

Stearns Counties. The St. Cloud MSA is the 222nd most populated MSA, with an estimated Year 2000 Census population of 167,392 persons (Census 2003a, Table 3a; Census 2003b, Table 2a).

The MNGP site is located in an area composed of small urban and rural communities (Wright Co. 1988). The majority of the Wright County population reside in small cities (Wright Co. 2004). The largest city and county seat in Wright County is the City of Buffalo, located approximately 10 miles south of the MNGP site. The City of Buffalo had an estimated Year 2000 Census population of 10,097 persons. The City of St. Michael, located approximately 20 miles southeast of the MNGP site, is the second largest municipality in Wright County with an estimated Year 2000 Census population of 9,099 persons. The MNGP site is located within the City of Monticello, which has an estimated Year 2000 Census population of 7,868 persons. There are 14 other incorporated cities in Wright County, with populations ranging between 13 and 6,400 persons (Wright Co. 2004). The population in Wright County is relatively young; the median age in the county is 33.1 years, compared to a median age of 31.4 years for Sherburne County and 35.4 years for the State of Minnesota (Census 2000a,b,c).

Minneapolis is the largest city within the 50-mile radius of the MNGP site. Located in Hennepin County, Minneapolis is approximately 30 miles south-southeast from the site and part of the larger Minneapolis-St. Paul-Bloomington, Minnesota-Wisconsin MSA. Populations have increased by a greater percentage in other areas of the MSA than in the cities of Minneapolis or St. Paul: 16.9, as compared to 3.9 and 5.5 percent respectively, between 1990 and 2000, depicting the greater relative growth in the surrounding communities (Census 2001a; Table 1; Census 2003b, Table 2a). Minneapolis had an estimated Year 2000 Census population of 382,618 persons, up from the 1990 population of 368,383 persons while the MSA increased from 2,538,834 in 1990 to 2,968,806 in 2000 (Census 2001a, Table 1; Census 2003a, Table 3a).

Approximately 73 percent of MNGP employees live in Wright and Sherburne Counties (see Section 3.4.1 for workforce description); therefore, the following discussion focuses on the demographics on that two-county area. Table 2.5-1 presents decennial population estimates and annual growth rates for these two counties.

The population in Wright County remained fairly constant from 1900 to 1960 and then doubled between 1960 and 1980 due to its proximity to the Twin Cities Metropolitan Area and improvements made to the major highways that provided access to the metro area. Though some population growth occurred in the northwestern portion of Wright County, where many lakes and recreational developments are concentrated, the greatest growth occurred in the eastern and northeastern portions of the county in the unincorporated areas (Wright Co. 1988). The period of 1990 to 2000 showed significant population growth continues in the following (MDEED 2004a):

- St. Michael (Year 2000 population 9,099, increase of 263 percent),
- Albertville (Year 2000 population 3,621, increase of 190 percent),

- Monticello (Year 2000 population 7,868, increase of 56 percent), and
- Buffalo (Year 2000 population 10,097, increase of 47 percent).

Sherburne County has experienced similar growth trends, with the population more than doubling between 1960 and 1980 (Census 1995). Between 1970 and 1990, the percentage of county residents living in the unincorporated townships relative to the seven cities decreased from 55 to 47 percent. As with Wright County, growth has been greatest in the portion of the county in closest proximity to the Minneapolis-St. Paul metropolitan area (Sherburne Co. 1992, page 10). The cities of Elk River (Year 2000 population 17,016), Big Lake (Year 2000 population 6,063), Becker (Year 2000 population 2,673), and Zimmerman (Year 2000 population 2,851) have continued to experience significant growth between 1990 and 2000, increasing by 52.7 percent, 94.8 percent, 196.3, and 111.2 percent, respectively (MDEED 2004b). In contrast, the portion of St. Cloud located in Sherburne County has grown from 5,246 in 1990 to 6,058 in 1999, a 15.5 percent increase (MDOA 2004). Clear Lake (Year 2000 population 266) and Princeton (Year 2000 population 3,933) grew by 23.7 and 5.8 percent, respectively during the period (Sherburne Co. 2003a). In central Scott County, the Shakopee-Mdewakanton Reservation, located within the city limits of Prior Lake had an estimated Year 2000 Census population of 338 persons (Census 2001b; Prior Lake 2005).

2.5.2 TRANSIENT POPULATIONS

Small daily and seasonal fluctuations in regional population occur due to the number of colleges and recreational facilities that attract visitors (see Section 2.1 of this ER). Area colleges, and universities draw thousands of students to the region. St. Cloud State University offers more than 175 undergraduate majors and 50 Master's degrees with an enrollment of over 16,000 students from the U.S. and over 80 foreign countries (St. Cloud State University 2003). The University of Minnesota-Twin Cities, the largest of the University's campuses, offering the widest range of graduate and professional programs of any institution in the state, has an enrollment of over 37,000 full-time and 11,000 part-time students (MHESO 2004; University of Minnesota 2003).

Temporary housing for seasonal, recreational, or occasional use is relatively strong in Wright County, accounting for 6.0 percent of all housing units (Census 2000c, Table DP-1). By comparison, temporary housing accounts for only 3.7 percent and 5.1 percent of total housing units in Sherburne County and the State of Minnesota, respectively (Census 2000a,b, Table DP-1). In addition, Wright and Sherburne Counties host relatively small numbers of migrant workers. According to 2002 Census of Agriculture estimates, 1,753 and 1,143 temporary farm laborers (defined as employed for less than 150 continuous days) were employed in Wright and Sherburne Counties, respectively (USDA 2004).

2.5.3 MINORITY AND LOW INCOME POPULATIONS

In the environmental justice analyses for previous license renewal applications, NRC used a 50-mile plant radius as the overall area that could contain environmental impact sites, and the state as the geographic area for comparative analysis. NMC adopts a similar approach in order to identify and analyze the minority and low-income populations that could be affected by continued MNGP operations.

2.5.3.1 Minority Populations

Minority populations were identified using the Year 2000 Census demographic data to the block group level for the following racial minority categories: Black or African American, American Indian or Alaskan Native, Asian, Native Hawaiian or Other Pacific Islander, Other Single Race, and Two or More Races. The Hispanic or Latino origin ethnicity designation is also identified. In addition to these groups, the minority population as a whole (an aggregate minority category) was included in the analysis, in accordance with NRC guidance (NRC 2004). The aggregate minority category included data from the following minority categories: Black or African American, American Indian or Alaskan Native, Asian, Native Hawaiian or Other Pacific Islander, Other Single Race, and Two or More Races (NRC 2004). The minority population determination for the MNGP environmental justice analysis included an evaluation of the seven minority categories used in the census and the aggregate minority population as indicated by NRC.

NRC guidance (NRC 2004) specifies that a minority population exists in either of the following cases:

Exceeds 50 Percent – the minority population of the environmental impact site exceeds 50 percent or

More than 20 Percentage Points Greater – the minority population percentage of the impact site is significantly greater (typically at least 20 percentage points) than the minority population percentage in the geographic area chosen for comparative analysis.

The area within a 50-mile radius of MNGP was used in this analysis to define the area of potential environmental impact. Census block groups with greater than 50 percent of their area located outside the 50-mile radius, as defined above, were excluded from this area. The 50-mile radius of MNGP is located entirely within the State of Minnesota, and encompasses all or part of 21 counties (see Figure 2.5-1). The geographic area chosen for comparative analysis consisted of the State of Minnesota. The population demographic data from the State comprises average numbers for both the minority population as a whole and each minority category for comparison (see Table 2.5-2).

The percentage of each minority group in an individual census block group was calculated as a percentage using the following:

$[(\text{minority group population})_{\text{block group}} / \text{total population}] * 100$

To calculate the aggregate minority population in an individual census block group, the populations of each of the six minority groups (Black or African American, American Indian or Alaskan Native, Asian, Native Hawaiian or Other Pacific Islander, Other Single Race, and Two or More Races) and the Hispanic ethnicity designation were added together and used in the above equation. Since Hispanics may be of any race, and therefore are included within the other racial categories, the number of persons identified as white Hispanics was included in the calculation of the aggregate minority population.

Census 2000 data for the block group level from Minnesota was analyzed to determine which block groups meet either or both of the above criteria (exceed 50 percent or more than 20 percentage points greater). The 50-mile radius includes 2,166 census block groups. Table 2.5-2 shows the number of census blocks groups in each county with a minority population, and the threshold values for determining if a minority population exists. No block groups exhibit minority populations greater than 50 percent. Therefore the applicable threshold values were calculated using the "greater then 20 percent points" criterion.

There were no census block groups with a minority population of Native Hawaiian or other Pacific Islander within the 50-mile radius of MNGP. There were 325 census block groups with an aggregate minority population (see Figure 2.5-1).

For the individual minority categories,

- 149 census block groups had a minority population of Black or African Americans (see Figure 2.5-2 and Table 2.5-2),
- 3 census block groups had a minority population of American Indian or Native Alaskan (see Figure 2.5-3 and Table 2.5-2),
- 46 census block groups had a minority population of Asians (see Figure 2.5-4 and Table 2.5-2),
- 11 census block groups had a minority population of "other" single race (see Figure 2.5-5 and Table 2.5-2),
- 1 census block group had a minority population of two or more races (see Figure 2.5-6 and Table 2.5-2), and
- 52 census block groups had a minority population of Hispanics or Latino origin (see Figure 2.5-7 and Table 2.5-2).

Hennepin County, Minnesota has 123 block groups with a Black or African American minority population, Ramsey County has 25, and Carver County had one block group (see Table 2.5-2). Hennepin County is the only county within the 50-mile radius of MNGP to have block groups with an American Indian or Native Alaskan minority population (3 block groups). Hennepin and Ramsey counties had block groups with

Asian minority populations and were the only 2 counties within the 50-mile radius with an Asian minority.

The majority of the block groups with minority populations (581 of 587) were located in Hennepin and Ramsey counties, part of the Minneapolis-St. Paul metropolitan area. In conclusion, the minority populations in the 50-mile radius of MNGP are concentrated near an urban center with a high population density approximately 30 or more miles from the plant.

2.5.3.2 Low-Income Populations

As for the minority group analysis above, information about the percentage of low-income households within the 50-mile radius of MNGP was compiled using Census 2000 data to the block group level. NRC guidance (NRC 2004) specifies that a low-income population exists in either of the following cases:

> Exceeds 50 Percent – the percentage of households below the poverty level in the census block group or environmental impact site exceeds 50 percent or
>
> More than 20 Percentage Points Greater – the percentage of households below the poverty level in the census block group or environmental impact site is significantly greater (typically at least 20 percentage points) than the percentage of households below the poverty level in the geographic area chosen for comparative analysis.

The environmental impact area and geographic area for comparative analysis used to identify low-income populations are identical to those described above for identifying minority populations (i.e., all block groups extending 50 percent or more within the 50-mile radius and counties with at least one block group extending within the 50-mile radius, respectively). The percentage of households below poverty level in the State of Minnesota comprised average regional number for comparison (see Table 2.5-2).

Data for both the total number of households and the number of households with an income below the poverty level was obtained for each census block group within the 50-mile radius of MNGP. The number of households below poverty in each census block group was then calculated as a percentage using the following:

$$[(\text{households below poverty})_{\text{block group}} / \text{total households}] * 100$$

Any census block group with a percentage of households below the poverty level greater than 27.9 percent (see Table 2.5-2) was considered a low-income population in this assessment.

A total of 91 census block groups within the 50-mile radius of MNGP meet the criteria for low-income populations (see Table 2.5-2). The majority of the census block groups with a low-income population were located in Hennepin County (61 block groups) and Ramsey County (23 block groups) 35 miles or more from the plant. The two other counties with census block groups that have low-income populations are Sherburne and Stearns counties (1 and 6 census blocks, respectively; see Table 2.5-2).

2.6 AREA ECONOMIC BASE

To discuss economic information pertinent to the License Renewal process, NMC will focus on Wright and Sherburne Counties. Seventy-three percent of MNGP's workforce resides in these counties (see Section 3.4 of this ER), both of which lie within the Minneapolis-St. Paul-Bloomington, Minnesota-Wisconsin Metropolitan Statistical Area (MSA). With a year 2000 population of approximately 3 million, this MSA ranks sixteenth in the nation and is experiencing moderate population growth, exhibiting an increase in population of 16.9 percent between 1990 and 2000 (Census 2003a, Table 3a).

Labor Force and Employment Opportunities

In 2003, Wright County had an estimated labor force of 54,879 persons, while Sherburne County had an estimated labor force of 39,279 persons in the same year. Since 1990, county workforces have increased by 46.8 and 74.7 percent, respectively, as Wright and Sherburne Counties had estimated workforces of 37,382 and 22,487 persons, respectively (BLS 2004). As the total workforce has increased over the period, unemployment rates decreased through 1998 to lows of 2.7 and 2.5 percent in Wright and Sherburne Counties respectively. However, more recently, both counties have seen sharp increases in their unemployment rates in 2003 comparable to the 1990 levels of 5.7 and 5.8 percent in Wright and Sherburne Counties, respectively. Both counties have historically had slightly higher unemployment rates than the state of Minnesota (BLS 2004).

Industry within Wright County employed an average of 28,851 persons in 2000, up from 17,536 in 1990. Over the past decade, employment opportunities have increased in all sectors in both counties. The construction sector has increased most dramatically - 125.6 percent in Wright County and 174 percent in Sherburne County. In 2000, the wholesale and retail trade sector lead in employment, accounting for 26.1 percent of employment in all industries in Wright County, while services accounted for 20.8 percent and manufacturing accounted for 17.7 percent (see Table 2.6-1). Manufacturing was the largest payroll-producing sector, accounting for 22.2 percent of total wages for all industries followed by wholesale and retail trade with 18.3 percent (MWFC 2004). In Sherburne County, while wholesale and retail trade sector led in employment, accounting for 27.8 percent of employment in all industries, services accounted for 17.8 percent, and government accounted for 17.1 percent (see Table 2.6-1). Manufacturing and wholesale and retail trade were also the largest payroll producing sectors in Sherburne County, accounting for 21.6 percent and 18.4 percent respectively of total wages for all industries (MWFC 2004).

The largest employers in Sherburne County, those employing more than 300 employees, are listed below (Sherburne Co. 2003b). These include two health care providers, a senior housing facility, a cabinet manufacturer, two utilities, and a major retailer.

Firm Name	City	Product	Number
Fairview Northland Clinics	Princeton	Health Care	800
Crystal Cabinet Works, Inc.	Princeton	Cabinet Mfg.	600
St. Benedicts Care Center	St. Cloud	Nursing Center	550
Xcel Energy	Becker	Utility	424
Guardian Angels Care Center	Elk River	Senior Housing	372
Wal-Mart	Elk River	Retail	325
Great River Energy	Elk River	Utility	316
Westling Mfg. Co.	Princeton	Re-Manufactured Auto Parts	315

The Wright County employers with greater than 300 employees are listed below (MDEED 2004a). They include:

Firm Name	City	Product	Number
Outlets at Albertville	Albertville	General Merchandise Stores	800
Progressive Contractors Inc.	St. Michael	Construction Contractor	540
Buffalo Public Schools	Buffalo	Education	514
Wright County	Buffalo	Government	450
Monticello Public Schools	Monticello	Education	450
Monticello-Big Lake Hospital	Monticello	Health Care	432
Xcel Energy	Monticello	Power Generation	368[a]
Landscape Structures Inc.	Delano	Sporting Goods, Hobby, and Musical Instruments	350
J&B Wholesale & Distribution	St. Michael	Fruit & Vegetable Preservation and Food Mfg.	350
Delano Public Schools	Delano	Education	300
Dura Supreme Inc.	Howard Lake	Furniture & Cabinet Mfg.	300

a. Xcel Energy labor number cited for MNGP not representative of current site employment.

In Sherburne County, the majority of employed residents, approximately 67 percent, commute to work outside the County and spend an average of 30 minutes traveling to their place of employment (Sherburne Co. 2004b). The St. Cloud-MSA, composed predominately of Stearns and Benton Counties, is a regional employment center drawing many Sherburne County residents (Tuck and Lofgreen 2004). The majority of Wright County residents, 57.2 percent, commute to work outside the county and spend approximately 29 minutes commuting to work (Census 2000d; McMurry 2003).

The Twin Cities Area is a magnet for workers from other regions. The central region, which includes Sherburne, Wright, Benton, and Stearns Counties, had a net flow of 34,212 workers to the area as documented by Census 2000. This represented the largest net flow of workers between any of Minnesota's regions (McMurry 2003).

Per capita personal income has also historically been lower in Sherburne and Wright Counties than the State of Minnesota (Census 2004a, Table C3). In 2000, Sherburne County had a per capita personal income of $21,322, compared to $21,844 for Wright County and $23,198 for the State of Minnesota (Census 2000d).

Historically, agriculture has been a mainstay of the regional economy with 66 percent of Wright County and 26 percent of Sherburne County currently classified within that land use category (Wright Co. 1988; Sherburne Co. 1992). In 1997, Sherburne County had 512 farms encompassing 105,042 acres. Market value of agricultural products sold in the county totaled 42,760,000 dollars. Wright County had 1,422 farms totaling 251,832 acres and sold agricultural products with a market value of 92,839,000 dollars (Cornell 2004).

Potentials for Economic Growth

Wright County and Sherburne County areas have the potential to experience significant growth due to close proximity to large urban areas within a 50-mile radius. The Minneapolis-St. Paul International Airport (MSP) is within a one- to two-hour drive from most of the two-county region. It is serviced by 13 major passenger airlines, three international carriers, three regional commuter airlines, seven charter airlines, and 19 air cargo companies. The MSP airport served over 35 million passengers in 2001 and processed about 340 metric tons of cargo, ranking 13th and 48th in the world, respectively (MDEED 2003). St. Cloud Regional Airport located on the southeastern side of St. Cloud, is served by a commuter airline offering flights to the MSP and two fixed based operators (Tuck and Lofgreen 2004). Light air travel and transport is available from two municipal airports in Wright County – one in Buffalo and another in Maple Lake (EDPWC 2004). Municipal airports are located in Princeton, Clear Lake, and Big Lake in Sherburne County (Sherburne Co. 1992).

In addition, the communities surrounding MNGP are growing in part due to the traffic corridors that link the areas to urban centers. Wright County has a developed transportation network that includes Interstate Highway 94, U.S. Highway 12, and State Highways 24, 25, 55, and 101. Running east-west across the northern, central and southern portions of the county, Interstate 94, U.S. Highway 12, and State Highway 55 provide access to the Minneapolis-St. Paul area and the western part of the state. State Highways 25 and 24, running north-south, create corridors across the eastern and western part of the county. The region's transportation network also includes two active railway systems. The Canadian Pacific parallels State Highway 55 and passes through Rockford, Buffalo, Maple Lake, Annandale, and South Haven. The Burlington Northern Railroad parallels U.S. Highway 12 and passes through Delano, Montrose, Waverly, Howard Lake, and Cokato (EDPWC 2004). Sherburne County is served by two U.S. highways and two State highways. U.S. Highway 169 and State Highway 25 run north-south in the eastern and central parts of the county while U.S. Highway 10 and State Highway 95 run east-west, connecting St. Cloud with the Minneapolis-St. Paul area and other parts of the state (Sherburne Co. 1992).

2.7 TAXES

This subsection focuses on Wright County because, other than a State General Tax, the property taxes for the MNGP site are paid only to taxing jurisdictions within Wright County.

NSP is assessed annual property taxes for the MNGP site by Wright County, the City of Monticello, School District 882, and the Monticello-Big Lake Hospital District. NSP is also assessed the State General Tax. Nuclear fuel is not taxed in the State of Minnesota and therefore is not included in the site's property tax assessment. Property taxes are paid directly to Wright County, which in turn distributes the money to the aforementioned taxing jurisdictions. Property taxes are the chief source of income for Minnesota counties, representing between 30 and 50 percent of their revenues (AMC 2002). Property taxes fund local government services such as highway maintenance, education, public health, public safety, public libraries, and various other social services (Wright Co. 2003; Monticello 2004a).

From 1994 to 2001, NSP's largest annual property tax contributions for MNGP went to School District 882. Payments during the period from 1998 to 2002 decreased by 70.2 percent, dropping from over 6.2 million dollars in 1998 to approximately 1.9 million dollars in 2002 as a result of the passage of a tax bill by the state in 2001 which replaced the State Assessed School Levy with the State General Tax. Assessments under the State General Tax are paid into the State General Fund and redistributed by a state-determined formula to school districts state-wide in part based on student numbers. The State Assessed School Levy had been included in School District 882 payments prior to year 2002. Contributions to the School District 882 accounted for 20.4 percent of the school district's total revenues and 18.5 percent of the total operating budget in 1999. By 2002, payments for MNGP represented a much smaller percentage of both the school district's total revenues and total operating budget, 5.2 percent and 5.5 percent, respectively (see Table 2.7-1).

Annual property tax payments to Wright County decreased from approximately 3.2 to 2.0 million dollars from 1998 to 2002, a 36.9 percent decrease. These contributions represented 6.9 to 3.4 percent of the county's total annual revenues during the period (see Table 2.7-1).

Annual payments to the hospital district decreased 30 percent during the period from 1998 to 2003. These payments represented an increasingly smaller percentage of total revenues from 1998 to 2002, from 1.4 to 0.5 percent. When viewed in relation to total Wright County property tax dollars received by the hospital district, NSP's tax payment for MNGP represented between 27.9 percent to 21.3 percent of the total tax levy during the period (see Table 2.7-2).

Annual NSP payments to the City of Monticello increased from approximately 2.8 to 3.4 million dollars from 1998 to 2002 (a 20.9 percent increase), but represented a smaller percentage of the city's total revenues than in previous years, decreasing from

29.8 to 24.6 percent between 1998 and 2002. In addition, these annual payments represented a slightly increasing percentage (11.7 to 12.8) of the total operating budget for the City of Monticello during the same period (see Table 2.7-1).

NSP projects that future tax payments will gradually increase due to increased levies by the aforementioned taxing jurisdictions. NSP's tax liability for MNGP could also be influenced by changes at higher levels of government. The Minnesota Department of Revenue is currently reviewing the rules determining the way electric utilities are valued. These reviews may result in a reduction of NSP's apportionable value regarding its MNGP properties, thereby potentially lowering future tax payments for MNGP. However, state law makers have discussed reducing some of the exemptions currently available to NSP, resulting in potentially higher future taxes liabilities for MNGP.

2.8 SOCIAL SERVICES AND PUBLIC FACILITIES

2.8.1 PUBLIC WATER SUPPLY

The discussion of public water systems focuses on Wright and Sherburne Counties where approximately 73 percent of the MNGP workforce reside (see Section 3.4 of this ER for workforce description). Potable water is provided to residents of the counties by a combination of public and private water supply systems serving the municipalities. There are approximately 147 and 104 regulated water systems in Wright County and Sherburne County, respectively (EPA 2004d). These providers are subject to regulation under the Federal Safe Drinking Water Act, as implemented by the State of Minnesota Department of Health under Minnesota Rules, Chapter 4720. Residents of unincorporated portions of the counties have individual onsite wells. NMC operates one of these regulated systems, providing potable water from four groundwater wells in support of MNGP operations (see Section 3.1.3.5 of this ER). Table 2.8-1 identifies the municipal water systems in Wright and Sherburne Counties along with information on system capacity and usage. Most systems in the two-county area are operating below maximum capacity. Portions of both Wright and Sherburne Counties are experiencing significant population growth and several municipal water systems (Elk River, Joint Powers Water Board, and Otsego) are responding by increasing capacity with additional wells.

2.8.2 TRANSPORTATION

Access to MNGP site is south of the power block via Wright County Road 75, a two-lane paved roadway that runs roughly parallel to Interstate 94 in the vicinity of the site. Interstate 94 runs northwest from Minneapolis less than a mile to the southwest of the site. Access points to the Interstate are approximately four miles to the southeast and six miles to the northwest of the site, at the State Highway 25 intersection in Monticello and the Wright County Road 8 intersection, respectively. Access to Sherburne County is via the State Highway 25 bridge in the City of Monticello approximately 3.5 mile to the south and the State Highway 24 bridge at Clearwater, approximately 11 miles to the north (see Figures 2.1-1 and 2.1-2). Minnesota Department of Transportation (Mn/DOT) average annual daily traffic counts (AADT) for the major roads in the vicinity of MNGP for year 2002 are listed in Table 2.8-2.

The most current data available for Wright County Road 75 is that compiled for the year 2000 (Mn/DOT 2004). The State of Minnesota does not normally calculate and keep up-to-date Level of Service (LOS) determinations for either state or county roadways; however, LOS information based on threshold values developed by Mn/DOT for use in District Long Range Transportation Plans was available for State Highways 24 and 25 and Interstate 94 in Wright County. LOS determinations (shown below) were made for current traffic volumes and with the addition of 60 additional vehicles assumed for license renewal. Results reveal that these roadways could accommodate the demand represented by the NMC bounding estimate for additional employees during the renewal

term without a noticeable effect on level of service. Mn/DOT long-term future plans (10 to 20 year timeframe) included adding capacity to I-94 in the area and constructing a new river crossing that would improve conditions on Highway 24.

	Wright County Level of Service (LOS)				
Highway	**2002 Volumes**	**2004 Volumes**	**Level of Service (LOS)**	**2004 Volumes (plus 60 veh)**	**Level of Service (LOS)**
24	15,500	16,490	D	16,550	D
25	31,300	32,860	D	32,920	D
I-94	48,000	51,360	C	51,420	C

Note: LOS determined by using threshold values developed by Central Office for use in District Long Range Transportation Plans.

2.9 LAND USE PLANNING

In the State of Minnesota, local governments provide such services as police and fire protection, road and highway maintenance, public sewer and water facilities, parks and open space, planning and zoning, and social services. Local governments are comprised of counties, the next level of government below the state, and their subdivisions, including cities and townships.

The State of Minnesota authorizes counties to plan for and manage land use, under the County Planning Act 394 of 1959 (AMC 2002). Counties are authorized but not required to adopt management plans and zoning ordinances for purposes of characterizing current conditions and setting standards, policies, and goals for land development. Townships may also adopt and enforce zoning regulations as long as those controls are at least as restrictive as those adopted by the county. Counties however, have no land use authority in cities, except as requested by the city. Minnesota Statute 462, the Municipal Planning Act authorizes but does not require comprehensive planning within municipalities. Both Statues 394 and 462 retain provisions from the Community-Based Planning Act of 1997 that encourage counties to engage in land use management through increased coordination and cooperation between counties, cities, and townships (AMC 2002).

This section focuses on Sherburne and Wright Counties because 73 percent of the MNGP workforce resides in these two counties and because Xcel Energy pays MNGP property taxes to four jurisdictions in Wright County: the County, the City of Monticello, the School District 882, and the Monticello-Big Lake Hospital District (see Section 3.4 of this ER for workforce description).

Comprehensive planning is in various stages in the two counties. With the exception of Middleville and Stockholm Townships in Wright County, which have implemented their own land use plans and zoning regulations, all unincorporated land in the remaining 18 townships (20 total) in Wright County and 10 townships in Sherburne County, are under the planning and zoning control of each county (Sherburne 1992, page 6; Wright Co. 1988, page 1). Sherburne County's plan was adopted by the County Board of Commissioners on December 15, 1992 and the most recent update adopted on May 4, 2004 (Sherburne Co. 1992; Sherburne Co. 2004b). Wright County's plan was adopted by the County's Planning Commission on May 26, 1988 (Wright Co. 1988). Incorporated cities occupy a small percentage of the counties' total land area, 13.5 percent in Sherburne County and 4 percent in Wright County (Sherburne Co. 1992, page 21; Wright Co. 1988, page 71). Thirteen of the 16 cities in Wright County and four of the six cities in Sherburne County have developed comprehensive land use plans and guide growth and development in their communities through zoning subdivision ordinances. The five cities that do not have active planning programs are the smallest in the counties (MDEED 2004a,b). County-level planning documents encourage growth in areas that can be served by existing infrastructure, while preserving open space and

environmentally sensitive areas, and county planning officials were not aware of any growth control measures in the municipalities that would limit residential development in their respective counties (Wright 1988; Sherburne 2004b). Neither county implements growth control measures that limit residential housing development.

In 1990, Wright and Sherburne Counties had housing stocks of 26,353 and 14,964 units, respectively. Homeowner vacancy rates were 1.3 percent in both Wright and Sherburne counties. Rental vacancy rates in these two counties were 7.0 and 6.2 percent, respectively (Census 1990). As the area's population continues to grow, so do housing stocks. U.S. Census Bureau year 2000 estimates for housing units have increased to 34,355 in Wright County and 22,827 in Sherburne County compared to 1990 values. Year 2000 homeowner and rental vacancy rates were low, 1.1 and 3.1 percent in Wright County and 0.8 and 2.5 percent in Sherburne County, respectively (Census 2000e). Between 1995 and 2000, the new housing construction within the counties was concentrated in areas along the main transportation corridors including Interstate 94, State Highways 12, 10, and 169, and County Roads 24, 25, 35, and 55. In Wright County, new construction was strongest in the northeastern cities and townships representing 30 to 42.9 percent of housing in the cities of St. Michael, Monticello, and Rockford; and 17 to 25.8 percent of housing in Clearwater and Chatham Townships and the cities of Hanover, Delano, Montrose, Howard Lake, Buffalo, and Annandale. In Sherburne County, new construction was strongest in the southeastern cities and the eastern townships. In Santiago Township and the cities of Zimmerman, Elk River, and Big Lake new construction represented 33.1 to 42.1 percent of housing and 25.4 to 27.6 percent of housing in Blue Hill, Baldwin, and Livonia Townships (Census 2004b; Wright Co. 1988, page 2).

Wright County encompasses approximately 70 square miles or 460,640 acres. Studies done in the 1980's by the Wright County Planning and Zoning Department found the predominant land use in the county to be cultivated fields, accounting for 52 percent of the total county acreage (242,280 acres). Approximately 16 percent was classified as residential (urban or rural) (73,890 acres), 14 percent was classified as forest (63,740 acres), 6 percent was classified as water bodies (29,600 acres), 6 percent as pasture and open (28,360 acres), 4 percent as marsh/wetland (17,170 acres), and only 2 percent was classified as urban and miscellaneous (7,680 acres) (Wright Co. 1988, page 46). Wetlands are an important natural resource in Wright County, and development of associated flood prone areas is restricted. Preservation of farmland is a major concern and goal of planning efforts, as Wright County contains approximately 337,240 acres of farmland that the State of Minnesota classifies as either prime or of statewide importance based on soil quality, growing season, and moisture supply characteristics (Wright Co. 1988, pages 13, 35, and 39). Between 1960 and 1980, the majority of population growth in the county took place in the unincorporated areas and was rural nonfarm in nature. In 1970, only 8 percent of the county's residents lived in the incorporated cities (Wright Co. 1988, page 19). However, by the Year 2000, this

percentage had increased to 63.5 percent (Census 2000f, GCT-PH1). Since 1980, the growth in Wright County has concentrated in the cities, such as Albertville, Monticello, Buffalo, St. Michael, and Otsego (Wright Co. 1988, page 23; MDEED 2004b). U.S. Census Bureau estimates show that Wright County was the 48th fastest growing county in the nation for the period 2000 to 2003 (Census 2004c).

Sherburne County encompasses less land area than Wright County, approximately 286,000 acres in total. A 1991 analysis of land use in the County found that open land (not farmed) was the largest land use category with 122,530 acres or 43 percent of the county's total land area. Included in the open land category are approximately 55,400 acres of woodlands (Sherburne Co. 1992, pages 16 and 21). Wetlands, lakes (11,443 acres), and other natural areas are also included in the open land category. Approximately 26 percent of the county was classified as farmland (73,700 acres), 13.5 percent as incorporated areas (39,990 acres), 12 percent as federal wildlife refuge and state forest (34,100 acres), 5 percent as residential (14,440 acres), and 0.5 percent as commercial and industrial (1,240 acres) (Sherburne Co. 1992, pages 13, 17, and 21). Wetlands are also an important natural resource in Sherburne County, and development is restricted by County, State, and Federal regulations (Sherburne Co. 1992, page 13). Farmland in Sherburne County does not have the natural soil productivity (ranked 73rd out of 87 counties in Minnesota) of its neighbor, Wright County, and only a small percentage is characterized by the State as prime farmlands or of statewide importance (9,350 acres). However, preservation of farmland and/or the rural character of the county is a major concern and goal of planning efforts in Sherburne County (Sherburne Co. 1992, page 17).

Between 1970 and 1990, the majority of population growth in the county took place in the incorporated cities, which grew approximately 167 percent. In 1970, 45 percent of Sherburne County's population lived in the cities; the percentage rose to 53 by 1990, and remained there through the Year 2000 (Sherburne Co. 1992, page 6; Census 2000f, GCT-PH1). U.S. Census Bureau estimates show that Sherburne County ranks as the 36th fastest growing county in the nation for the period 2000 to 2003 (Census 2004c).

2.10 HISTORIC AND ARCHAEOLOGICAL

The construction of MNGP and the associated transmission line corridors did not impact any known historic or archaeological resources. No significant resources were found on or near the site during historic and archaeological investigations performed prior to operations (AEC 1972, Section II.C and Appendix C, page 51; NSP 1971, Section II.16).

The National Register of Historic Places (NRHP) lists ten historic sites within approximately ten miles of MNGP (see Table 2.10-1). The Minnesota Historical Society designates one of these sites as nationally significant and nine as locally significant. The nationally significant site is in Sherburne County, the Oliver H. Kelley Farmstead, designated a National Historic Landmark. The 9 sites of local significance are in Wright County - four in the City of Monticello, one in Monticello Township, and three in the Town of Clearwater, approximately 4 miles northeast of the MNGP site (MNHS 2004). None of the listed historic sites of national interest or sites of local interest are on the MNGP site.

The area has a history of Indian and early French trader activity, however, no evidence of this activity has been found at the site (AEC 1972, Section II.C).