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EL05-022

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JUL 21 2005
SOUTH DAKOTA PUBLIC
UTILITIES COMMISSION

OTTER TAIL
POWER COMPANY

July 20, 2005

Pam Bonrud
Executive Director
South Dakota Public Utilities Commission
500 East Capitol Ave.
Pierre, SD 57501

Dear Ms. Bonrud:

Subject: Application for an Energy Conversion Facility Siting Permit
Big Stone II Project

Enclosed are 33 copies of an Application for an Energy Conversion Facility Siting Permit for the addition of Big Stone II to the existing Big Stone Plant site. Also enclosed is the $8000 minimum filing fee as specified in South Dakota Code of Law 49-41B-12.

Otter Tail Corporation dba Otter Tail Power Company is making the filing on behalf of the Big Stone II co-owners:

- Central Minnesota Municipal Power Agency
- Great River Energy
- Heartland Consumers Power District
- Montana-Dakota Utilities Co., a Division of MDU Resources Group, Inc.
- Otter Tail Corporation dba Otter Tail Power Company
- Southern Minnesota Municipal Power Agency
- Western Minnesota Municipal Power Agency

I look forward to working with you on this project.

Sincerely,

Mark Rolfes
Project Manager

Enclosures

C. Grant County Auditor

EL05-022

Application for a South Dakota Energy Conversion Facility Siting Permit

RECEIVED
JUL 21 2005
SOUTH DAKOTA PUBLIC UTILITIES COMMISSION

BIG STONE II
PARTNERS IN GENERATION

Prepared for

Big Stone II Co-Owners

Prepared by

Barr Engineering Co.
Otter Tail Power Company
Burns and McDonnell, Inc.
The First District Association of Regional Governments
The 106 Group, Ltd.

July 2005

Application for a South Dakota Energy Conversion Facility Siting Permit Big Stone II Project

Big Stone II Co-Owners

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Exhibit B	Supplement to the June 2002 Evaluation of Water Supply for Increased Power Generation, Barr Engineering Co., March 2005
Exhibit C	Economic Impact of Constructing the Big Stone II Power Plant, Stuefen Research & Business Research Bureau, 2004.
Exhibit D	Archaeological Assessment and Architectural History Survey for the Big Stone II Project, Big Stone City, Grant County, South Dakota, The 106 Group Ltd., May 2005.
Exhibit E	Resolution of Support-City of Big Stone City, South Dakota
Exhibit F	Resolution of Support-County of Grant, South Dakota
Exhibit G	Resolution of Support-City of Milbank, South Dakota
Exhibit H	Resolution of Support-School Board of Milbank School District, South Dakota

List of Application Contributors

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Glossary of Terms

Project	The proposed nominal 600 MW (net) electric generating facility and associated facilities, which the Project Co-owners have named Big Stone II, to be located on an industrial site adjacent to the existing Big Stone Plant unit I.
Project Co-owners	The parties participating in the Big Stone II Project and who will collectively be the owners of Big Stone II consisting of Central Minnesota Municipal Power Agency; Great River Energy; Heartland Consumers Power District; Montana-Dakota Utilities Co., a Division of MDU Resources Group, Inc.; Otter Tail Corporation d/b/a Otter Tail Power Company; Southern Minnesota Municipal Power Agency; and Western Minnesota Municipal Power Agency.
Big Stone Plant	Refers to the total facility, Big Stone unit I and Big Stone II and their associated facilities, collectively.
Big Stone II	The nominal 600 MW coal-fired unit and associated facilities proposed for construction at the existing Big Stone site.
Big Stone Plant unit I	The existing 450 MW coal-fired unit and associated facilities at the Big Stone site.
Study area	The area subject to investigation or data gathering for assessing potential impacts from the Project. May extend beyond Property Area and Project Area.
Property Area	The approximate 3115 acres that include the existing Big Stone site and property purchased and property optioned for purchase specifically for the Big Stone II Project.
Project Area	A subset of the property area that includes areas previously developed or that have potential to be directly impacted (permanently or temporarily) as part of development of Big Stone II. This also includes a small homestead parcel that is not currently owned or optioned for purchase by OTP.

Acronyms and Abbreviations

°C	Degrees Celsius
°F	Degrees Fahrenheit
ACFB	atmospheric circulating fluidized bed
APE	Area of Potential Effect
ARSD	Administrative Rules of South Dakota
BACT	best available control technology
BMPs	Best management practices
Btu	British thermal unit
CAIR	Clean Air Interstate Rule
CAMR	Clean Air Mercury Rule
$CaSO_3$	calcium sulfite
CEMs	Continuous emissions monitors
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CMMPA	Central Minnesota Municipal Power Agency
CWA	Clean Water Act
d/b/a	Doing business as
DCS	distributed control system
e.g.	For example
EPA	[United States] Environmental Protection Agency
ESP	electrostatic precipitator
FGD	flue gas desulfurization system
FLM	Federal Land Managers
FTR	Financial transmission rights
g/dscf	Grains per dry standard cubic foot
gpm	Gallons per minute
GPS	Global positioning system
GRE	Great River Energy
GWh	Giga-watt hours
HAZWOPER	Hazardous Waste Operations and Emergency Response
HCPD	Heartland Consumers Power District
HHV	High heat value
HRSG	heat recovery steam generator

i.e.	That is to say
ICR	Information Collection Request
ID	Induced draft
IGCC	Integrated Gasification Combined Cycle
kV	kilovolt
kWh	Kilowatt-hour
LHV	Low heat value
LRLF	Long-Range Load Forecast
MAPP	Mid-Continent Area Power Pool
MDNR	Minnesota Department of Natural Resources
MDU	Montana-Dakota Utilities Co., a Division of MDU Resources Group, Inc.
mg/m^3	Milligrams per cubic meter
MISO	Midwest Independent System Operator
MN	Minnesota
MRES	Missouri River Energy Services
MSDS	Material Data Safety Sheets
MW	Megawatt
NOI	Notice of Intent
NO_x	Nitrous oxides
NRHP	National Register of Historic Places
NSPS	New Source Performance Standards
NSR	New Source Review
OPPD	Omaha Public Power District
OSHA	Occupational Safety and Health Administration
OTP	Otter Tail Corporation d/b/a Otter Tail Power Company
PC	Pulverized Coal
PJFF	pulse-jet fabric filter
PPA	Participation Power Agreement
ppm	Parts per million
PRB	Powder River Basin
PSA	Power sales agreement
PSD	Prevention of Significant Deterioration
psia	Pounds per square inch absolute
psig	Pounds per square inch gauge

SCR	Selective catalytic reduction
SD	South Dakota
SD DENR	South Dakota Department of Environment and Natural Resources
SDDGFP	South Dakota Department of Game, Fish and Parks
SDDOT	South Dakota Department of Transportation
SMMPA	Southern Minnesota Municipal Power Agency
SNCR	Selective Non-Catalytic Reduction
SO_2	Sulfur dioxide
SPCC	Spill Prevention, Control, and Countermeasure
SWPPP	Storm Water Pollution Prevention Plan
TMDL	Total Maximum Daily Load
tph	Tons per hour
tpy	Tons per year
USACOE	United States Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geologic Survey
WAPA	Western Area Power Administration
WFGD	Wet Flue Gas Desulfurization
WLFO	wet limestone forced oxidization
WMMPA	Western Minnesota Municipal Power Agency
WPA	Waterfowl production area
ZLD	Zero liquid discharge

Regulatory Requirement/Application Section Cross Reference Table

ARSD Section	Description	Application Section
20:10:22:01	Definitions.	No information requested by rule
20:10:22:02	Content of notification of intent.	
20:10:22:03	Prefiling conference.	
20:10:22:04	General format of application for permit.	
20:10:22:05	Application contents.	
20:10:22:06	Names of participants required.	1.5
20:10:22:07	Name of owner and manager.	1.6
20:10:22:08	Purpose of facility.	1.1
20:10:22:09	Estimated cost of facility.	1.3
20:10:22:10	Demand for facility.	3.1
20:10:22:11	General site description.	2.1
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20:10:22:14	Effect on physical environment.	4.1
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20:10:22:24	Employment estimates.	5.1
20:10:22:25	Future additions and modifications.	2.1.2
20:10:22:26	Nature of proposed energy conversion facility.	2.1
20:10:22:27	Products to be produced.	2.1.1
20:10:22:28	Fuel type used.	2.2.4
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20:10:22:32	Estimate of expected efficiency.	2.1
20:10:22:33	Decommissioning.	2.1.3
20:10:22:34	Transmission facility layout and construction.	Not included—Information is not required for Energy Conversion Facilities
20:10:22:35	Information concerning transmission facilities.	
20:10:22:36	Additional information in application.	Section 6
20:10:22:37	Statement required describing gas or liquid transmission line standards of construction.	Not included—Information is not required for Energy Conversion Facilities
20:10:22:38	Gas or liquid transmission line description.	

ARSD Section	Description	Application Section
20:10:22:39	Testimony and exhibits.	Entire Application, Tables and Exhibits
20:10:22:40	Application for party status.	No information requested by rule

Executive Summary

This application for a Permit for an Energy Conversion Facility in accordance with applicable portions of the South Dakota Code of Law Chapter 49-41B and the Administrative Rules of South Dakota Section 20:10:22 is made for a proposed nominal 600 MW (net) coal-fired electric generating facility and associated facilities, which the Project Co-owners have named Big Stone II, to be located on an industrial site adjacent to the existing Big Stone Plant unit I in Grant County, South Dakota (the "Project").

This application is being made by Otter Tail Power Company on behalf of the Project Co-Owners:

- Central Minnesota Municipal Power Agency (CMMPA);
- Great River Energy (GRE);
- Heartland Consumers Power District (HCPD);
- Montana-Dakota Utilities Co., a Division of MDU Resources Group, Inc. (MDU);
- Otter Tail Corporation dba Otter Tail Power Company (OTP);
- Southern Minnesota Municipal Power Agency (SMMPA); and
- Western Minnesota Municipal Power Agency (WMMPA).

The Project will help meet the projected demand of the Project Co-Owners and the needs of the Mid-Continent Area Power Pool (MAPP) for baseload generation early in the next decade.

The Project would be located on an industrial site adjacent to the existing Big Stone Plant unit I. The approximate 2200-acre Big Stone Plant unit I site is located in Grant County east of Milbank and northwest of Big Stone City, South Dakota. An additional 915 acres has been purchased or is under option for purchase to accommodate the Project.

Current plans are to construct a single pulverized coal-fired steam generator and a single steam turbine. The unit would be designed to burn Powder River Basin sub-bituminous coal. The new unit will be designed to meet baseload demand, and will normally operate at its maximum continuous rating output. Construction is scheduled to start in the spring of 2007 with commercial operation targeted for the spring of 2011.

Big Stone II will share existing major infrastructure with the existing Big Stone Plant unit I including the cooling water intake structure, pumping system and delivery line; coal delivery rail spur and unloading facilities; and solid waste disposal facilities. .

Alternatives to the Project were considered. The Project Co-owners conducted a study to identify a preferred site and alternate sites for a new coal-fired generating unit. The search area included the States of Minnesota, North Dakota and South Dakota. Following extensive study and evaluation, the study findings concluded that the Big Stone site is the preferred site for the proposed coal-fired generating unit.

The Project Co-owners also evaluated four baseload generation technologies and chose the PC super-critical technology for Big Stone II over the other technologies evaluated, principally because it was estimated to have the lowest production cost of the evaluated generation alternatives.

This application describes the existing environment in the vicinity of the Project and provides information describing the estimated effect of the Project on the existing environment. Adverse environmental impacts from the Project are expected to be minimal.

An environmental assessment is provided on the Project vicinity:

- Physical environment, including land forms and topography, geology, soils and economic deposits, erosion and sedimentation, seismic, subsidence and slope stability risks;
- Hydrology, including surface water drainage, water use and sources;
- Terrestrial ecosystems, including vegetation communities, wildlife, threatened and endangered species;
- Aquatic ecosystems, including wetlands and fisheries;
- Land use and local land use controls, including existing land use, displacements, land use controls and compatibility with existing land use, noise impacts;
- Water quality, including the Whetstone River system, new makeup storage pond water quality, and construction stormwater management;
- Air quality; and
- Solid or radioactive waste.

This application identifies and analyzes the effects the construction, operation, and maintenance of the Project will have on the regional community. The Big Stone area regional community will generally benefit from the Project. The application addresses potential Project impacts to the area:

- Economy, including the employment/labor market, agriculture, commercial and industrial sectors, land values, and taxes;
- Infrastructure impacts, including housing, energy, sewer and water, solid waste management and transportation;
- Community services including health services and facilities, schools, recreation and public safety; and
- Population and demographics and cultural resources.

The Big Stone II Project has strong community support as evidenced by Resolutions of Support passed by several area units of government.

Section 1

1 Introduction

Otter Tail Corporation doing business as Otter Tail Power Company is filing this application for a Permit for an Energy Conversion Facility in accordance with the applicable portions of South Dakota Code of Law (SDCL) Chapter 49-41B and the Administrative Rules of South Dakota (ARSD) Section 20:10:22. The proposed Energy Conversion Facility (the "Project") is a nominal 600 MW (net) coal-fired electric generating facility and associated facilities, which the Project Co-owners have named Big Stone II, to be located on an industrial site adjacent to the existing Big Stone Plant unit I in Grant County, South Dakota.

This filing is made on behalf of the following energy conversion facility Project Co-Owners

- Central Minnesota Municipal Power Agency (CMMPA)
- Great River Energy (GRE)
- Heartland Consumers Power District (HCPD)
- Montana-Dakota Utilities Co., a Division of MDU Resources Group, Inc. (MDU)
- Otter Tail Corporation dba Otter Tail Power Company (OTP)
- Southern Minnesota Municipal Power Agency (SMMPA)
- Western Minnesota Municipal Power Agency (WMMPA)

The information provided in this Application represents the best knowledge and judgment of the current Project Co-Owners, but is considered to be preliminary at this stage. The final facility description, facility operation methods, quantities, and other items described herein may be modified as development progresses to the final stage of design. Where assumptions have been made that affect the potential environmental and community impacts from the Project, the intent has been to be reasonably conservative in those assumptions to reduce the likelihood of understating those potential impacts.

1.1 Project Purpose

The purpose of the Project is to address the Co-owners' anticipated electrical energy needs in a low-cost, environmentally responsible manner. Mid-Continent Area Power Pool (MAPP) data indicate a potential shortfall of baseload generating capacity will occur by 2011 with energy consumption in the region estimated to increase by 15 percent during the next decade. A highly efficient coal-fired plant in the 600-megawatt range is the most cost-effective choice for helping to meet the anticipated need for increased generation. The need for the Project is discussed further in Section 3 of this report.

1.2 Project Overview and General Site Description

The Project would be located on an industrial site adjacent to the existing Big Stone Plant unit I. The Big Stone Plant unit I site is located in Grant County east of Milbank and northwest of Big Stone City, South Dakota, as shown in Exhibit 1-1. The Big Stone Plant unit I owns the existing approximately 2200-acre site shown in Exhibit 1-2. Otter Tail Power Company owns a 295-acre parcel adjacent to the existing site and has under option to purchase, on behalf of the Project, an additional 620 acres. Based on the preliminary project engineering, the Big Stone II Project Co-owners have legal access to all property that is necessary to complete Big Stone II construction.

Construction of the Project at the site of an existing facility considerably reduces the construction cost of a new plant. This approach enables Big Stone II to share existing major infrastructure with the existing Big Stone Plant unit I including the following:

- Cooling water intake structure, pumping system and delivery line
- Rail spur
- Coal unloading facilities
- Solid waste disposal facilities

The major features of the existing Big Stone Plant are shown in Exhibit 1-3. The existing Big Stone Plant unit I road and rail spur would provide site access. No changes are expected to either of these features for purposes of accommodating Big Stone II.

Current plans are to construct a single pulverized coal (PC) fired steam generator (boiler) with balanced-draft combustion and a single, reheat steam turbine. The unit would be designed to burn Powder River Basin (PRB) sub-bituminous coal. The new unit will be designed to meet baseload demand, and will normally operate at its maximum continuous rating output.

Subject to a final design and regulatory approval, emissions control equipment will likely include selective catalytic reduction (SCR) for NO_x reduction, a fabric filter (baghouse) for particulate collection followed by a wet limestone scrubber for sulfur dioxide (SO_2) removal. The scrubber would be designed to treat the flue gases from both Big Stone unit I and Big

Stone II. The proposed emission control technologies are configured to provide the greatest mercury emission reductions.

Steam generated by the super-critical pulverized coal boiler will be supplied to the steam turbine to complete the power generation cycle. This technology typically offers about 3 to 4 percent greater overall energy conversion efficiency as compared to the conventional sub-critical technologies.

Treated cooling water for the water-cooled surface condenser will be provided from a closed-loop circulating water system that includes a new mechanical draft cooling tower, water lines and circulating water pumps. Raw water for the cooling system will be supplied from existing Big Stone Plant unit I cooling pond. Makeup water for the cooling pond will be supplied from nearby Big Stone Lake, via an existing water line, pumps, and lake intake structure.

1.3 Estimated Cost

The estimated capital cost of the Big Stone II Project is $1 billion.

1.4 Time Schedule

Construction of a coal-fired power generation plant entails a considerable amount of work, time and money, in both the development stage and the construction stage. The Big Stone II Project Co-Owners plan to continue with Project development by:

- Identifying transmission system needs following completion of the Midwest Independent Transmission System Operator system studies
- Negotiating fuel and rail delivery contracts
- Securing all necessary pre-construction permits

Construction is scheduled to start in the spring of 2007 with commercial operation targeted for the spring of 2011. Exhibit 1-4 is a graphical timeline of the major activities.

1.5 Project Participants

The permit applicant is Otter Tail Corporation d/b/a Otter Tail Power Company on behalf of the Big Stone II Project Co-Owners:

- Central Minnesota Municipal Power Agency
- Great River Energy
- Heartland Consumers Power District
- Montana-Dakota Utilities Co., a Division of MDU Resources Group, Inc.
- Otter Tail Corporation d/b/a Otter Tail Power Company
- Southern Minnesota Municipal Power Agency
- Western Minnesota Municipal Power Agency

Otter Tail Power Company is acting as the agent for the Project Co-Owners for the South Dakota energy conversion facility siting and other permitting processes. The individual authorized to receive communications regarding this application is:

Mr. Terry Graumann
Manager, Environmental Services
Otter Tail Power Company
PO Box 496
215 South Cascade Street
Fergus Falls, MN 56538-0496
Phone No. 218-739-8407

1.6 Ownership and Management

The Project Co-Owners will be the owners of the completed Big Stone II. Otter Tail Power Company will be the operating agent of the facility and will have primary responsibility for operation of Big Stone II.

1.7 Other Required Permits and Approvals

In addition to the South Dakota Energy Conversion Facility Siting Permit, the applicants have identified additional permits and regulatory approvals that may be required for construction and operation of proposed Big Stone II. The principal additional permits and approvals are listed in Table 1-1 on the following page.

Table 1-1 Potentially Required Permits and Approvals

Timing	Gov't Level	Agency	Type of Permit/Approval
Prior to Construction	Federal	Western Area Power Administration	Environmental Impact Statement
		Corps of Engineers	404 Dredge and Fill
		FAA	Stack height and lighting approval
		Federal Land Managers	Class I Area Analysis
		FERC	(To Be Determined)
		USFWS	Threatened and Endangered Species
	State	SD Aeronautics Commission	Aeronautical Hazard Permit
		SD DENR	401 Certification
		SD DENR	PSD (Air) Permit
		SD PUC	Notification of Intent to file Energy Conversion Facility Permit application
		SD PUC	Plant Siting
		SD PUC	Transmission Facility Route Permit
		MN PUC	Certificate of Need for High Voltage Transmission Line
		MN EQB	MN Transmission Line Route Permit
		SD – Water Rights Program	Water Appropriation
		SD State Historic Preservation Office	Cultural and Historic Resources Review
		MN State Historic Preservation Office	Cultural and Historic Resources Review
	Local	Grant County Planning Commission	Zoning Approval
For Construction	State	SD DENR	NPDES Stormwater Permit for Construction
		MN DNR	Work in waterfowl or wildlife management areas?
		MN DNR	State-listed Endangered Species
		MN DNR	License to cross
		MPCA	NPDES Construction Stormwater
		MNDOT	Work in ROW
		Grant County	Erosion and Sediment Control
		Grant County or Big Stone Township	Driveway Permit for Construction Lay Down Area
		Multiple LGU's	Wetland filling or excavation for transmission line
		County Highways	Work in ROW
For Operation	Federal	DOE	Fuel Use Act Certification
		DOE	ORIS code number designation
		EPA	SPCC Plan
	State	SD DENR	Acid Rain Allowances
		SD DENR	AST certification
		SD DENR	Solid waste disposal permit.
		SD DENR	NPDES Storm Water Permit

Section 1 Exhibits

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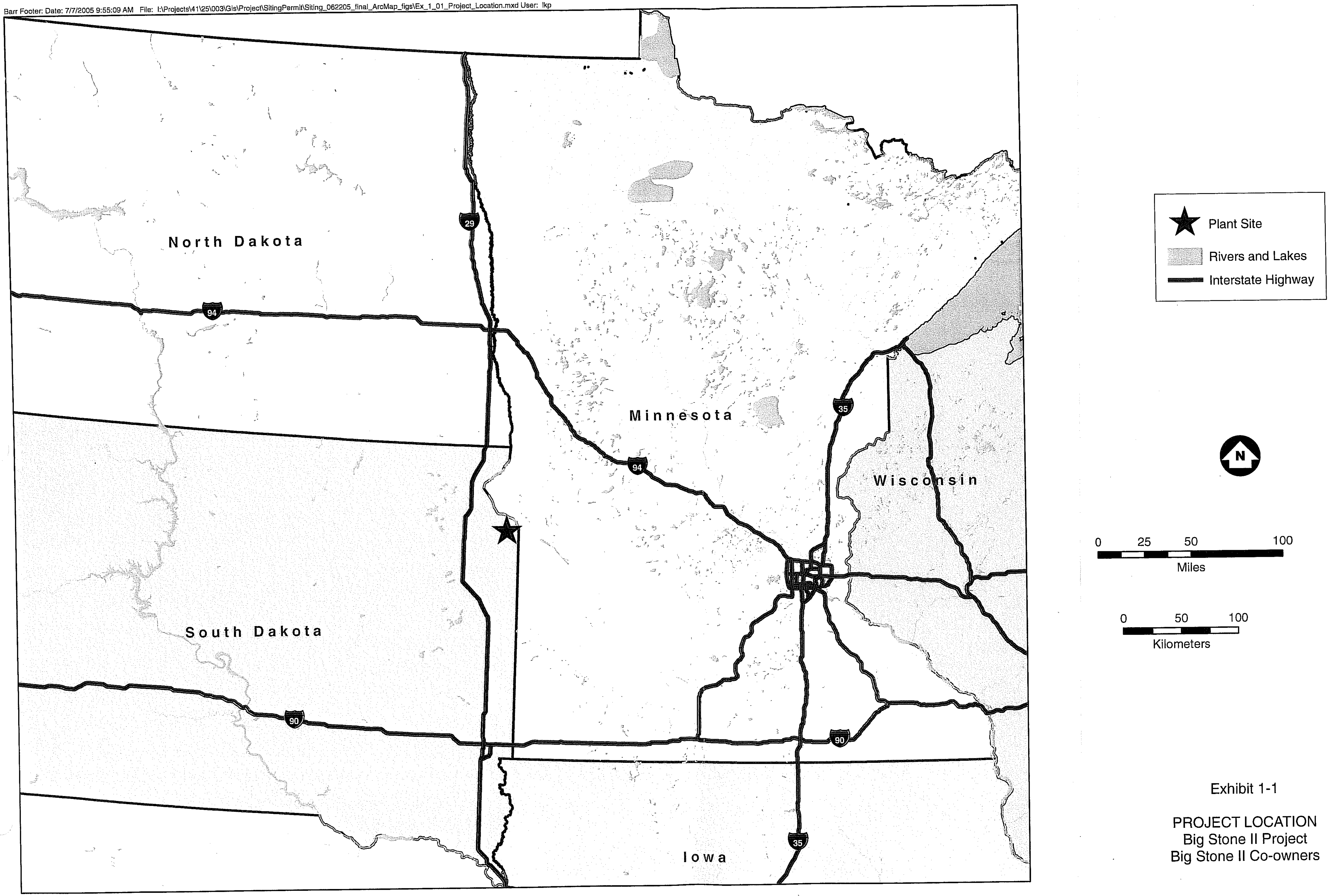

Exhibit 1-1

PROJECT LOCATION
Big Stone II Project
Big Stone II Co-owners

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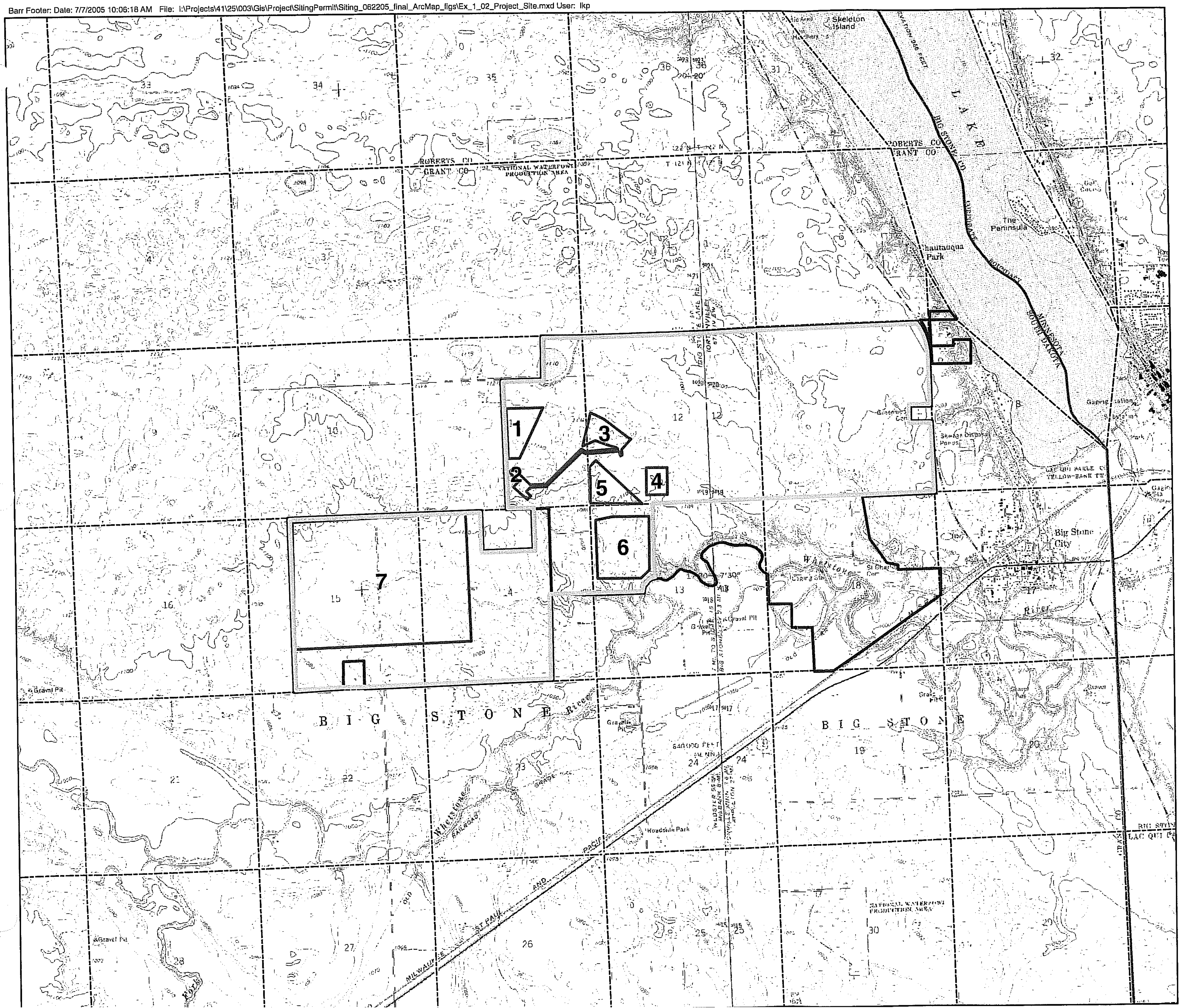


Project Area

Property Boundary (Currently Owned or Optioned)

Project Features

1 Cooling Tower Blowdown Pond

2 Cooling Tower

3 New Plant

4 Construction Parking

5 Ethanol Plant

6 Construction Laydown

7 Makeup Storage Pond

N

0 0.25 0.5 1 1.5

Miles

0 0.5 1 2

Kilometers

Exhibit 1-2

PROJECT SITE
Big Stone II Project
Big Stone II Co-owners

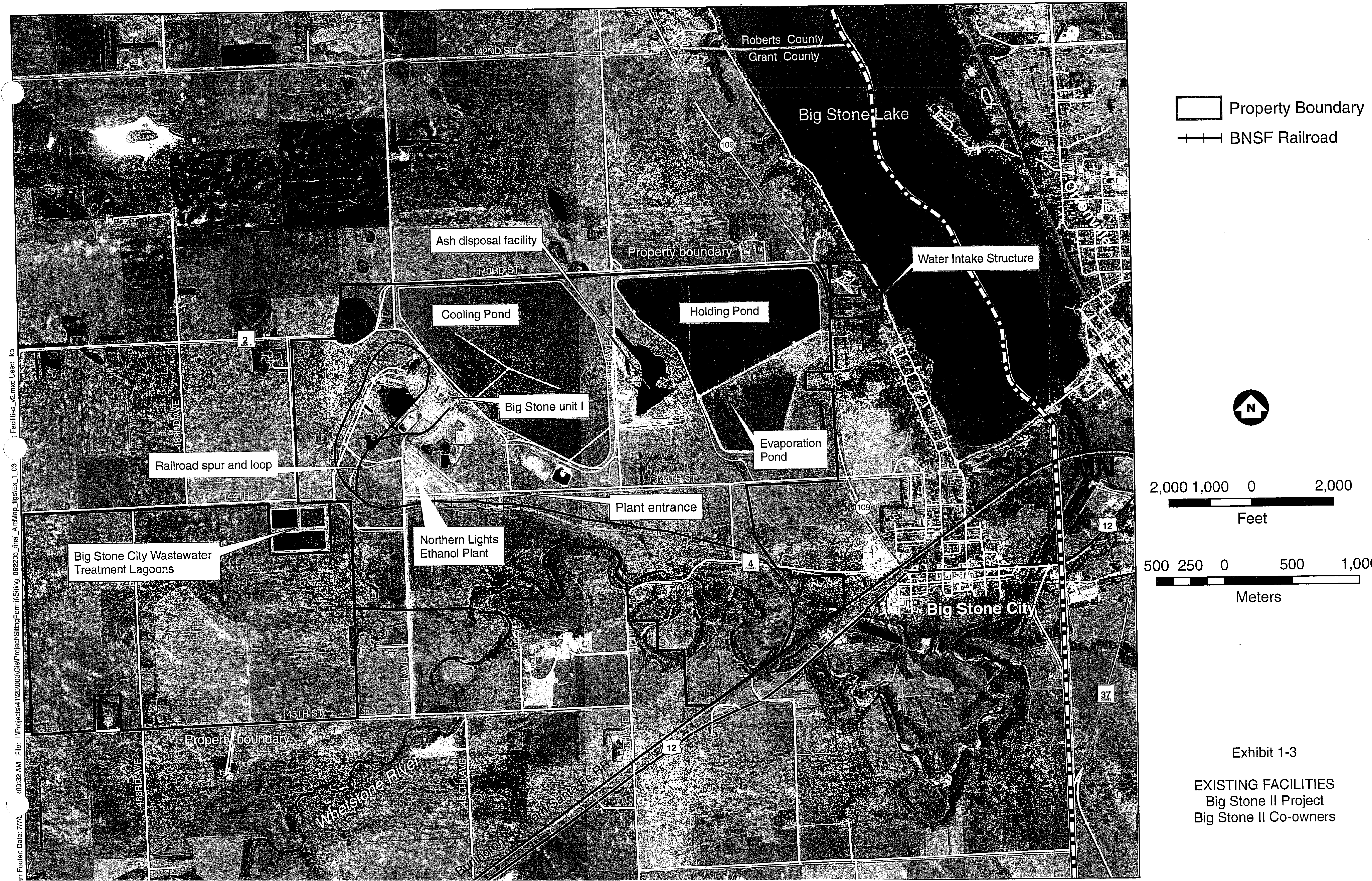


Exhibit 1-3

EXISTING FACILITIES
Big Stone II Project
Big Stone II Co-owners

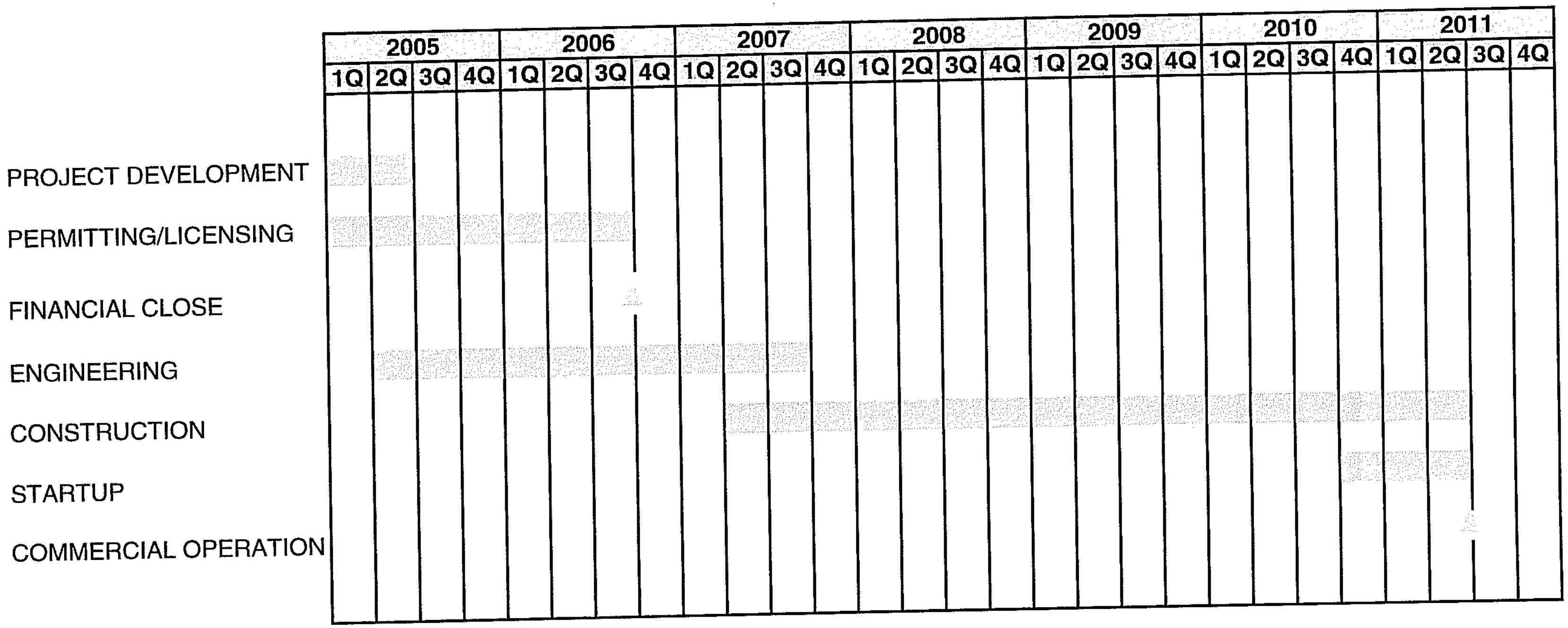


Exhibit 1-4

PROJECT SCHEDULE SUMMARY
Big Stone II Project
Big Stone II Co-owners

Section 2

2 Project Description

2.1 Nature of Proposed Energy Conversion Facility

2.1.1 Facility Description Overview

The proposed Energy Conversion Facility that is the subject of this Siting Permit application is a coal-fired electric power generating unit, Big Stone II, to be constructed adjacent to the existing Big Stone Plant unit I. The Big Stone Plant unit I site is located in northeastern South Dakota, near Big Stone City in Grant County (Exhibit 1-1). The site is approximately two miles west-northwest of Big Stone City, 1.75 miles from the nearest point of Big Stone Lake shoreline, and is approximately two miles from the Minnesota border.

The existing Big Stone site was designed originally to accommodate future units, and includes the following:

- Road Access
- Railroad Access
- Plant Makeup Water (Big Stone Lake)
- Potable Water
- Sanitary Sewer
- Electricity
- Transmission Corridors

The Project will generate approximately 600 megawatts (MW) net of electricity from a new coal-fired steam generation unit. Fuel for the Project will be Powder River Basin (PRB) coal from a number of mines located in Wyoming and Montana, which is the fuel currently being burned at Big Stone Plant unit I. The facility will be designed to burn opportunity fuels in the new boiler, if feasible.

Electricity will be transmitted via an interconnection to the 230 kV transmission system. The interconnection will accommodate the output from both Big Stone Plant unit I and Big Stone II.

The Project's water appropriation from Big Stone Lake will need to be increased to supply both the existing Big Stone Plant unit I and Big Stone II, but modifications to the water intake structure or pumps on Big Stone Lake are not expected to be necessary.

Construction is planned to begin in Spring 2007, after all pre-construction permitting requirements are met. Construction will span a period of almost four years, with operation of Big Stone II projected to begin in Spring 2011. Big Stone II is expected to have an operating life of at least 30 years.

The Northern Lights Ethanol Plant is located adjacent to the Big Stone Plant unit I. The facility began operation in mid-2002. It has a design production capacity of 40 million gallons per year. Big Stone Plant unit I supplies the ethanol plant with process steam as well as other support services including water for fire protection, process water, and rail access.

2.1.2 Future Expansion and Other Industrial Facilities

ARSD Section 20:10:22:25 requests that applicant describe any plans for future modification or expansion of the proposed facility, or construction of additional facilities, that applicant would like to be approved in the permit.

The Co-owners have chosen a site that is currently used for electric generation. Therefore, the potential for land use and environmental impact is minimized. The Big Stone site is ideally suited for the addition of the proposed new Big Stone II. While the Co-owners desire to keep open opportunities for future modification or expansion of the proposed generation facility, or for construction of additional facilities, there are no current or pending specific generation expansions or modifications planned.

The Big Stone Co-owners may identify and acquire additional property in the vicinity of the site to comply with current or future regulatory requirements, additional site buffer areas, or other ancillary needs, such as future ash disposal sites.

ARSD Section 20:10:22:13 requests that the applicant provide *"...a list of other major industrial facilities under regulation which may have an adverse affect of the environment as a result of their construction or operation in the transmission site or siting area."* The Big Stone II Co-owners are not aware of any other major industrial facilities that qualify.

2.1.3 Decommissioning

ARSD Section 20:10:22:33 requests that applicant provide a plan or policy statement regarding action to be taken at the end of the energy conversion project's on-line life. While the proposed Project is being designed for a 30-year minimum operating life, it is common in the power industry for units to operate well beyond their initial projected design operating life. There are solid fossil fuel plants originally designed for a 20- to 30-year life that are still operating after 50 to 60 years. Assessments of plant components are made periodically and repairs and improvements are made as needed. Future improvements oftentimes are made that take advantage of the most recent technological advances in equipment and materials. Such future technological advancements cannot be identified at this time. Therefore, it cannot be predicted at this time when the proposed unit will be decommissioned.

If, at some future time, the site is no longer used as an energy conversion facility, the facility will be evaluated for other site-compatible beneficial uses. In absence of such uses for portions or all of the facility, the site will be decommissioned based on the applicable regulatory requirements or public policy at that time.

2.2 Engineering Design

This section describes the design of the major facility elements. The proposed Big Stone II Project will include a pulverized coal (PC), super-critical boiler and a steam turbine generator capable of generating approximately 600 MW of net electric power. The unit's net electrical output is subject to final design and equipment availability.

The schematic presented in Exhibit 2-1 defines the overall plant process, beginning with coal delivery to the Project site and concluding with electricity delivery to the customers home or business. Information relating to specific equipment or areas labeled on the schematic is included on the Exhibit 2-1 descriptions.

Exhibit 2-2 shows the layout of many of these system features specific to the Big Stone II, including the following:

- Power generation
- Cooling (heat rejection)
- Air emissions control
- Fuel (Coal) receiving, handling, and storage
- Other materials receiving, handling, and storage
- Waste management
- Water supply and wastewater management
- Electrical
- Transportation facilities

These major Big Stone II systems are described further in the following sections.

2.2.1 Power Generation

2.2.1.1 Primary Power

The Big Stone II Project will operate a pulverized coal-fired steam generator technology firing low-sulfur, Powder River Basin coal. While the majority of the existing coal-fired power generation facilities in the United States use a sub-critical steam cycle, the industry trend has been toward super-critical steam cycles. Super-critical boilers have advantages over sub-critical boilers including; higher efficiency, lower air emissions, and reduced fuel consumption.

The steam boiler will provide steam to a single steam turbine generator. The steam turbine generator converts mechanical energy of the steam turbine to electrical energy. For the Project, a super-critical, single-reheat, condensing steam turbine is arranged with multiple stages of feedwater heaters and a steam condenser. The turbine will drive a hydrogen-cooled electric generator. The steam-turbine generator unit will be designed for indoor operation.

A water-cooled steam condenser will accept the steam exhausted from the turbine. A circulating water system will supply cooling water from a wet cooling tower to the water-cooled steam condenser to dissipate the energy in the condensing steam.

Operations personnel located in the common Big Stone Plant unit I/Big Stone II main control room will control and monitor Big Stone II systems using a distributed control system (DCS).

Electricity produced by the steam turbine generator will be supplied to the 230 kV transmission system through a new generator step-up transformer and switching equipment.

2.2.1.2 Temporary Construction Power

Power for construction will be available from the local 13.8kV substation line that exists on the site. Distribution through overhead lines and buried power lines to construction transformers will serve the construction site. Construction power will be delivered via step-down transformers to provide power at the 480 volt level needed to supply construction loads.

2.2.1.3 Permanent Back-up Power

Big Stone II will be supplied with a new back-up diesel generator. The back-up generator will be capable of safely shutting down the new unit in the event of a plant trip or blackout conditions. The back-up generator will not be capable of starting the plant without the availability of the local substation. The 230kV substation and the 13.8kV bus must be available for Big Stone II to operate.

Although the back-up generator will be available for continuous operation for the life of Big Stone II, it is expected that it will be typically operated as required for loss of power at Big Stone II, and to test its electrical production capability. During normal operation, the intent is that one of the two coal-fired units at Big Stone will remain in operation and be capable of providing start-up power to the second coal-fired unit via the 13.8 kV bus in the substation.

2.2.2 Cooling (Heat Rejection)

Big Stone II includes a wet cooling system, which uses circulating water to condense turbine-generator exhaust steam in a shell and tube heat exchanger (condenser).

The wet cooling system functions by circulating cool water to the tube side of the condenser where heat is transferred from the shell-side steam. Steam exhausted from the steam-turbine-generator flows into the condenser and is condensed through indirect heat transfer with the cool circulating water. The condensed steam (condensate) is collected in the condenser where condensate pumps return it to the boiler feedwater system.

The warm water is then circulated from the condenser through a wet, multiple cell, mechanical draft cooling tower. The wet mechanical draft cooling tower dissipates heat through evaporation by contacting the warm circulating water with ambient air. Once cooled, the circulating water is returned to the condenser to complete the cooling circuit.

Due to circulating water evaporation, a water vapor plume will be emitted into the atmosphere from the cooling tower. Small droplets of circulating water (drift) will be entrained within the cooling tower plume. The drift will contain both dissolved and suspended solids, which essentially will be converted to particulate matter in the atmosphere, as water within the drift droplets evaporates. As a result, the cooling tower will be a source of particulate emissions. Specially designed drift eliminators will be employed to remove droplets from the cooling tower plume, which will both conserve water, and reduce drift and resultant particulate emissions.

Most of the makeup water entering the Big Stone Plant II circulating water circuit will be consumed by cooling tower evaporation and drift. The remaining makeup water will replace circulating water blowdown, which is required to maintain circulating water chemistry (cycles of concentration). In order to conserve fresh water from the Big Stone Lake, Big Stone Plant unit I cooling pond water will be reused as makeup to the Big Stone II cooling tower.

The Big Stone II circulating water system will operate at approximately 3.7 cycles of concentration. Again, in order to conserve fresh water, a portion of the Big Stone II cooling tower blowdown will be reused as makeup water to the wet flue gas desulfurization system ("FGD System" or "Scrubber"). Blowdown from the circulating water system will be discharged to a new cooling tower blowdown holding pond, which will serve as the makeup water source for the scrubber. Excess water not used by the scrubber, along with blowdown from the scrubber, will be sent to a "Zero Liquid Discharge System" or ZLDS. This system includes brine concentrators and other equipment, necessary to achieve "zero water discharge" from the Big Stone site. Blowdown (wastewater) from the Big Stone unit I and Big Stone II is evaporated, leaving the previously dissolved solids of the blowdown water in a solid form for disposal. The evaporated water is condensed and reused within the Big Stone Plant or sent to the ethanol plant. The ZLDS is described in detail in Section 2.2.8.2.

2.2.3 Air Emissions Control

2.2.3.1 Primary Power Plant Air Emissions Control

The Big Stone II emissions control system will be subject to a final design and regulatory approval. Emissions control will be provided for the main boiler, the material handling systems, the cooling tower, and other ancillary sources.

Flue gas exhaust from the boiler will be treated by controls designed to minimize emission of pollutants to the atmosphere. The exhaust gas will pass through a Selective Catalytic Reduction (SCR) system to control NO_x; a fabric filter, or baghouse, to capture particulate matter; and a wet limestone flue gas desulfurization (FGD) system to control SO_2. The FGD system, commonly referred to as a scrubber, will treat flue gases from both Big Stone Plant unit I and Big Stone II. Each of these air pollution control technologies are described further below.

After treatment, boiler flue gas will be routed to the chimney for exhausting to the atmosphere.

2.2.3.2 NO_x Emissions Control

NO_x is formed during combustion primarily from nitrogen in the combustion air (thermal NO_x), and partly from nitrogen compounds in the fuel (fuel NO_x). The boiler will be designed to minimize NO_x formation. Additionally, the exhaust flue gas will be treated by a SCR system to further reduce NO_x emissions. The SCR system is a specifically-designed reactor vessel containing a catalyst installed between the economizer and air heater. Anhydrous ammonia injected into the SCR reactor, reacts with NO_x in the presence of the catalyst, thereby reducing the NO_x to molecular nitrogen and water vapor. There is typically a trace amount (i.e., <10 ppm) of ammonia "slip" into the flue gas, which will be minimized through operational controls.

Anhydrous ammonia, delivered by truck as a liquid under pressure, will be stored in large pressurized tanks to supply the SCR system. Anhydrous ammonia is pumped from the storage tanks as a liquid to the ammonia vaporization and injection equipment. The liquid ammonia is vaporized by an electric heater, fed to the dilution equipment to mix with air, and finally injected into the SCR reactor vessel just upstream of the catalyst bed.

2.2.3.3 Flue Gas Particulate Emissions Control

A fabric filter (baghouse) will be used to collect and remove particulate matter (fly ash) in the flue gas by passing the flue gas through filter bags. A pulse-jet fabric filter (PJFF) unit consists of isolatable compartments with common inlet and outlet manifolds containing rows of fabric filter bags. The tube sheet separates the particulate-laden flue gas from the treated flue gas and supports the filter bags, which are suspended from a tube sheet mounted at the top of each fabric filter compartment. The tube sheet is a flat sheet of carbon steel with holes designed to accommodate filter bags through which the bags are hung.

The flue gas passes through the PJFF by flowing from the outside of the bag to the inside up the center of the bag through the hole in the tube sheet and out the PJFF. Fly ash particles are collected on the outside of the bags, and the treated gas stream passes through the induced draft (ID) fans, the FGD system, and lastly on to the chimney. A long narrow wire cage is located within the bag to prevent collapse of the bag as the flue gas passes through it.

Each filter bag alternates between relatively long periods of filtering and short periods of cleaning. During the cleaning period, fly ash that has accumulated on the bags is removed by pulses of air and then falls into a hopper for storage and subsequent disposal. The cleaning is either initiated at a preset differential pressure across the tube sheet, or based on a maximum time between cleanings. Bags in a PJFF are cleaned by directing a pulse of pressurized air down countercurrent to the flue gas flow to induce a traveling ripple (pulse) in the filter bag. This pulse travels the length of the bag deflecting the bag outward separating the fly ash dust cake from the bag as it moves.

2.2.3.4 SO_2 Emissions Control

A wet limestone forced oxidization (WLFO) FGD system, common to existing Big Stone Plant unit I and Big Stone II, will be installed to control emissions of SO_2 (sulfur dioxide) of both units. The existing Big Stone Plant unit I chimney will be retained, however, to allow Big Stone Plant unit I to continue to operate (in scrubber bypass mode) in the event the common scrubber is off-line. Sulfur dioxide is formed during combustion from naturally-occurring sulfur contained in coal. In the wet FGD process, a slurry of finely ground limestone ($CaCO_3$) in water is recirculated through an absorber vessel to provide turbulent contact with the flue gas. The contact between the flue gas and the slurry cools and saturates the flue gas, and results in the absorption of SO_2 into the slurry liquid. The gas/liquid contact also results in removal of much of the residual fly ash from the flue gas entering the absorber. The chemical reaction between the limestone and absorbed SO_2 takes place within the absorber and in the absorber reaction tank, resulting in the formation of solid particles of calcium sulfite ($CaSO_3$). Some of the oxygen in the flue gas participates in the reaction, resulting in the formation of particles of calcium sulfate ($CaSO_4$, or gypsum) as well. Air is also injected into the absorber reaction tank to further promote the formation of gypsum and minimize the formation of calcium sulfite solids. This process is commonly referred to as "forced oxidation."

The resultant waste slurry, which is predominately composed of gypsum particles, will be processed in the dewatering system. First stage dewatering hydrocyclones will be used to separate the small particles from the much larger gypsum crystals. The hydrocyclone overflow (the smaller particles) is returned to the FGD absorber, with a portion being discharged to prevent dissolved solids buildup in the system, while the gypsum slurry underflow (larger particles) is sent to the second stage dewatering system, comprised of vacuum filters, for further dewatering. The filtrate water (reclaimed water) from the vacuum filters is returned to the limestone reagent preparation process for reuse as discussed below.

As the limestone reagent ($CaCO_3$) in the recirculating slurry is depleted, it is replenished with fresh slurry prepared by wet grinding crushed limestone. In order to conserve water, the limestone grinding system uses reclaimed water (filtrate) from the dewatering system. The highest quality water used in the FGD process will be for mist eliminator washing. Mist eliminators are devices that separate entrained slurry from the flue gas as it leaves the absorber. Relatively good quality water is required to prevent plugging of the mist eliminators. Mist eliminator wash water will be from the Big Stone Plant unit I cooling pond.

Limestone will be delivered to the site by truck or rail, and will be stockpiled for use in the wet FGD system.

2.2.3.5 Mercury Emissions Control

A fabric filter (baghouse) followed by a wet FGD will be installed to control mercury (Hg) emissions. Mercury is present in coal in trace amounts, and when coal is combusted mercury is volatilized and converted to elemental mercury (Hg^0). As the flue gas cools, a portion of the Hg^0 is oxidized to Hg^{2+} (the predominant form is thought to be $HgCl_2$). The rate of mercury oxidation is dependent on many factors including temperature, flue gas composition, and fly ash composition. A small fraction of the elemental mercury may also condense onto the fly ash in the flue gas. However, the predominant forms of mercury in flue gas are Hg^0 and Hg^{2+}, which are present in vapor form at the flue gas temperatures common in utility air pollution control equipment.

The speciation of mercury refers to the relative fractions of Hg^0 and Hg^{2+} to the total mercury in the flue gas. The speciation of the mercury in the flue gas is an important parameter in estimating the capability of some types of pollution control equipment to remove mercury. Hg^{2+} is soluble in water and therefore may be effectively removed in wet scrubbing (FGD) systems. However, Hg^0 is not water-soluble and is generally more difficult to capture than Hg^{2+}. Furthermore, different coal types, boilers, and flue gas compositions can affect the mercury speciation. Chlorine content in the coal is believed to have a strong influence on the mercury speciation. Coals with lower chlorine contents, such as PRB coal, produce flue gas with relatively high fractions of Hg^0.

Conventional air pollution control equipment, such as electrostatic precipitators (ESPs), fabric filters, and FGD systems, can achieve varying levels of mercury control. The level of mercury control achieved by existing equipment depends significantly on the type of coal combusted (mercury speciation) and the type of pollution control equipment employed. The EPA's 1999 Information Collection Request (ICR) gathered data on the mercury content of coal burned by coal-fired electric utility steam generating units. The EPA also required mercury emission testing at a subset of these units to obtain data on mercury control under a variety of fuel, boiler design and air pollution control equipment configurations. EPA concluded from these tests that the "co–benefits" from a fabric filter followed by a wet FGD will exhibit greater mercury removal than other conventional emissions control configurations when firing sub-bituminous coal.

2.2.3.6 Fugitive Particulate Emissions Control

Controls will be applied to potential sources of fugitive particulate emissions. Controlled units will include the cooling tower and materials handling operations for coal, fly ash, and limestone. Section 2.2.2 describes the particulate controls for the cooling tower.

In general, it is expected that particulate emissions from materials (coal, fly ash, and limestone) handling system drop points will be controlled by baghouses and/ or passive dust control processes, or other devices with similar particulate removal efficiencies that will be connected to the enclosed handling system. Material collected from dust control systems will be fed back into the respective material handling system.

Additional discussions and details of the various material handling system fugitive particulate controls can be found in the following paragraphs:

- Section 2.2.4.6 – "Coal Handling Dust Control System"
- Section 2.2.5.1 – "Limestone Handling and Storage"
- Section 2.2.7.1 – "Coal Combustion By-Products"

2.2.3.7 Back-up Generator Air Emissions Control

As described in Section 2.2.1.3, operational requirements include the installation of a diesel-fired internal combustion engine driven generator for back-up and emergency power. This engine will include state-of-the-art engine technology to minimize emissions and is expected to meet all emissions limits without add-on controls. Active emission controls that require a "warm-up" period, such as those using catalysts, are not practical for this system.

2.2.3.8 Diesel Fire Pump Air Emissions Control

As described in Section 2.2.6, a diesel-fired internal combustion engine-driven emergency fire water pump will be installed to support fire suppression in the event of a fire at the site. Similar to the emergency generator, this engine will include state-of-the-art engine technology to minimize emissions and is expected to meet all emissions limits without add-on controls. Active emission controls that require a "warm-up" period, such as those using catalysts, are not practical for this emergency system.

2.2.3.9 Continuous Emissions Monitoring

The proposed unit is subject to the compliance monitoring requirements under the Acid Rain regulations in 40 CFR Part 75 and New Source Performance Standards in accordance with 40 CFR Part 60. The boiler will employ continuous emission monitoring systems (CEMS) in accordance with 40 CFR Part 75 and 40 CFR Part 60 to continuously monitor NOx, SO_2, CO_2, opacity, mercury, and volumetric flow rate.

Continuous monitoring of mercury will be required under the Clean Air Mercury Rule. CEMS or a sorbent trap can be used.

The procedures for Part 75 regarding emissions monitoring for units sharing a common stack will be followed.

2.2.4 Fuel Receiving, Handling, and Storage

2.2.4.1 Fuel Type, Source and Transportation

Fuel for the Project will be Powder River Basin (PRB) coal, which is the fuel currently being burned at Big Stone Plant unit I. An evaluation was prepared of the ultimate analysis of the coal burned in Big Stone Plant unit I over the last five years to determine the minimum and maximum values. Unless otherwise noted, the worst-case values based on that review were used to determine the emissions criteria, combustion by-product production (fly ash, bottom ash, gypsum, etc.) for Big Stone II.

Table 2-1 Coal Analysis Design Ranges

Ultimate Analysis	Min	Max
Carbon	43.90	55.18
Hydrogen	2.50	5.09
Nitrogen	0.45	1.89
Chlorine	0.00	0.04
Sulfur	0.19	0.80
Ash	3.80	9.00
Oxygen	6.76	14.36
Moisture	21.42	33.00
BTU	7,980	9,500

Coal is currently transported to the site by rail, and that delivery mode is planned to continue for the second unit. Unit train capacities and delivery frequencies for the new unit's coal handling system are discussed in Section 2.2.4.3.

Back-up diesel generators and the emergency fire pumps for Big Stone II will be fueled by No. 2 diesel fuel (≤0.05 percent sulfur) delivered by truck. Delivery frequency will be determined by the normal operational requirements of the Big Stone II.

2.2.4.2 Existing Coal Handling System

Existing Big Stone coal handling system is comprised of the following:

- Unit Train Positioner
- Rotary Dumper
- Four (4) Vibrating Feeders
- 72-inch Belt Conveyor 1
- A-Frame Storage Barn
- 72-inch Belt Conveyor 2
- 72-inch Tripper Belt Conveyor 3
- 36-inch Belt Conveyor 4
- 36-inch Belt Conveyor 5
- Transfer (Crusher) House
- Dual 36-inch Belt Conveyors 6A & 6B
- Plant Building Distribution Bin
- In-Plant Coal Silo Conveyors
- In-Plant Coal Bunker

The system currently handles 3,150 tons per hour (tph). Tripper Conveyor 3 fills an enclosed A-frame storage barn with a capacity of approximately 25,000 tons. Emergency stock-out is accomplished via a diverter gate and telescopic chute located at the head-end of Conveyor 2. Mobile equipment is used for transferring coal to the storage pile. The existing storage pile contains approximately 30 days (approximately 195,000 tons) of inactive storage.

Reclaim from the enclosed coal storage barn is via a 10-foot-diameter, variable speed rotary plow and 36-inch Conveyor 4. Reclaim from the inactive storage pile is via a single in-ground reclaim hopper with vibrating feeder and 36-inch Conveyor 5. Conveyors 4 and 5 each handle 550 tph and transfer coal to the existing Transfer (Crusher) House.

The Transfer (Crusher) House is provided with two (2) vibrating feeders and two (2) ring granulator crushers handling 550 tph. The crushers discharge to dual 36-inch Conveyors 6A and 6B which transport coal to Big Stone Plant unit I.

Big Stone Plant unit I coal "in-plant" coal silo fill is accomplished via a 50-ton distribution bin, 36-inch transfer conveyors, and a series of 36-inch cascade conveyors at the rate of 550 tph. Total Big Stone Plant unit I in-plant coal silo storage is approximately 3,000 tons.

2.2.4.3 New Coal Handling System

The expected coal burn rate for the new unit is approximately 376 tons per hour (tph). The existing Big Stone Plant unit I burn rate is approximately 270 tph, making the total for both units approximately 646 tph. Based on a 100-percent plant capacity factor, existing Big Stone Plant unit I and new Big Stone II will require approximately 5.7 million tons per year of PRB coal. Based on 100-percent capacity requirements and a unit train size of 14,400 tons (120 car unit trains with 120 tons each car), the unloading system will have to handle approximately 7½ unit trains each week. For simplicity, it has been assumed the coal unloading system will handle one unit train per day. The coal handling system is based on handling Powder River Basin coal (PRB) with an assumed density of 45 pounds per cubic foot.

In order to achieve an increased unloading rate from 3150 tph to 3,600 tph, the four (4) existing vibrating feeders, 72-inch Conveyor 1, 72-inch Conveyor 2, and 72-inch Tripper Conveyor 3 will be upgraded as required. This will allow unit trains to be consistently unloaded in approximately 4 hours. The existing transfer point structure, located adjacent to the existing coal barn storage, will be upgraded to provide the necessary support for the new conveyor upgrades and additions.

The existing emergency stock-out system (telescopic chute at the head-end of Conveyor 2) will be replaced with a new chute, which will feed a new 72-inch Silo Feed Conveyor. The new Silo Feed Conveyor will also be provided with a motorized belt plow to form a new emergency stock-out pile. The new emergency stock-out pile formed at this location will contain approximately 28,000 tons, and will provide coal to the existing reclaim hopper, as well as to a new reclaim hopper. Coal will be transferred to inactive storage from this location by mobile equipment. A new dual reclaim hopper with two (2) vibrating feeders will be provided (adjacent to the existing reclaim hopper) which will transfer coal from the emergency stock-out pile to a new Crusher House. The inactive storage pile will contain approximately 697,000 tons of coal for Units I and II. In order to provide 4 days live storage for new Big Stone II, three (3) new concrete yard storage silos will be constructed to provide an additional 36,000 tons of dedicated storage. Each yard silo will be 70 feet in diameter by approximately 196 feet tall, with a single conical mass flow hopper. Coal will be withdrawn from each yard storage silo by a variable speed belt feeder, and transferred to the new Crusher House via a new 36-inch belt conveyor rated at 725 tph.

New conveyors for Big Stone II will be provided in enclosed (enclosed with corrugated roofing and siding on both sides of the gallery) walk-thru conveyor trusses. The revised coal handling system for Big Stone I and II is shown in Exhibit 2-3.

2.2.4.4 Coal Crushing

A new totally enclosed Crusher House will receive coal from the Live Storage Silos (or from the reclaim system). The Crusher House will contain a surge bin, two variable speed belt feeders, two ring granulator crushers and motors, and all necessary chutework and gates. Each crushing system will be capable of reducing the received coal to the required size at a rate of 725 tph. Coal from the new Crusher House to Big Stone II will be provided by new dual 36-inch belt conveyors.

2.2.4.5 "In-Plant" Coal Silo Fill System

Each Plant Feed Conveyor will transport coal to the surge bin located in the new plant transfer tower. A new surge bin will be provided with cut-off gates and two variable speed belt feeders which will feed two silo-transfer cascade conveyors. Each silo transfer cascade conveyor will feed dual en-masse "in-plant" coal silo fill conveyors at the rate of 725 tph.

2.2.4.6 Coal Handling Dust Control System

Dust control for the existing railcar unloading baghouse dust collectors (4) will be upgraded by replacing all the internal bags with new bags. Dust control for the new coal handling system will be a dry baghouse type collection system and/ or passive dust control system, or other devices with similar particulate removal efficiencies, designed to limit particulate emissions in compliance with current local, state and federal rules and regulations.

Baghouse type dust collectors will be complete with walk-in clean air plenum, centrifugal fan, ductwork, and dust return systems. Passive dust control systems will be provided with Discrete Element Modeled (DEM) transfer chutes. The DEM design will simulate and predict material flow and behavior during the system design process. These two dust control systems (either separately or in combination) will be provided at the following locations:

- Live Storage Silos & Reclaim System
- Crusher House
- Plant Transfer Tower and Silo Fill System

2.2.5 Other Materials Receiving, Handling, and Storage

2.2.5.1 Limestone Handling and Storage

Limestone required for the Wet Flue Gas Desulfurization (WFGD) system will be transported to the Big Stone site by rail or by truck depending on which is the most cost-effective means of transportation.

Limestone will be used in the flue gas desulfurization system to remove sulfur dioxide (SO_2) from the flue gases. Limestone will be received by rail (100 tons per railcar) or truck (22 tons per truck) deliveries, and unloaded through a track/truck hopper. Vibrating feeders will transfer limestone from the receiving hopper to the unloading conveyor at the rate of 500 tons per hour. The unloading conveyor will transfer limestone to a stacking tube at the limestone storage pile. The stacking tube will reduce dust generation during stack-out operations. The storage pile will contain approximately 30 days of limestone (approximately 15,000 tons) and will be provided with an "umbrella" type cover to provide weather protection. The limestone pile "umbrella" cover will be approximately 160 feet in diameter and 63 feet in height.

Limestone consumption is projected to be a maximum of approximately 10.7 tph, or 94,000 tons per year (tpy) for Big Stone II and approximately 10.4 tph or 91,000 tpy for Big Stone

Plant unit I. Therefore, the maximum limestone consumptions for both units combined is approximately 21.1 tph or 185,000 tpy. Limestone reclaim will be accomplished via three vibrating reclaim feeders (one under the stacking tube rated at 500 tph and the remaining two on opposite sides of the stacking tube, each rated at 125 to 250 tph) located in the reclaim tunnel discharging to the limestone reclaim conveyor.

The limestone reclaim conveyor will be designed to convey limestone to the day bins at the rate of 500 tph. Limestone will be fed to the first day bin or diverted to the second day bin via a motorized gate and transfer chute. The limestone reclaim conveyor will be provided with a belt scale and a magnetic separator. All transfer points will be shrouded and provided with dust control systems (see Exhibit 2-4).

2.2.6 Fire Protection

The Project will include an integrated fire protection program. While this fire protection program includes monitoring and extinguishing equipment, a well-trained work force is the first line of defense in the fire protection program. All employees will be trained on the fire protection program as an important part of job training.

The fire protection system will include an extension of the existing underground fire protection loop around the Project. Laterals will extend from this loop into key areas including the main power block, air pollution control equipment, ammonia storage, coal handling, and boiler burner areas. Fire hydrants will be located at intervals along the fire protection loop and laterals as required for proper fire protection coverage.

The water supply for the fire protection loop will be provided from the existing Big Stone Plant unit I cooling pond. Water will be delivered from the cooling pond to the fire protection loop by new electric- and emergency diesel engine-driven fire water pumps. The pumps will be located in a new intake structure located adjacent to the existing Big Stone Plant unit I cooling pond intake structure. A small electric jockey pump will maintain pressure on the fire protection loop to prevent cycling of the fire protection pumps. Electric booster pumps will be included in the boiler building if required to assure adequate pressure to the highest required level in the boiler.

An automatic sprinkler fire protection system will be provided for the entire coal handling conveying system. In addition to the sprinkler system, alarms, fire hoses, and cabinets containing all necessary appurtenances (e.g., extinguishers, shovels, and other control equipment) also will be provided. All sprinkler systems will be Underwriter's Laboratory listed, Factory Mutual approved, and in accordance with National Fire Protection Association guidelines. Water for the sprinkler system will be provided by the primary fire protection loop..

Fire protection systems will be included for key areas including the steam turbine lube oil and hydrogen seal oil systems, coal pulverizers, and other critical areas. These systems will comply with local regulations and Owner insurance requirements.

2.2.7 Waste Management

2.2.7.1 Coal Combustion By-Products

Coal combustion by-products will consist primarily of bottom ash, fly ash, and gypsum from the wet FGD system. The estimated average and maximum production rates for these by-products for Big Stone II and Big Stone unit I are presented in Table 2-2 (assuming 88 percent capacity factor for average waste generation and 100 percent capacity factor for maximum waste generation):

Table 2-2 Estimated Coal Combustion By-Product Generation

By-Product	Big Stone II Average	Big Stone unit I Average	Big Stone II Maximum	Big Stone unit I Maximum
Bottom Ash	32,000	84,000	73,000	230,000
Fly Ash	127,000	45,000	293,000	124,000
Gypsum	62,000	51,000	183,000	177,000
Total	221,000	180,000	549,000	531,000

Bottom Ash

Bottom ash will be removed from the bottom of the boiler by drag chain conveyor, and transferred to a temporary storage area for loading, transport, and disposal in the onsite landfill.

Fly Ash

Fly ash collected by the baghouse will be pneumatically conveyed to fly ash storage silo. The fly ash will be unloaded from the silo to trucks for potential sale and shipment offsite to customers for use in Portland cement concrete, soil stabilization or as structural fill.

Excess fly ash or fly ash not meeting marketable specifications will be disposed in the onsite landfill. Fly ash will be mixed with water for dust control when it is loaded into trucks or scrapers for transport to the onsite landfill. While transfers to the silo will be controlled by bin vent filters, all exposed (uncontained) ash will be wetted prior to any handling operations in the open.

Fly ash collected in hoppers from the economizer and selective catalytic reduction (SCR) sections will be conveyed to the bottom ash hopper, where it is mixed with bottom ash. The bottom ash will be removed from the boiler with the bottom ash drag chain conveyor, and will ultimately be disposed in the onsite landfill along with the fly ash.

Gypsum Handling and Disposal

Dewatered waste slurry (FGD sludge) from the extended aeration flue gas desulfurization (FGD) process is gypsum ($CaSO_4 \bullet 2H_2O$). At present, it is anticipated the gypsum will be disposed in the onsite landfill. The gypsum material from the dewatering system (vacuum filters) will be mechanically conveyed to a temporary storage area for loading into trucks for transport to disposal at the onsite landfill. However, in the future the gypsum could potentially be sold and shipped by truck to customers for use as feedstock in the manufacturing of sheetrock or wallboard for buildings.

2.2.7.2 Onsite Combustion Product Landfill

Combustion by-products that cannot be marketed for reuse will be transported by trucks or scrapers to the onsite landfill for disposal. Before being loaded into trucks, dry fly ash will be mixed with approximately 20 percent (by weight) water for dust control. Once hydrated, fly ash will become a stable cemented material as it dries. Bottom ash and gypsum will be in a stable form that can be transported directly to the onsite landfill. At the landfill, fly ash, bottom ash, and gypsum will be distributed in layers and compacted. Water from the stormwater pond and other plant wastewater sources will be applied to the layers to assist in compaction and dust control.

The existing landfill will accommodate approximately 10 years of disposal before it will need to be expanded. This projection is based on average coal characteristics, an 88 percent plant capacity factor, and average ash and sulfur content of the coal.

2.2.7.3 Other Solid Waste

Solid wastes other than coal combustion by-products generated by the addition of Big Stone II will include construction debris, office waste, laboratory wastes, and wastes generated during normal operation and maintenance activities.

Construction debris will include packaging materials, metal used for securing transported equipment and materials, and painting and cleaning residues. During construction, removal of construction debris, packing materials, trash, and office waste are expected to require on average three, 40-cubic yard roll-off containers per day. This solid waste will be transported offsite to an approved solid waste landfill for disposal.

When construction is completed, solid waste materials will be generated on a daily basis, including plastics, cardboards, paper, small pieces of wood, food waste, miscellaneous trash, and office waste. The non-hazardous wastes are expected to require one, 20-cubic yard container picked up twice a week. The waste will be trucked by a private contractor to an approved solid waste landfill or treatment facility.

2.2.7.4 Chemical Materials and Waste

Most materials classified as hazardous under state and federal laws that may be used and stored at Big Stone II relate to water treatment needs and operation of the air pollution control equipment.

All liquid reagents will be trucked or shipped via rail to the site and stored in specially designed containers within containment areas. These areas will be designed to contain 110 percent of the capacity of the largest storage tank within the containment structure. All hazardous solid reagents will be trucked to the site and stored in flow bins or silos specifically designed for these materials. All hazardous reagents will be stored in a manner that will inhibit any inter-mixing and subsequent reactions. Reagent storage and cleanup procedures will be included in the site's OSHA Process Safety Standards or HAZWOPER plans as appropriate. Oils and fuel storage and cleanup will be included in the Site's Spill Prevention, Control, and Countermeasure (SPCC) Plan. Hazardous gaseous materials such as anhydrous ammonia will have local leak detection indication in the plant control room and have a site Risk Management Plan in accordance with federal, state, and local regulations. Material Data Safety Sheets (MSDS) for all reagents will be maintained onsite, with copies provided to the appropriate agencies. The key reagents/materials expected to be used onsite for Big Stone II are listed in Table 2-3.

Table 2-3 Expected Big Stone II Chemical Use Summary

Material	Annual Use	Delivery Method and Amount per Load	Delivery Frequency	Storage Method and Location	Amount Stored Onsite
Wastewater Treatment System					
Scale Inhibitor	1,000 gallons	Truck 250 gal. Tote	Four times per year	Tote with curbed area	500 gallons
Sulfuric Acid (96%)	10,000 gallons	Truck 3,000 gallons	Four times per year	Bulk Tank w/ containment	6,000 gallons
Anti-Foaming Agent	500 gallons	Truck 250 gal. Tote	Two times per year	Tote with curbed area	500 gallons
Sodium Hydroxide (50%)	1,000 gallons	Truck 250 gal. Tote	Four times per year	Tote with curbed area	500 gallons
Cooling Tower Chemicals					
Sulfuric Acid (98%)	310,000 gallons	Truck 3,000 gallons	Twice a week	Bulk Tank w/ containment	6,000 gallons
Dispersant	5,600 gallons	Truck 1,500 gallons	Four times per year	Bulk Tank w/ containment	3,000 gallons
Scale Inhibitor	13,400 gallons	Truck 1,500 gallons	Nine times per year	Bulk Tank w/ containment	3,000 gallons
Biocide – 12.5% NaClO	100,000 gallons	Truck 4,000 gallons	Twenty-five times per year	Bulk Tank w/ containment	6,000 gallons
Boiler Makeup RO/EDI					
Sodium Chloride (10%)	500 gallons	100 lb bag	Once a year	Chemical Storage Area	100 lb
Cycle Chemical Feed					
Oxygen	500 lb	150 lb cylinders	Once a year	Cylinder storage area	500 lb
Other Chemicals and Fluids					
Anhydrous Ammonia	870,000 gallons	Truck 8,000 gallons	Weekly	Bulk Storage Tank	30,000 gallons
Hydrogen	2,000 lb	Truck -	Weekly	Bulk Storage Tank	25,000 gallons
Nitrogen	500 lb	Truck - Cylinders	Monthly	Cylinders	500 lb
Carbon Dioxide	2,500 lb	Truck - Cylinders	Monthly	Cylinders	2,500 lb

Material	Annual Use	Delivery Method and Amount per Load	Delivery Frequency	Storage Method and Location	Amount Stored Onsite
Lubricating Oil – Turbine Lube Oil	Negligible	Truck - Barrels	As required	Storage Tank with curbed containment	5,000 gallons
Electro-hydraulic Fluid	Negligible	Truck - Barrels	As required	Storage Tank with curbed containment	500 gallons
Diesel Fuel – Fire Pump	500 gallons	Truck	Monthly or as required.	Tanks with containment	500 gallons
Diesel Fuel – Emergency Diesel Generator	500 gallons	Truck	Monthly or as required	Tanks with containment	500 gallons

All reagents will be consumed onsite. Any non-hazardous waste will be shipped offsite by contractors to be recycled when possible or transported to an approved treatment or disposal facility.

Although hazardous wastes will be minimized wherever possible, small quantities of such wastes will be generated. Hazardous wastes expected to be generated include discarded chemical products and other listed hazardous wastes. Any regulated quantities of hazardous materials that are not recyclable or reclaimable will be trucked by licensed contractors to a location approved for the disposal of the materials.

2.2.8 Water Supply and Wastewater Management

A schematic diagram of the existing and future water supply system and water balance are shown in Exhibits 2-5 and 2-6. Big Stone II will be immediately adjacent to existing Big Stone Plant unit I. Big Stone II will be a zero liquid discharge (ZLD) facility, which utilizes wastewater concentration equipment designed so that no wastewater will leave the facility. Big Stone II systems have been designed to reuse water within the facility such that fresh makeup water consumption from Big Stone Lake is minimized.

The addition of Big Stone II will change the plant site's water utilization procedures. Exhibit 1-2 shows the location of the additional makeup storage and Exhibit 2-2 shows the location of proposed treatment ponds and equipment. A new makeup storage pond will be created to provide storage that will be used as a source of water for the existing Big Stone Plant unit I cooling pond. The existing evaporation and holding ponds will also be converted into a single makeup storage pond. Valves and new piping will be installed to allow water to be pumped from Big Stone Lake to the new storage pond, existing cooling pond, or to the converted evaporation and holding ponds. Two pump stations will be added to allow water to be pumped from the converted ponds and the new storage pond to the cooling pond.

In order to conserve fresh water, a cooling tower will also be constructed for Big Stone II. Makeup for the cooling tower circulating water will be provided from the existing cooling pond. Big Stone II would have its own circulating water system piping and pumps.

Additionally, a new holding pond for cooling tower blowdown/scrubber supply water will be constructed adjacent to the new Big Stone II cooling tower. This divided pond will supply makeup water to the Big Stone II scrubber. Overflow from the higher quality section of the cooling tower blowdown pond, as well as scrubber system blowdown, will be discharged into the lower quality section of the cooling tower blowdown pond, which in turn will discharge to the brine concentrators.

An additional brine concentrator will be installed to handle the additional blowdown stream flow. Recovered water from the brine concentrators will be used as the supply for boiler process water, or pumped to the ethanol plant with excess brine concentrator product returned to the Big Stone unit I cooling pond.

2.2.8.1 Water Sources and Transport

The fresh water makeup requirement for operation of existing Big Stone Plant unit I is approximately 4200 acre-feet per year. With the addition of Big Stone II, the total fresh makeup requirement for the Big Stone Station will increase to approximately 10,900 acre-feet per year. Both plants will draw plant makeup water from Big Stone Lake, which, in turn is recharged by precipitation from the surrounding basin. Makeup water is drawn from Big Stone Lake to refill onsite makeup ponds, provided the lake is at acceptable levels in accordance with the water appropriation permit from the State of South Dakota. Currently, the permit authorizes the appropriation of up to 100 cubic feet per second (cfs), and up to 8,000 acre-feet per year. Additional water appropriation up to a total annual volume of at least 15,300 acre-feet will be requested.

The existing cooling pond currently has the capacity to store onsite a full year of makeup water for Big Stone Plant unit I. Additional makeup storage will be added to allow for sufficient storage capacity to operate both existing Big Stone Plant unit I and the additional Big Stone II, during most drought conditions, without recharging onsite storage from Big Stone Lake.

Big Stone Lake is located approximately ¼ mile east of the northeast corner of the existing evaporation pond. Currently, three existing pumps deliver water from Big Stone Lake to the site. Two pumps can each deliver approximately 50 cubic feet per second (cfs), giving a total of approximately 100 cfs pumping capacity. The current water permit allows for a maximum of 100 cfs being withdrawn from the lake at any one time. The third pump can deliver approximately 10 cfs and it is used to during those time periods when the water appropriations permit allows pumping but at rates of less than 100 cfs. The additional makeup will come from extended operation time of the existing pumps.

Makeup water from Big Stone Lake is currently delivered via an existing 48-inch concrete underground water pipeline to the Big Stone cooling pond. For Big Stone II, those pipelines would be modified to allow water to be transported to the new storage makeup pond or the existing holding pond. The pipeline system will also be modified to allow water to be pumped from the new storage pond and the converted ponds to the cooling pond.

2.2.8.2 Water Quality and Treatment

Existing Big Stone Plant unit I is a zero liquid discharge (ZLD) facility. Existing Big Stone unit I cooling pond water quality is currently being maintained by a cold lime softening process and also by blowing down approximately 1457 acre-feet per year of water to the evaporation pond. The blowdown water is allowed to evaporate to concentrate solids. From the evaporation pond, the water is drained to a holding pond, and is allowed to evaporate further. From the holding pond, the water is pumped to the brine concentrator, which concentrates the blowdown water into a brine sludge, which is then pumped to the brine sludge pond. Exhibit 1-3 shows the locations of the existing water ponds.

In the new arrangement, the blowdown from the existing Big Stone Plant unit I cooling pond will be used as makeup to the Big Stone II cooling tower. Using the cooling pond blowdown in this manner serves two purposes. First, using the lesser quality blowdown from the Big Stone Plant unit I cooling pond as the makeup water for the Big Stone II cooling tower is a better water management approach than using fresh water for makeup to both the Big Stone Plant unit I cooling pond and Big Stone II cooling tower. Additionally, the cooling tower serves the function of an evaporation pond in that it will also concentrate solids by evaporation. However, evaporation from the cooling tower will provide the added benefit of providing a source for heat rejection from the steam cycle.

The cooling tower evaporation will concentrate the dissolved solids within the circulating water quality before blowing it down to the new cooling tower blowdown pond. The new cooling tower blowdown pond will supply makeup water to the Big Stone II scrubber. Blowdown of reclaim water from the scrubber and overflow from the cooling tower blowdown portion of the pond will flow into a segregated portion of the cooling tower blowdown pond. That blowdown stream will be sent to a pair of brine concentrators; one existing and one new. From there, brine sludge will be sent to the existing brine sludge pond, or to a new crystallizer which will convert the brine sludge into a solid. The dewatered brine sludge and the crystallizer solids will be disposed in the onsite ash disposal landfill.

It should be noted the existing Big Stone Plant unit I cooling pond will benefit from the new arrangement in the form of lower cycles of concentration. The cooling pond currently runs up to 3.0 cycles of concentration; this will be reduced to 1.5 cycles in the new arrangement.

2.2.8.3 Water Storage

Fresh water from Big Stone Lake will be stored in the existing Big Stone Plant unit I cooling pond, in the new Big Stone II makeup pond, and in the existing holding and evaporation ponds which will be converted into additional makeup ponds. A pipe installed in the dike between the converted ponds will be used to connect the ponds, effectively turning them into a single pond. The surface area and storage capacity of the four ponds are listed in Table 2-4.

Table 2-4 Water Storage Ponds

	Surface Area (acres)	Storage Volume (acre-ft)
Existing Unit I Cooling Pond	340	5,440
New Makeup Pond	450	9,900
Evaporation Pond	143.6	1,436
Holding Pond	96.5	965

Water will be delivered from Big Stone Lake to the converted evaporation and holding pond, or directly to the new makeup storage pond. Water delivered to the converted evaporation and holding ponds will subsequently be fed into the existing cooling pond. If water is delivered to the new makeup storage pond, it can be pumped either to the converted storage ponds, or directly to the cooling pond.

2.2.8.4 Cooling Tower Blowdown and Plant Wastewater Treatment

Big Stone II heat rejection will be accomplished by utilizing a mechanical, counter-flow cooling tower as described in Paragraph 2.2.1.4. The cooling water quality in the cooling tower will be maintained by adding water-conditioning chemicals and by blowing down a portion of the circulating water to the cooling tower holding pond. Makeup for water lost due to cooling tower evaporation and blowdown will be provided from the existing Big Stone Plant unit I cooling pond. The cooling tower blowdown will control the concentration of potential scaling parameters such as calcium hardness and silica. Circulating water in the cooling tower will be allowed to concentrate to about 3.7 cycles of concentration based on maintaining silica at 150 mg/l or less. Blowdown from the cooling tower will be sent to one of two cells of the cooling tower blowdown pond. Water from this cell will be used as makeup water to the FGD scrubber. Any excess water will overflow to the second cell, the wastewater cell of the cooling tower blowdown pond. In order to minimize corrosion, the chloride content in the FGD scrubber is controlled to acceptable concentrations via a reclaim water purge stream from the scrubber, which is sent to the wastewater section of the cooling tower blowdown pond. All water entering the wastewater section of the cooling tower blowdown pond will be directed to the existing and new brine concentrators. The brine concentrators produce distilled quality product water which will be reused by other plant services or pumped to the ethanol plant, with the excess being returned to the Big Stone Plant unit I cooling pond. The waste stream from the brine concentrator contains a very high concentration of salt, which will be directed to the existing brine sludge pond or further treated using a crystallizer. The crystallizer will produce a dry product suitable for landfill disposal.

2.2.8.5 Storm Water Control

Storm water will be controlled during construction using best management practices in accordance with the Project Storm Water Pollution Prevention Plan. After construction, all disturbed areas not covered with structures or pavement will be stabilized to prevent erosion from wind and water.

2.2.9 Electrical

The output of the new generator will connect to the 230 kV transmission system through a new generator step-up transformer and switching equipment. The auxiliary electrical system of the new facility will connect to the existing 13.8 kV bus in the 230 kV switchyard. An additional 230 kV/13.8 kV transformer would be installed, and the 13.8 kV bay of the substation will be converted to a ring bus to allow maximum flexibility.

The 13.8 kV bus will supply all of the startup power for the Big Stone Plant. When the plant is online, the auxiliary electrical system will be supplied by tapping a portion of the output of the generator to redundant auxiliary transformers. Connection to the 13.8 kV bus of the switchyard will be open during normal running.

To move the energy from Big Stone II out, two additional 230 kV lines will be built. The 230 kV bus will be expanded into a breaker and a half scheme to allow for the new 230 kV terminations.

2.2.10 Transportation Facilities

2.2.10.1 Train Operations and Rail Spur

Big Stone II will receive coal, and possibly other commodities such as limestone, by rail. Big Stone II will be served by the existing Big Stone Plant unit I access spur from the Burlington Northern Santa Fe mainline which is a single track main line.

The existing access spur (Exhibit 1-3) begins at a turnout just east of the bridge crossing the North Fork of the Whetstone River about ¾ mile southwest of Big Stone City. From the turnout, the access spur turns back to the west and stays on the north side of the North Fork of the Whetstone River to the plant site. There is an overpass where the access spur crosses 484th Avenue.

On the plant site, the existing rail facilities include the loop track for unit train coal deliveries and two plant sidings. One of the plant sidings provides rail access to the Big Stone Plant unit I turbine building. The other plant siding stops approximately 180 feet west of the west side of the Big Stone Plant unit I turbine building.

The existing plant sidings will be removed as required to provide space for the Big Stone II turbine building. The turbine building access siding will be used for access to the Big

Stone II turbine building. The other siding will be used for rail limestone deliveries and a new siding will be constructed parallel to this existing track for limestone car storage.

2.2.10.2 Primary Access Road

The Big Stone Plant site will continue to be accessible from U.S. Highway 12 at Big Stone City via State Highway 109 and County Road 34 (144th Street) and from U.S. Highway 12 approximately 1.5 miles southwest of Big Stone City via County Road 4 and 484th Avenue to the plant site (see Exhibits 1-1 and 1-2). State Highway 109, County Road 34, County Road 4, and 484th Avenue are all paved roads.

2.2.10.3 Construction Access Roads

The primary access roads will also be used as the construction access roads.

2.2.10.4 Pond Access Roads

Access to the existing Big Stone unit I cooling pond, evaporation pond, and holding pond is from existing roads. Access to the Big Stone II cooling tower blowdown pond will be by a new road connecting to the existing plant roads. The new makeup storage pond access will be a new road constructed from County Road 34 (144th Street).

2.3 Construction

Construction is expected to commence in the spring of 2007 after all necessary permits and approvals are obtained. Construction will span a period of almost four years, with commercial operation of Big Stone II projected to begin the spring of 2011.

Commercial operation will be dependent upon successful completion of permitting, engineering, major equipment procurement and delivery, and critical construction and start-up sequences, on or before required schedule dates.

Critical work sequences include purchase of major equipment, including the steam turbine, boiler, air pollution control systems, which are needed to support engineering, fabrication and onsite delivery requirements for construction. In general, construction work sequences will be as follows:

- Mobilization
- Sitework and Foundations
- Erection of Structures and Buildings
- Installation of Major Equipment

- Installation of Supporting Systems
- Electrical and Controls Testing and Functional Check-out
- Start-up of Equipment and Systems
- Initial Operation
- Performance and Environmental Testing
- Commercial Operation

Key construction milestone dates, based on a Commercial Operation Date in March 2011, are presented in Table 2-5.

Table 2-5 Key Construction Milestones

Activity	Expected Start
Mobilization	March 2007
Start Sitework and Foundations Construction	April 2007
Start Boiler Steel Erection	May 2008
Complete Sitework and Foundations Construction	September 2008
Start Steam Turbine Erection	October 2008
Start Boiler Erection	November 2008
Start Material Handling System Erection	December 2008
Start Balance of Plant Construction	February 2009
Complete Boiler Steel Erection	February 2009
Complete Material Handling System	August 2009
Energize Substation	November 2009
Complete Steam Turbine Erection	December 2009
Complete Boiler Erection	March 2010
Complete Boiler Hydro	April 2010
Start Boiler Commissioning	April 2010
Start Steam Turbine Commissioning	May 2010
Complete Balance of Plant Construction	May 2010
Complete Steam Turbine Commissioning	July 2010
Complete Boiler Commissioning	August 2010
Initial Energy & Synchronization	August 2010
Start Tuning, Performance & Availability Testing	September 2010
Complete Tuning, Performance & Availability Testing	March 2011
Commercial Operation	April 2011

The Project is projected to employ approximately 1,400 workers during peak construction. The onsite worker peak is projected to be around 28 months after mobilization. Based on mobilization in March 2007, peak onsite workers would occur starting August 2009 (see Section 5.1).

Mobilization at the site will be the first construction activity, with the contractor(s) setting up construction field offices, communications, etc.

Temporary facilities and infrastructure necessary to support construction, will follow mobilization and will include activities such as, site security fencing and entrances, roads, construction parking, equipment and material lay-down yards, construction power centers, potable water, sanitary sewer, and temporary warehouses.

Initially, site work will consist of civil activities, including earthwork for construction of roads and ponds; excavation for foundations; below grade piping, utilities and structures; and railroad construction. Installation of protective measures to control storm water runoff and minimize erosion will precede earthwork. Control measures include sediment traps, diversion ditches, and silt traps. Storm water management practices will be in accordance with the Project Storm Water Pollution Prevention Plan (SWPPP).

Roads, drives and parking areas will be located to provide satisfactory traffic pattern and to provide access to all plant facilities. Temporary roads and parking will be crushed stone surfacing, and will be watered during dry periods to control dusting. Permanent roads will be crushed rock or surfaced with asphalt, depending on expected traffic.

Extensive concrete work for construction of foundations and structures will commence as earthwork in specific areas is completed. Major areas of emphasis and the sequence for completing foundations are steam turbine, boiler, chimney, air pollution control systems, and balance of plant.

As foundations are completed, steel erection and construction of buildings and above grade structures will commence. Mechanical and electrical equipment will subsequently be installed as areas, buildings and structures are completed. Installation of wiring, piping, and instrument and controls will follow equipment installation.

Equipment and systems of critical importance will be identified and scheduled to meet a predefined start-up sequence. The fire protection system will be a priority for personnel safety and equipment protection. Other water, and compressed air systems needed for start-up of other mechanical systems, will be the first to be started-up, along with electrical systems to provide start-up power. Control systems for these initial systems will also be required.

At boilout and steamblows, all the major systems operate to initially clean the boiler and steam piping as required to admit steam to the turbine for the first time. Turbine-generator checks are then performed, and equipment loaded to achieve boiler water purity, and to tune the systems. System operation continues with synchronization, and a switch from start-up oil firing to coal firing, as required to attain adequate load for additional testing. The unit will be operated for a period of time to provide for adjusting coal-firing equipment, and to initially tune air emissions control systems, in a phased sequence to protect equipment and confirm safe operation. Once the unit is capable of reliable full load operation, the focus will shift to tuning the unit, including air emissions control systems, to achieve guaranteed performance. Lastly, performance and guarantee testing will be performed as a condition of declaring the unit is ready for commercial operation.

Final demobilization by the contractor(s) will occur after completion of testing and punchlist items. At that time, temporary construction facilities, including construction trailers, construction equipment, temporary fencing, etc., will be removed from the site.

Construction of Big Stone II has the potential for short-term noise effects from equipment and vehicles used during the construction period. Equipment, process and sound sources that can contribute to sound levels include the following:

- Earth moving equipment
- Material-handling and transport equipment
- Impact equipment and processes (such as pile driving)
- Miscellaneous construction equipment (such as engine-driven pumps, welding machines, air compressors)
- Plant testing and cleaning (such as boil-out and steam blows)

Most of the construction equipment is engine-driven. Therefore, the main source of noise will be engine related. All engines will require mufflers. Additionally, low noise level equipment will be used when practical.

Construction will normally be performed during normal daytime working hours. Construction noise should therefore not usually be produced during the nighttime, when people are more sensitive to noise disturbances.

Traffic in the Project area will increase during the construction period, due to increased construction work vehicles, and by materials and equipment delivered by truck. The maximum effect on traffic is expected to coincide with the maximum peak workforce (see Section 5.2.5).

All construction truck traffic will be required to conform to size and weight limits established by the state and local authorities to protect streets and roads. The primary traffic impacts are expected on the following roads and highways:

- State Highway 109
- County Road 34 (144th Street)
- U.S. Highway 12 at Big Stone City

2.4 Operation and Maintenance

2.4.1 Operating Philosophy

The Project is expected to be operated at baseload and is configured to normally operate at maximum continuous rating output. The proposed Big Stone II is capable of load following with overnight/weekend/holiday load reductions (steam generator at 50-percent load); however, the advantage of a super-critical unit is its superior cycle efficiency operating at baseload. The Project is not configured to generate electricity while isolated from the utility grid or to have "black-start" capability.

All routine start-up and shutdown operations will be from a central control room via a distributed control system. The Big Stone II and the existing Big Stone Plant unit I control room will be combined in a common area. Big Stone II will share operational staff with the existing unit. The existing staff of 74 employees will be expanded to approximately 109 employees to accommodate the unit expansion. By sharing staff, both units will benefit from added flexibility and will be able to operate with fewer onsite staff per unit. Big Stone II operational characteristics are summarized in Table 2-6.

Table 2-6 Project Operational Characteristics Summary

General Project Description	
Unit Type	Super-critical Coal-fired boiler, single steam turbine
Nominal Capability	600 MW
Annual Capacity Factor	88 to 100 percent
Heat Rate	10,000 Btu/kWh (HHV)
Efficiency	34 percent
Fuel Use	
Fuel Type	Sub-bituminous Coal
Fuel Source	Powder River Basin
Maximum Expected Fuel Use Rate (at full load)	376 tons/hour
Maximum Expected Annual Fuel Use	2.9-3.3 million tons
Maximum Expected Annual Ash Generation	367 thousand tons
Water Use	
Maximum Groundwater Withdrawal Rate	0 gpm
Annual Groundwater Appropriation	0 acre-feet
Maximum Surface Water Withdrawal Rate	100 cfs
Annual Surface Appropriation	10,900 acre-feet
Annual Wastewater Discharge	0 gallons

2.4.2 Maintenance

Maintenance will consist of routine periodic maintenance, unscheduled maintenance, and scheduled maintenance.

Routine maintenance consists of periodic maintenance, usually performed with the unit online, such as lubrication of rotating machinery, repairs, cleaning, etc. In some cases, maintenance/repairs are performed with the unit offline during unscheduled outages, typically when unforeseen equipment failures are experienced. However, the objective of the Maintenance Program will be to achieve high unit reliability and minimize unscheduled outages. Additionally, redundancy will be included in the plant design for critical equipment and systems to prevent unit outages in the event of an equipment failure and also to allow maintenance of critical equipment to be performed with the unit online. The level of equipment redundancy included in the design will represent accepted industry standards for similar utility grade units.

Scheduled maintenance is performed during pre-planned scheduled unit outages. Scheduled maintenance typically includes annual outages for inspections and maintenance, and also major maintenance.

Annual outages typically require approximately two weeks. Annual outages are principally to conduct inspections of the following major equipment:

- Boiler
- Steam Turbine
- Air Pollution Control Equipment

For major maintenance, typically the entire facility will undergo an outage of approximately six weeks, every five years. Major maintenance typically includes the following:

- Steam Turbine Overhaul
- Major Boiler Repairs
- Baghouse Bag Replacement
- SCR Catalyst Replacement
- Water Treatment System Replacements

Maintenance support will be supplied by onsite staff as required for routine maintenance activities. Maintenance support for major shutdown work (boiler repairs, steam turbine overhauls, etc.) is expected to be contracted.

Big Stone II will share operation and maintenance staff with existing Big Stone Plant unit I. The existing staff will be expanded as described in Paragraph 2.4.1 above, to accommodate the unit expansion. By sharing staff, both units will benefit from added flexibility and will be able to operate with fewer onsite staff per unit.

Section 2 Exhibits

The schematic defines the overall plant process, from the time when coal enters the project site to electricity delivered to the *customers home or* business. Information relating to specific equipment or areas labeled on the schematic are defined as follows:

(1) Coal Train Car Rotary Dumper
From the 115-car unit trains are unloaded daily in the existing rotary dumper. The automated *unloading process takes approximately* 2 minutes per car and requires only 1 operator.

(2) Coal Storage building
From the rotary dumper, a belt conveyor system transfers the coal to the transfer point adjacent to the existing storage building and then to the new yard coal silos, or the yard storage pile.

(3) Crusher *house*
Coal is transferred via conveyor belt from the coal storage silos or the yard storage pile to the crusher house. There, the coal is crushed to 3/4-inch diameter before being conveyed to the plant.

(4) In-Plant Coal Silos
Once inside the plant, the coal is transferred into the in-plant **silos**, from which it's fed automatically into pulverizers that reduce its size before it is burned in the furnaces.

(5) Limestone-handling facility
From the limestone unloading structure, a conveyor transfers the limestone to the limestone day bins which are capable of holding a 72-hour supply. Limestone (calcium carbonate) is used in the wet scrubber to remove sulfur dioxide.

(6) Limestone Day Bins and Limestone Preparation Area
The day bins feed the limestone preparation system where the limestone is ground and mixed with water to form a slurry which feeds the scrubber.

(7) Boiler
The coal-fired **burners** heat the boiler to create steam. The **boiler furnace** converts 4.3 million pounds of water to steam every hour.

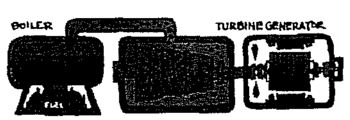
(8) Turbine
The steam generated in the boiler furnace, at a pressure of 3,690 pounds per square inch, drives blades in the **turbine** that in turn drive the generator. Steam from the low-pressure section of the turbine is exhausted into the condenser.

(9) Condenser
In the **condenser** cooling water removes heat from the low-pressure steam that has exited from the turbine. The steam is converted back to water to complete the cycle and for reuse within the boiler.

(10) Cooling Tower
The **cooling tower** provides cool water to the condenser. The heat from the condenser is exhausted to the atmosphere through evaporation in the cooling tower. Makeup water supplied to the cooling tower is fed from the existing Big Stone I cooling pond.

(11) Brine concentrator
Because water from the cooling tower is reused many times, its mineral content becomes concentrated. This can result in undesirable scaling in pipes and tubing, reducing their heat transfer efficiency. An additional **brine concentrator,** similar to the existing brine concentrator for Unit 1 removes the mineral content from the water so it can be reused within the plant to minimize fresh water use.

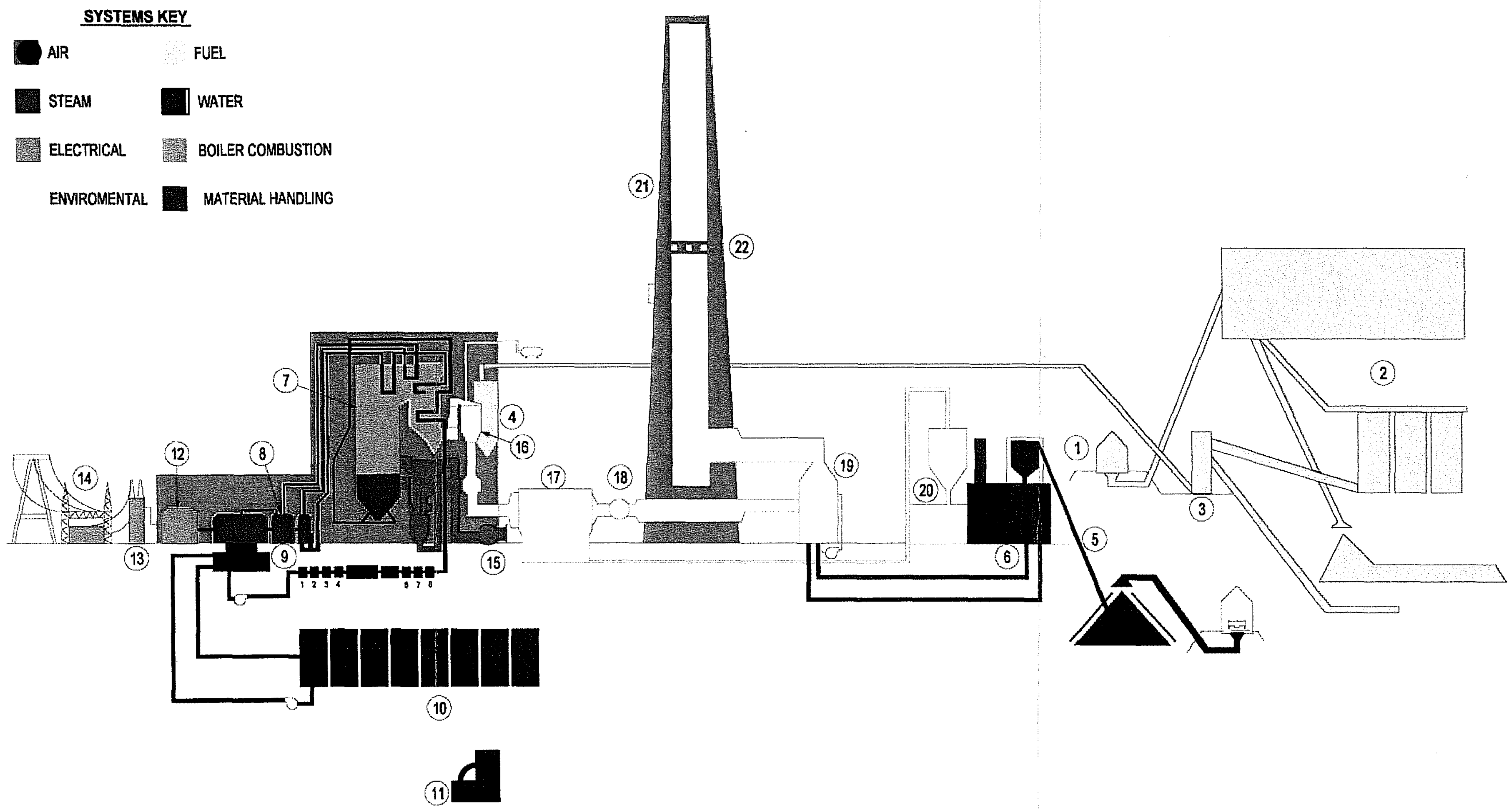
(12) Generator
The generator is driven by the steam turbine. Inside the **generator** a large spinning magnet (rotor) is surrounded by copper wire coils (stator).



The rotation of the rotor within the stationary coils, *creates a magnetic field that creates a* flow of electric current. Electricity leaves the generator at 24,000 volts.

(13) Transformer
At the **transformer** the voltage of the current *produced by the generator is increased to* 230,000 volts, and the electricity moves to the substation.

(14) Substation
From the **substation** the electricity is carried *over high-voltage transmission lines to other* transmission substations, which reduced the voltage and subsequently supply customer's homes and businesses.



(15) Forced-draft fan
For combustion, ***forced-draft fans*** *force air into the boiler furnace.*

(16) Selective Catalytic Reduction (SCR)
Flue gas exiting the boiler furnace enters the SCR. The SCR injects ammonia from a bulk storage tank into the *flue gas stream and reacts in the catalyst section to convert NOx* emissions to nitrogen and water.

(17) Fabric Filter / Baghouse
Combustion gases *(flue gas) exiting the SCR pass through large* ***baghouses,*** *which are in* essence large filter bags used to capture very fine and light ash (fly ash) entrained in the flue gas. They remove more than 99% of the fly ash (fine dust particles) from the flue gases before they leave the baghouse.

(18) Induced Draft Fans
Induced draft **Fans** are used to draw air through the baghouse and discharge the flue gas through the wet scrubber and out the chimney.

(19) Wet Scrubber
The wet scrubber sprays a limestone slurry into the flue gas stream. The calcium *carbonate in the limestone reacts* with SO_2 to remove a high percentage of the SO_2 from the flue gas stream before it is exhausted to the atmosphere through the chimney.

(20) Ash silo
Fly ash collected in the baghouse is conveyed to the fly ash silo for temporary storage. The fly ash will be unloaded from the silo to trucks for potential sale and shipment off-site to customers for use in Portland cement concrete, soil stabilization or as structural fill. Excess fly ash or fly ash not meeting marketable specifications, will be disposed of in the on-site landfill. Fly ash will be mixed with water before being loaded into trucks for transport to the on-site landfill.

(21) Chimney
After the combustion gases have been treated for SO_2, NO_x, and particulate removal, a 500-foot **chimney** exhausts and disperses the combustion gases over a wide area. The white plume visible in winter months is due to the moisture content in the flue gas.

(22) Continuous emission monitors
A **continuous emissions monitoring system** takes samples from the flue gas in the chimney. Its function is to measure and monitor the flue gas emissions after treatment to ensure that emission levels meet Environmental Protection Agency standards.

Exhibit 2-1

COAL-FIRED
POWER PLANT SCHEMATIC
Big Stone II Project
Big Stone II Co-owners

P:\41251003\Plant Schematic.CDR RLG 06-20-05

Exhibit 2-2

POWER PLANT SITE

Big Stone II Project
Big Stone II Co-owners

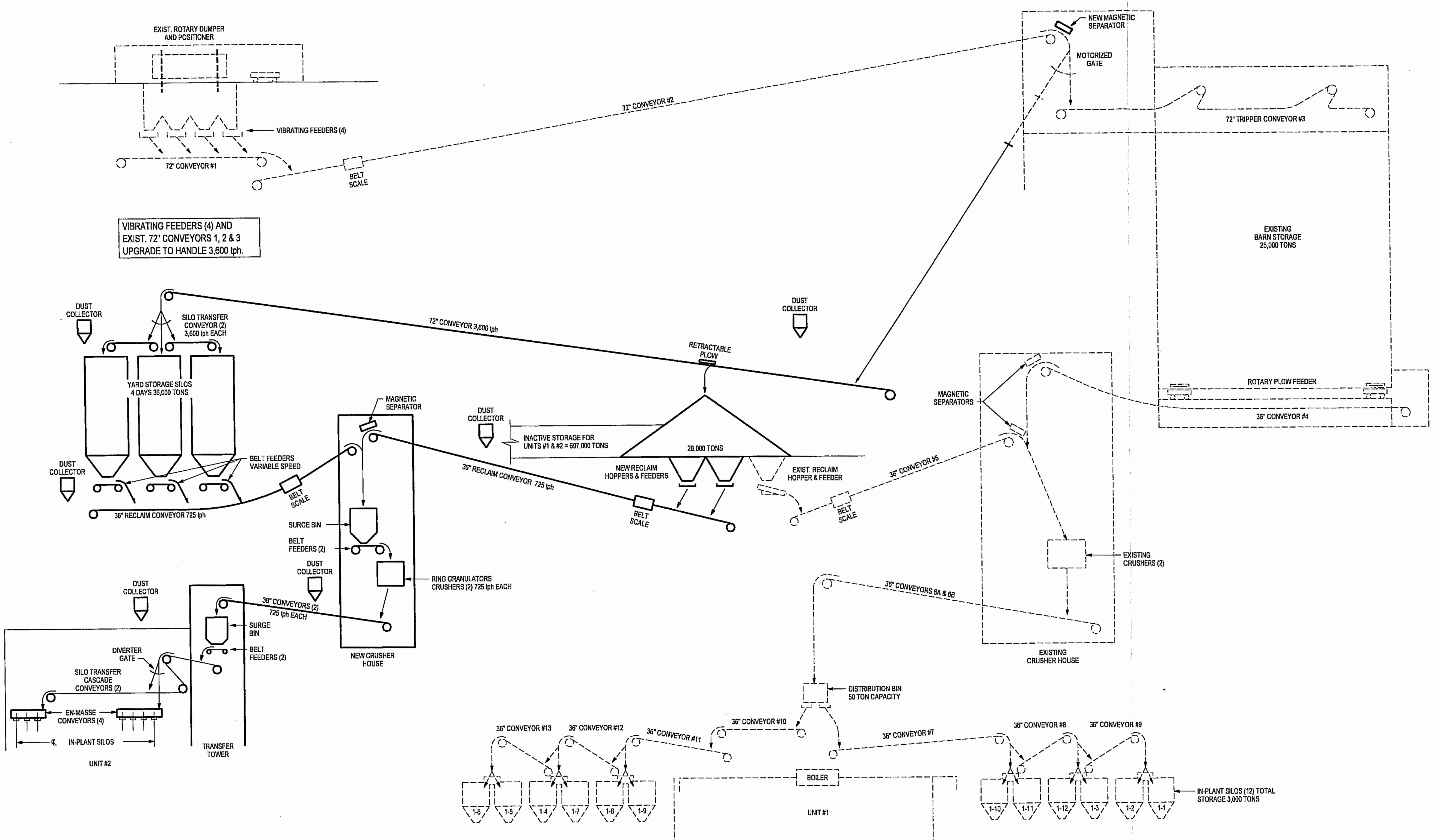


Exhibit 2-3

COAL HANDLING SYSTEM
FLOW DIAGRAM

Big Stone II Project
Big Stone II Co-owners

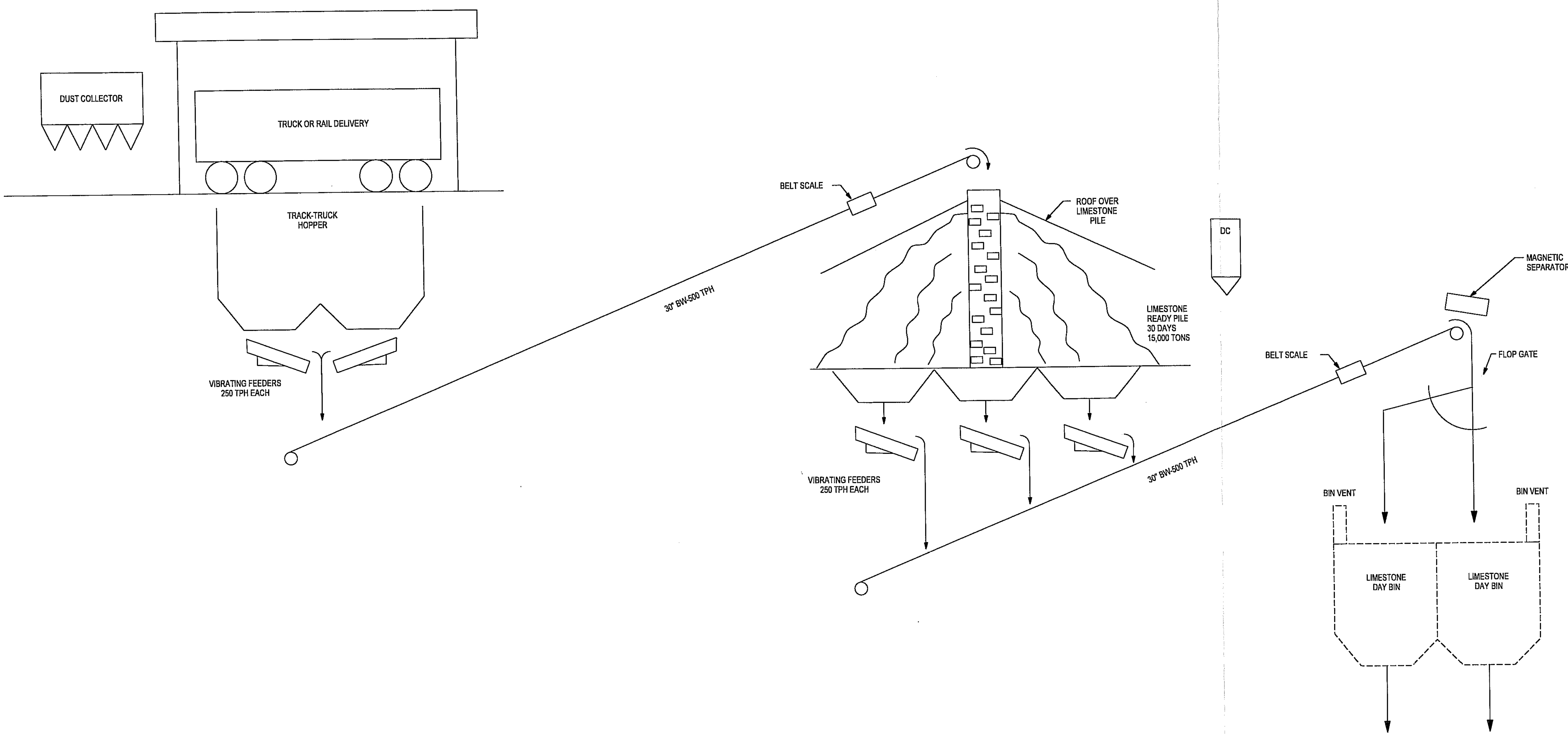
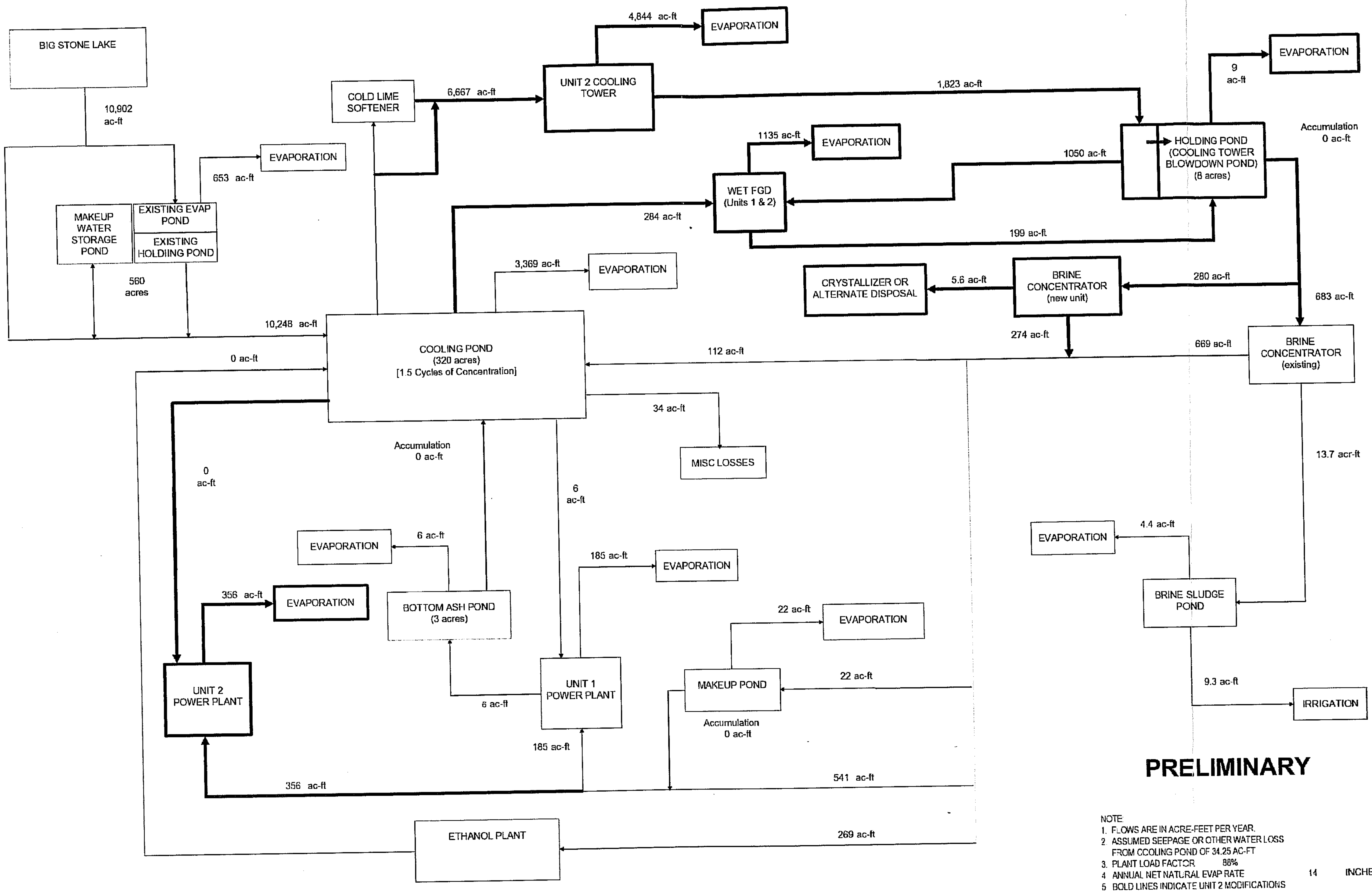


Exhibit 2-4

LIMESTONE HANDLING SYSTEM FLOW DIAGRAM

Big Stone II Project
Big Stone II Co-owners



PRELIMINARY

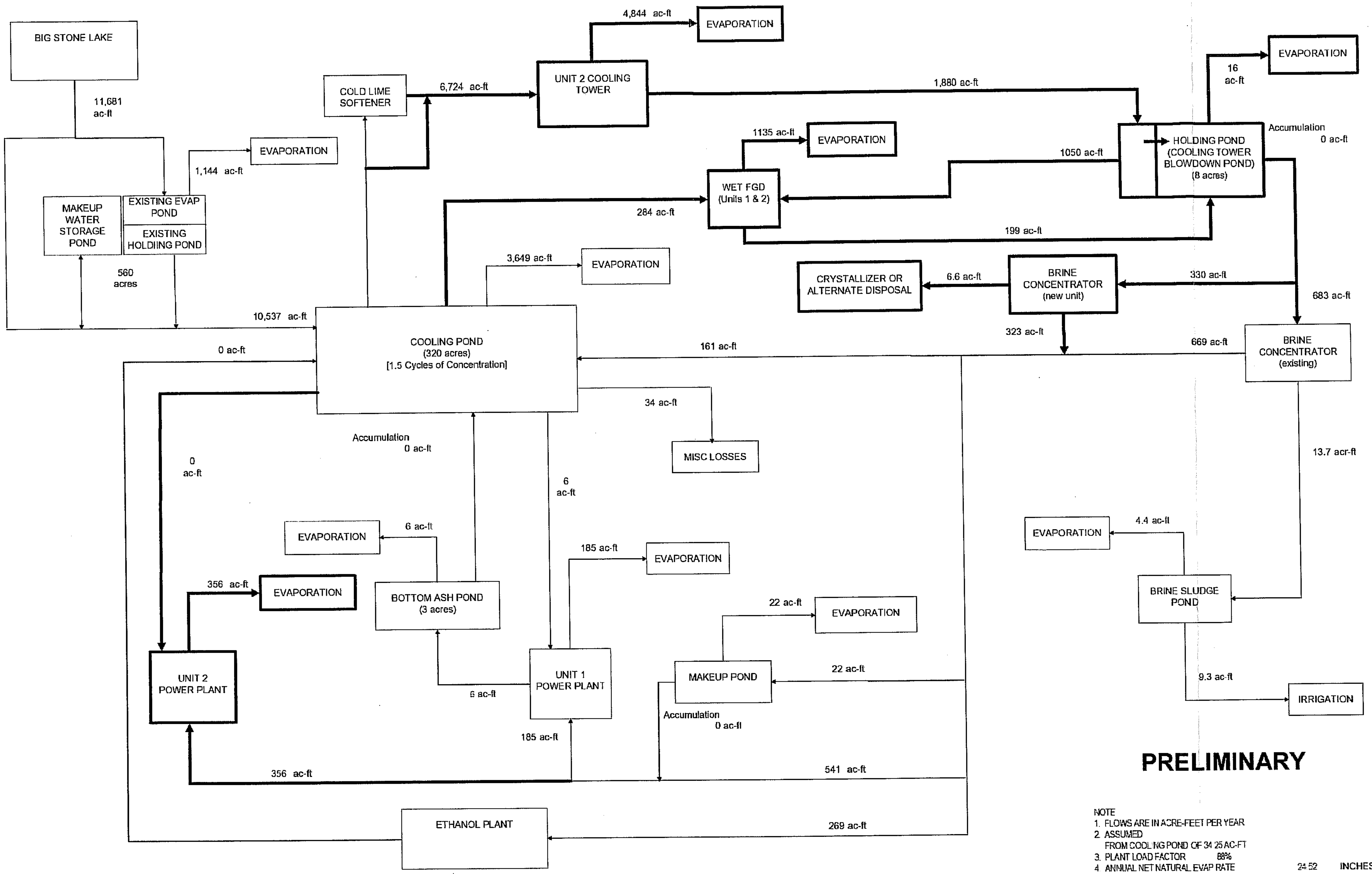
NOTE
1. FLOWS ARE IN ACRE-FEET PER YEAR.
2. ASSUMED SEEPAGE OR OTHER WATER LOSS FROM COOLING POND OF 34.25 AC-FT
3. PLANT LOAD FACTOR 88%
4. ANNUAL NET NATURAL EVAP RATE 14 INCHES
5. BOLD LINES INDICATE UNIT 2 MODIFICATIONS

Figures 2-5 and 2-5a.xls

Exhibit 2-5

WATER SUPPLY SYSTEM SCHEMATIC

Big Stone II Project
Big Stone II Co-owners



PRELIMINARY

NOTE
1. FLOWS ARE IN ACRE-FEET PER YEAR
2. ASSUMED
FROM COOLING POND OF 34.25 AC-FT
3. PLANT LOAD FACTOR 88%
4. ANNUAL NET NATURAL EVAP RATE 24.52 INCHES
5. BOLD LINES INDICATE UNIT 2 MODIFICATIONS

Figures 2-5 and 2-5a.xls

Exhibit 2-6

WATER SUPPLY SYSTEM SCHEMATIC

Big Stone II Project
Big Stone II Co-owners

Section 3

3 Facility Need

3.1 Demand for Facility

The Big Stone II Project brings together seven diverse Co-owners. There are two Investor-Owned Utilities (MDU and OTP), three municipal power agencies (WMMPA, CMMPA and SMMPA), a generation and transmission cooperative (GRE), and a public utility district (HCPD). Only OTP and MDU serve retail customers. The other Co-owners serve wholesale customers that include rural electric cooperatives and municipal utilities. Current peak summer demand for the Co-owners ranges from a low of about 90 MW for the smallest utility (HCPD) to a maximum peak demand of about 2,500 MW for the largest utility (GRE).

Despite their differences, these seven utilities share a common need for baseload resources in the 2011 timeframe. They also share a commitment to provide their customers with reliable, affordable and environmentally responsible energy. The addition of the 600 MW Big Stone II Project will satisfy those commitments as well as enhance the reliability of the transmission in the region and provide economic development benefits to Big Stone, South Dakota and the surrounding area.

3.1.1 MAPP Deficit Forecast

Based on the 2004 Mid-continent Area Power Pool (MAPP) Load & Capability study, the MAPP-U.S. utilities are forecasted to become capacity deficit starting in 2010 (MAPP, 2004). While there is surplus capacity available in MAPP-Canada, because of open access on the transmission ties between Canada and the United States, there is no guarantee that there will be transmission available to transfer energy and capacity between the regions. Exhibit 3-1 indicates the forecasted capacity surpluses and deficits for MAPP-U.S. and MAPP-Canada.

The MAPP region's energy requirements are expected to grow by more than 15 percent over the next 9 years, as shown in the Exhibit 3-2. The seven utilities in the Big Stone II Project are keenly aware of the capacity and energy situation in the MAPP region. It is a very important factor as each regional utility evaluates their future generation resource needs. While there have been a number of new natural gas fired peaking and intermediate facilities built in the last 5 to 10 years, there haven't been any large baseload facilities built in the region since the 1980s. In the next five years, the excess capacity in the MAPP region will be gone. Utilities will need to secure new capacity and energy resources to meet their customers' growing electricity needs.

3.1.2 Market Factors Affecting Demand

Additional factors play a part in the decision of the Big Stone II Co-owners to build a new baseload generating facility. Open access has created new markets for the low-cost energy that is generated in the MAPP region and this has changed the regional power market. Increasing amounts of energy from the MAPP region is now being sold to higher cost markets south and southeast of the MAPP region. This results in increasing energy and capacity prices in the MAPP region, and increasing price volatility. It is not uncommon for utilities to rely on the market to provide 10 percent to 30 percent of their energy requirements. In fact, there are utilities that have no firm energy resources and rely solely on the market for energy. Some utilities that rely on economic spot market energy purchases for a portion of their energy requirements have experienced significant price increases in recent years as well as increased exposure to market volatility. Utilities are now looking now for opportunities to lower their exposure to the volatile market prices.

Spot market purchases have been and will likely continue to be an effective way to meet short-term obligation whenever the market is economically competitive. However, this type of market purchase is not a preferred strategy for meeting baseload requirements. These types of spot market purchases provide no price certainty for energy costs. Typically, market energy prices are low when regional demand is low and high when regional demand is high. To replace a high capacity factor baseload resource such as Big Stone, a utility would be forced to take market energy at both the high and low prices. Thus, spot market purchases are extremely useful to augment a portfolio of resources, but are not an appropriate source for long-term baseload needs.

Transmission constraints in the region have severely limited many utilities' access to any surplus power that may be available for sale. Like other utilities, Otter Tail Power Company has experienced situations where it has identified an economic purchase from proposals received through a request-for-proposals, only to find that it cannot secure firm transmission to deliver the energy from the seller's system to the buyer's system due to transmission constraints. With the new MISO Locational Marginal Pricing (LMP) market in place as of April 1, 2005, utilities now have a mechanism to "buy through" these transmission constraints by paying the difference in LMP values or alternately hedging this congestion cost risk through the purchase of financial transmission rights (FTR). The new MISO market may eliminate the risk of being unable to obtain firm transmission service, but it does introduce new financial risks and associated opportunities to hedge those financial risks through the purchase of FTRs.

The new MISO LMP market may bring additional benefits and the Big Stone II Co-owners are monitoring the development and potential of this regional market. However, at this time it would be too risky to rely upon potential MISO LMP market solutions; the Big Stone II Co-owners need to have a more certain resource available to serve their baseload needs.

3.1.3 Generation Resource Type

All seven Co-owners of the Big Stone II Project have identified the need for baseload resources in the 2011 timeframe. Generation resources are typically classified as baseload, intermediate load, or peaking on the basis of energy production, which is characterized by capacity factor[1].

Baseload resources are intended to run 24 hours a day, 7 days a week with high capacity factors. The expectation is that baseload units will be generating electricity at all times except when they are down for maintenance. Baseload resources have high capital costs and low operating costs. Baseload resources are typically the most cost-effective alternative when there is a need for a relatively significant amount of energy.

Intermediate resources are capable of increasing or decreasing power production quickly, and are able to operate for long periods of time with moderate capacity factors. Intermediate resources have capital costs and fuel costs in between those of baseload and peaking resources. Intermediate resources are the most cost-effective when there is a need for a relatively moderate amount of energy.

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[1] **Capacity factor** is the ratio of the actual energy produced in a given period, to the hypothetical maximum possible that would be produced if the generating unit had run at maximum output for that same period.

Peaking resources are intended to run a limited number of hours during the year with low capacity factors. Typically these hours take place when the customer demand for electricity is high or when generation and transmission system emergencies occur. Peaking resources can respond quickly to changes in demand. Peaking resources are typically the most cost-effective generating technology when there is a need for a relatively small amount of energy. Table 3-1 summarizes generation type characteristics.

Table 3-1 Generation Type Summary

Type of Generation	Capital Cost	Fuel Cost	Typical Energy Production or Capacity Factor
Peaking	Low	High	Low
Intermediate	Medium	Medium	Medium
Baseload	High	Low	High

Exhibit 3-3 is a generic representation of the total cost of a baseload, intermediate, and peaking plant as a function of its capacity factor. In this example, the total cost includes the amortized capital cost, operations and maintenance costs, and fuel costs. The graph is presented for illustrative purposes and is based on generic assumptions for financing costs and generating technologies. These curves would be different for each utility depending on its load characteristics, available technologies, and available financing.

As can be seen from the graph, a peaking facility is the least-cost alternative for low capacity factors (to the left of Point A on Exhibit 3-3). Intermediate resources are the least-cost alternative for moderate capacity factors (in between Point A and Point B on Exhibit 3-3). Baseload resources are the least-cost alternative for moderate to high capacity factors (to the right of Point B on Exhibit 3-3).

3.1.4 Co-Owner-Specific Needs

Each Co-owner performed a system planning or resource planning analysis to determine its future resource needs. While the methodology used by the co-owners varied, their analyses consistenty considers forecast energy and capacity and available resource technologies to produce a plan that satisfies future needs.

The majority of Co-owners utilized an econometric forecast methodology to determine future capacity and energy needs. One of the Co-owners uses an end-use forecasting model for the same purpose. The level of sophistication of the forecasting method employed by a utility is dependent upon many factors including cost, staffing requirements and data availability. Econometric or end-use forecasting models can be very complex and require extensive historical data that may not always be available for some smaller utilities, rural electric cooperatives and municipals. In those cases, the alternative may be to use simpler forecasting models.

Once the future capacity and energy needs are identified, a planning model is used to evaluate potential resource alternatives. Multiple plans to satisfy future needs are considered in the process, with one plan ultimately being selected as the preferred plan. Selection of a preferred plan is based on an individual utility's own set of criteria such as cost, environmental impact, risk mitigation, compliance with applicable regulations, fuel availability, and maturity of technology. While the Big Stone II Project Co-owners have different criteria, they all selected some level of baseload generation in the 2011 timeframe as part of their preferred plan. The reasons behind the need for the Big Stone II Project may be different for the Co-owners, but they all include a combination of the following:

- Satisfying load growth,
- Replacing current capacity and energy contracts that expire,
- Reducing reliance on and exposure to market prices, and
- Addressing the limited deliverability of future capacity and energy purchases due to transmission constraints.

It is the Co-owners' energy needs that dictate that the capacity addition be a baseload generating unit. The capacity needs and energy requirements of the Co-owners are shown in Exhibits 3-4 through 3-17. The capacity needs are defined as the capacity surpluses and deficits that represent how much capacity is required to meet the Co-owner's own peak demands plus the 15 percent MAPP reserve requirement obligation. While not all of the utility systems are summer peaking, the driver behind the capacity needs for the Co-owners is the summer peak demand.

The following discussion presents each Co-owners' forecasting methodology and specific needs for baseload capacity.

3.1.4.1 Central Minnesota Municipal Power Agency

Central Minnesota Municipal Power Agency ("CMMPA") is a joint action agency that was created and incorporated as a municipal corporation and a political subdivision of the State of Minnesota. CMMPA was established to serve the mutual needs of its members and has the power and authority to finance and acquire facilities for the generation or transmission of electric energy.

CMMPA is a project-oriented agency and as such each of the members individually decides which project it chooses to participate in through CMMPA. CMMPA also allows non-member municipal utilities to participate in CMMPA projects. Each participant in a project with CMMPA, including members and non-members, is required to sign a power sales agreement ("PSA") with CMMPA.

There are currently fifteen members of CMMPA. Each member is individually responsible for providing an adequate, economical, and reliable supply of electric energy to meet the needs of its customers, and must accordingly plan for and maintain electric generation, transmission, and distribution facilities, including generation capacity reserves and other ancillary services. CMMPA d/b/a Utilities Plus ("UP"), assists the members with the purchase and sale of capacity and energy on a short-term basis or other basis, as requested and arranges for transmission services for such purchases and sales. The members rely on UP to dispatch the various member resources together with purchases from the market to minimize their total power costs.

Twelve of the CMMPA members ("Members") plus the City of Willmar, MN ("Willmar") have signed a PSA with CMMPA (collectively the Members and Willmar are referred to as "CMMPA BSP II Participants"), and CMMPA will acquire a 30 MW or 5 percent ownership interest in Big Stone II. The CMMPA Big Stone II Participants are listed below.

City of Blue Earth, MN ("Blue Earth")
City of Delano, MN ("Delano")
City of Fairfax, MN (Fairfax")
City of Glencoe, MN ("Glencoe")
City of Granite Falls, MN ("Granite Falls")
City of Janesville, MN ("Janesville")
City of Kasson, MN ("Kasson")
City of Kenyon, MN ("Kenyon")
City of Mountain Lake, NM (Mountain Lake")
City of Sleepy Eye, MN ("Sleepy Eye")
City of Springfield, MN ("Springfield")
City of Windom, MN ("Windom")
City of Willmar, MN ("Willmar")

CMMPA prepared a projection of net energy requirements and net peak demand for each of the Participants. The peak demand and energy requirements are net of station services requirements of the Participants' generating units. The historical and forecast annual net peak demand, monthly net peak demand and net energy requirements are presented for the Participants as a group.

Because of the relatively small size of the Participants and in consideration that the Participants are considering baseload facilities, a simplified method was used to prepare the projections of net energy requirements and net peak demand.

Net energy requirements were projected for each of the Participants based on reviewing the average annual compound growth rate for each Participant's total net energy requirements over several of the historical periods between 1994 and 2003. The periods reviewed included 1994 to 1999, 1999 to 2003, and 1994 to 2003. Based on this review, the average annual compound growth rate for the period 1994 through 2003 was selected and applied to 2003 net energy requirements for each Participant to project net energy requirements over the period 2004 to 2020. Actual net energy requirements reported for 2004 for all of the Participants were subsequently used in place of the projected amounts without changing the forecasted amounts for the 2005 though 2020 period.

CMMPA prepared a projection of capacity needs annual energy requirements for the CMMPA Big Stone II Participants as shown in Exhibits 3-4 and 3-5, respectively. The peak demand is projected to increase from approximately 167 MW in 2004 to 261 MW in 2020 which represents a 2.8 percent compound annual average growth rate. Net energy requirements are projected to increase from approximately 732 GWh in 2004 to 1181 GWh in 2020 which represents a 3.0 percent compound annual average growth rate.

Twelve members of CMMPA currently have a participation interest in the Nebraska City Power Station Unit No. 2 ("NC2"), a single coal-fueled generation unit with anticipated generating capacity that totals 600 MW. NC2 will be constructed and solely owned by the Omaha Public Power District ("OPPD"). The Participation Power Agreement between CMMPA and OPPD executed on September 30, 2003 (the "OPPD PPA") provides for CMMPA to purchase 2.17 percent or 13 MW of NC2.

CMMPA Big Stone II Participants capacity resources individually include a portfolio of self generation assets and various amounts of purchases from Western Area Power Administration (WAPA), Great River Energy (GRE), Alliant Energy (Alliant), and Xcel Energy (NSP). The CMMPA Big Stone II Participants also purchase power from the spot market. As shown in the table below, the CMMPA Big Stone II Participants are projected to obtain the majority of their energy needs through energy-only contract purchases and spot market purchases which are based on system incremental pricing. These two sources of energy are projected to supply approximate 70 percent of their energy needs through 2008, the year before the first new baseload coal unit is projected to be placed in commercial operation.

Table 3-2 Projection of CMMPA Energy Requirements & Energy Dispatch

Energy Resources	2005	2006	2007	2008	2009	2010	2011	2012
WAPA Resources	14%	13%	13%	13%	12%	12%	12%	11%
Wind Resources	1%	2%	3%	4%	5%	6%	7%	8%
NC2	0%	0%	0%	0%	6%	11%	10%	10%
BSP II	0%	0%	0%	0%	0%	0%	15%	25%
Alliant Purchase	6%	6%	5%	5%	5%	5%	5%	5%
Contract Energy Purchases	48%	44%	44%	42%	42%	42%	33%	25%
Self Generation	7%	7%	7%	6%	6%	6%	5%	5%
Spot Purchases	25%	28%	28%	30%	23%	18%	12%	10%

There are two major reasons why the CMMPA BSP II Members are planning to participate in the NC2 and BSP II baseload coal projects:

1. Currently a majority of the energy requirements is provided from a combination of (a) energy-only contract purchases from NSP and Great River, and (b) UP spot market purchases. Dependence on spot market purchases is expected to increase through 2008. The price for both purchases is based on incremental system costs or the highest hourly system cost.

2. Incremental system costs are expected to rise significantly in the coming decade. This is due primarily to the following reasons. Almost all new generation installed in the recent years has been natural gas units. Several older coal units have been converted from coal-fueled operation to gas-fueled operation. Thus,

the addition of new coal units is being outpaced by the future demand and the installation of natural gas fueled units. These changes have resulted in natural gas units being dispatched during an increasing number of hours per year and these gas units are being used to establish the incremental price of energy during many hours of the year.

CMMPA's strategy is to diversify its baseload requirements between two or three different baseload coal resources. This provides diversity in fuel and rail contracts, provides shaft diversity, and minimizes the potential future transmission delivery constraints. To date, only two baseload coal resources alternatives have been identified in their market region. CMMPA plans to continue to seek another baseload coal resource for their members.

3.1.4.2 Great River Energy

Every two years, GRE prepares an Integrated Resource Plan (IRP or Resource Plan) to provide the resource planning framework and action plan necessary to accomplish GRE's vision of effectively serving its member cooperatives. The most recent plan was filed on June 30th, 2005. The IRP is prepared to comply with the State of Minnesota regulations governing utility resource plans administered by the Minnesota Public Utilities Commission (MPUC). The IRP covers a fifteen-year planning horizon.

GRE compares the load forecast with its existing resources to determine its resource requirement over the fifteen-year IRP planning period. GRE utilizes a production cost model and risk analysis to compare potential plans for meeting its resource needs. A preferred plan is identified by minimizing costs and risks over the planning horizon. An action plan is identified in the IRP, which is then implemented through GRE management with the oversight of the GRE Board of Directors. Actions taken by GRE may include such things as implementing demand side management and conservation programs, issuing request for proposals for the supply of capacity and energy, partnering with other utilities on joint-build projects, and developing GRE own/build options to meet forecasted needs.

GRE's planning forecast is the sum of its 28 member systems' energy and demand forecasts. GRE assists the member systems in the development of their forecasts by providing information and forecasts that are useful in quantifying their future loads.

Forecasting at the member system level is a three-step process. First, the energy requirements for each customer class are calculated. Next, a load factor forecast for each member system is created. Using the member system's forecasted energy requirements and forecasted load factor, the member system's demand is derived.

The member systems use information prepared by GRE to assist in determining if their forecast is reasonable. If a member's forecast cannot be explained using the models constructed by GRE, additional study must be performed to explain the differences and conclude which model best describes the future. A forecast may differ because of information known about the future that is not reflected in the historical data.

Each member forecasts the number of consumers and the energy usage per consumer for the following RUS-defined customer classes:

- Residential.
- Seasonal.
- Small commercial.
- Large commercial.
- Street and highway lighting.
- Public authorities.
- Sales for resale.

In addition, GRE's member cooperatives forecast their own energy requirements ("Own Use") and line losses ("System Losses") are calculated.

Residential consumers represent more than half of GRE's end-use consumers and energy usage. In addition, residential consumer growth influences growth in other categories, such as small commercial, through service industries that develop to serve growing residential areas. Therefore, accurately forecasting the energy requirements of the residential customer class is the most critical part of constructing GRE's forecast. Based on its 2004 load forecast, GRE's summer demand is expected to grow an average of almost 93 MW per year over the planning period. This is a 3.0 percent average annual rate of increase. GRE's system energy is expected to increase at an average annual rate of 2.3 percent over the planning period. Tables 3-3 and 3-4 show GRE's historic and forecasted summer demand and energy. GRE's forecasted capacity needs and annual energy requirements are shown in Exhibits 3-6 and 3-7, respectively.

Table 3-3 GRE Historical and Forecast Summer Demand, 1980-2023

System Summer Demand (MW)			
Summer Season	*Historical & Scenario 5 Forecast*	*Growth*	*Percent Growth*
1980	908.3		
1981	870.5	-37.8	-4.2%
1982	970.2	99.7	11.5%
1983	978.9	8.7	0.9%
1984	999.8	20.9	2.1%
1985	950.1	-49.7	-5.0%
1986	1,050.5	100.4	10.6%
1987	1,106.0	55.5	5.3%
1988	1,271.7	165.7	15.0%
1989	1,270.4	-1.3	-0.1%
1990	1,323.5	53.1	4.2%
1991	1,362.8	39.3	3.0%
1992	1,252.5	-110.3	-8.1%
1993	1,359.5	107.0	8.5%
1994	1,416.3	56.8	4.2%
1995	1,552.9	136.6	9.6%
1996	1,579.4	26.5	1.7%
1997	1,609.6	30.2	1.9%
1998	1,748.0	138.4	8.6%
1999	1,875.0	127.0	7.3%
2000	1,853.9	-21.1	-1.1%
2001	2,094.4	240.5	13.0%
2002	2,164.3	70.0	3.3%
2003	2,306.1	141.7	6.6%
2004	2,413.1	107.0	4.6%
2005	2,531.5	118.4	4.9%
2006	2,637.8	106.3	4.2%
2007	2,700.3	62.5	2.4%
2008	2,788.7	88.4	3.3%
2009	2,878.2	89.5	3.2%
2010	2,966.0	87.8	3.1%
2011	3,061.2	95.2	3.2%
2012	3,149.8	88.6	2.9%
2013	3,241.2	91.4	2.9%
2014	3,338.5	97.3	3.0%
2015	3,433.1	94.6	2.8%
2016	3,527.9	94.8	2.8%
2017	3,628.5	100.6	2.9%
2018	3,724.7	96.1	2.7%
2019	3,825.6	100.9	2.7%
2020	3,924.4	98.8	2.6%
2021	4,024.8	100.4	2.6%
2022	4,126.1	101.3	2.5%
2023	4,231.0	104.9	2.5%
2004-2023		95.7	3.0%

Table 3-4 GRE Historical and Forecast System Energy Requirements, 1980-2023

System Energy Requirements (MWh)			
Year	*Total Energy*	*Growth*	*Percent Growth*
1980	4,815,196	25,372	0.5%
1981	4,848,107	32,911	0.7%
1982	5,152,535	304,428	6.3%
1983	5,244,519	91,984	1.8%
1984	5,456,572	212,053	4.0%
1985	5,534,314	77,742	1.4%
1986	5,648,060	113,746	2.1%
1987	5,744,993	96,933	1.7%
1988	6,520,353	775,360	13.5%
1989	6,731,739	211,386	3.2%
1990	6,842,027	110,288	1.6%
1991	7,233,294	391,267	5.7%
1992	7,221,443	-11,851	-0.2%
1993	7,489,350	267,907	3.7%
1994	7,950,314	460,964	6.2%
1995	8,364,841	414,527	5.2%
1996	8,784,085	419,244	5.0%
1997	8,696,612	-87,473	-1.0%
1998	9,013,032	316,420	3.6%
1999	8,955,750	-57,282	-0.6%
2000	9,025,229	69,479	0.8%
2001	9,919,757	894,528	9.9%
2002	11,030,839	1,111,082	11.2%
2003	11,407,173	376,334	3.4%
2004	11,737,280	330,107	2.9%
2005	12,183,889	446,609	3.8%
2006	12,556,817	372,928	3.1%
2007	12,833,663	276,846	2.2%
2008	13,140,069	306,406	2.4%
2009	13,470,799	330,730	2.5%
2010	13,775,316	304,517	2.3%
2011	14,104,521	329,204	2.4%
2012	14,410,904	306,383	2.2%
2013	14,735,072	324,169	2.2%
2014	15,075,413	340,340	2.3%
2015	15,404,260	328,847	2.2%
2016	15,732,621	328,361	2.1%
2017	16,074,863	342,242	2.2%
2018	16,403,890	329,027	2.0%
2019	16,751,440	347,550	2.1%
2020	17,092,478	341,038	2.0%
2021	17,440,247	347,769	2.0%
2022	17,789,406	349,159	2.0%
2023	18,151,100	361,694	2.0%
2004-2023		337,569	2.3%

The results of GRE's 2003 IRP showed that GRE would need baseload capacity in the 2010 to 2013 timeframe. The top two plans for meeting GRE's needs were less than one percent apart in total costs (as measured by present value of revenue requirements). One plan called for adding 586 MW of intermediate resources in 2007 and 521 MW of baseload resources in 2013. The other plan called for adding 300 MW of peaking resources in 2007 and 521 MW of baseload resources in 2010. Because the two plans were so similar in overall costs, GRE committed to doing additional analysis to account for non-cost factors in making its final resource decisions.

GRE has taken steps to implement its plan and has also refined its analysis. First, GRE pursued an offer to contract for capacity and energy from existing resources in the region. GRE found this plan to be preferred since it utilized excess capacity in the region, its costs were similar to the costs for construction of new resources and the added flexibility a relatively short-term purchase gives allowing deferral of new resource construction. This contract was for 130 MW of resources that have characteristics similar to baseload and another 45 MW with characteristics similar to intermediate resources. Next, GRE issued an RFP for peaking and intermediate power. Subsequent analysis showed that when including the new contract, GRE's needs were more clearly for peaking power. GRE's generation submitted the lowest bid for peaking power. GRE is now in the process of securing permits and funding for its proposed Cambridge Station, a peaking plan that will have approximately 170 MW of capacity.

The final action GRE pursued in response to its 2003 IRP analysis was to begin discussions and project development for future baseload resources. Because of the long lead-time required to permit and construct such resources, it was necessary to begin this work soon after the 2003 IRP results were known. It was through these efforts that GRE became associated with the Big Stone II project. However, before deciding to participate, GRE issued an RFP for baseload resources. The results of the RFP showed Big Stone II to be the only viable option for baseload power available at that time.

GRE continued its resource analysis and on June 30th filed its new 2005 IRP. The modeling used in this filing included in its baseline all resources that GRE had committed to (Cambridge, Big Stone II, and some new wind resources). The results of this modeling provided some additional assurance that GRE's past resource decisions (including participation in Big Stone II) are sound. Because GRE's existing resources are such a good match to its load, GRE found that different plans for meeting its future needs had relatively little difference in their overall costs. Thus, GRE plans to incorporate similar planning principles going forward: balancing its modeling results and practical realities in making sound resource decisions to serve its members needs.

Table 3-5 below shows GRE's current resource situation. The first column shows the deficits without any of the proposed resources included. The second column shows what the deficits will be after Cambridge is included. GRE has a clear need for its share of Big Stone II and will need to plan for additional resources to meet its continuing load growth.

Table 3-5 GRE Summer Resource Surplus/Deficit

YR	DEFICIT (MW)	w/Cambridge (MW)
2007	-207	-37
2008	-309	-139
2009	-412	-242
2010	-664	-494
2011	-680	-510
2012	-782	-612
2013	-888	-718
2014	-999	-829
2015	-1280	-1110

3.1.4.3 Heartland Consumers Power District

Heartland Consumers Power District (HCPD) currently has a peak demand of approximately 90 MW and annual energy requirements of approximately 600,000 MWh. Econometric models based on demographic and economic factors and weather conditions were developed for each of HCPD's customers to determine annual energy projections. The annual energy forecasts were allocated to months through the use of monthly econometric models for each customer. Monthly models included month-specific variables and additional weather and economic factors to improve the fit of the model.

Individual models were also developed for each customer to project monthly peak demands. The model relates peak demand to total energy requirements and selected weather conditions.

Each customer's monthly energy and demand forecasts were allocated to the various power suppliers for that customer. HCPD's energy and demand allocation for each customer were then aggregated to provide HCPD's monthly forecasts.

Load growth is expected to average 6 percent per year during 2005 – 2008 due primarily to the addition of several new customers. Demand and energy requirements are expected to increase by approximately 2.9 percent per year from 2009 to 2015. HCPD is actively pursuing new load to replace an expected reduction in load in 2016. Table 3-6 shows the projected demand and energy requirements for HCPD including load growth and new customer additions. HCPD's forecasted capacity needs and annual energy requirements are shown in Exhibits 3-8 and 3-9, respectively.

Table 3-6 Heartland Consumers Power District Demand and Energy Requirements

Year	Demand (MW)	Energy (MWh)
2005	94	619,692
2006	108	682,849
2007	115	715,243
2008	119	736,583
2009	123	758,859
2010	127	781,151
2011	130	803,480
2012	134	825,957
2013	138	849,538
2014	141	872,958
2015	145	896,928
2016	145	687,216
2017	91	486,679
2018	94	511,249
2019	98	535,719

2020	102	560,621

In 2005, HCPD will be purchasing more than one half of its capacity and energy resources from other utilities through participation power agreements. As these agreements expire and as HCPD's load grows, HCPD will need additional capacity and energy resources. HCPD's 25 MW share of the Big Stone II project will help to meet these resource requirements.

3.1.4.4 Montana-Dakota Utilities Co.

Montana-Dakota Utilities Co. uses an end-use forecasting model to develop a long-range (20-year) electric load forecast for its Integrated System, which comprises the service territories in Montana, North Dakota, and South Dakota.

A basic end-use forecasting procedure consists of the following steps. First, total company sales are identified by customer class. Second, the customer classes are segregated into end-use components and each end-use is defined by the equation:

Energy Use by End-Use = Number of Users in End-Use x Energy Use per End-Use

Finally, the end-uses are totaled by customer class to arrive at the forecasts by customer class.

The software used in the development of MDU's end-use forecast is SHAPES II, an integrated forecasting model from New Energy Associates, L.L.C. of Atlanta, Georgia, a subsidiary of Siemens Company.

SHAPES II is used to forecast sales for the three primary customer categories: residential, small commercial and industrial, and large commercial and industrial, while sales for the miscellaneous sector and street lighting are forecasted exogenously and then input to SHAPES II.

This basic principle leads to the development of the peak demand forecast. To arrive at the peak demand forecast, the forecasted annual sales by class are allocated to the 8760 hours of each year by applying use patterns applicable for each sales class.

Projections of capacity needs and annual energy requirements for MDU are shown in Exhibits 3-10 and 3-11, respectively. MDU's Integrated System is projected to incur a capacity deficit of 78 MW in the summer of 2007 and 102 MW in the summer of 2011. The capacity deficit further increases to 159 MW in the summer of 2020 (not shown on the graph). The Integrated System consists of the company's service territories in Montana, North Dakota, and South Dakota.

The capacity deficit would occur mainly for two reasons. First, MDU's power baseload purchase agreement with Basin Electric Power Cooperative for 66.4 MW will expire on October 31, 2006. Second, MDU's load growth projected at an annual rate of 1.1 percent will add another 54 MW of demand on the Integrated System during the next ten years.

The constraints experienced on the existing transmission system in the region will not allow the delivery of future power purchases from the potential sellers' systems to MDU's system. Therefore, the company will need the capacity (116 MW) from the Big Stone II unit to reliably serve the demand for electricity of its customers in the Integrated System.

3.1.4.5 Otter Tail Power Company

Otter Tail Power Company has worked with Christensen Associates of Madison, Wisconsin to develop a traditional econometric forecasting model to replace the previous end-use model.

Aggregate econometric models of energy sales were developed for each customer class, using historical data on monthly sales, economic activity, and weather conditions. Monthly sales forecasting models were estimated as a function of these explanatory variables, plus month-specific variables to capture any seasonal patterns that are not related to the other explanatory variables. To forecast system peak demand, an econometric model was developed that explains monthly system peak demands as a function of weather, economic conditions, the number of households in OTP service territory, and month-specific variables.

Otter Tail Power Company's projections of capacity needs and and annual energy requirements are shown in Exhibits 3-12 and 3-13, respectively. The utility experiences summer season capacity deficits beginning in 2006 with the expiration of a 50 MW capacity and energy contract coupled with the expiration of a diversity agreement under which OTP was providing 75 MW of summer capacity to another utility. The net effect of these two transactions ending is a deficit of 5 MW in 2006. This summer season deficit increases each year due to system load growth, and then takes another step-function increase in 2010 to 116 MW with the expiration of a second 50 MW capacity and energy contract. Continued forecasted load growth results in a projected capacity deficit of 173 MW in 2014.

OTP's 116 MW share of the Big Stone II Project is meant to replace the expiring purchases as well as cover forecasted load growth. Until the baseload facility begins operation in 2011, the utility will purchase capacity and energy from the market to cover its requirements. The company does project capacity needs greater than its share of Big Stone II. Those needs will be met by peaking capacity resources (either purchases, if economic and available, or construction of a new unit) and demand side management activities. Analysis performed as part of OTP's July 1, 2005 Integrated Resource Plan filing with the Minnesota Public Utilities Commission determined that 120 MW of baseload capacity was an optimum amount with the remaining capacity coming from other resources.

3.1.4.6 Southern Minnesota Municipal Power Agency

Econometric modeling (Regression analysis) was the primary method utilized in developing the load forecasts at Southern Minnesota Municipal Power Agency. Two regression analysis model forms were used in developing the long-term forecasts discussed in this report. Simple regression models were used to forecast non-coincident peaks for most members. Simple regression models contain two variables, i.e., a variable to be forecast (the dependent variable) and an independent or driver variable (the explanatory variable). It is assumed that changes in the explanatory variable cause changes in the dependent variable.

The second model form used is the multiple regression model. All of the long-term energy models developed for this forecast are multiple regression models. Multiple regression models include more than two variables. There is a variable to be forecast (the dependent variable) and two or more independent or driver variables (the explanatory variables). As with simple regression models, it is assumed that changes in the explanatory variables will cause changes in the dependent variable.

A slightly different type of regression model form, known as Dynamic Regression, was used to develop the short-term IMS energy forecasts for most members. A Dynamic Regression model is a multiple regression model that contains lagged values of the dependent variable as explanatory variables, as well as other independent variables. Dynamic Regression models also frequently contain lagged error terms.

SMMPA's forecasted capacity needs and annual energy requirements are shown in Exhibits 3-14 and 3-15, respectively. Table 3-7 presents a tabulation of the projected demand and energy requirements.

At the conclusion of the ownership and purchase evaluations, SMMPA elected to enter into a 5-year contract for peaking capacity and energy from existing units in the region rather than construct its own combustion turbine. Effective for the contract term of January 1, 2003 through December 31, 2007 (5 years), SMMPA has entered into a firm power purchase agreement with Split Rock Energy LLC (Split Rock). Under this agreement, SMMPA has available firm capacity starting at 30 MW for 2003 and 2004, increasing to 35 MW for 2005, and ending at 45 MW for 2006 and 2007.

SMMPA's firm power purchase agreement with Split Rock will cease in 2008. With demand growth of 1.2 percent and energy growth of 2.1 percent, SMMPA is actively pursuing new load to replace Split Rock purchase and the increase in demand and energy for the future.

Table 3-7 Southern Minnesota Municipal Power Agency Demand and Energy Requirements

Year	Demand (MW)	Energy (MWh)
2005	536	2,943,972
2006	543	3,032,999
2007	549	3,106,876
2008	555	3,180,381
2009	561	3,253,801
2010	567	3,330,954
2011	574	3,408,682
2012	580	3,483,826
2013	588	3,564,508
2014	595	3,637,903
2015	601	3,711,387
2016	608	3,783,582
2017	616	3,849,800
2018	623	3,914,410
2019	631	3,976,798
2020	640	4,037,580

3.1.4.7 Western Minnesota Municipal Power Agency

Western Minnesota Municipal Power Agency's resource need is driven by Missouri River Energy Services' (MRES) need due to the contractual relationship between WMMPA and MRES. MRES has power supply contracts with fifty-eight municipal utilities throughout the region, including twelve communities in South Dakota, and forty-six in Iowa, Minnesota and

North Dakota. These contracts form the basis of the obligation of MRES to provide power and energy to its members.

For 57 of its members, MRES is responsible for providing all of the increased electrical power needs into the future. The load growth of the members continues to be the predominant reason that MRES needs additional generating capacity. One other reason is the need to replace approximately 60 megawatts (MW) of power supply in the year 2016 that is currently provided by another supplier.

MRES is a wholesale power supplier with no retail customers, so the focus of the MRES resource planning process is on the wholesale purchases made by its members for transmission service, WAPA power supply, and MRES power supply.

Western Minnesota Municipal Power Agency's resource need is driven by Missouri River Energy Services' (MRES) need due to the contractual relationship between WMMPA and MRES. The MRES load forecasts are based upon a short-term monthly time-series forecast blended into a long-term annual econometric forecast. The resulting blended forecast predicts the aggregate total usage for each member city for each month of the forecast horizon. By subtracting the allocated amounts of WAPA demand and energy, the monthly MRES demand and energy sales to each member is obtained.

As part of the process of minimizing the long-term costs to the members, MRES periodically performs transmission and power supply studies. The decision to obtain a share of the BSP II was an outcome of the power supply study process completed in early 2005.

Projections of capacity needs and annual energy requirements for MRES are shown in Exhibits 3-16 and 3-17, respectively. According to the current MRES load forecasts, the existing MRES resources are adequate to serve expected loads through the year 2010. By 2015, the projected shortfall is 88 MW; by 2020 it jumps to 243 MW, and it continues to escalate into the future. MRES has only one baseload resource, which can only supply half of the capacity requirements by 2010; the remainder is supplied by natural-gas and other peaking resources. Based on the calculations of MRES, the lowest-cost method to meet this shortfall is through a combination of Big Stone II baseload capacity and later peaking resource additions.

Big Stone II is ideally located in the center of the MRES member area, minimizing the transmission costs and impacts, and reducing the chances of expensive transmission curtailments. All but 14 MRES power supply members are within 150 miles of Big Stone II. In addition to this geographic "fit," Big Stone II is being built just when MRES needs to have new capacity to serve its members. The timing of the construction and operation of Big Stone II coincides with the projected resource needs of MRES members.

Hutchinson, Minnesota, recently entered into a long-term purchased power agreement with MRES for 40 MW of capacity and energy from BSP II and is also considering membership. Hutchinson will receive a fixed amount of power from MRES and will supply the remainder of their needs from their own resources.

3.1.5 Consequences of Delay

Delaying construction of the Big Stone II could have significant negative consequences for the Co-owners and for the region. It would increase the probability of inadequate regional generation capability and cause a reduction in the reliability of the Co-owners' systems and the regional electrical supply system. Additional negative consequences include increased costs to customers due to a greater reliance on higher-cost peaking resources and a greater reliance on the volatile energy market. Spot market purchases can be extremely useful to augment a portfolio of resources, but are not an appropriate source for long-term baseload resource needs.

The MAPP region is expected to experience capacity deficits beginning in 2010 and energy requirements are forecasted to increase by 15% over the next nine years. There have been no new baseload facilities constructed since the 1980s. In many cases, utilities are pushing their existing generating units to full capacity already. Further reliance on existing baseload resources is not expected to be an option. Utilities in the region have experienced transmission constraints that limit their ability to deliver power to their system. New generating resources and the associated transmission upgrades are necessary to satisfy the energy and capacity needs of the Co-owners.

3.2 Alternative Sites

The Co-owners recognize that development of a large, jointly-owned generating facility will be more cost-effective than construction of several smaller units. Previous analyses had identified the Big Stone Plant site as the preferred site for a new 600 MW coal-fired generating unit. Because much of the previous analyses were dated and were not well-documented, the Co-owners completed a fresh review and evaluation of prospective baseload plant locations. In this study, prospective power plant sites were identified within a project area that included the entire states of Minnesota, North Dakota and South Dakota. This three-state area includes the service territories of the majority of the potential Project participants. The study, included as Exhibit A, is summarized here.

3.2.1 Selection of Candidate Site Areas

The first step in the site selection process was to identify candidate site areas. Candidate site areas are general locations that possess the necessary infrastructure and other characteristics that may make them suitable power plant sites. The candidate sites must also be of sufficient size to accommodate plant development plus allow sufficient buffer area to mitigate some of the impact on surrounding areas.

Before specific sites could be identified, it was necessary to map locations within the project study area where power plant siting may be impractical for institutional or social reasons, and where the required infrastructure is available.

There are certain land classifications that are considered undesirable for siting a power plant or other large industrial facility. These include such areas as residential or urban areas; national, state and local parks, monuments, recreation areas, forests and wildlife refuges; and wetlands. However, the only constraint areas mapped on a regional scale were Class I areas and certain designated use areas. Also mapped for the entire study area were the locations of infrastructure critical to economical power plant development: electric transmission lines with voltage of 230 kV or higher, rail lines, and major rivers and lakes.

The Class I areas, designated use areas, and infrastructure locations were overlaid to help identify specific areas with better potential for development as power plant sites. From this composite map and available topographic maps and aerial photographs, 38 specific site areas were identified. These areas were designated preliminary site areas. The locations of the 38 preliminary site areas are shown on Exhibit 3-18.

Following identification of the preliminary site areas, these areas were subjected to a desktop screening to eliminate those sites with more obvious development constraints. Through this process, 30 of the 38 preliminary site areas were eliminated for two primary reasons: limited water supply potential or nearby residential development. The remaining eight site areas are listed below:

- Big Stone – Grant County, South Dakota
- Coyote – Mercer County, North Dakota
- Dickinson – Wright County, Minnesota
- Fargo – Cass County, North Dakota
- Glenham – Walworth County, South Dakota
- Maple River – Cass County, North Dakota
- Split Rock – Minnehaha County, South Dakota
- Utica Junction – Yankton County, South Dakota

A field reconnaissance of these eight site areas was conducted in early March 2005. This reconnaissance consisted of an automobile survey along public roads in the vicinity of each site area. During the field reconnaissance, information was collected on the amount of available land, local land use, number of nearby residences and other structures, suitability of terrain, and the condition of local transportation systems.

Following completion of this reconnaissance, two of the eight sites were recommended for elimination. These were the Maple River and Split Rock site areas. Maple River was eliminated because it has relatively more nearby residences and other development than the nearby Fargo site. The Split Rock site was eliminated because it lacks sufficient developable land area and because of encroaching residential development. The remaining six site areas were designated candidate site areas (Exhibit 3-18) and retained for continued evaluation.

3.2.2 Candidate Site Evaluation

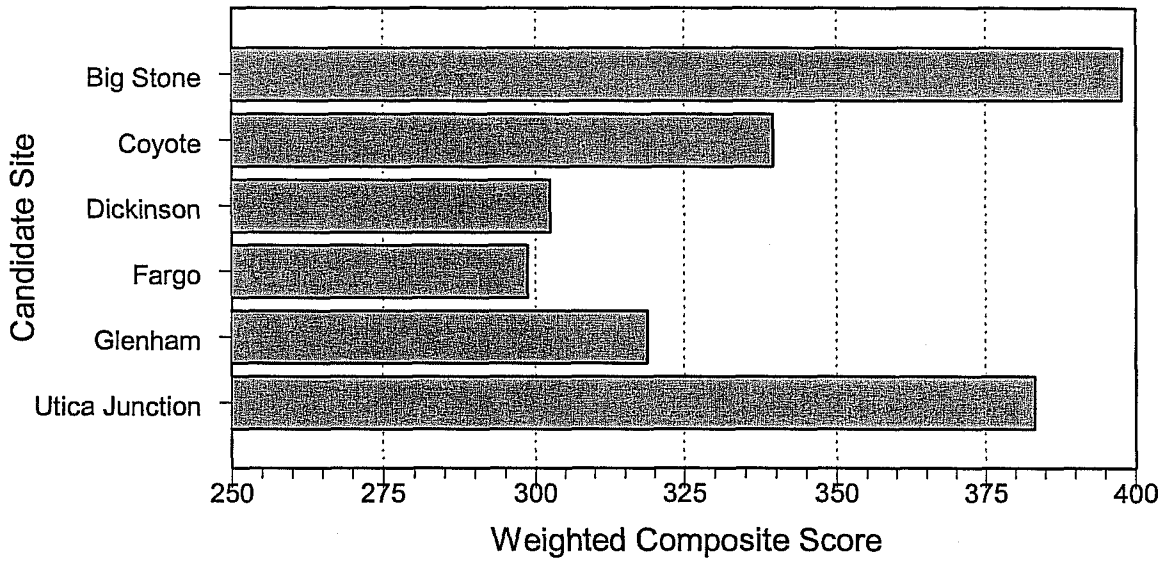
After their selection, the six candidate site areas were evaluated using a numerical decision analysis process to help further screen and rank these sites. The first step in using such a process is to identify the objectives or criteria to use in evaluating these sites. These criteria vary in their importance to the decision-making process so each criterion was also assigned a weight. Criteria with the highest weights are considered to be the most significant factors. These weights were assigned by first organizing the evaluation criteria into major categories. These major categories were then assigned weights totaling 100 percent. Within each major category, the individual evaluation criteria were assigned subweights to define their relative importance within that category. The major category weights and subweights were combined to yield a composite weight for each criterion as presented in Table 3-5.

Table 3-5 Candidate Site Evaluation Criteria

Major Category	Category Weight	Criterion	Subweight	Composite Weight
Air Impacts	15%	Class I Areas	10	10.71%
		Airspace Restrictions	4	4.29%
		Category Totals:	14	15.00%
Water Supply	20%	Surface Water Proximity	5	6.67%
		Water Supply Potential	10	13.33%
		Category Totals:	15	20.00%
Environmental	15%	Socioeconomics	5	2.68%
		Land Use Compatibility	4	2.14%
		Protected Species Impacts	2	1.07%
		Noise Impacts	10	5.36%
		Wetlands	7	3.75%
		Category Totals:	28	15.00%
Fuel Supply	20%	Rail Line/Mine Proximity	10	11.11%
		Fuel Delivery Competition	6	6.67%
		Reagent Delivery	2	2.22%
		Category Totals:	18	20.00%
Transmission	20%	Proximity to Interconnection Point	2	2.67%
		Expected System Impacts	13	17.33%
		Category Totals:	15	20.00%
Other	10%	Highway Access	2	1.05%
		Land Availability	10	5.26%
		Common Facilities/Staff	7	3.68%
		Category Totals:	19	10.00%

Each of the six candidate sites was assigned a relative score between one and five for each of the 17 evaluation criteria. These scores were combined with the composite weights listed in Table 3-5 to yield a weighted composite score for each candidate site area. These scores are shown graphically below. The highest ranked site in this evaluation was Big Stone with a score of 397.7 and the lowest ranked site was Fargo with a composite score of 298.7.

The sensitivity of the evaluation scores to varying weights was also tested. The base weights assigned to each major category are considered to be an appropriate balance between these factors but each major category was emphasized in turn to determine what impact these changes may have on the overall ranking. The weight for the category that was emphasized



was doubled and the other weights adjusted downward so the category weights still totaled 100 percent. The composite weights for each category and weighted composite scores for each site were then recalculated. The resulting site rankings generally showed that a site's rank was not very sensitive to the assigned category weights. Most importantly, the Big Stone site area maintained its top ranking for each of the cases in the sensitivity analysis.

3.2.3 Selection of Preferred and Alternate Site Areas

After completion of the site evaluations, these results along with consideration of other intangible and strategic factors were used to identify a preferred site and alternate sites for the proposed generating unit. The relative strengths and weaknesses of each candidate site are summarized below.

- Big Stone Site Area: The principal advantage of the Big Stone site is that it is located at an existing power plant. During the original design of this plant, it was laid out to accommodate a second generating unit and some of the existing facilities, such as coal handling, are already sized for this additional unit. For the base case, the Big Stone site received the highest evaluation score by a significant margin and maintained this number one ranking for three of the six sensitivity cases. For the other three sensitivity cases, this site was ranked second.

- Coyote Site Area: Like Big Stone, the Coyote site area is located at an existing power plant that was initially designed to accommodate a second generating unit; however, this site has a couple of distinct disadvantages that are not present at Big Stone. These disadvantages relate to air quality and transmission.

  The Coyote Plant is located only about 73 miles from Theodore Roosevelt National Park and 94 miles from Lostwood National Wildlife Refuge, which are both Class I areas. In the vicinity of the Coyote Plant, there are also six other lignite-fired power plants. The close proximity of these existing emissions sources and Class I areas will make permitting a new generating unit at the Coyote site very challenging.

  The existing transmission system at the Coyote site does not have capacity to accommodate additional power exports out of the North Dakota lignite mining area. Upgrading this system to allow location of another 600 MW of generation in this same area would be very expensive.

  The Coyote site received a base evaluation score of 339.6, giving it a third-place ranking. For the sensitivity analyses, this site's ranking ranged from second to sixth and averaged 3.86. Although these rankings place the Coyote site near the middle of the six candidate sites, the air quality and transmission issues discussed above are serious flaws that justify eliminating this site from further consideration at this time.

- Dickinson Site Area: The Dickinson site area was the fifth-ranked site under the base case and its ranking ranges from fourth to sixth under the various sensitivity cases, with an average ranking of 5.00. Although this site is located at a major substation and close to load centers in eastern Minnesota, the transmission system that serves this substation is currently operating near capacity. Therefore substantial new transmission investments would still be required to develop the proposed generating unit at this site. Because this site is located less than 25 miles outside of the Twin Cities metropolitan area and surrounded by rural residential development, the population densities near this site are easily the highest of any of the six candidate sites. This factor makes the potential for significant public opposition to power plant development here rather high. Because of concerns about intense public opposition, it is recommended that this site not be considered further.

- Fargo Site Area: This site area is located in a rural agricultural area outside of Fargo. The evaluation scores for this site area are consistently among the lowest of all the six candidate sites for the base case and the sensitivity cases. The chief disadvantage of this site is its water supply potential. Because of its low evaluation scores and questionable water supply potential, this site was eliminated from further consideration.

- Glenham Site Area: The Glenham site area is located in north-central South Dakota near the Missouri River and has an excellent water supply potential. The sparse population of the area also reduces the potential for impacts to neighbors at this site. The chief concern at this site is transmission capacity because this site is relatively close electrically to the lignite fields of North Dakota and the existing transmission constraints from this region. For the base case, the Glenham site area was ranked fourth. These rankings ranged from third to fifth for the various sensitivity cases and averaged 4.00.

- Utica Junction Site Area: Like the previous site, the Utica Junction site area is located near the Missouri River and has an excellent water supply potential. In fact, these two South Dakota sites share many similarities. Transmission capacity is also a potential concern at this site but it is farther from the congested area in North Dakota than Glenham and other planned transmission additions in Nebraska and Iowa should help alleviate transmission constraints to the south. The Utica Junction site area is ranked second under the base case and from first to third for the various sensitivity cases. The average ranking of this site was 1.73.

- Final Site Ranking: Based on evaluation scores and the other factors discussed above, it is recommended that three of the six candidate site areas be dropped from further consideration at this time. These less-attractive site areas are Coyote, Dickinson and Fargo. Of the remaining three sites, the Big Stone site consistently ranked at or near the highest and is therefore identified as the preferred location for the proposed generating unit. The other two site areas, Glenham and Utica Junction, share many similarities but the Utica Junction site ranks higher than Glenham for the base case and all of the six sensitivity cases. Therefore, Utica Junction is identified as the first alternate location and Glenham as the second alternate site. The preferred and alternate site areas are also indicated on Exhibit 3-18.

3.3 Alternate Energy Resources

South Dakota Administrative Code Section 20:10:22:33 requests that applicant provide information concerning the alternate energy resources considered in the construction of the energy conversion facility, and to discuss the reasons for selecting the proposed energy source rather than an alternative resource.

The purpose of the Project is to address the Co-Owners' customers' anticipated baseload energy needs in an economical, environmentally responsible manner. Studies point to a potential shortfall of baseload generating capacity among the Co-Owners and throughout the Mid-Continent Area Power Pool by 2011 (see Section 3.1).

When considering the most appropriate energy resource to develop, the Big Stone II Co-owners made a qualitative assessment of the available alternative technologies' ability to meet the Project objectives. Those objectives include:

- Ability to reliably meet customer baseload energy demand;
- Commercially-proven technology at the several hundred megawatt scale;
- Minimize environmental and community impacts by leveraging existing generation site and transmission infrastructure; and
- Enhance customer value and reduce customer risk by implementing a proven, efficient technology

Consideration by the Co-Owners of alternative energy resources pointed to a clean and efficient fossil fuel-fired plant in the 600-megawatt range as being the most cost-effective choice for helping to meet the anticipated need for increased generation.

Fossil fuel technologies were judged to be most compatible with the Project objectives. Four fossil fuel alternatives were considered in detail. The evaluation of those alternatives is summarized below.

The most common and economically viable renewable resource technology employed in the region, wind turbines, is not appropriate for this Project; primarily because it cannot reliably provide baseload capacity. According to the American Wind Energy Association (www.awea.org), North Dakota, South Dakota and Minnesota rank 1, 4 and 9, respectively, among the states with the best wind resource. But even in this relatively windy region, wind turbines typically generate electricity only 30 to 40 percent of the time. Additionally, it is not possible to schedule the dispatch of wind turbines, as their operation is as unpredictable as the wind. Baseload capacity must be reliable and able to provide virtually continuous output (with only scheduled short-term outages).

An assessment of fossil-fuel potential generation technologies to provide an additional 600 MW of generation capacity was performed. The assessment included a discussion of technical features and benefits, and a comparison of costs of the following technologies:

- Super-critical Pulverized Coal
- Coal Circulating Fluidized Bed
- Integrated Coal Gasification Combined Cycle
- Natural Gas-Fired Combined Cycle

For all of these fossil fuel alternatives, it was assumed treated cooling water would be provided from a closed loop circulating water system that includes a mechanical draft cooling tower and circulating water pumps. Makeup water to the cooling system would be supplied from the existing Big Stone Plant unit I cooling pond. Makeup water for the existing cooling pond would be supplied from onsite water storage ponds and from the Big Stone Lake. The makeup water system is described in detail in Section 2.

Electrical output from all the alternative technologies would be stepped up to 230 kV and interconnected with the transmission system.

Fuel for the coal technologies would be Powder River Basin (PRB) sub-bituminous coal, the same fuel currently being burned by existing Big Stone Plant unit I. An existing rail spur will be used to provide the PRB coal supply via unit train. Existing facilities will be used for coal train unloading.

3.3.1 Technology Descriptions

Each of the technologies evaluated is described below. An overview of the technology process is presented, followed by a discussion of the relative advantages and disadvantages of the technology with regards to operational ease and flexibility, efficiency, air emissions and solid waste generation, and technology maturity.

3.3.1.1 Super-critical Pulverized Coal

For the super-critical pulverized coal (PC) technology, a nominal 600 MW (net) electric generating unit was assumed. This technology would utilize a single PC-fired super-critical steam generator (boiler) and a single, reheat steam turbine.

The PC-fired steam generator would consist of balanced-draft combustion with reheat steam. In the steam generator, high-pressure steam is generated for throttle steam to the steam turbine. The steam expansion provides the energy required by the steam turbine generator to produce electricity. A portion of the steam is also extracted to the feedwater heaters. The power cycle includes eight stages of feedwater heating for the super-critical cycle.

The steam turbine exhausts to a condenser where the steam is condensed. The heat load of the condenser is typically transferred to a wet cooling tower system. The condensed steam is then returned to the steam generator through the condensate pumps, low-pressure feedwater heaters, boiler feed pumps and high-pressure feedwater heaters.

Pulverized coal boilers utilize coal that has been supplied to the unit through coal silos, then to the feeders and into the pulverizers, where the coal is crushed and ground into fine particles. The primary air system transfers the coal from the crushers/pulverizers to the steam generator low NO_x burners for combustion.

Flue gas exits the steam generator, through a selective catalytic reduction (SCR) system for additional NO_x reduction and into an air heater. Flue gas exits the air heater to particulate and SO_2 removal systems.

Pulverized coal boiler technology is a mature and reliable energy producing technology around the world. The operating pressure of conventional coal-fired power plants can be classified as sub-critical and super-critical. Sub-critical and super-critical technologies refer to the state of the water that is used in the steam generation process. The critical point of water is 3208.2 psia and 705.47°F. At this critical point, there is no difference in the density of water and steam. At pressures above 3208.2 psia, heat addition no longer results in the typical boiling process in which there is an exact division between steam and water. The fluid becomes a composite mixture throughout the heating process.

Super-critical boilers have been incorporated into the United Stated power generation mix since the mid-1950s. There are over 80GW of super-critical units in the U.S., with the majority of units coming online before 1980. At the same time, several new nuclear power plants were constructed for baseload capacity. Therefore, the super-critical plants were required to follow the utility load. Due to a lack of high temperature materials, the existing materials were required to be thick to withstand super-critical operating conditions. Excessive valve wear, turbine thermal stresses and turbine blade solid particle erosion were common problems encountered with early super-critical units. This resulted in lower availability and higher maintenance costs than comparable sub-critical units.

Since the start of the 1980s, the majority of super-critical units have been installed in Europe and Asia. Development of high strength materials has helped to minimize the thermal stresses that caused problems in the early units. The development of Distributed Control Systems (DCS) has helped make a complex starting sequence much easier to control and minimize tube overheating due to lack of fluid flow. The newer units also use a particle separator placed into the fluid process during startup to minimize solid particle carryover, which causes erosion of the turbine blades. Therefore, many of the early problems experienced with super-critical units have been corrected.

A major difference of the super-critical steam generator is that it is a once-through system and does not include a steam drum.

Since there is no steam drum to allow blowdown of impurities in the system, super-critical boiler water chemistry is critical to maintain a reliable system. A full-flow condensate polisher is typically incorporated into the condensate system to remove condensate impurities.

Many plants are implementing an oxygenated water treatment system into their operation. An oxygenated water treatment system forms a ferric oxide hydrate on the inner surface of the steam generator. The traditional volatile system forms a magnetite oxide in the system. The advantage is that the ferric oxide is much less soluble; therefore, the quantity of the oxide transported to the steam turbine is reduced.

Super-critical boilers are provided with essentially two types of tube arrangements: spiral or vertical. The spiral tube design has more than 30 years of experience. The primary disadvantage is the hardware needed to support the tubes during construction causes increased construction costs. The spiral tube design also imparts additional friction drop in the system requiring larger boiler feedwater pumps. The vertical tube design has a much shorter history, but is gaining interest due to the reduced pressure drop and simpler configuration.

One of the difficulties in designing super-critical boilers is providing adequate cooling of the water walls with a limited flow of fluid. With smaller boilers, the perimeter of the furnace wall reduces as the unit size reduces. Therefore, the problem of covering the furnace wall with tubes while simultaneously maintaining an acceptable cooling water velocity becomes more difficult for smaller unit sizes. For these reasons, super-critical boilers are more suitable for larger unit sizes. Although the average super-critical unit size in the U.S. is 650 MW, there is a super-critical unit built in the U.S. with a 350 MW generation capacity. In Europe there have been a number of modern units installed in the 250 to 400 MW range.

Super-critical units typically operate at 3500 psig and at 1000°F or 1050°F at the steam turbine inlet. Development is currently underway to increase the pressures to 4350 psig and the temperatures to 1112°F. These are considered "ultra-critical" units and have not been commercially developed in the United States.

Conventional super-critical units can be expected to provide an increased efficiency of 3 to 4 percent over sub-critical units when the temperature is increased to 1050°F. If the temperature of the process is 1000°F, the increase in efficiency is an additional 1.5 to 2 percent. Operation is also more efficient at partial loads. For example, at 75 percent load, the efficiency of a super-critical unit is reduced by 2 percent compared to 4 percent for a sub-critical unit. At 50 percent load, the efficiency of a super-critical unit is reduced by 6 to 8 percent compared to 10 to 11 percent for a sub-critical unit.

In a super-critical unit, the auxiliary power input is substantially higher due to the feedwater system as compared to a sub-critical unit. In a typical sub-critical unit, boiler feedwater pumps require approximately 2.5 percent of the turbine output. This may increase to 5 percent in a super-critical unit. However, the increase is justified in the improved thermal cycle efficiency.

The emission controls for NO_x, SO_2, and mercury for super-critical PC units are typically identical to those of a similar sub-critical unit. However, the advantage is the improved efficiency of the super-critical unit reduces the amount of fuel consumed, which in turn reduces the total emissions and waste generation. NO_x emissions of a PC unit are controlled with low NO_x burners and Selective Catalytic Reduction (SCR). A baghouse has been selected to remove particulate from the flue gas.

SO_2 control on a PC unit is accomplished through the use of a dry or wet flue gas desulfurization (FGD) system. A dry FGD system can achieve a maximum of 92 percent removal and a wet FGD system can achieve 95 percent removal or higher. For Big Stone II, a wet limestone, forced oxidized (WLFO) has been selected.

The by-products of the unit, assuming a wet limestone FGD system with forced oxidation, are bottom ash, fly ash, and gypsum. Bottom ash can potentially be used for road base and other commercial uses. Fly ash could potentially be utilized as structural fill for developing new roads, and for mixing with concrete. Additionally, the gypsum produced by a wet FGD system potentially could be used for making wall board or supplementing cement.

3.3.1.2 Atmospheric Circulating Fluidized Bed (ACFB)

For the atmospheric circulating fluidized bed (ACFB) technology, construction of a 600 MW (net) electric generating station utilizing two ACFB-fired boilers and a single, reheat steam turbine was assumed. 300 MW is the practical size limit for commercially available ACFB boilers at the present time.

The combustion process within a fluidized bed boiler occurs in a suspended bed of solid particles in the lower section of the boiler. Combustion within the bed occurs at a slower rate and lower temperature than a conventional pulverized coal boiler. Deviations in fuel type, size or Btu content have minimal effect on the furnace performance characteristics. Therefore, ACFB technology is well suited to burn fuels with large variability in constituents. Plant sites with access to an abundant source of fuel that presents combustion challenges in a pulverized coal boiler are typically good prospects for application of fluidized bed technology. The bed also allows for re-injection of a sorbent, such as fly ash or limestone, to reduce SO_2 emissions.

Fluidized bed technology has historically been characterized as a "Clean Coal Technology." This perception is being challenged in many areas of the country by BACT requirements. Achieving emission levels meeting BACT requirements include addition of SNCR systems for NO_x control and a fly ash and/or limestone re-injection system for SO_2 control. The re-injection system adds to the complexity of material handling systems.

The largest atmospheric fluidized bed boilers in operation are approximately 300 MW. Utilizing two 250MW units supplying steam to a single steam turbine is the most cost-effective configuration utilizing fluidized bed technology for 500 MW. Individual units larger than 250 MW could potentially encounter maintenance and operational issues associated with prototype development.

All ACFB boilers built to date are of a sub-critical design. Super-critical ACFB boilers are currently being offered by Foster Wheeler and Alstom; however, none are in operation at this time. Because of the lack of industry experience and increased risk associated with super-critical ACFB units, only sub-critical ACFB units were considered.

Selective Non-Catalytic Reduction (SNCR) is typically utilized for ACFB boilers to control NO_x emissions. The inherent design of an ACFB boiler allows SO_2 control with the addition of limestone and fly ash re-injection into the boiler combustion process. An ACFB utilizing fly ash re-injection typically achieves a 95 percent SO_2 removal rate. SO_2 control in a fluidized bed boiler requires approximately 1.5 times the quantity of limestone to achieve a similar reduction level to that achieved in a wet limestone scrubber application on a conventional coal-fired boiler. A baghouse is typically utilized to remove particulate from the flue gas and mercury control issues on ACFB units are the same as PC units.

Atmospheric fluidized bed boilers produce waste product that is a combination of ash, limestone and calcium sulfate, and typically has not had commercial value. If a suitable market cannot be found, then waste disposal will be required.

3.3.1.3 Integrated (Coal) Gasification Combined Cycle

The evaluation of Integrated Gasification Combined Cycle (IGCC) technology assumed construction of a 550 MW (net) electric generating station comprised of two coal gasifiers, two "F" class gas turbines, each coupled to a heat recovery steam generator (HRSG), and a single, reheat steam turbine—referred to as a 2 on 1 configuration.

IGCC technology produces a low energy value syngas from coal or solid waste, for firing in a conventional combined cycle plant. Coal was assumed to be the feedstock for producing the syngas. The gasification process in itself is a proven technology having been previously utilized extensively for production of chemical products such as ammonia for use in fertilizer. However, utilizing coal as a solid feedstock in a gasifier for power generation is currently under development. The Department of Energy (DOE) has jointly funded several power plant facilities throughout the United States as indicated in Table 3-6. The gasification process represents a link between solid fossil fuels such as coal, and existing gas turbine technology.

A 550 MW net IGCC plant would typically be comprised of two coal gasifiers, a coal handling system, an air separation unit, a gas conditioning system to remove sulfur and particulate, two gas turbines, two heat recovery steam generators with supplemental duct firing (with syngas), and a single steam turbine.

Integrated gasifier technology, with gas turbine combined cycle technology, is a relatively recent development, and continues to be improved at existing DOE jointly funded power plants. Because gasification-based power generation is a relatively new technology with few operating plants, its unique operating features and environmental performance capabilities are not well defined.

The majority of the DOE test facilities utilize entrained flow gasification design with coal as feedstock. In that process, coal is fed in conjunction with water and oxygen from an air separation unit (ASU), into the gasifier at around 450 psig where the partial oxidation of the coal occurs. The raw syngas produced by the reaction in the gasifier exits at around 2400°F, and is cooled to less than 400°F in a gas cooler, which produces additional steam for both the steam turbine and gasification process. Scrubbers then remove particulate, ammonia (NH_3), hydrogen chloride and sulfur from the raw syngas stream. The cooled and treated syngas then feeds into a modified combustion chamber of a gas turbine specifically designed to accept the low calorific value syngas. Exhaust heat from the gas turbine then generates steam in a heat recovery steam generator (HRSG) which in turn powers a steam turbine.

Three gasifier manufacturers have IGCC experience with various U.S. coals. Each of the manufacturers has a slightly different technology that has proven to work differently on different fuels. Of the currently operating U.S. IGCC units, none are operating on low sulfur sub-bituminous Powder River Basin (PRB) coal. Testing of various coals on the different gasifiers is continuing, however, at the present time there is no long-term commercial operating IGCC experience with PRB.

Table 3-9 lists the DOE jointly funded test facilities constructed in the United States, with various gasification system designs.

Table 3-9 Constructed U.S. IGCC Test Facilities

Facility	Owner	Capacity (MW)	Commercial Operation Date	Gasifier Manufacturer	Status
Polk County	Tampa Electric	252	1996	Chevron Texaco	Operating
Wabash River	PSI Energy	262	1995	Conoco Phillips	Operating
Pinon Pine	Sierra Pacific	99	1997	KRW	Decommissioned
LGTI	Dow Chemical	160	1987	Conoco Phillips	Decommissioned
Cool Water	Texaco	125	1984	Chevron Texaco	Decommissioned

Significant design issues have prevented operating coal gasification units from achieving industry acceptable availability levels. These design issues include fouling within the syngas cooler, design of the pressurized coal feeding system, molten slag removal from the pressurized gasifier, durability of gas clean-up equipment and solid particulate carryover resulting in erosion within the gas turbine. The complexity of the combined cycle unit in conjunction with the reliability of numerous systems, including the gasifier, oxygen generator, air separation unit and multiple scrubbers, have all contributed to reduced IGCC plant availabilities.

Unit availability at the DOE jointly funded plants has been improving due to design modifications intended to improve equipment life and reliability. Polk County was able to achieve 83 percent availability for 2003 and Wabash River achieved 83.7 percent availability for 2003. All of these DOE-funded coal gasification plants have experienced down-time for design modifications and replacement of equipment. Polk County and Wabash River are the only two coal IGCC plants in the United States that have achieved extended periods of commercial operation. Current state-of-the-art IGCC plants are expected to achieve an availability of around 85 percent, compared to 90 percent or higher for conventional steam electric plants.

In addition to the constructed units referenced in Table 3-6, the following IGCC projects are currently in the development phase:

- 540 MW power station located in Lima, OH for Global Energy, Inc.

- 530 MW Mesaba Energy Project located in Minnesota for Excelsior Energy.
- 285 MW Stanton Energy Center Project in Florida, jointly owned by Orlando Utilities Commission and The Southern Company.

Commercial operation of these plants, provided the projects proceed, is at least 5 to 6 years in the future.

Much of future IGCC technology development will be supported through government funding of Clean Coal Technology Initiative within the power industry. The resurgence of coal-fired generation within the power industry, and the relative price of natural gas, will also influence the continuation and future development and commercialization of IGCC in the United States. Current technical issues which must be addressed and resolved for widespread commercialization of IGCC technology are expected to be addressed through future generations of government jointly funded large scale coal IGCC facilities. Once the development effort has been successfully completed, coal-fueled IGCC technology may have the potential to be a reliable clean-coal generation within the United States. To date, gasifier manufacturers and IGCC contractors have shown reluctance to provide firm pricing to engineer, procure and construct a nominal 600 MW IGCC facility, or provide complete performance and emissions guarantees.

IGCC facilities have not been built or proven in the larger unit size ranges being considered. Further, of the currently operating U.S. IGCC units, none are operating on low sulfur Powder River Basin coal. Testing of various coals on the different gasifiers is continuing, however, at the present time there is no long-term commercial operating IGCC experience with PRB. Lastly, capital cost per kW is currently higher than that of similar size solid fuel units, and availabilities of existing smaller facilities have been 10 percent to 15 percent below that of PC units.

In conclusion, IGCC is considered a developing technology that has not performed reliably in commercial operation to date. Therefore, IGCC is not considered feasible for the Project. However, it is recognized there is planned development of the gasification process for coal in the near future and therefore IGCC could potentially become a reliable, low emission source of electrical energy in the future. It is anticipated that the first of the next generation of 500MW IGCC facilities should become operational within the next four to six years.

3.3.1.4 Combined Cycle Gas Turbine

The basic principle of the Combined Cycle Gas Turbine (CCGT) plant is to utilize gaseous fuels, such as natural gas, or liquid fossil fuels, such as No. 2 fuel oil, to produce power in a gas turbine—which is converted to electric power by a coupled generator, and to use the hot exhaust gases from the gas turbine to produce steam in a Heat Recovery Steam Generator (HRSG). This steam is then used to create electric power with a steam turbine generator. Combined cycle generation is widely used, and is a mature technology.

The use of both gas and steam turbine cycles in a single plant to produce electricity results in high conversion efficiencies and low emissions. The gas turbine (Brayton) cycle is one of the most efficient cycles for the conversion of gaseous fuels to mechanical power or electricity. Adding a steam turbine to the cycle, to utilize the steam produced by the HRSG, increases the efficiencies to a range of 50 percent to 58 percent.

Output for combined cycle plants can be increased with the use of duct firing in the HRSG. This method employs burning fuel gas in the HRSG at an intermediate stage to reheat the exhaust gas stream after some energy has been removed for steam superheating. Though the output is increased, the heat rate also increases and the plant becomes less efficient. Duct firing is limited (for economical reasons) by the HRSG materials of construction but can be used to increase the steam turbine output to equal that of the gas turbine(s). Without duct firing the steam turbine(s), output is typically half of the gas turbine total output.

Gas turbine and HRSG manufacturers are continuing to develop high temperature materials and cooling techniques to allow higher firing temperatures of the gas turbines and duct burners, as well as to increase the efficiency.

Typical combined cycle plants operate with natural gas as the operating fuel. Often, the ability to operate on fuel oil is also required in case the demand for power exists when the natural gas supply does not. The combined cycle plant was evaluated with dual fuel capabilities using 100 percent natural gas as the primary fuel, and distillate #2 as the back-up fuel.

A power block of 500 MW is composed of a two "F" class gas turbine, two heat recovery steam generators, and a single reheat steam turbine. The steam cycle consists of a three pressure level HRSG with reheat.

3.3.2 Economic Analysis

An economic analysis was performed based on estimated capital costs, performance, fuel costs, and operating costs of each of the energy resource alternatives described in Section 3.3.1. Estimated annual production costs ($s/MWh) of the PC Super-critical and ACFB coal-fired alternatives were compared against the natural gas-fired combined cycle (CCGT) alternative based on forecasts of future delivered fuel costs. IGCC, discounted for reasons stated above, was not included in this economic analysis.

The 600MW PC unit is estimated to have the lowest production cost of the three remaining generation alternatives, as summarized in Table 3-10 below.

Table 3-10 Estimated Annual Production Cost Comparison

600 MW PC Super-critical	600 MW ACFB	550 MW CCGT
BASE	BASE + 5%	BASE + 21%

The disparity between the coal and natural gas-fired alternatives is attributed to the projected future high cost of natural gas, and the projected relatively stable future costs of PRB coal. If long-term natural gas prices remain at high levels, the CCGT option will not provide economical energy.

3.3.3 Alternative Resource Summary

A summary of estimated performance and air emissions for the various technologies considered is provided in Table 3-11 below.

Table 3-11 Summary of Alternative Resource Technologies

Criteria	PC Super-critical	ACFB Unit	IGCC	CCGT Unit
Plant Size	600 MW (Net)	600 MW (Net)	550 MW (Net)	500 MW (Net)
Number of Units	1 x 600	2 x 300 MW Boilers (1 Steam turbine)	2 Gasifiers 2 on 1 (2 GTs & 1 ST)	2 on 1 (2 GTs & 1 ST)
Energy Source	PRB Coal	PRB Coal	Bituminous Coal (PRB Coal not demonstrated)	Natural Gas

Criteria	PC Super-critical	ACFB Unit	IGCC	CCGT Unit
Boiler Technology	Super-critical	Sub-critical	Sub-critical - Heat Recover Steam Generator (HRSG)	Sub-critical
Approx. Net Heat Rate (HHV) (Design)	9,400 – 10,000 Btu/kWh	10,100 Btu/kWh	9,100 Btu/kWh	6,900 Btu/kWh
Approx. Thermal Efficiency	34-36%	34%	37%	49%
Air Emissions Control Technology				
NO_x	SCR	SNCR	GT Combustor Steam or Nitrogen Injection	Dry Low NOx Burners & SCR
SO_2	Wet Limestone Scrubber	Limestone and Ash Reinjection	Amine Scrubber	Calculated From Fuel Input
Particulate	Baghouse	Baghouse	Syngas Particulate Scrubber	Calculated From Fuel Input
Mercury	Co-Benefits and/or Activated Carbon Injection	Activated Carbon Injection	Carbon Filters	Not required
CO	Controlled By Good Combustion Practice	Controlled By Good Combustion Practice	None	CO Catalyst

The Project Co-owners chose the PC super-critical technology for Big Stone II over the other technologies evaluated, principally because, as indicated in Table 3-8 above, it was estimated to have the lowest production cost of the evaluated generation alternatives. Again, provided long-term natural gas prices remain at high levels, the CCGT option will not provide economical energy.

Aside from having approximately 5 percent estimated lower production costs, for larger plant sizes, PC super-critical technology is preferred over next lowest cost ACFB technology for the following additional reasons:

1. PC super-critical technology is less capital cost intensive than ACFB technology; therefore low cost opportunity fuels typically must be utilized for ACFB in order for it to be competitive with PC technology.

2. The efficiencies of a larger super-critical PC unit versus a sub-critical ACFB unit with two steam generators feeding one steam turbine presents an inherent performance advantage and a capital cost advantage for the PC unit. Additionally, two steam generators coupled to a single steam turbine, is inherently more complex in terms of design and operation, than a single steam generator/steam turbine configuration.

3. The cost savings for using small amounts of cheaper opportunity fuels in a ACFB unit is too small to offset additional cost if the main source (PRB) represents 90 percent of the heat input for both technologies.

4. Air emissions from the PC super-critical technology are generally lower than ACFB technology on a per MW basis because of its higher thermal efficiency.

5. The 600MW PC super-critical unit is estimated to have the lowest production cost compared to ACFB technology, IGCC technology, and CCGT technology.

6. PC super-critical technology is considered a reliable technology, comparable to CCGT and ACFB, while IGCC is considered a developing technology that has not performed reliably in commercial operation to date.

Section 3 Exhibits

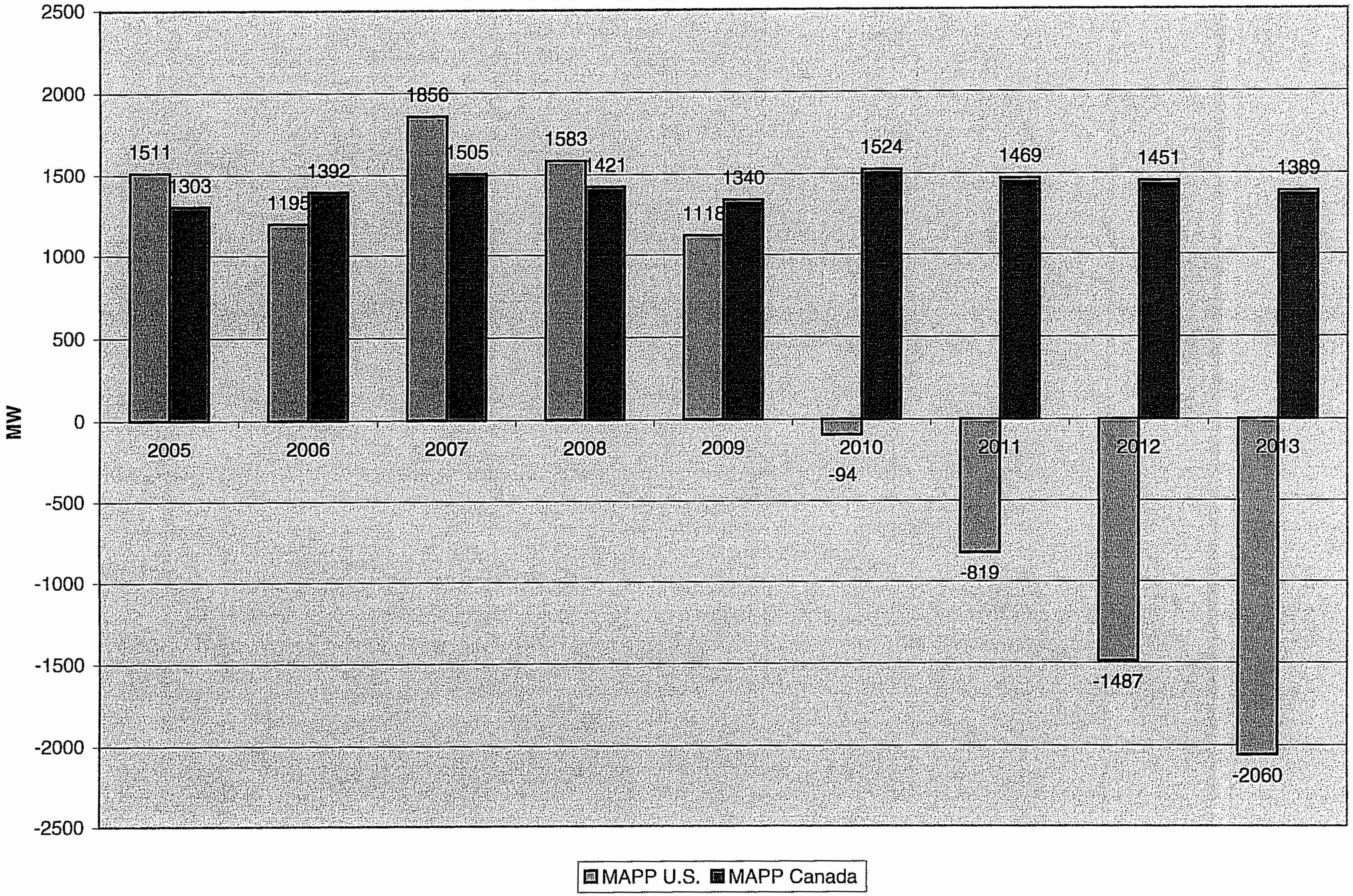


Exhibit 3-1

MAPP U.S. SURPLUS/DEFICIT FORECAST
Big Stone II Project
Big Stone II Co-owners

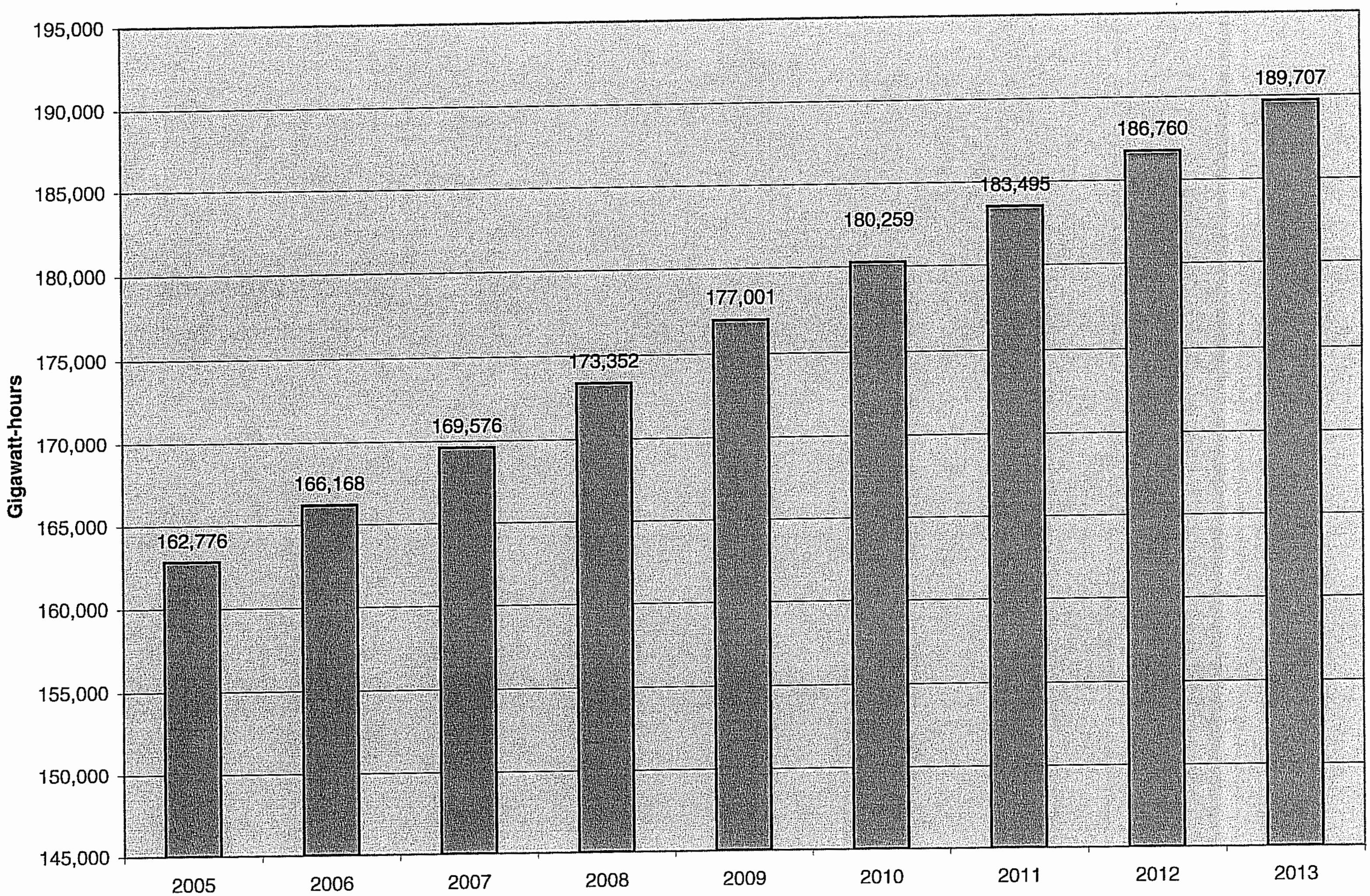


Exhibit 3-2

ANNUAL NET ENERGY FORECAST
Big Stone II Project
Big Stone II Co-owners

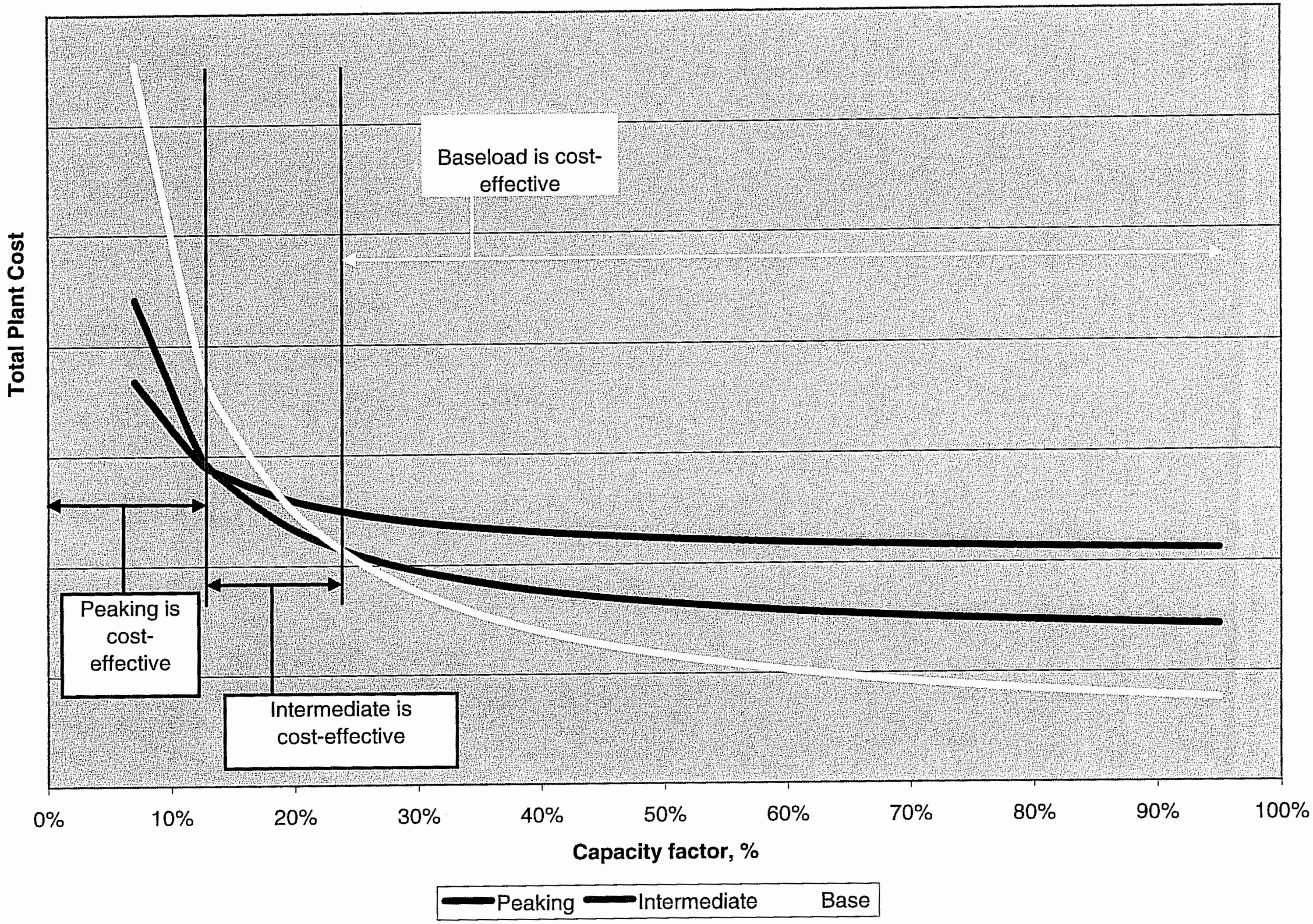


Exhibit 3-3

BASELOAD, INTERMEDIATE & PEAKING
FACILITY RELATIVE COST
Big Stone II Project
Big Stone II Co-owners

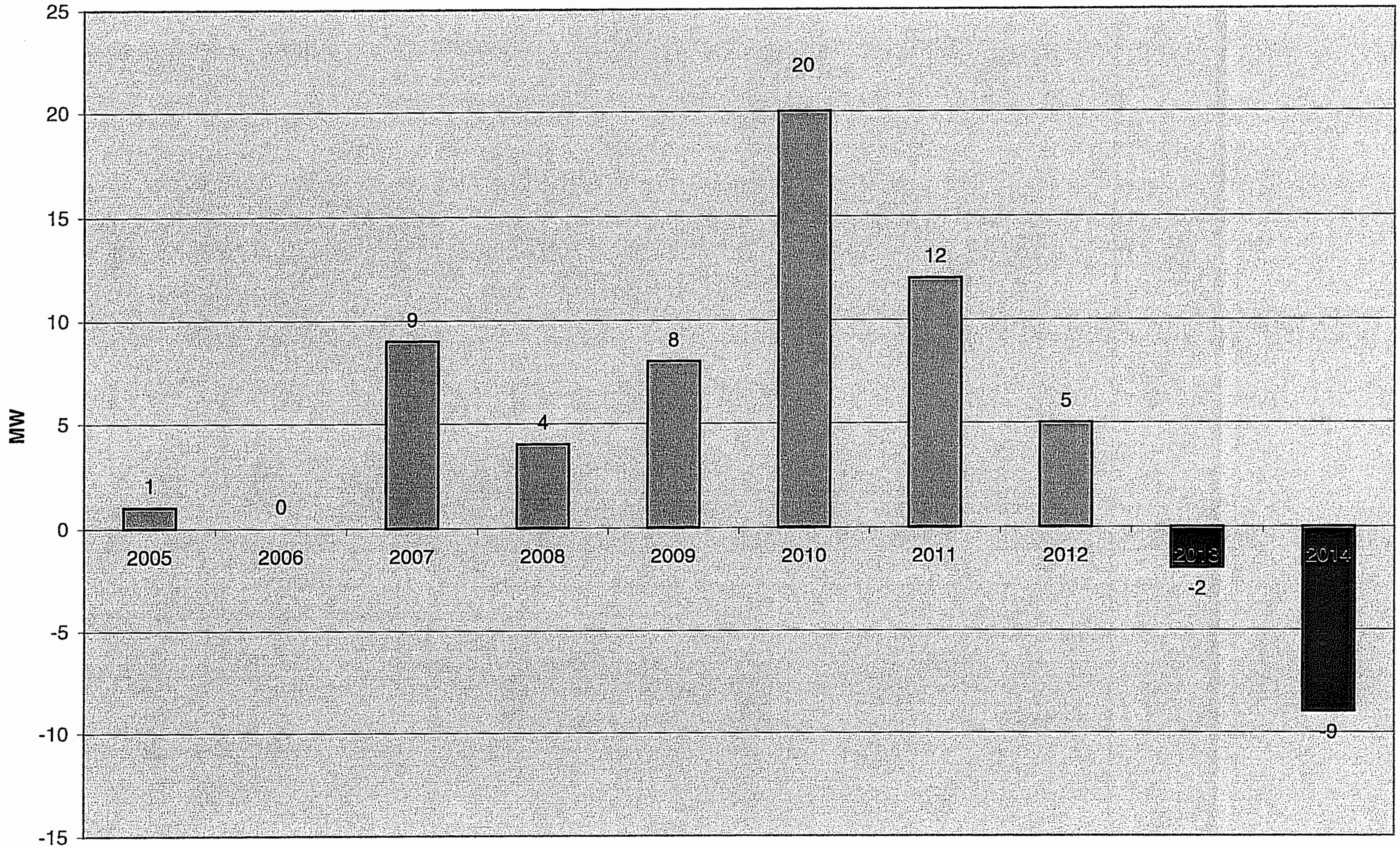


Exhibit 3-4

CMMPA SUMMER SURPLUS/DEFICIT FORECAST
Big Stone II Project
Big Stone II Co-owners

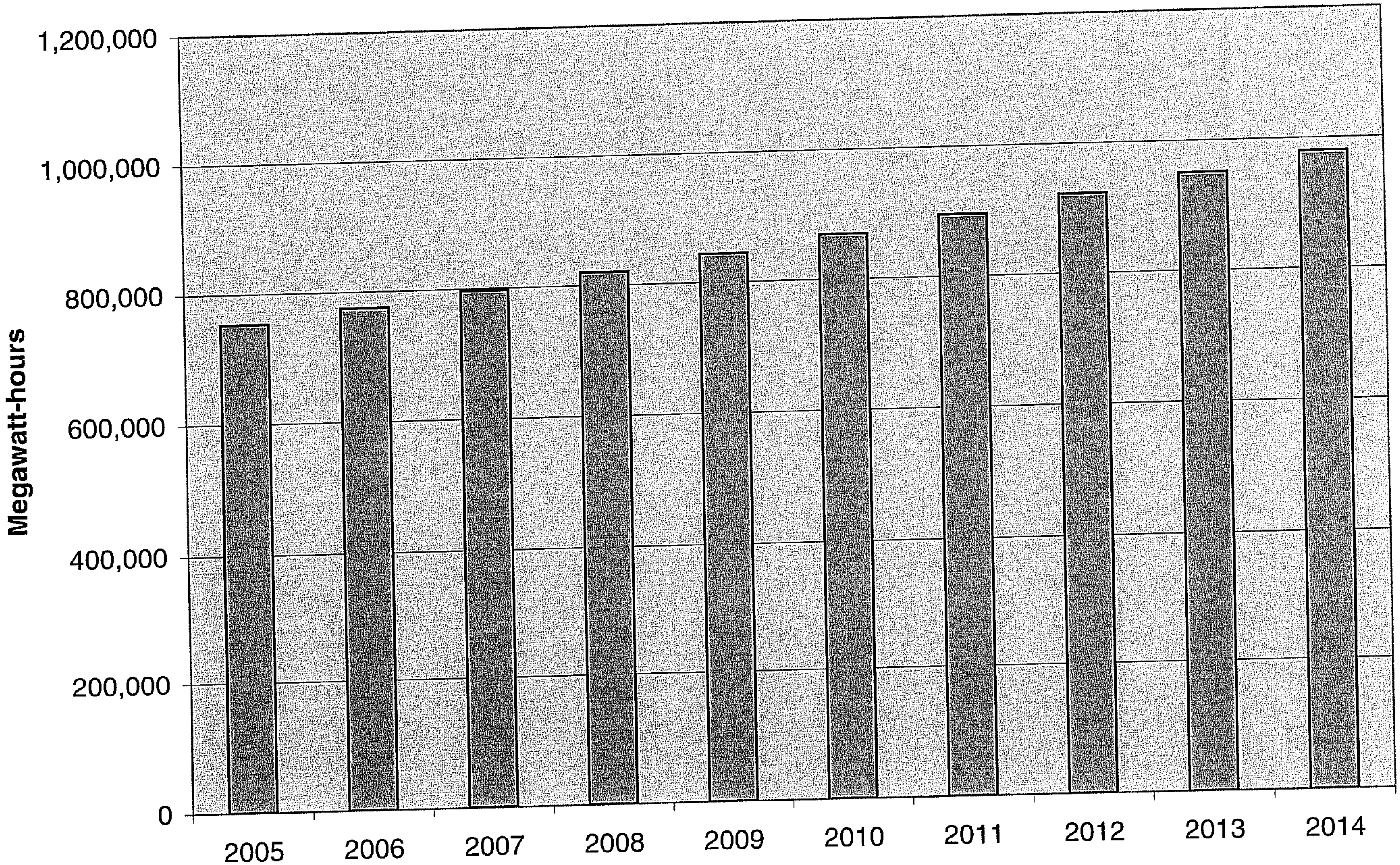


Exhibit 3-5

CMMPA ENERGY REQUIREMENTS FORECAST
Big Stone II Project
Big Stone II Co-owners

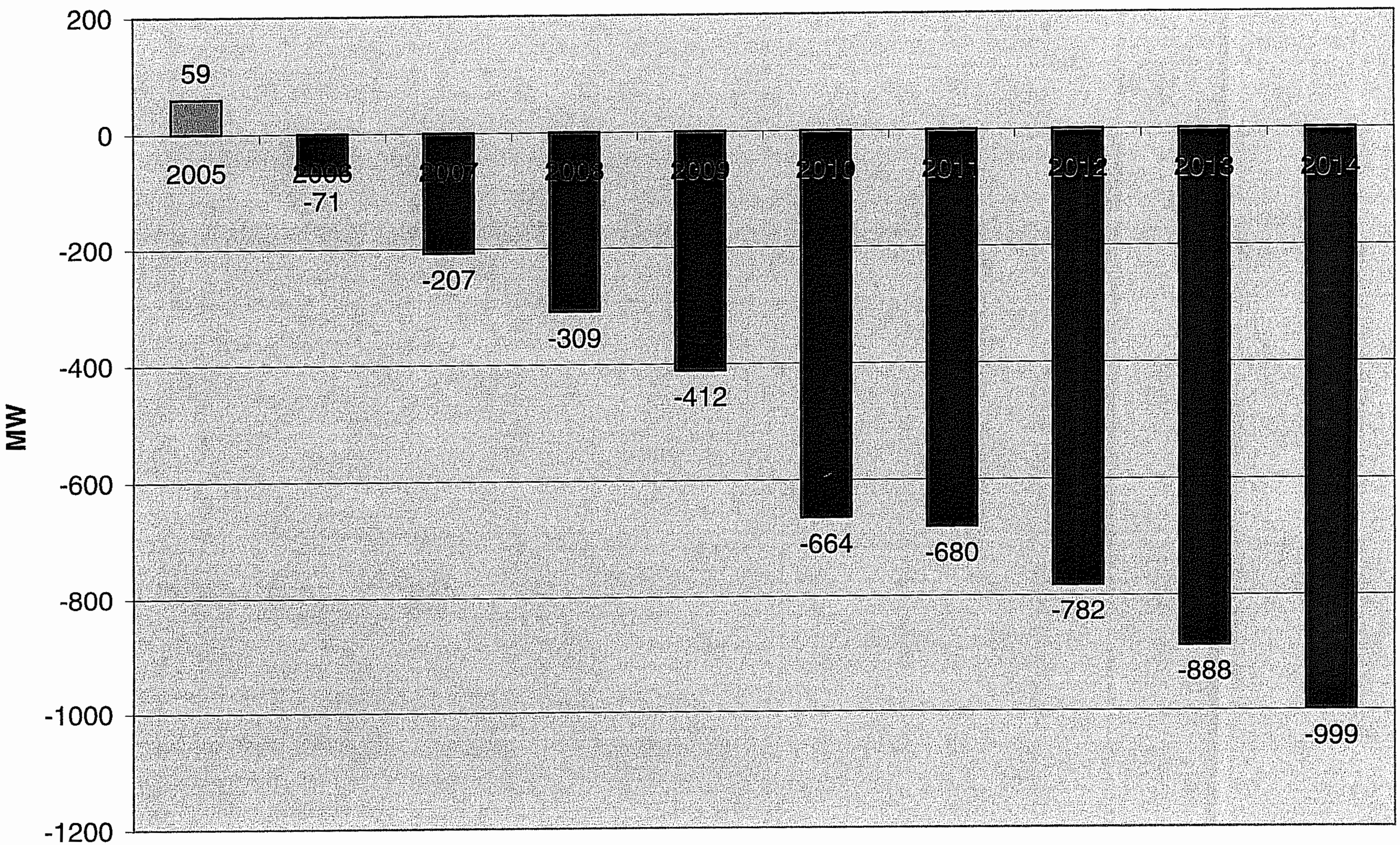


Exhibit 3-6

GRE SUMMER SURPLUS/DEFICIT FORECAST
Big Stone II Project
Big Stone II Co-owners

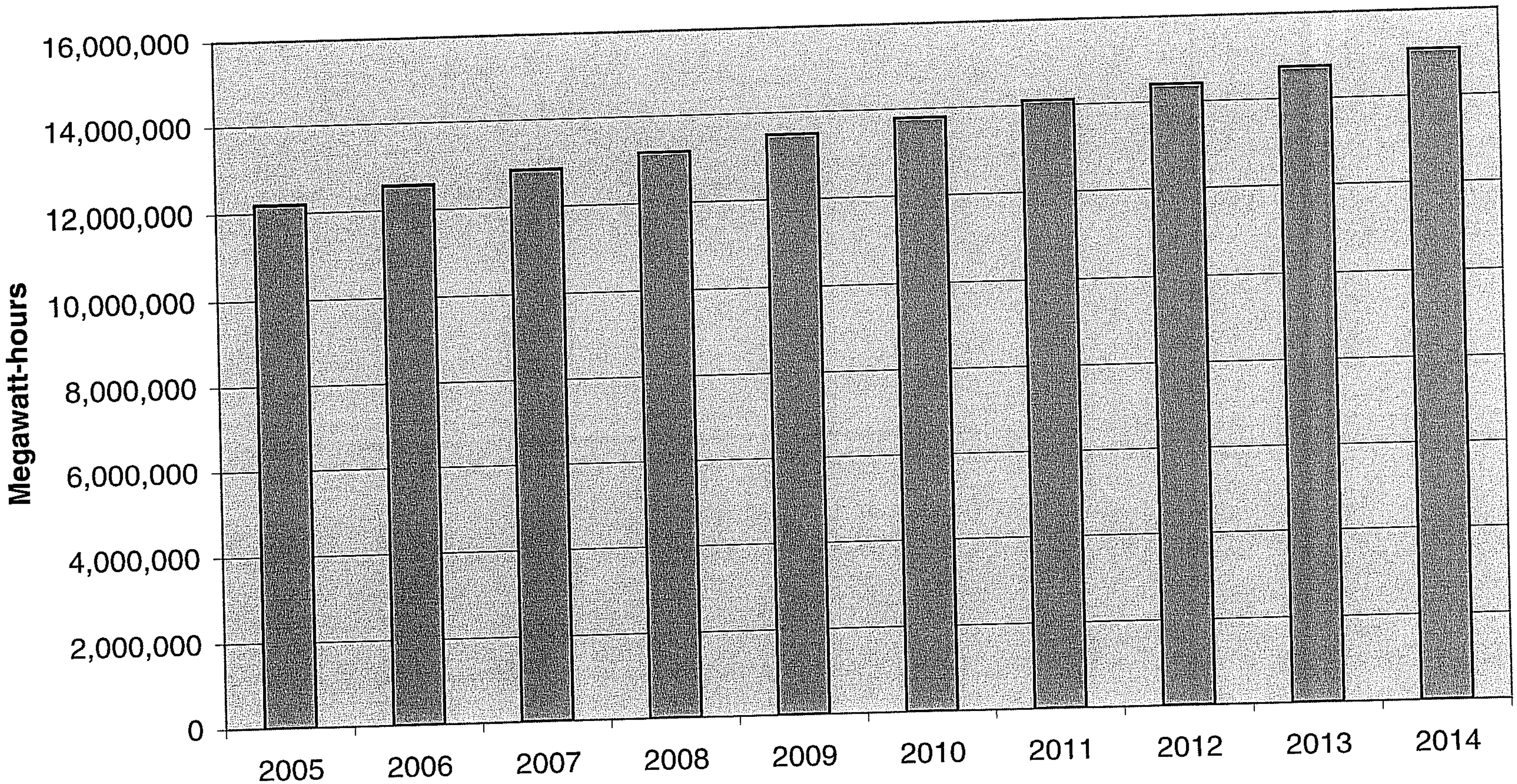


Exhibit 3-7

GRE ENERGY REQUIREMENTS FORECAST
Big Stone II Project
Big Stone II Co-owners

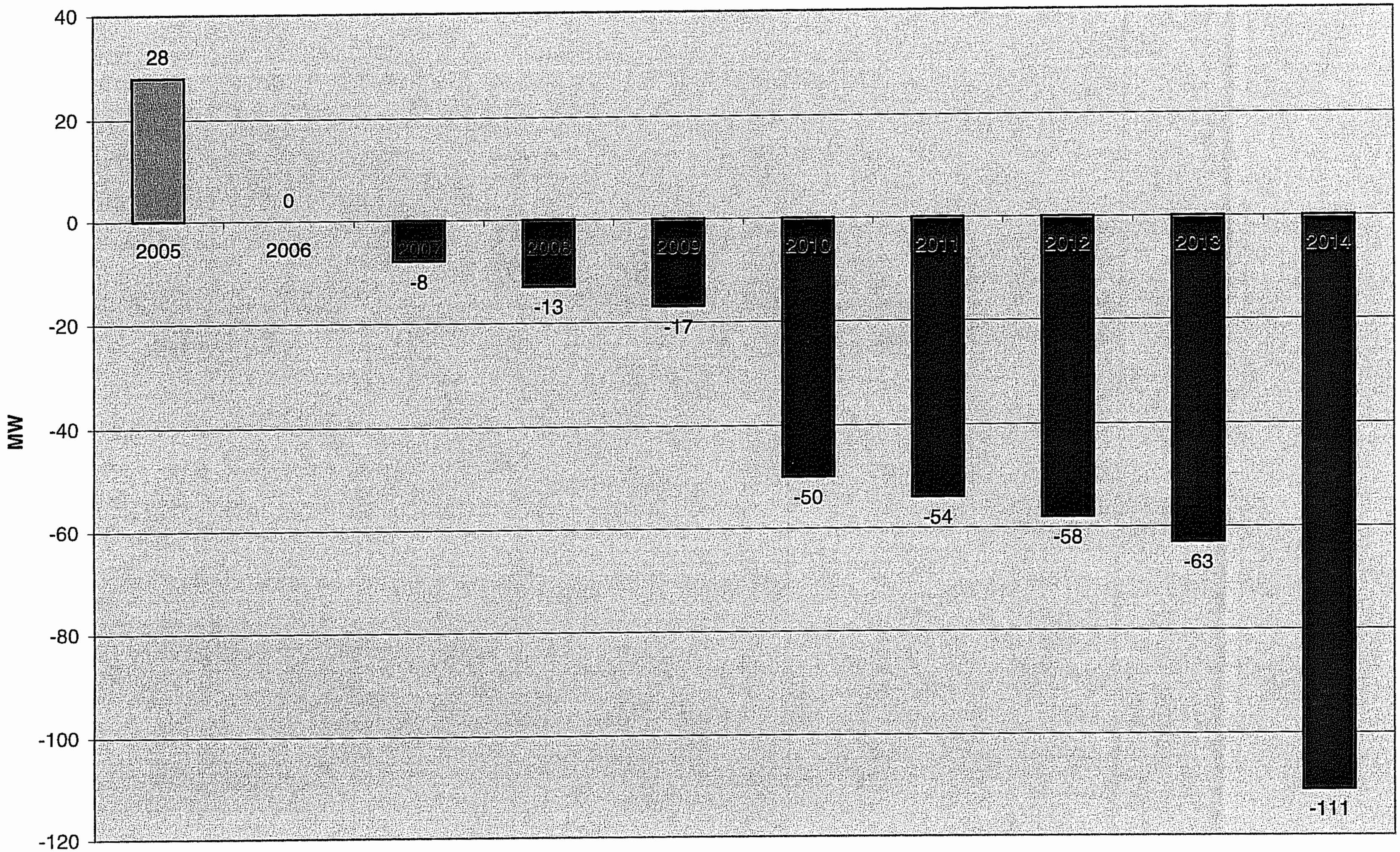


Exhibit 3-8

HCPD SUMMER SURPLUS/DEFICIT FORECAST
Big Stone II Project
Big Stone II Co-owners

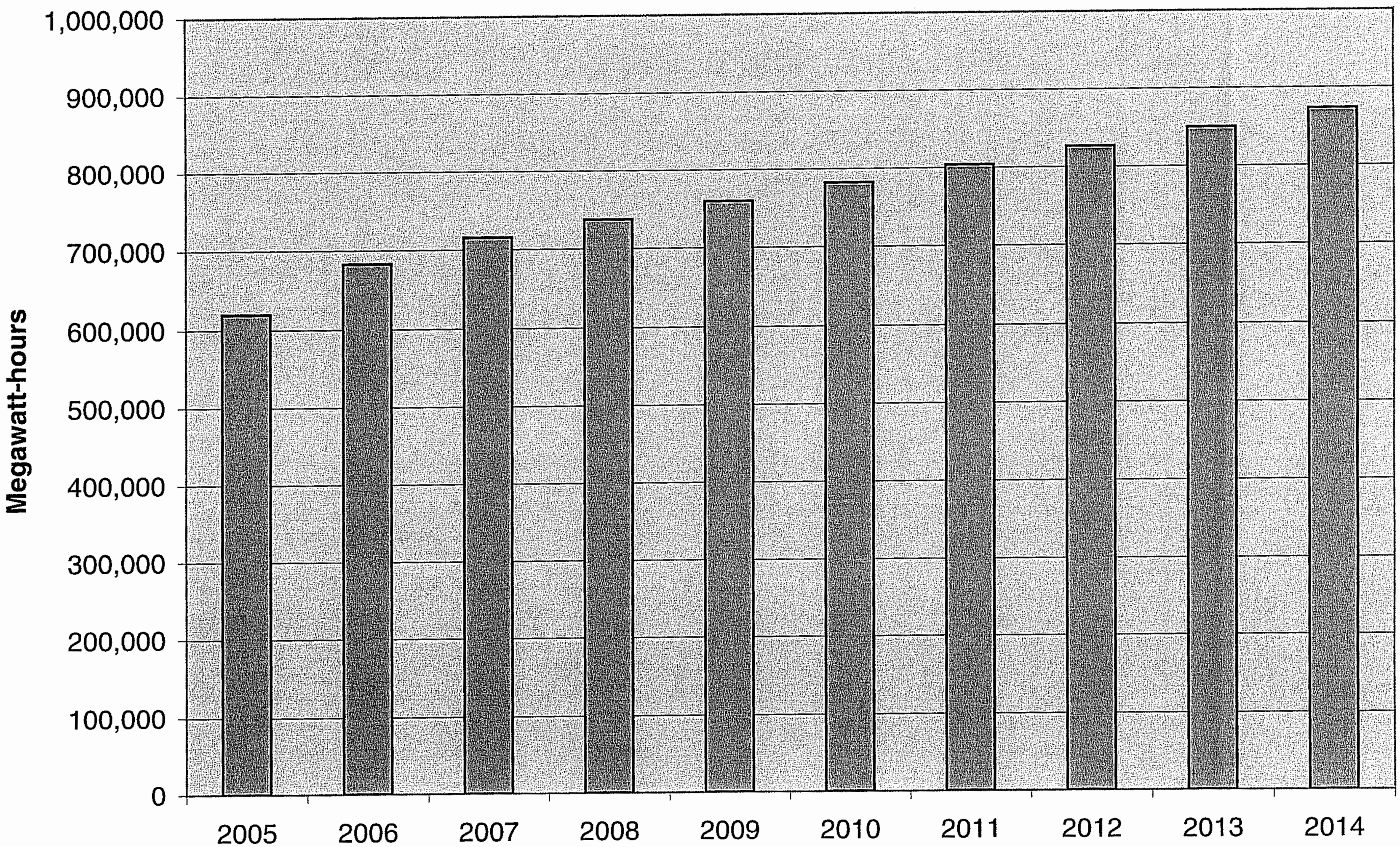


Exhibit 3-9

HCPD ENERGY REQUIREMENYTS FORECAST
Big Stone II Project
Big Stone II Co-owners

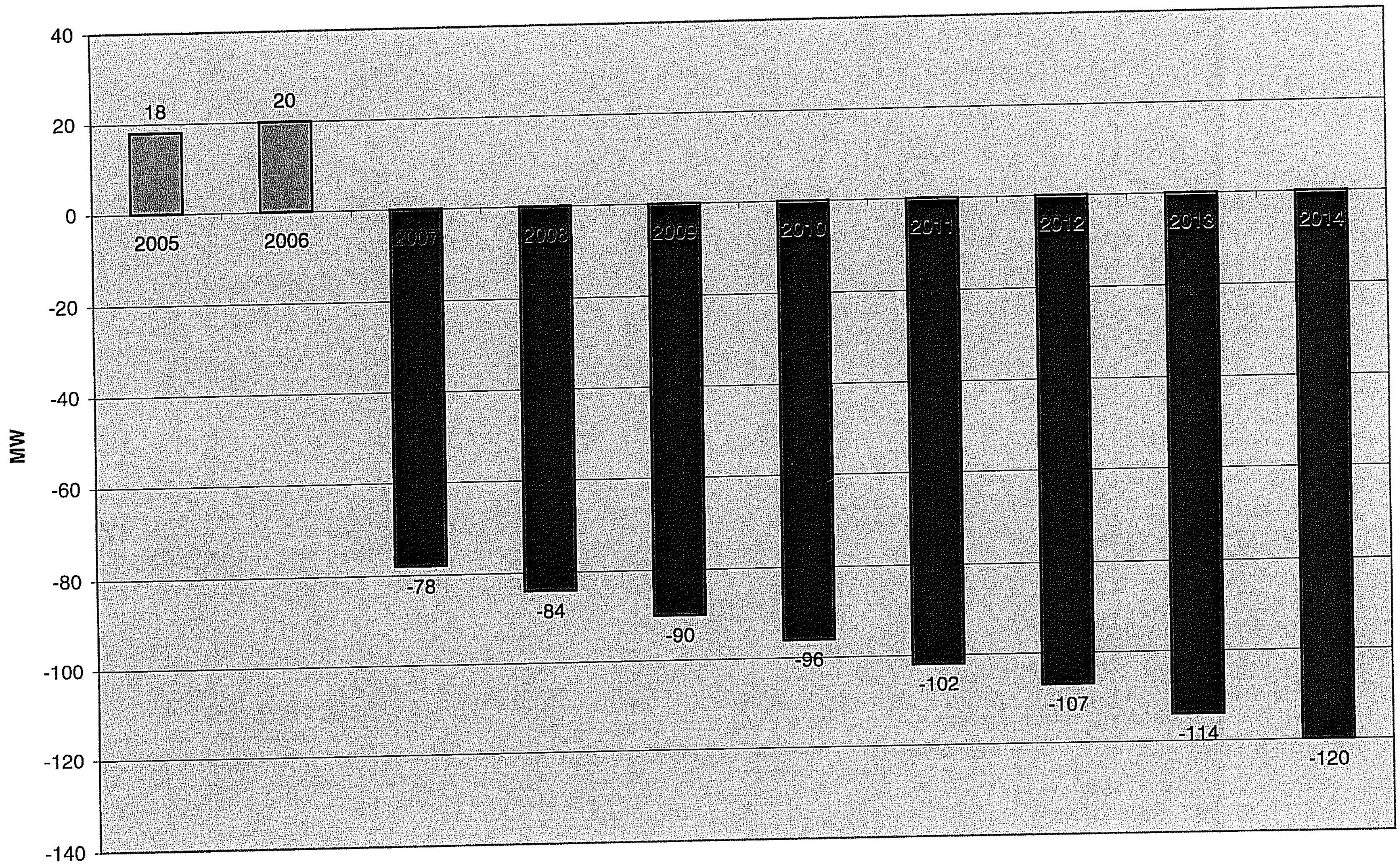


Exhibit 3-10

MDU SUMMER SURPLUS/DEFICIT FORECAST
Big Stone II Project
Big Stone II Co-owners

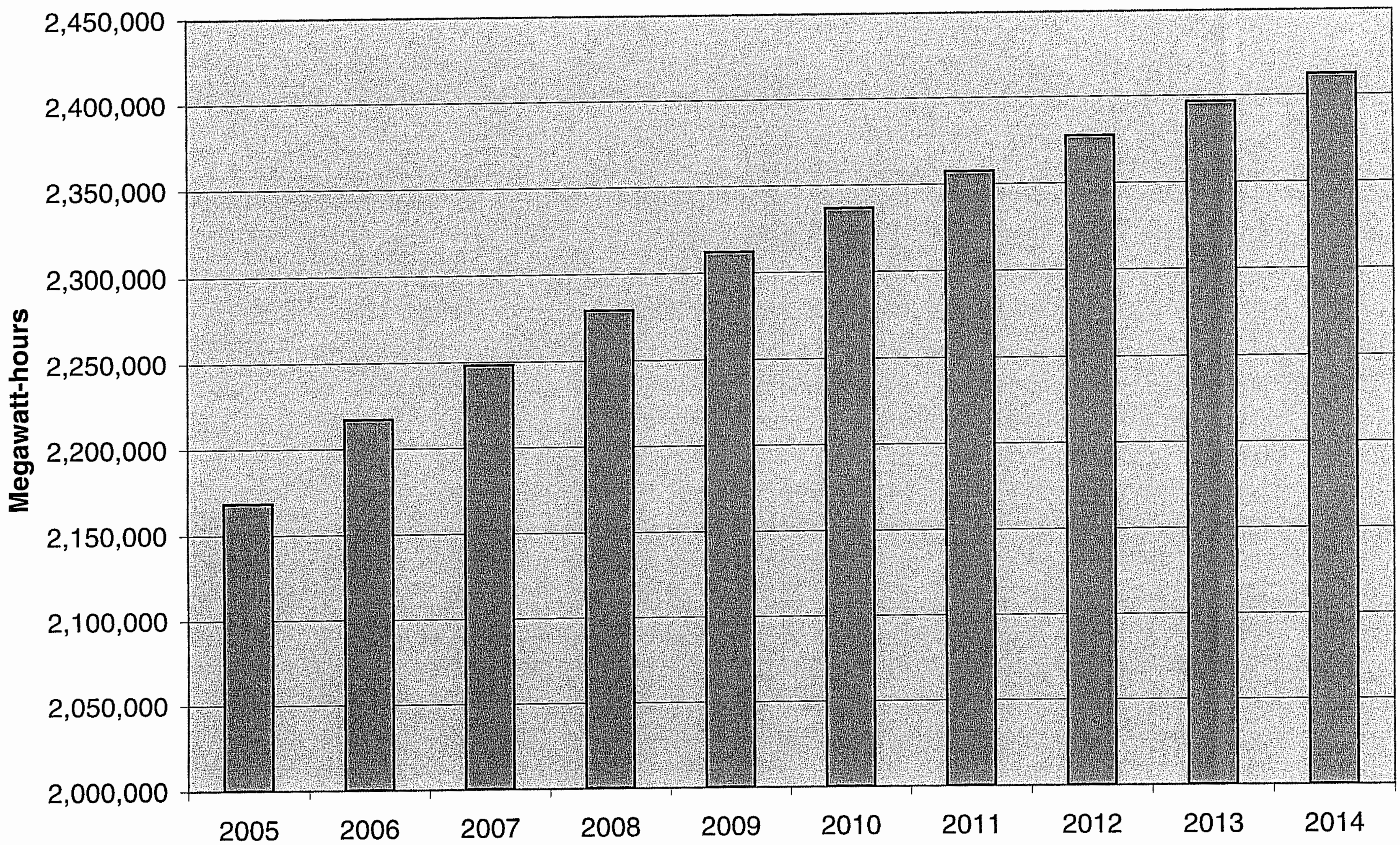


Exhibit 3-11

MDU ENERGY REQUIREMENTS FORECAST
Big Stone II Project
Big Stone II Co-owners

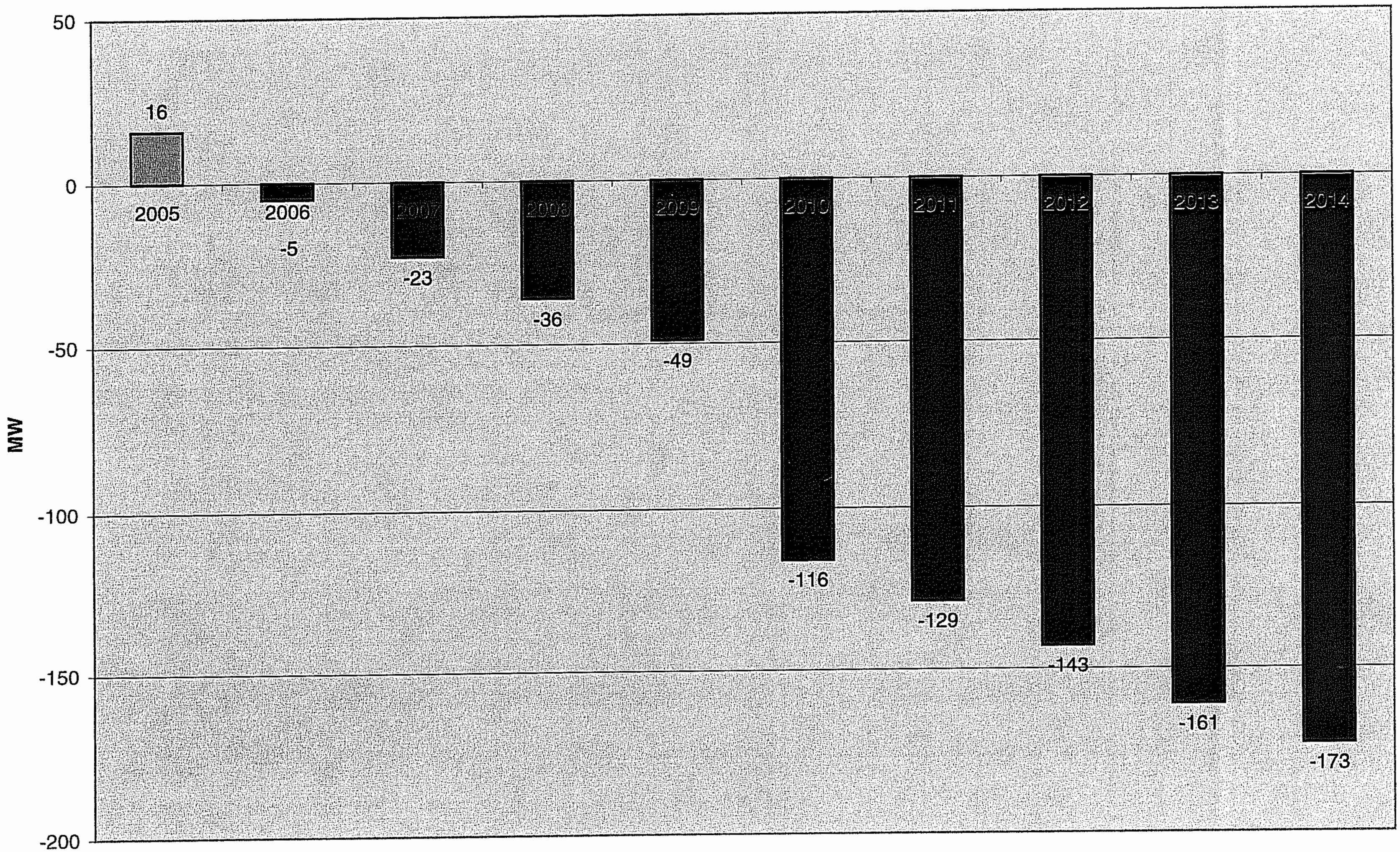


Exhibit 3-12

OTP SUMMER SURPLUS/DEFICIT FORECAST
Big Stone II Project
Big Stone II Co-owners

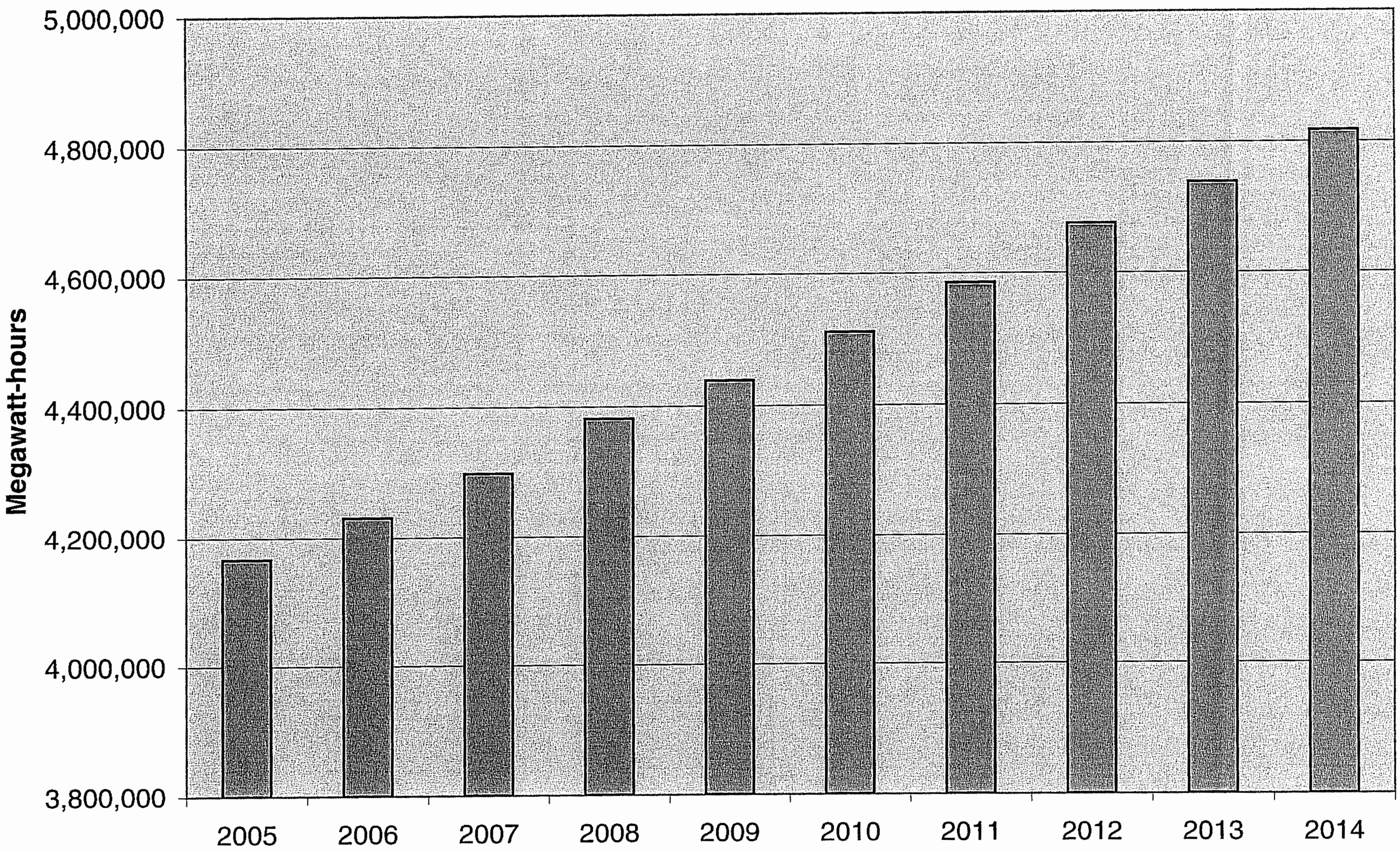


Exhibit 3-13

OTP ENERGY REQUIREMENTS FORECAST
Big Stone II Project
Big Stone II Co-owners

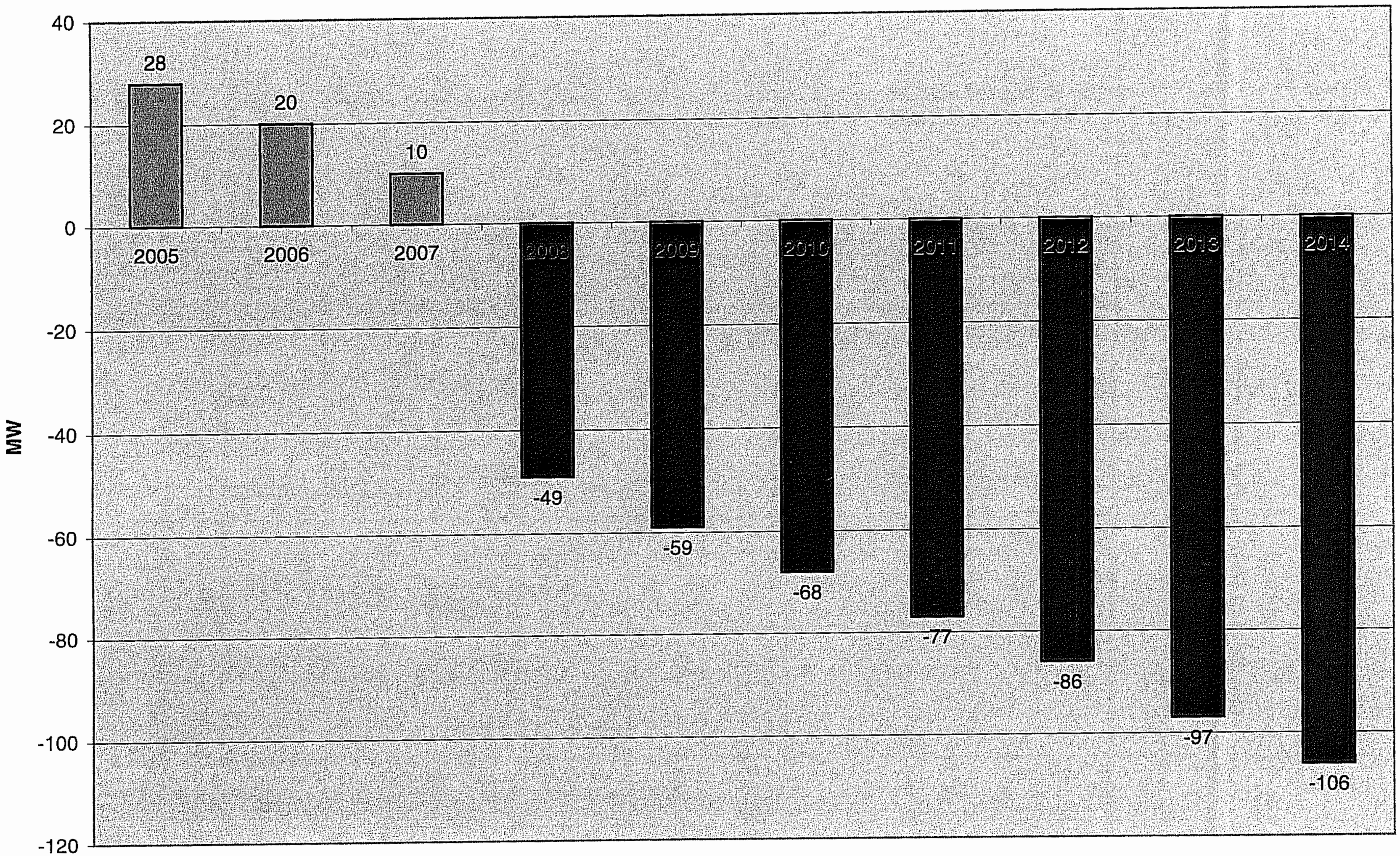


Exhibit 3-14

SMMPA SUMMER SURPLUS/DEFICIT FORECAST
Big Stone II Project
Big Stone II Co-owners

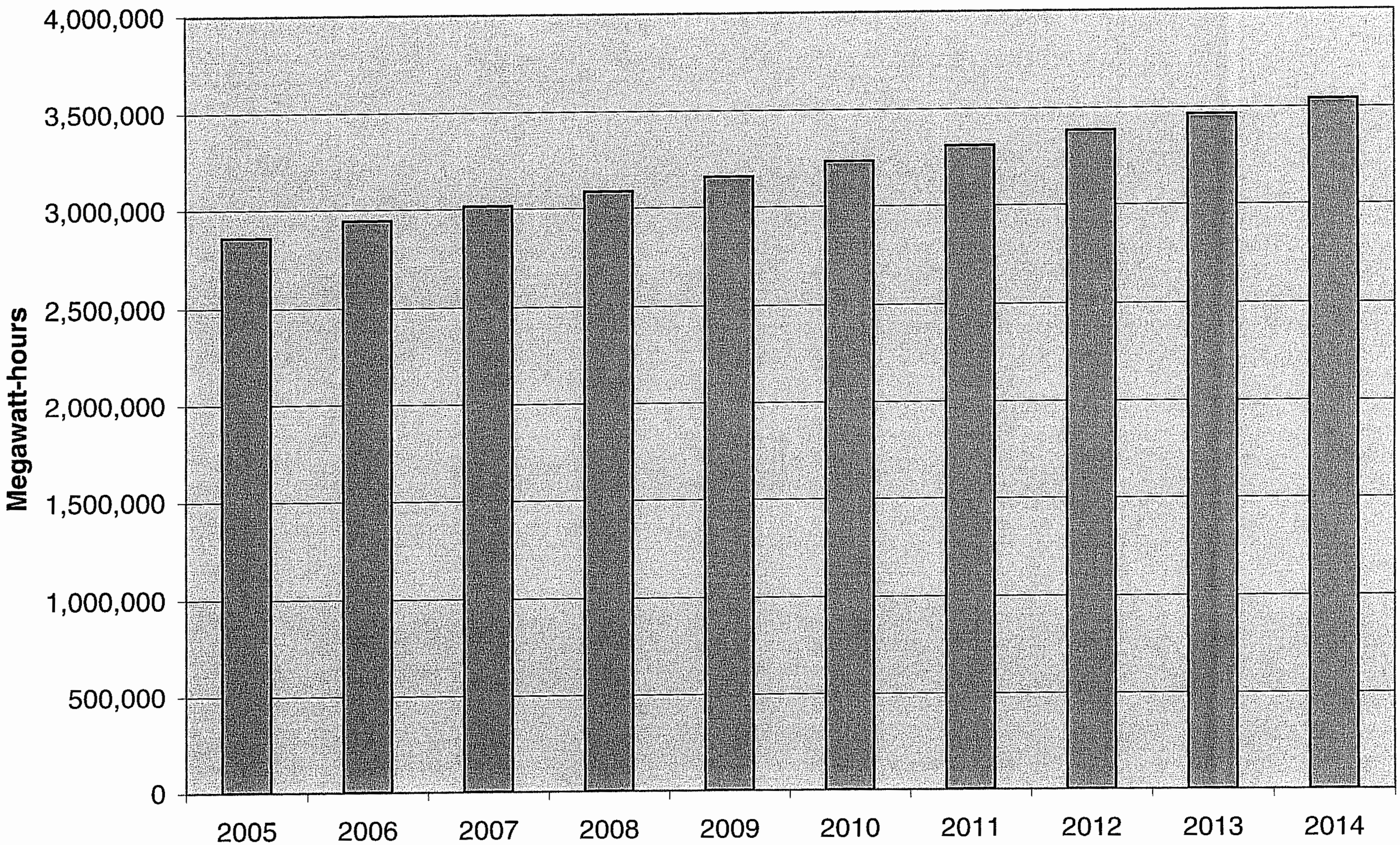


Exhibit 3-15

SMMPA ENERGY REQUIREMENTS FORECAST
Big Stone II Project
Big Stone II Co-owners

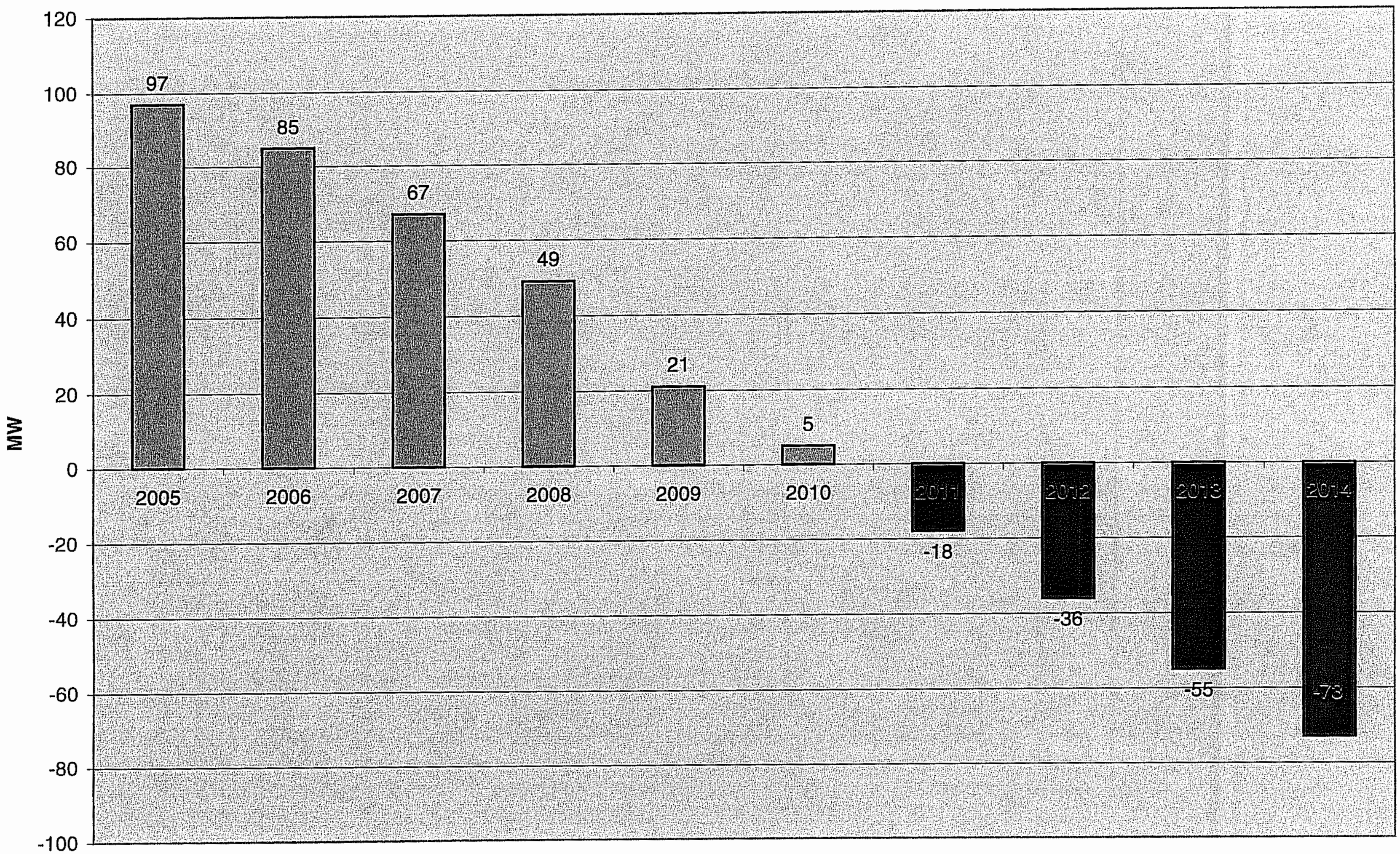


Exhibit 3-16

WMMPA SUMMER SURPLUS/DEFICIT FORECAST
Big Stone II Project
Big Stone II Co-owners

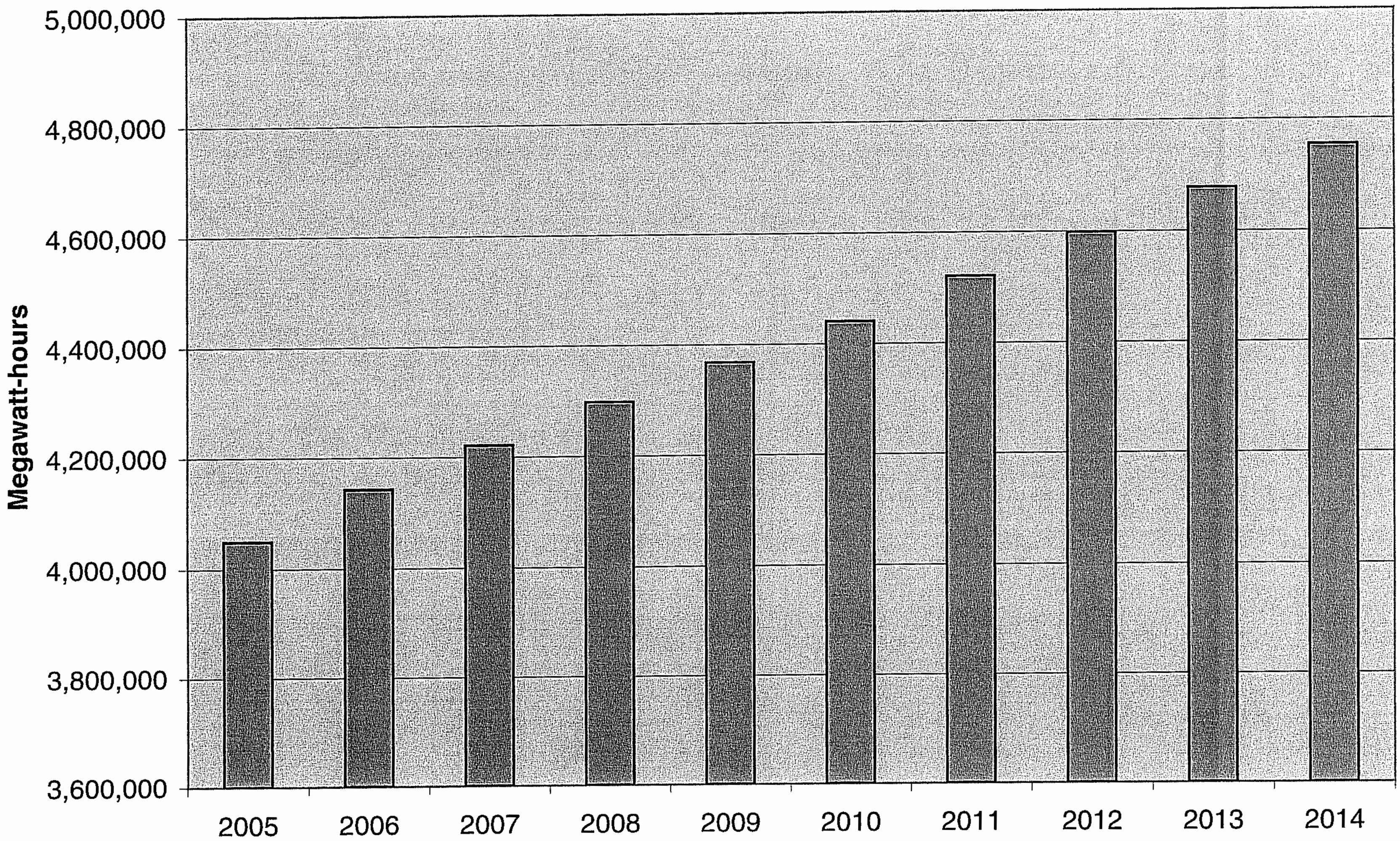


Exhibit 3-17

WMMPA ENERGY REQUIREMENTS FORECAST
Big Stone II Project
Big Stone II Co-owners

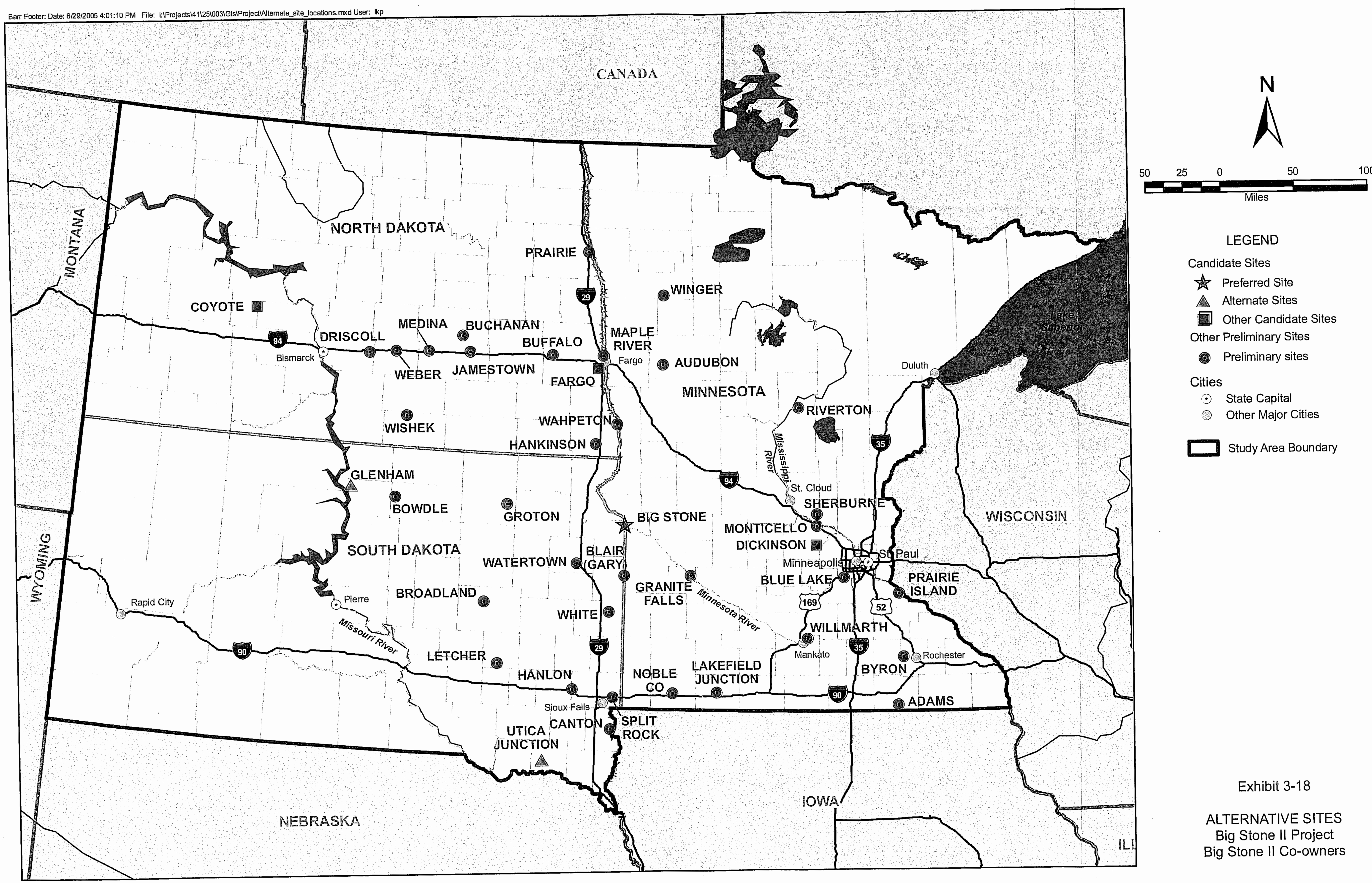


Exhibit 3-18

ALTERNATIVE SITES
Big Stone II Project
Big Stone II Co-owners

Section 4

4 Environmental Information

This section provides detailed descriptions of the physical environment and natural resources found within the immediate vicinity of Big Stone II. The potential and anticipated impacts of the construction of Big Stone II on these resources is evaluated and described as well. Impact analysis considers direct, indirect and cumulative effects on the existing environment and natural resources of the area.

4.1 Physical Environment

4.1.1 Land Forms and Topography

The Big Stone II Project area is situated in a relatively flat to gently rolling landscape comprising agricultural fields interspersed with small emergent wetlands. The existing Big Stone Plant unit I is situated on an area developed for industrial use, and includes one large artificial cooling pond, an evaporation pond, a holding pond, and several smaller impoundments. Southeast of the plant, the Whetstone River meanders eastward to the Minnesota River. Immediately adjacent to the Whetstone River, the topography changes abruptly to steep 50 to 60-foot embankments. Exhibit 4-1 shows the topography of the local area at 10-foot contours.

Construction of the Big Stone II facility will result in the conversion of additional land into active industrial use. Approximately 500 acres, mostly in existing cropland, will be converted to an open makeup storage pond. Another 30 acres will be converted to a cooling tower blowdown pond. Grading for the new plant structure and cooling tower within the existing Big Stone Plant unit I site will not appreciably alter the existing topography.

Completion of the new makeup storage pond will alter surface water flow patterns from the north and west of the proposed pond location. Surface water flowing toward the north edge of the makeup storage pond will be diverted eastward beyond the pond, where it can follow the existing topography south toward a wetland complex draining into the Whetstone River.

Cumulative impacts are those effects arising from future government or private activities that are reasonably certain to occur within the Project area. The Big Stone II site is part of and adjacent to an already developed industrial site located within an area that is predominantly agricultural, with no large metropolitan areas nearby. There is a low likelihood of future government or private activities that would contribute to cumulative impacts on the land forms or topography of the Project area. As a result, there are minimal cumulative impacts on the land forms or topography associated with this Project.

4.1.2 Geology

The Big Stone II site lies on a glacial drift plain that stands 140 feet above Big Stone Lake to the east and the Whetstone River to the south and west. To the west, the ground surface rises 900 feet in the distance of 15 to 20 miles to the crest of the Coteau des Prairies, a prominent regional highland.

Approximately 150 to 200 feet of glacial drift underlies the site, the majority of which was deposited during the Upper Wisconsin stage of Pleistocene glaciation. Eastern South Dakota has a complex glacial geologic record, characterized by numerous northwest-southeast trending end and stagnation moraines. Trending east-west across the site and extending to the northwest is the end moraine from the Big Stone Advance (Exhibit 4-2). The northern portion of the site is underlain by ground moraine (Martin et. al, 2004). Both the end moraine sediments and the ground moraine sediments are primarily sandy, gravelly clay till with discontinuous seams, lenses, and beds of sand. The major river valleys in the area, including the Whetstone River valley, are underlain by younger alluvium that can be up to 75 feet thick (Martin et. al, 2004).

The glacial sediments at the site are underlain by a sequence of Cretaceous aged sedimentary rocks, which in turn is underlain by Precambrian granite. The sedimentary rocks consist of interbedded shale, clastic sediments and limestone. Beneath much of the site, the upper bedrock unit is the Carlile Shale, a dark-gray to black silty to sandy shale. A buried bedrock valley, trending southwest to northeast, underlies the site (Exhibit 4-3) and appears to be greater than 50 feet deep. South of the site, the Precambrian Milbank Granite outcrops near the Minnesota boarder (Tomhave and Schulz, 2004).

The Big Stone II expansion will have no direct, indirect or cumulative effects on the geology of the region.

4.1.3 Soils and Economic Deposits

Soils within the property boundaries consist of 29 different soil types (see Exhibit 4-4). The area is dominated by upland soil types, which comprise 77 percent of the area while hydric soils comprise 23 percent of the site. The predominant of the upland soils is loam, comprising 90 percent of the upland soils with minor areas of sandy loam, silt loam, and silty clay loam. Nearly one-half of the wetland soils (46 percent) within the Project boundary are mapped within the extent of the existing western water storage pond. Approximately 27 percent of the hydric soils are mapped as silt loam, 18 percent mapped as loam soils, and the remaining 10 percent are mapped as silty clay loams.

The mapped hydric soils are generally found within the valley bottoms and depressional areas where, historically, wetlands may have been present (see Exhibit 4-5). Due to the significant land use alterations that have occurred since human settlement of the area, many of these areas no longer contain wetlands due to hydrologic and other changes. Areas containing mapped hydric soils were generally investigated for the presence of wetlands.

The Natural Resources Conservation Service has classified soils that are considered prime farmland soils. On the Project site, there are a total of 20 soil mapping units that are classified as prime farmland soils. These soils make up 66 percent of the Project site (2,100 acres). A total of 7 of the 20 prime farmland soils within the Project boundaries are conditionally classified as prime since these soils must be drained to be considered prime. The conditional prime farmland soils make up 14 percent of the Project area or 22 percent of the total prime farmland area. Four of the hydric soils are classified as prime farmland soils, but they must be drained in order to be considered prime.

The proposed makeup storage pond will be excavated from a 500-acre area that is in primarily prime farmland soils. Portions of the proposed pond site are also in hydric soils.

There are no economically valuable mineral deposits within the Project boundaries. As a result, the Project will not result in the loss of or reduced access to, economic deposits.

4.1.4 Erosion and Sedimentation

According to the Soils Survey of Grant County, South Dakota (USDA/SCS (NRCS) 1979), soils at the Big Stone II site have moderate to low erosion factors. Site clearing and plant construction will take place on a relatively flat topography, with runoff during clearing and construction managed through the implementation of a Storm Water Pollution Prevention Plan (SWPPP) as described further in Section 4.6.3. After construction, all disturbed areas not covered with structures or pavement will be stabilized to prevent erosion from wind and water.

4.1.5 Seismic, Subsidence and Slope Stability Risks

The existing Big Stone Plant unit I and the Big Stone II expansion are located on relatively level terrain, and well outside of any known seismically active features and subsidence zones. No construction will occur in or near the steep slopes adjacent to the Whetstone River. As a result, there are no risks associated with slope stability.

There are no direct, indirect or cumulative impacts associated with this particular component of the Project's physical environment.

4.2 Hydrology

4.2.1 Surface Water Drainage

The Big Stone II Project is located within the Whetstone River Watershed. The Whetstone River drains 389 square miles of eastern South Dakota; the North Fork of the Whetstone River originates in Roberts County and flows southeasterly into Grant County where it joins the South Fork of the Whetstone River. The Whetstone River flows to the Minnesota River south of Big Stone City. The Whetstone River has an annual mean discharge of 59.1 cfs and mean annual discharge volume of 42,180 acre-feet (1910 to 1997 period of record) at the gaging station located 1.5 miles west of Big Stone City (USGS, 1997, Annual Report for Minnesota River Basin).

The Big Stone site is located at the northern edge of the Whetstone watershed such that there is minimal overflow from the north across the site. Exhibit 4-6 provides an overview of the existing drainage patterns on the site. Drainage on the Big Stone II makeup storage pond site currently flows south, either directly to the Whetstone River or via an intermittent stream that flows west to east across the new property. The overland flow path from the immediate watershed to the intermittent stream extends 1.1 miles from the north, 1.4 miles from the west, and 0.8 miles from the south. This intermittent stream also receives water from the Big Stone City wastewater lagoon outfall. The existing Big Stone generating facility has a minimal amount of overland flow to the site from the west. Overland flow patterns from the current Big Stone facility are south through a series of wetlands to the intermittent stream and easterly to the Whetstone River. The existing Big Stone Plant unit I generating facility does not discharge any process water to the surface drainage system.

Changes in drainage patterns due to the Big Stone II Project will be primarily related to the construction of the new makeup storage pond (reservoir). The location options for the makeup storage pond intersect and cross a number of the existing drainage ways. Configuration of the new makeup storage pond will redirect surface runoff around the pond and back into existing drainage ways. The Big Stone II facility will be a zero liquid discharge facility so that no process water will discharged to the surface drainage network.

The plant facilities will create new runoff from impervious surfaces. Retention of surface new water runoff will be provided for within the areas adjacent to the plant. Surface drainage off the site will be intermittent and most likely only during wet years and possibly spring runoff periods. All surface drainage will be directed into the existing drainage pattern following retention onsite for treatment.

4.2.2 Water Use and Sources

The fresh water makeup requirement for operation of existing Big Stone Plant unit I is approximately 4200 acre-feet per year. Makeup water is currently drawn from Big Stone Lake to refill the onsite cooling pond when the lake is at acceptable levels in accordance with the water appropriation permit from the State of South Dakota. The current permit authorizes the appropriation of up to 100 cubic feet per second (cfs), and up to 8,000 acre-feet/year. Currently, three existing pumps can deliver water from Big Stone Lake to the site. Two pumps can each delivering approximately 50 cubic feet per second (cfs), giving a total of approximately 100 cfs pumping capacity. The third pump can deliver approximately 10 cubic feet per second and it is used to during those time periods when the water appropriations permit allows pumping but at rates of less than 100 cubic feet per second.

Big Stone Lake is located approximately ¼ mile east of the northeast corner of the existing evaporation pond. The addition of Big Stone II will increase the total fresh makeup requirement for the Big Stone Station to approximately 10,900 acre-feet/year. Both Big Stone Plant unit I and Big Stone II will draw makeup water from Big Stone Lake, which, in turn is recharged by precipitation from the surrounding basin. Makeup water will be withdrawn from Big Stone Lake to refill onsite makeup ponds when the lake is at acceptable levels in accordance with the conditions set forth in the modified water appropriation permit from the State of South Dakota. Additional water appropriation will be requested to support the two units' operations.

Additional makeup ponds will be added as part of the development of Big Stone II to allow for enough storage capacity to operate both existing Big Stone Plant unit I and the proposed Big Stone II during most drought conditions without recharging onsite storage from Big Stone Lake. Big Stone II systems have been designed to reuse water within the facility such that fresh makeup water consumption from Big Stone Lake is minimized. The new makeup storage pond will have a storage capacity of approximately 9,900 acre-feet, which, along with the existing ponds, will provide approximately 15,300 acre-feet of makeup water storage. This storage volume is designed to provide sufficient storage capacity for the plant to operate through extended drought periods, when withdrawing water from Big Stone Lake would be restricted.

The current water appropriations permit allows for a maximum of 100 cfs to be withdrawn from the lake at any time. The additional makeup will come from extended operation time of the existing pumps with no increase in withdrawal rate. The increase in annual appropriation volume will require an amendment to the Big Stone water appropriations permit. The amendment application will have to demonstrate conformance to current statutes and regulations and not significantly increase impacts to Big Stone Lake and the Minnesota River. Given the average annual lake outflow of over 90,000 acre-feet, there should be surplus water available in most years. Based on a study completed by Barr Engineering in March 2005 (Exhibit B), the impact on the Big Stone Lake level would be infrequent; the worst effect is predicted to be in one year out of a 70-year period that the lake level would be 1 foot lower.

Big Stone II may use groundwater during construction and may consider groundwater sources for water supply during periods of extended drought.

Big Stone II will be an environmentally-friendly, zero liquid discharge facility, which utilizes wastewater concentration equipment designed so that no wastewater will leave the facility. The Big Stone II systems have been designed to reuse water within the facility such that fresh makeup water consumption from Big Stone Lake is minimized.

The addition of Big Stone II will change the plant site's water utilization procedures. A new makeup storage pond will be created to provide storage that will be used as a source of makeup for the existing Big Stone Plant unit I cooling pond. The existing evaporation and holding ponds will also be converted into a single makeup storage pond. Valves and new piping will be installed to allow water to be pumped from Big Stone Lake to the new storage pond, existing cooling pond, or the converted evaporation and holding ponds. Two pump stations will be added to allow water to be pumped from the new storage pond and the converted ponds to the cooling pond.

In order to conserve fresh water, a cooling tower will also be constructed for Big Stone II. Makeup for the cooling tower circulating water will be provided from the existing cooling pond. Additionally, a new holding pond for cooling tower blowdown / scrubber supply water and will be constructed adjacent to the new Big Stone II cooling tower. This divided pond will supply water to the scrubber. Overflow from the higher quality section of the cooling tower blowdown pond and scrubber system blowdown will be discharged into the lower quality section of the cooling tower pond. Pumps will pump water from the lower water quality section of the cooling tower blowdown pond to the brine concentrators.

An additional brine concentrator will be installed to handle the additional blowdown stream flow. Water from the brine concentrators will be used as the supply for boiler process water or pumped to the ethanol plant, with the excess flowing to the cooling pond.

4.3 Terrestrial Ecosystems

4.3.1 Vegetation Communities

Vegetation communities present on the existing Big Stone II property and the area acquired for the new makeup storage pond were mapped in September 2004 (see Exhibit 4-7). There are 24 vegetation cover types comprising 120 distinct plant communities in the Big Stone II Project area. A summary of vegetation cover types is found in Table 4-1.

Most of the Big Stone II Project area is in disturbed and/or degraded vegetation cover types, with perennial row crops and non-native grasslands alone accounting for over half of the total coverage. Overall, over 87 percent of the total vegetative cover is rated as low ecological quality. Areas of high quality vegetative cover total 27.45 acres (0.86 percent of the total site area). These areas are primarily concentrated near the Whetstone River, and include native cordgrass wet prairie, northern bur oak mesic forest and northern plains transitional bluestem prairie. Medium ecological quality communities comprise 358.81 acres (11.21 percent of the Project area). Exhibit 4-8 details plant community quality.

Table 4-1 Summary of Vegetation Community Types

Vegetation Community Type	Site Total	Percent of Project Total
Cottonwood-reed canary grass depressional wetland	1.0	0.03
Cottonwood-willow floodplain woodland	113.2	3.54
Cottonwood-willow-reed canary grass depressional wetland	3.6	0.11
Disturbed grassland w/ trees	11.8	0.37
Excavated/fill	79.4	2.48
Farmed wetland	8.4	0.26
Impervious surfaces	26.5	0.83
Industrial	201.4	6.29
Mixed deciduous woodland	51.7	1.61
Mixed native/non-native meadow	4.0	0.13
Mixed native/non-native meadow/Northern Great Plains cattail marsh	29.8	0.93
Non-native dominated grasslands	518.0	16.19
Northern bur oak mesic forest	8.8	0.27
Northern bur oak openings	33.7	1.05
Northern cordgrass wet prairie	11.2	0.35
Northern cordgrass wet prairie/Northern Great Plains cattail marsh	16.4	0.51
Northern plains transition bluestem prairie	164.1	5.13
Northern sedge wet meadow/Northern Great Plains cattail marsh	8.8	0.28
Northern sedge wet meadow/Willow woodland	4.5	0.14
Oak woodland with non-native grasses	9.7	0.30
Open water	717.1	22.41
Perennial crops	185.1	5.78
Planted deciduous trees with non-native grasses	17.3	0.54
Row crops	974.7	30.46
TOTAL	3200	100

Direct impacts to vegetation communities include clearing and excavating activities. Most of the direct impacts associated with the Big Stone II, cooling tower, cooling tower blowdown pond and construction laydown area will occur in vegetative cover types with low ecological quality. The new makeup storage pond may require the excavation of several native prairie communities, including one rated high quality and several others rated medium quality. Direct impacts to these vegetation communities would depend upon the ultimate capacity and configuration of the pond.

Indirect impacts to vegetation communities include alteration of surface water drainage patterns, which could cause shifts in the species composition of an affected community. The potential for this type of indirect impact is greatest near the new makeup storage pond, since the pond's configuration may require the diversion of surface drainage from north and west of the pond.

A second indirect impact is the Project's potential for introducing additional non-native invasive plant species to the area, as well as creating disturbance conditions that confer a competitive advantage on non-native invasive species over native species. Non-native invasive species tend to be opportunistic colonizers on disturbed sites, in this case clearing and construction of Big Stone II and its associated structures and ponds. Even after the initial disturbance, new communities of non-native invasive plant species may remain around and within the Big Stone II perimeter, providing an additional seed source for further invasion of other vegetation communities.

Mitigation of direct impacts to vegetation communities around the Big Stone II includes reseeding of disturbed areas with native plant species, and improved management of existing high and medium ecological quality vegetation communities. Improved management of degraded native plant communities, primarily some of the area's northern plains transition bluestem prairie remnants, could also be incorporated into the site's overall mitigation plan.

Construction and operation of Big Stone II will make a minimal contribution to cumulative impacts to vegetation communities in the region. This is because the regional vegetative cover is primarily agricultural, and there is a low likelihood of additional activities that would generate similar impacts to vegetation communities. Moreover, improved management of native plant communities on the Big Stone Plant property will provide a positive cumulative impact by increasing the regional coverage of better-quality vegetation communities.

4.3.2 Wildlife

The lakes, swamps, reservoirs, and streams within the Upper Minnesota River Watershed are suited for wildlife habitat, limited water sports, recreational areas, and hunting lands.

The valley bottoms provide a rich diverse habitat for many species of wildlife-large and small game animals, song birds, waterfowl, and fur-bearers. Marsh and Lac Qui Parle lakes are incorporated into some of the largest and most important wildlife management areas and public hunting grounds in the state, and are stopovers for great concentrations of migrating waterfowl in spring and fall. Brushy, wooded hills bordering the river bottoms with agricultural fields, swamps, and wetlands, provide both food and cover.

4.3.3 Threatened and Endangered Species

The U.S. Fish and Wildlife Service has identified three federally listed species that may occur in the Project area (USFWS/Gober 2004, September 16, 2004 letter to Jeffrey Lee/Barr Engineering). They are the Bald eagle (*Haliaeetus leucocephalus*), the Topeka shiner (*Notropis topeka*), and the western prairie fringed-orchid (*Platanthera praeclara*).

The bald eagle, a federally threatened species, is known to occur in Grant County and throughout South Dakota. New nests appear in Grant County and in South Dakota in general each year, and the birds nest from January through August. The USFWS restricts construction within one-quarter (0.25) mile of an active bald eagle nest. A bald eagle nest was identified and mapped approximately 1700 feet (0.3 mile) north of the existing east water storage and cooling pond (see Exhibit 4-9). The nest is nearly 1.5 miles northwest of the proposed Big Stone II site, and over 1.5 miles from the proposed cooling tower. It is nearly 3 miles northwest of the proposed new makeup storage pond.

The Topeka shiner, a federally endangered species, is listed as a "possible" occurrence in Grant County. The species is not listed as South Dakota state threatened or endangered. The South Dakota Department of Game, Fish and Parks has no current or historic locations of the Topeka shiner in Grant County, and all known occurrences of the Topeka shiner in South Dakota are in streams south southeast of Grant County (S.Dakota Dept. of Game, Fish and Parks 2003, Topeka Shiner Management Plan for South Dakota).

Construction of Big Stone II is not likely to result in any direct, indirect or cumulative impacts on the Topeka shiner. This is because the only potential habitat for the fish, the

Whetstone River, is outside of the construction limits of the Project, and will receive no discharge from Big Stone II. In the event that, prior to or during construction, the Topeka shiner is found in the Whetstone River, the South Dakota Department of Transportation Special Provisions for Construction Practices in Streams Inhabited by the Topeka Shiner (SDDOT 2003) can be implemented.

The western prairie fringed-orchid, a federally threatened species, is also listed as a "possible" occurrence in Grant County. There are currently no known populations of this plant species in South Dakota. However, the species has historically been distributed throughout the tallgrass prairie west of the Mississippi River in the Central United States and southern Canada, and one of the three largest remaining populations is approximately 122 miles north of the Big Stone II site. Moreover, the species' preferred habitat of mesic prairie swales exists in several small areas within the Big Stone II Project area. A number of the known plant associates of the western prairie fringed-orchid are also present, including big bluestem (*Andropogon gerardii*), little bluestem (*Schizachyrium scoparium*), and several sedge (*Carex* spp.) species.

Field surveys conducted in September 2004 did not locate any populations of western prairie fringed-orchid. As a result of further consultation with USFWS botanists and regional experts in the phenology of the western prairie fringed-orchid, an additional field survey for the western prairie fringed-orchid was conducted on the Big Stone property by a certified ecologist on July 11, 2005. The search area included the unnamed tributary to the Whetstone River that begins in a 35-acre wetland and flows eastward to the Whetstone River. This unnamed tributary is a broad, meandering swale for most of its length, and develops a recognizable bed and bank only east of 484th Street. The entire tributary west of 484th Street was dry at the time of the survey, with several lengths of saturated soils and/or standing water.

The timing of the survey for the western prairie fringed-orchid was determined following consultation with Dr. Carolyn Sieg, a biologist who has published several technical papers on the species and Dr. Bonnie Alexander, who is currently continuing research on the species at the Sheyenne National Grasslands. The search area was selected based on several factors, including the:

- preferred habitat of the species,
- previously-conducted vegetation community type and community quality surveys;
- presence of species commonly associated with the species, and
- area with potential impacts associated with the project.

No western prairie fringed-orchid was located during the survey. The eastern portion of the unnamed tributary to the Whetstone River flows through an area that is heavily grazed. The western end of the tributary is dominated by reed canary grass and cattails. Common associates of the western prairie fringed-orchid, including big bluestem and sedges, were isolated and sparsely distributed.

Land on Big Stone property along the northern edge of the Whetstone River had more of the known plant associates of the western prairie fringed-orchid, but was drier than the species' preferred soil moisture range, and was separated from the river by tall (20'-40'), steep banks.

Based on the July 11, 2005 field survey, it is unlikely that the western prairie fringed-orchid is present on the Big Stone property.

Since the western prairie fringed-orchid is not currently known from the Big Stone II site and potential habitat occurs in a number of other areas in the region, the Project will have no cumulative impacts on the species.

4.4 Aquatic Ecosystems

4.4.1 Wetlands

Preliminary wetland delineations were conducted on the site in September 2004. Methods followed the *Corps of Engineers Wetland Delineation Manual* (USACOE Waterways Experiment Station 1987). Wetlands were classified following the *Wetlands of the United States* ("Circular 39") guidance (USFWS 1971) and the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al 1979). Wetland boundaries were tracked using a handheld GPS unit, with points taken at regular intervals. Wetland areas were derived from loading the GPS data into ArcMap 9.0 and calculating acreages of the delineated wetland polygons. The delineations were confirmed during a field inspection with a Corps of Engineers representative in early June 2005.

The September 2004 wetland survey identified 19 wetland areas totaling approximately 105 acres within the Project boundaries (see Table 4-2 and Exhibit 4-10). The largest wetland basin is a 52.0-acre wet meadow/deep marsh. Six of the wetlands, totaling 9.6 acres, are Type 1 seasonally flooded basins. Five of the 18 wetlands, totaling 15.8 acres, are Type 2 wet meadows. An additional three sites, totaling 22.7 acres, are Type 2 wet meadows with Type 3 shallow marsh components. The remaining four sites, totaling 4.7 acres, are deep marsh/wooded swamp communities. The final delineation and jurisdictional determination for wetlands present in the Project boundaries was completed in June 2005 during a field inspection with a Corps of Engineers representative. Of the 19 wetland basins identified, four basins totaling 82.4 acres were determined to be under the Corps' jurisdiction. The remaining 15 basins are isolated, meaning that they have no surface hydrologic connection to other wetlands or streams. Isolated wetlands are not considered jurisdictional wetlands under the regulatory authority granted to the Corps by Section 404 of the Clean Water Act..

Table 4-2 Wetland Summary

Wetland ID	Circular 39 Type	Area (ac)	Corp Jurisdiction
1	1	1.2	N
2	2/3	5.2	N
3	1	0.9	N
4	2/3	0.8	N
5	1	0.5	N
6	2	0.2	N
7	2/7	0.3	N
8	2/4	52.0	Y
9a	2	4.7	Y
9b	2	9.0	Y
10	2/3	16.7	Y
11	2	0.3	N
12	2/7	1.8	N
13	2/7	0.8	N
14	2/7	1.8	N
15	2	1.6	N
16	1	3.4	N
17	1	1.4	N
18	1	2.2	N
Total (acres)		105	82.4

Wetlands provide many functions and values that directly or indirectly benefit society. Commonly assessed functions and values include flood storage and stormwater control, baseflow and groundwater support, erosion and shoreline protection, water quality improvement, biological support and wildlife habitat functions, and cultural values.

The relative amount of any given function provided by a particular wetland depends on many factors, such as the size of the wetland, topography, geology, hydrology, types and distribution of habitat present, relationship between the wetland and adjacent ecosystems, and surrounding land uses. The Minnesota Rapid Assessment Methodology (MnRAM) version 3.0 was used to assess wetland functions in the three wetland basins that are under Corps jurisdiction and that will have direct wetland impacts from construction of Big Stone II. The results indicate that the largest wetland, Wetland 8, provides moderate levels of all MnRAM-evaluated wetland functions except fishery habitat and commercial utilization. Wetland 8 functions primarily as a groundwater recharge area. Wetlands 9a and 9b provide a high level of wildlife habitat function, and moderate levels of fishery habitat, flood storage and downstream water quality. These wetlands, which include a watercourse flowing through their centers, are combination groundwater recharge/discharge areas. The results of the function assessment are summarized in Table 4-3.

Table 4-3 Wetland Function

Wetland No.	Wetland Function									
	Hydro-logic Regime	Flood Storage	Down-stream Water Quality	Wetland Water Quality	Wildlife Habitat	Fishery Habitat	Amphibian Habitat	Aesthetics, Recreation, Education	Commercial	Ground-water Inter-action
8	M	M	M	M	M	L	M	M	L	R
9a	M	M	M	L	H	M	L	L	L	C
9b	M	M	M	L	H	M	L	L	L	C

H= High M = moderate L= Low R=Recharge C= Combination Recharge/Discharge

Section 404 of the Clean Water Act (CWA) establishes jurisdiction over impacts to waters of the U.S., including wetlands such as those on the Big Stone Plant property. Activities covered by Section 404 include the discharge of dredge or fill material into wetlands, and excavation within wetlands conducted in such a way that material becomes redeposited in the water body during excavation.

The U.S. Army Corps of Engineers is charged with administering Section 404 of the Clean Water Act. However, in some cases, this responsibility has been delegated to another government agency. The Pierre, South Dakota office of the USACOE, which is in the Omaha District of the Corps, is responsible for administering Section 404 and authorizing activities in the state of South Dakota that are covered by the CWA. There are three types of permits that may apply to a project: (1) Nationwide Permits, (2) Regional Permits, and (3) Individual Permits. It does not appear that the Nationwide or Regional Permits will apply to the Big Stone II Project. Typically, projects with cumulative wetland impacts greater than 2 acres require an Individual Permit.

Section 404(b)(1) guidelines of the Clean Water Act describe the alternatives analysis requirements for compliance with this Act. These guidelines require that the project proponent evaluate alternatives to the proposed project which consider the following in order of priority:

1. Avoid impacts to wetlands and waters of the U.S.,
2. Minimize impacts to wetlands and waters of the U.S., and
3. Mitigate for unavoidable impacts to wetlands and waters of the U.S.

For the Big Stone II Project, alternatives that avoid wetland impacts include siting features of the plant outside of the delineated wetland boundaries and the no-build alternative.

The no-build alternative is not feasible for this Project because it would result in continued shortfalls for the Co-owners and regional power production. Projected rises in regional energy consumption in the next decade, along with the efficient and cost-effective manner in which Big Stone II would provide the required energy, make the no-build alternative infeasible.

The proposed location of Big Stone II, on an industrial site adjacent to the existing Big Stone Plant unit I facility, allows the sharing of existing infrastructure, including: the cooling water intake structure, pumping system and delivery line; the rail spur; the coal unloading facilities and solid waste disposal facilities. By sharing these infrastructure features, rather than building an entirely new facility in a different location, Big Stone II avoids potential wetland impacts on a new site, and minimizes wetland impacts on the existing Big Stone property.

Additional design alternatives that would avoid direct impacts on the wetlands are determined by several factors, including:

- the required capacity and configuration of the new makeup storage pond;
- the size and design of the cooling tower blowdown pond, and
- the size and placement of the cooling tower.

For each of these factors, the design process has attempted to avoid or minimize impacts to wetlands to the extent practicable. The cooling tower blowdown pond has been reconfigured to avoid wetlands to the north that were to be filled based on the pond's preliminary design. However, the required capacities of the makeup storage pond make direct impacts on wetlands unavoidable.

Alternative configurations for the makeup storage pond have been considered that would avoid or minimize impacts to wetlands. Alterations to the boundaries of the pond that would avoid wetland impacts are constrained by the required 9900 acre-foot capacity of the pond and the consequent required dimensions of the basin. Alternative placements of the pond have been considered that would shift it to another part of the Big Stone property. However, there is no part of the Big Stone property where a pond of the required dimensions would avoid wetlands. This is because the required dimensions of a 450-acre storage pond are approximately 5200 feet by 3800 feet. With the addition of the area taken up by the bases of the dikes that form the pond, the total required area is approximately 500 acres. There is a limited number of locations for a 500-acre rectangular diked pond within the Big Stone property boundaries, and all of these locations would directly impact wetlands. As a result, all alternative placements of the pond within the Big Stone property boundaries would produce approximately the same 58-acre loss of wetland area.

No alternative sites are available to the east because of the proximity of Big Stone Lake and Big Stone City. Alternatives to the south are unavailable because of the Whetstone River. Alternative pond locations have been evaluated to the north and west of the Big Stone facility. However, as with alternative locations on the current property, there are no potential pond sites that do not have wetland impacts.

All potential sites to the north would result in direct wetland impacts that are approximately equal to or greater than at the proposed location. The landscape to the north of the Big Stone Plant is dotted with small depressional wetlands characteristic of the prairie pothole region. These small- to medium-sized wetlands are more densely distributed over a broader area to the north of the Big Stone Plant than to the west or southwest. As a result, the number of wetland basins affected by construction of a makeup storage pond would likely be greater to the north.

Moreover, north of the Big Stone Plant there are several parcels with easements under the USFWS Native Grassland and Wetland Easement Program. These parcels cannot be excavated for the pond, and their area and distribution precludes any location of the pond to the north.

There is one site to the west of the Big Stone facility that has been evaluated as an alternative makeup storage pond location. Direct wetland impacts at this site are lower than at any other alternative considered. However, the topography of the site has more rolling slopes than in other areas, and varies by 50 to 60 feet. This would require greater excavation costs than at other sites. Excavation could be reduced by building higher dikes around the lowest edges; however, this would introduce greater structural integrity risks and increased seepage potential than at other alternative sites. The west site would also displace more residences. Finally, the west site would also infringe on USFWS Native Grassland and Wetland Easement Program sites on two parcels.

As a result, purchasing additional property to place the makeup storage pond in an area where there would be no wetland impacts is not practicable. The cost of a 500-acre parcel would be prohibitive and the makeup storage pond must be sufficiently near the plant in order to function reliably. All plausible alternatives to the proposed location have been considered. The conclusion of this alternatives evaluation is that it is not possible to build a 500-acre makeup storage pond anywhere near the Big Stone II site without removing wetlands.

Another alternative to the proposed makeup storage pond that might avoid or minimize wetland impacts would be to create a series of smaller ponds. This is also not practicable due to a number of reasons:

- First, a series of smaller ponds would require multiple pumping and distribution systems, which would increase construction and operating costs.

- Second, at least one of the smaller ponds would still need to be placed off of the existing property. The cost of acquiring new property and the difficulty in finding local parcels that do not have wetlands on them make this infeasible.
- Finally, there is no possible combination of ponds totaling 500 acres and sufficiently close to Big Stone II that would avoid wetland impacts. It is also doubtful that a series of ponds would generate less than 58 acres of wetland losses, given the size and distribution of local wetlands.

The proposed makeup storage pond configuration and location reflect the most practicable alternative to avoid or minimize impacts to wetlands.

Construction of Big Stone II will nevertheless result in excavation and/or filling of 57.7 acres in three wetland basins that are under the Corps' jurisdiction. This direct impact will result from construction of the makeup storage pond. Three jurisdictional wetlands totaling approximately 57.7 acres will be completely excavated for the construction of the makeup storage pond. This includes excavation of the makeup storage pond basin and filling for the construction of the dikes that form the sides of the pond.

The cooling tower and cooling tower blowdown pond have been configured to avoid wetland impacts. The complete direct wetland impacts resulting from the construction of Big Stone II in Corps jurisdictional wetlands are summarized in Table 4-4.

Table 4-4 Wetland Impacts

Wetland No.	Circular 39 Type	Cowardin Classification	Current Acreage	Acres Removed
8	4/2	PEMG/PEMB	52.0	52.0
9a	2	PEMB	4.7	4.7
9b	2	PEMB	9.0	1.0
TOTAL			65.7	57.7

The Project's indirect impacts on wetlands include the alteration of surface water drainage and potential increases in non-native invasive species cover.

Alterations to existing surface water drainage patterns have the potential to disrupt the water regimes and/or hydroperiods of remaining wetlands. This could cause an overall loss of water to an indirectly impacted wetland, or a change in the frequency and amplitude of peak flows into a wetland. Alterations to the water regime or hydroperiod of an indirectly impacted wetland could result in changes in the wetland's vegetation community.

The risk of this type of indirect impact is low for the Big Stone II Project. This is because the principal cause of surface water flow alteration is the makeup storage pond. The pond will alter surface water drainage patterns currently flowing toward its north and west perimeter. These surface water drainage patterns currently flow into a series of wetlands that will be excavated for construction of the pond. No other wetlands that would remain receive water from these surface water drainage sources. The existing surface water drainage from the north and west of the pond will be rerouted along the north edge of the pond, then south and eastward toward the proposed mitigation site.

A second indirect impact is the Project's potential for introducing additional non-native invasive plant species to the area, as well as creating disturbance conditions that confer a competitive advantage on non-native invasive species over native species. Non-native invasive species tend to be opportunistic colonizers on disturbed sites, in this case clearing and construction of Big Stone II and its associated structures and ponds. Even after the initial disturbance, new communities of non-native invasive plant species may remain around and within the Big Stone II perimeter, providing an additional seed source for further invasion of other vegetation communities.

The risk of introducing non-native species into remaining wetlands is low for this Project. This is because, with the exception of the makeup storage pond and cooling tower foundation, the disturbance from clearing and excavation will occur in upland areas. The introduction and establishment of non-native species that could invade wetlands is therefore not likely to occur. Moreover, the wetlands adjacent to the proposed makeup storage pond, where the risk of disturbance-driven non-native invasions is highest, will be managed and monitored as part of the mitigation plan. This will help ensure that non-native species cover remains at its current or lower percentage.

The Omaha District of the Corps is responsible for approving appropriate compensatory mitigation plans for projects that have unavoidable wetland impacts. The amount of compensatory mitigation for wetland impacts related to construction of Big Stone II is determined by the type of mitigation proposed. The types of compensatory mitigation include:

- Restoration (re-establishment) of an area that was previously wetland, but has had its hydrology altered such that the basin no longer supports hydrophytic vegetation;
- Restoration (rehabilitation) of an existing wetland that has been degraded by disturbances within and/or adjacent to the basin, leading to dominance by non-native invasive species and loss or significant reduction of wetland functions;
- Enhancement of the physical, chemical or biological characteristics of an existing wetland in order to improve and/or add to existing wetland functions;
- Establishment of new wetland area on a site where wetlands did not previously exist;
- Protection of an existing wetland via legal means, such as conservation easements and deed restrictions, or by repairs to structures (water control structures, barrier islands, etc.) that protect the wetland.

Each type of compensatory mitigation has its own replacement ratio. Generally, restoration has the lowest ratio, and protection/maintenance has the highest. The construction of Big Stone II will result in the loss of 57.7 acres of wetlands under Corps jurisdiction. Using the required replacement ratios for the various types of mitigation generates the options shown in Table 4-5 for the compensatory mitigation acreages on the Big Stone II Project site:

Table 4-5 Required Replacement Ratios for Compensatory Mitigation

Mitigation Type	Ratio	Acres Required
Restoration (re-establishment)	1.5:1	86.6
Restoration (rehabilitation)	1.5:1	86.6
Enhancement	4:1	330.8
Establishment	2:1	115.4
Protection/Maintenance	10:1	577.0

In addition to providing additional wetland acreage, the mitigation plan is required to replace the wetland functions lost and to provide a detailed monitoring plan that will ensure that the goals and objectives of the plan are met.

Measures that would contribute to meeting the overall compensatory mitigation needs include:

- Restoration and/or enhancement of one or more of the delineated wetlands unaffected by construction;
- Establishment of additional new wetland acreage on the Big Stone property;

- Restoration and/or enhancement of local wetlands off of the Big Stone property, and
- Establishment of additional wetland acreage off of the Big Stone property.

The overall conceptual wetland mitigation plan for Big Stone II will be designed to replace the functions of the filled wetlands. The goal of the mitigation plan will be to restore primarily Type 2 / palustrine emergent saturated wetland. The design of the mitigation wetlands will provide at least equivalent, and more likely greater, wetland functions than the removed wetland acreage. Plant communities chosen for the mitigation sites will be composed of native species appropriate to the desired water regime and hydroperiod of the mitigation design. Where practicable, upland buffer vegetation will be incorporated into the mitigation design. Mitigation will occur prior to or concurrent with the construction of the Big Stone II facility.

The wetland mitigation plan will provide detailed performance standards for the newly created wetland area(s). These performance standards will be formulated to ensure that the goals of the mitigation plan are met, and will serve as the basis for post-construction monitoring evaluations on the mitigation site. The mitigation site will be monitored for a minimum period of five years following construction.

The permanent protection of the mitigation site will be ensured through the use of covenants, deed restrictions, permanent easements or other similar legal devices. The Big Stone II Co-owners will transfer ownership and oversight of the mitigation wetlands to an appropriate government agency or natural resource organization.

The construction of the Big Stone II facility will result in a temporary reduction in the total wetland area of the region. However, as discussed above, there is a low likelihood of additional future state or private activities that would result in further reduction in wetland area. Moreover, the proposed location of the Big Stone II facility is in an area where emergent wetlands are regionally widespread. As a result, the contribution of the Big Stone II facility to cumulative impacts on wetlands is minimal.

4.4.2 Fisheries

Big Stone Lake and the Whetstone River provide habitat for fish and other aquatic wildlife. Fish populations in Big Stone Lake are managed cooperatively by the Minnesota Department of Natural Resources and the South Dakota Department of Game, Fish and Parks. The

MN DNR periodically stocks the lake with black crappies, walleyes, northern pike, channel catfish and sunfish. A 2003 fish sampling survey recorded nineteen species of fish and two species of turtles in Big Stone Lake (MN DNR 2003).

The Whetstone River has a number of riffles and pools, and frequent stretches of densely wooded riparian areas. These features lead to good quality fish habitat along much of the Whetstone River. Fish species inhabiting the Whetstone River are primarily species considered rough fish (buffalo, suckers, redhorse and carp). However, northern pike are found in shaded pools along the Whetstone, and other sport fish, including smallmouth bass and walleye are likely present as well (NPS 2000).

A complete list of fish species in Big Stone Lake and the Whetstone River was compiled from a guidebook published by the South Dakota Department of Game, Fish and Parks (Neumann and Willis 1994). The list is provided in Table 4-6.

Table 4-6 Potential Fish Species in Big Stone Lake and the Whetstone River

Common Name	Scientific Name
Rock bass	*Ambloplites rupestris*
Black bullhead	*Ameirus melas*
Yellow bullhead	*Ameirus natalis*
American eel	*Anguilla rostrata*
Freshwater drum	*Aplodinotus grunniens*
White sucker	*Catostomus commersoni*
Brook stickleback	*Culaea inconstans*
Common carp	*Cyprinus carpio*
Northern pike	*Esox lucius*
Johnny darter	*Etheostoma nigrum*
Channel catfish	*Ictalurus punctatus*
Bigmouth buffalo	*Ictiobus cyprinellus*
Pumpkinseed	*Lepomis gibbosus*
Orange-spotted sunfish	*Lepomis humilis*
Bluegill	*Lepomis macrochirus*
Common shiner	*Luxilus cornuta*
Smallmouth bass	*Micropterus dolomieu*
Largemouth bass	*Micropterus salmoides*
White bass	*Morone chrysops*
Shorthead redhorse	*Moxostoma macrolepidotum*
Golden shiner	*Notemigonus crysoleucas*

Common Name	Scientific Name
Emerald shiner	*Notropis atherinoides*
Stonecat	*Noturus flavus*
Yellow perch	*Perca flavescens*
Logperch	*Percina caprodes*
Fathead minnow	*Pimephales promelas*
White crappie	*Pomoxis annularis*
Black crappie	*Pomoxis nigromaculatus*
Creek chub	*Semotilus atromaculatus*
Walleye	*Stizostedion vitreum*
Saugeye	*walleye x sauger*

The construction of Big Stone II will not result in either direct or indirect impacts to fish populations in the Whetstone River. There is no current or planned discharge into the river, and temporary impacts due to construction runoff will be controlled by the implementation of the Storm Water Pollution Prevention Plan (SWPPP) for the Project.

Operation of Big Stone II may result in direct impacts similar to those caused by operation of the existing Big Stone unit I. At power plants in general, the principal impact to fish results from impingement and entrainment associated with water intake for cooling. Impingement is the trapping of individual fish against screens at the water intake. Entrainment occurs when fish and fish eggs are drawn into the water intake pipes.

The Big Stone facility has been operating for thirty years, with protections in place at the water intake structure to minimize impacts to fish. Operation of Big Stone II will utilize this same water intake structure and its systems to reduce fish entrainment. A trash rack is in place to prevent entrainment of larger fish. In addition, the water intake structure utilizes a water jet barrier and a light barrier, along with a fish conveyance system to minimize the entrainment of fish. There are no traveling screens at the water intake; therefore, there are no impingement impacts to fish at the Big Stone facility.

4.5 Land Use and Local Land Use Controls

4.5.1 Existing Land Use

The existing Big Stone II Project area comprises sixteen land use types, as illustrated in Exhibit 4-11 and listed in Table 4-7. Existing land use is dominated by row crops, which account for over half of the total Project area. Grass-dominated land uses, including industrial grasslands, pastured areas and hayfields account for another third of the Project area.

Table 4-7 Existing Land Use Types

Land Use Type	Total Area	Percent of Total
Disturbed grassland w/ trees	28.2	0.88
Farmed wetland	3.8	0.12
Farmstead	14.3	0.45
Grassland	119.9	3.75
Grassland pasture	136.5	4.27
Hayfield	185.1	5.78
Impoundments	699.4	21.86
Industrial	280.8	8.78
Mixed deciduous woodland	51.7	1.61
Mixed native/non-native meadow	4.2	0.13
Non-native dominated grassland	347.5	10.86
Northern bur oak	18.8	0.59
Roadways/railroads	76.6	2.39
Row crops	983.1	30.72
Wetland	88.0	2.75
Windbreak	17.3	0.54
Wooded pasture	145.1	4.53
Total	3200	100

The construction of Big Stone II will take place primarily in existing industrial grassland areas. The cooling tower blowdown pond and the makeup storage pond will be constructed mainly in row crops and pasture lands, as will the construction laydown area and parking.

There are no indirect or cumulative impacts to land use associated with the Big Stone II Project.

4.5.2 Displacements

One and possibly two residential properties, located immediately south of the proposed Big Stone II makeup storage pond, may need to be vacated to accommodate the construction and operation of the pond.

4.5.3 Land Use Controls and Compatibility with Existing Land Use

The existing Big Stone property is zoned for commercial use. This includes the existing Big Stone Plant unit I and the property south of 144th Street continuing south to the Whetstone River. It does not include the property to the southwest of the Big Stone Plant. This property was acquired for the makeup storage pond, and is currently zoned for agricultural use. Prior to construction of the makeup storage pond, the Big Stone II Co-owners, must go through the process of changing the zoning of this property to commercial. This involves going before the Grant County Planning Commission to obtain that Commission's recommendation to the Grant County Commissioners to pass a zoning change ordinance. The complete process, with several public notice periods and readings of the draft ordinance, takes approximately 40 to 60 days to complete.

4.5.4 Noise

The Big Stone Plant received complaints from residences located northeast of the Plant ponds in the summer of 2004. The noise source that has been the subject of those complaints has apparently been the snow machines that operate on the pond dike located between the evaporation and blowdown ponds. The snow machines have historically been operating to enhance evaporation of water from the evaporation pond. The changes in water management that will be implemented with the operation of Big Stone II will make the use of the snow machines unnecessary, so that noise source will be eliminated.

No noise standards have been promulgated in South Dakota. The Minnesota Pollution Control Agency has established standards for environmental noise in Minnesota. While the Minnesota standards do not apply in South Dakota where the Big Stone II is located, the Minnesota standards do provide a reasonable benchmark for evaluation on measured noise levels near the residences.

The Minnesota standards apply at the nearest receptor and specific to the type of land use at the receptor location. Household units (including farm houses) located outside the plant's boundaries fall under the most stringent MPCA noise area classification – NAC 1. Daytime noise levels in an NAC-1 area may not exceed 60 dBA for more than 30 minutes in any given hour (L_{50}) nor exceed 65 dBA for more than six minutes in a given hour (L_{10}). Nighttime noise levels in an NAC-1 area may not exceed 50 dBA for more than 30 minutes in any given hour (L_{50}) nor exceed 55 dBA for more than six minutes in a given hour (L_{10}). (MN Rule 7030.0040).

4.5.4.1 Baseline Noise Monitoring

Barr monitored sound levels at four locations at and around the perimeter of the Big Stone Power Plant. The monitoring locations, shown on Exhibit 4-11, are:

- Location 1: Northwest of the plant at the intersection of 143rd Street and 484th Avenue.
- Location 2: At the intersection of 144th Street and 484th Avenue Streets, southwest of the Northern Lights Ethanol Plant.
- Location 3: West of 484 Avenue at the south edge of the plant property, immediately northeast of the Rabe homestead.
- Location 4: Northwest corner of State Route 109 and 144th Street.

The noise levels at all four locations where measured for a 24-hour period using a Quest Technologies, Noise Pro DLX data logging noise monitor. Barr staff also kept a log of observations and recorded noise levels during the daytime portions of the monitoring period using a Quest Model 2900 Sound Level Meter with QC300 Octave band filter. The monitoring period was scheduled to be capture representative noise generating activities at the plant (e.g. the unloading of a coal delivery unit train). The plant was operating under normal conditions and received a coal delivery during the monitoring period.

Noise levels were measured across all frequency spectra on a dBA scale–decibels A-weighted, using a standard A-weighting filter. From the 24-hour monitoring data we calculated the following for each monitoring location:

- L_{eq} – The equivalent or average noise level measured over the sampling period;
- L_{50} – The noise level exceeded for 50 percent of the sampling period. This is the median sound level during the monitoring period.
- L_{10} – The noise level exceeded for 10 percent of the sampling period.

Monitored levels are summarized in Table 4-8.

Table 4-8 Baseline Noise Monitoring Results

	(dBA)		
Monitoring location	L_{eq}	L_{50}	L_{10}
1	64	55	65
2	70	66	70
3	64	47	63
4	74	56	76

Barr staff noted the plant's noise character as a broadband whooshing sound. It was observed to be relatively constant in frequency and intensity. Noise at monitoring Location 2 was dominated by noise coming from the Northern Lights ethanol plant. The ethanol plant was also observed to be of a relatively constant nature. Peaks in noise level occurred due to truck and train traffic passing through the area, a frequent daytime occurrence. Truck traffic was not present during the nighttime hours. The large differences between L_{10} and L_{50} are indicative of the duration of the high level sounds. It is likely that the high L_{10} values are a result of truck and train pass by. If either plant (Big Stone Power or Northern Lights Ethanol) were the source of these elevated levels, one would expect this level reflected in both L_{10} and L_{50}, whereas in the monitoring, elevated levels are found only in the L_{10} levels.

During monitoring, it was observed that the Big Stone facility seemed audible from Locations 1, 2 and 3. Audible noise sources at Location 4 were a whooshing from a business to the south as well as heavy truck traffic throughout the day. On the evening of the 22nd, prolonged mooing of cows was very audible from the southwest at Location 4. Audible sources at Locations 1 and 3 seemed to be the Big Stone facility, along with local traffic. Determining the actual source of the whoosh at Locations 1 and 3 is difficult, as both Big Stone Power and Northern Lights Ethanol are in the same relative location. During monitoring on the grounds of the Big Stone Plant, Northern Lights Ethanol appeared to be the loudest source of noise. The similar nature of the sounds between the ethanol facility and the air intakes at the power plant make differentiating these sources difficult at a distance. The sources audible at Location 2 were the Northern Lights Ethanol plant and its associated traffic (trucks and trains).

Short-term monitoring was also performed a several locations at the Big Stone Plant. Conversations with plant employees indicated that the primary noise source external to the plant was the air intakes. There are two pairs of air intakes at the plant, both in operation at the time of monitoring. Monitoring was done for one of these pairs. Initial checks of each pair indicated the same noise levels between the two, so only one pair was selected for monitoring. Measurements were taken of overall dBA, octave band levels, and 1/3 octave band levels. This data will be used in the modeling of the plant.

4.5.4.2 Modeling of Big Stone II

Modeling of Big Stone II included simulations of the new sources with SPM9613 software. Inputs for the model included standard octave band sound levels, in unweighted dB, for each modeled source (31.5, 63, 125, 250, 500, 1000, 2000, 4000, and 8000Hz bands). The software model uses ISO 9613-2 to calculate the predicted L_{eq}. The model was used to calculate the potential noise levels at the monitoring locations. The SPM9613 model calculates noise levels under ideal conditions for noise propagation, yielding appropriately conservative results.

Modeled noise levels expected from the Project will have no significant impact on the noise levels in surrounding areas. Monitored levels indicated nighttime noise levels from 43 to 66 dBA (L_{50}). The projected levels with the addition of the Project are shown in Table 4-9.

Table 4-9 Projected Nighttime Noise Levels

	PROJECTED			MN standard	
	L50	L10	Leq	L50	L10
Site 1	54.9	59.7	55.4	50	55
Site 2	66.5	67.7	66.7	75	80
Site 3	47.3	55.4	48.4	50	55
Site 4	50.2	58.6	50.8	50	55

The increase in noise levels from the Project will be insignificant. The maximum predicted increase is 4 dB at Site 3. A 3 dB increase is just barely noticeable. Site 3 will experience a slightly noticeable increase in noise, primarily from the cooling tower. All the other sites are projected to see insignificant increases of less than 3 dB. Increases from the Project are not predicted to cause any new exceedances of the reference Minnesota noise standards.

4.6 Water Quality

4.6.1 Whetstone River System

The Whetstone River is a perennial stream that meanders roughly eastward along or near the southern edge of the Big Stone property. The North Fork and the South Fork of the Whetstone River join approximately 3.5 miles southwest of the existing facility. The north fork is approximately 40 miles long, and begins to the northwest in Roberts County. The south fork is approximately 35 miles long, and begins as an outlet to Meyers Lake in the Meyers Lake Waterfowl Production Area (WPA) to the southwest. Downstream of the confluence of the two forks, the Whetstone River flows through a winding 50-foot to 70-foot deep ravine generally northeast for approximately 10 miles before discharging into the Minnesota River at Ortonville. Altogether, the Whetstone River drains an area of 398 square miles, and is part of the Upper Minnesota River Watershed (USGS Watershed Unit 07020001).

Flow data exists for the Whetstone River for the periods March 1910 to November 1912 and March 1931 to the present date. Recorded mean annual flows for the Whetstone River have ranged during that period from a low of 1.42 cubic feet per second (cfs) in 1934 to 229 cfs in 1997. Daily mean flows have been at their lowest throughout the period of record in late January, averaging 6.2 cfs, and at their highest in early April, averaging 324 cfs.

The Whetstone River has moderate shoreline erosion problems and water quality issues typical of rivers that drain watersheds that are largely agricultural. The river was on the 2002 South Dakota 303(d) Impaired Waters list for high ammonia concentrations. A TMDL Study for ammonia in the Whetstone River was conducted and approved by the USEPA on October 16, 2003.

The construction of Big Stone II will result in no additional water quality impacts to the Whetstone River. This is because Big Stone II is a zero liquid discharge (ZLD) design. No wastewater will discharge from the plant into the Whetstone River. All stormwater runoff created by the new facilities will be routed through onsite BMPs for treatment before discharge to the natural drainage system.

4.6.2 New Makeup Storage Pond Water Quality

Water quality within the new makeup storage pond should be comparable to typical shallow lakes of the region. Water quality predictions for the pond were obtained using Canfield & Bachman modeling analyses. The results show total phosphorus, chlorophyll and Secchi depths characteristic of a mildly eutrophic lake (Table 4-10). Water quality in the storage pond will be maintained in part by the consequences of operating the Big Stone II facility, specifically the expected high turnover rate and resulting short residence time for water in the basin. The depth of the pond will also limit the growth of aquatic vegetation, which will ameliorate the potential for eutrophication.

Table 4-10 Predicted Water Quality Parameters for Makeup Storage Pond

Water Quality Parameter	Predicted Value
Total Phosphorus (mg/m^3)	53.4
Chlorophyll a (mg/m^3)	11.8
Secchi depth (meters)	0.9

The predicted chlorophyll a concentrations would result in the presence of nuisance algal blooms approximately 3.5 percent of the summer months, or 4 to 5 days per summer.

4.6.3 Construction Stormwater Management

The principal source of potential water quality impacts will be sedimentation and erosion during excavation and construction of Big Stone II. These impacts can be reduced and controlled through the implementation of an effective Storm Water Pollution Prevention Program (SWPPP). An effective SWPPP should include at a minimum the following elements:

- Temporary sedimentation basins to retain stormwater runoff onsite during construction;
- Stabilization of exposed soils immediately following grading or filling;
- Proper placement and maintenance of silt fences;
- Placement of storm drain inlet protection devices;
- Covering or seeding of dirt stockpiles; and
- Scheduling or phasing excavation to minimize area and duration of exposed surfaces.

The SWPPP will be required in order to receive a NPDES permit for the Project. In South Dakota, NPDES permits are issued by the Department of Environment and Natural Resources (DENR). Construction of Big Stone II will require filing a Notice of Intent (NOI) with the DENR at least 15 days prior to start of construction to obtain a General Permit for Storm Water Discharges Associated with Construction Activities. Operation of the Big Stone II facility will require filing a Notice of Intent (NOI) with the DENR at least 15 days prior to operational start-up to obtain a General Permit for Storm Water Discharges Associated with Industrial Activities.

4.7 Air Quality

Big Stone II air emissions will comply with all air quality standards and regulations of the Clean Air Act and its amendments, the U.S. Environmental Protection Agency, and the State of South Dakota.

The Big Stone Plant site is located in a Class II airshed that is in attainment with the ambient air quality standards for all criteria pollutants. There are no nonattainment areas in South Dakota, nor in Minnesota, which is generally downwind of the facility.

The attainment review requirements are prescribed at 40 CFR 52.21 (Prevention of Significant Deterioration of Air Quality (PSD)). The proposed Project will be considered a new major source under Federal New Source Review (NSR) PSD regulations. As a new major source, the air permit application for the proposed Project must include the applicable requirements of the PSD program for those emissions that exceed the PSD level of significance:

- Demonstration of best available control technology (BACT);
- Analysis of ambient air quality impacts;
- Analysis of impacts on soils, vegetation, and visibility;
- Demonstration that Class I areas (pristine areas such as national parks) will not be adversely affected; and
- Allowance for adequate public participation in the review process.

The Big Stone II Project will add new emissions related to coal combustion, coal and ash handling, cooling tower operation, and coal yard activities. These emissions will enter the atmosphere via a main boiler stack, several material handling point baghouse stacks, or as fugitive emissions.

Each new emissions point that is installed as part of the Project will be characterized by its emission rate and stack parameter information to allow emissions to be modeled. The dispersion modeling analysis must demonstrate modeled attainment of both the national ambient air quality standards (NAAQS) and the PSD increment at the fenceline of the property. PSD increment modeling considers the impact of other regional PSD projects that have been permitted since the PSD program was enacted. Consultation with the SD DENR will be necessary to determine which other sources must be considered in the increment modeling.

Dispersion modeling requirements can be the driving force behind more restrictive emission limits in a permit if needed to achieve modeled attainment. However, more typically, a PSD project determines BACT for each pollutant whose potential to emit is greater than the significant emission rate under the PSD program. BACT is essentially an emission limit deemed to represent the lowest technically and economically feasible emission rate that the project can achieve. BACT determinations can range from "no control" to one of several commercially available control options. At a minimum, the BACT determination must meet applicable standards of performance, such as Subpart Da under 40 CFR Part 60.

The PSD program requires that new major projects apply BACT and demonstrate that their impacts are within the allowable standards for each pollutant whose potential to emit is greater than the significant emission threshold under the PSD program. Public participation in the review process, as specifically required under the PSD regulations, is assured through submittal of the PSD (air permit) application, public notice of the proposed permit, and any other participatory activities which the DENR determines to be necessary.

Finally, Big Stone II must comply with the requirements of Title IV of the Clean Air Act Amendments of 1990 (the Act) with respect to appointing a designated representative, emissions monitoring, and holding of sulfur dioxide allowances as prescribed by the Act and by EPA rules.

Within 12 months after commencing operation, the Big Stone II Co-owners must submit a complete application for an Operating Permit for Part 70 Sources as prescribed in ARSD Chapter 74:36:05.

4.8 Solid or Radioactive Waste

Coal combustion by-products will consist primarily of bottom ash, fly ash, and gypsum from the wet FGD system. Details of these and other waste streams are discussed in Section 2.2.7.

The South Dakota Department of Environment and Natural Resources regulates solid waste facility activities under the SDCL 34A-6 and the ARSD Chapter 74:27. Big Stone Plant unit I has a current Permit to Operate a Solid Waste Facility. The Big Stone Plant unit I Co-owners plan to request a permit amendment or other applicable permit revision to allow Big Stone II solid waste disposal in the existing Big Stone Plant unit I solid waste facility.

The existing landfill will accommodate approximately 10 years of disposal before it will need to be expanded. This projection is based on average coal characteristics, an 88 percent plant capacity factor, and expected average ash content of the coal. The Project does not include any disposal reduction for sales or other possible utilization of Big Stone II coal combustion by-products. Prior to the end of the useful life of the existing facility, a new solid waste facility will be jointly developed by Big Stone Plant unit I and Big Stone II.

Big Stone II may use radioactive sources to monitor coal levels or coal flow and wet scrubber slurry density. Those sources will likely Cesium 137 and are regulated by the U.S. Nuclear Regulatory Commission.

Section 4 Exhibits

Property Boundary

Project Features

ID

1 Cooling Tower Blowdown Pond
2 Cooling Tower
3 New Plant
4 Construction Parking
5 Ethanol Plant
6 Construction Laydown
7 Makeup Storage Pond
10ft Contours

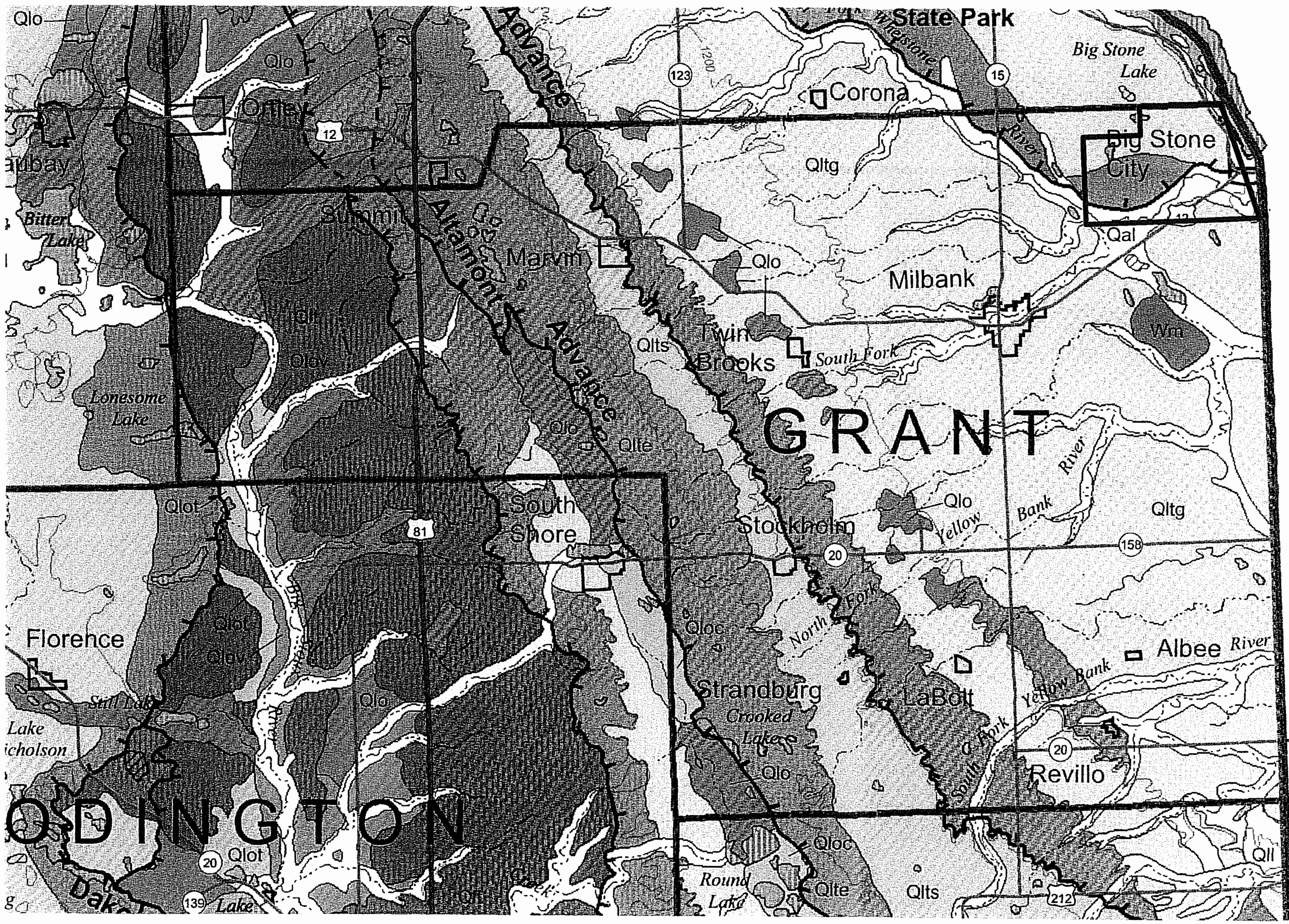
Data Source: Contour lines created from USGS Digital Elevation Model

2,000 0 2,000 4,000
Feet

1,000 0 1,000
Meters

Exhibit 4-1

TOPOGRAPHIC MAP
OF PROJECT VICINITY
Big Stone II Project
Big Stone II Co-owners



Qal	Alluvium (Quaternary) - Clay- to boulder-sized clasts with locally abundant organic material. Thickness up to 75 ft.
Qlo	Outwash, undifferentiated (Upper Wisconsin) - Heterogeneous sand and gravel with minor clay and silt, of glaciofluvial origin, including outwash plains, kames, kame terraces, and other undifferentiated deposits. Thickness up to 30 ft.
Qlte	Till, end moraine (Upper Wisconsin) - Compact, silty, clay-rich matrix with sand- to boulder-sized clasts of glacial origin. A geomorphic feature characterized by elevated linear ridges with hummocky terrain locally at former ice cheet margins. Composite thickness of all Upper Wisconsin till may be up to 300 ft.
Qltg	Till, ground moraine (Upper Wisconsin) - Compact, silty, clay-rich matrix with sand- to boulder-sized clasts of glacial origin. A geomorphic feature characterized by smooth, rolling terrain. Composite thickness of all Upper Wisconsin till may be up to 300 ft.
Qlts	Till, stagnation moraine (Upper Wisconsin) - Compact, silty, clay-rich matrix with sand- to boulder-sized clasts of glacial origin. A geomorphic feature characterized by hummocky terrain with abundant sloughs resulting from stagnation of ice sheet. Composite thickness of all Upper Wisconsin till may be up to 300 ft.
Wm	Milbank Granite (Upper Archean) - Pink to dark-red, coarse-grained granite composed of orthoclase, quartz, and biotite.
▭	Extended Study Area

N

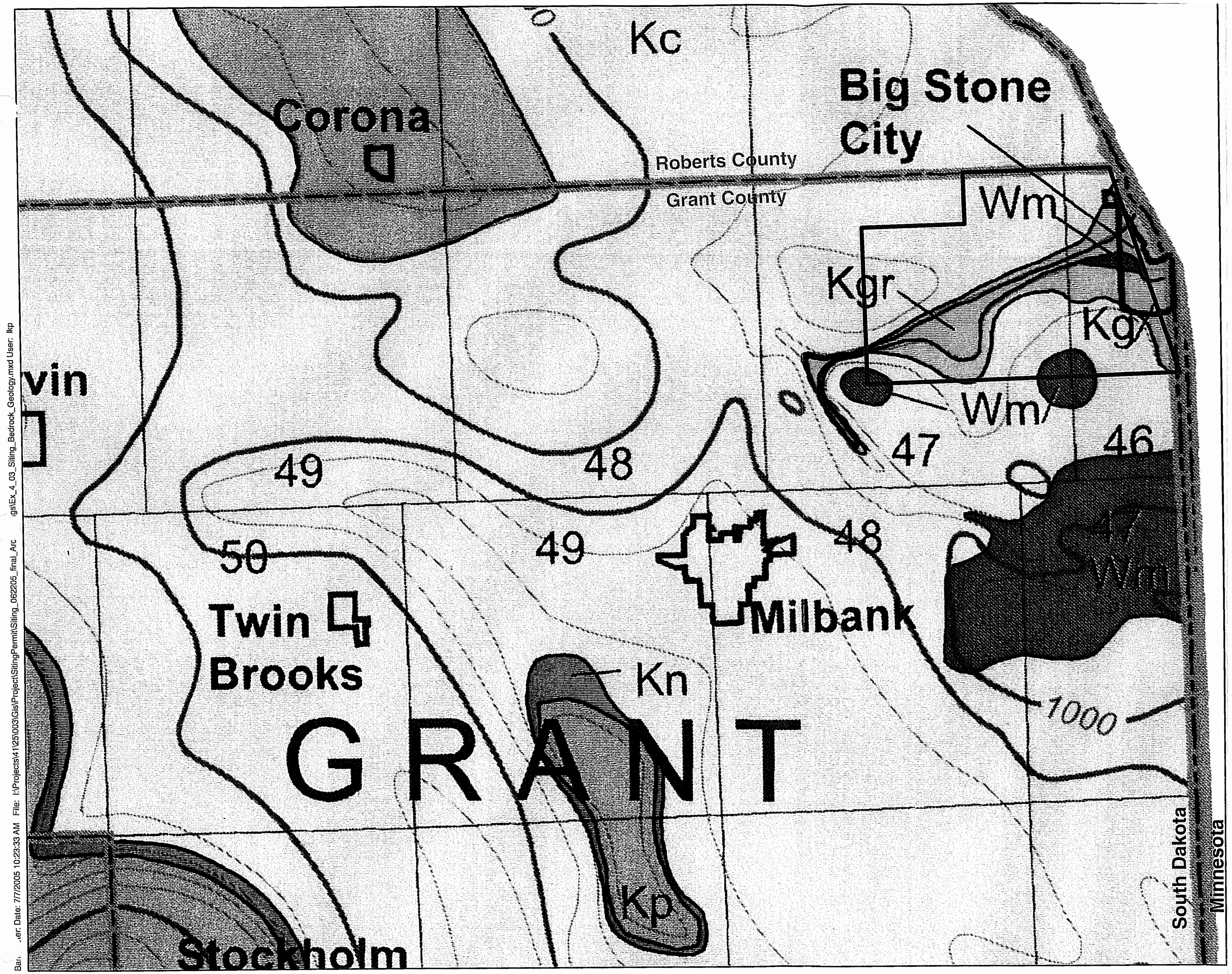
2 0 2 4 6 8 10
Miles

5 2.5 0 5 10 15
Kilometers

Exhibit 4-2

SURFICIAL GEOLOGY
Big Stone II Project
Big Stone II Co-owners

Geologic data from Martin et. al, 2004, "Geologic Map of South Dakota", South Dakota Department of Enivronment and Natural Resources - Geological Survey.



Kp — Pierre Shale (Upper Cretaceous) - Blue-gray to dark-gray, fissile to blocky shale with persistent beds of bentonite, black organic shale, and light-brown chalky shale. Contains minor sandstone, conclomerate, and abundant carbonate and ferruginous concretions. Thickness up to 1,000 ft.

Kn — Niobrara Formation (Upper Cretaceous) - White to dark-gray argillaceous chalk, marl, and shale. Weathers yellow to orange. Contains thin, laterally continuous bentonite beds, chalky carbonaceous shale, minor sand, and small concretions. Thickness up to 150 ft.

Kc — Carlile Shale (Upper Cretaceous) - Dark-gray to black, silty to sandy shale with several zones of septarian, fossiliferous, carbonate concretions. Contains up to three sandshone units in the upper portion of the formation and sandy calcareous marl at the base. Thickness up to 330 ft.

Kg — Greenhorn Formation (Upper Cretaceous) - Gray shale, mudstone, marl, calcarenite, and shaly limestone grading upward into light-gray to tan, alternating marl and thin-bedded, fossiliferous limestone. Thickness up to 40 ft.

Kgr — Graneros Shale (Upper Cretaceous) - Dark-gray, noncalcareous, pyritic, poorly fossiliferous shale, with numerous sandstone layers at the base. Thickness up to 110 ft.

Wm — Milbank Granite (Upper Archean) - Pink to dark-red, coarse-grained granite composed of orthoclase, quartz, and biotite.

Extended Study Area

N

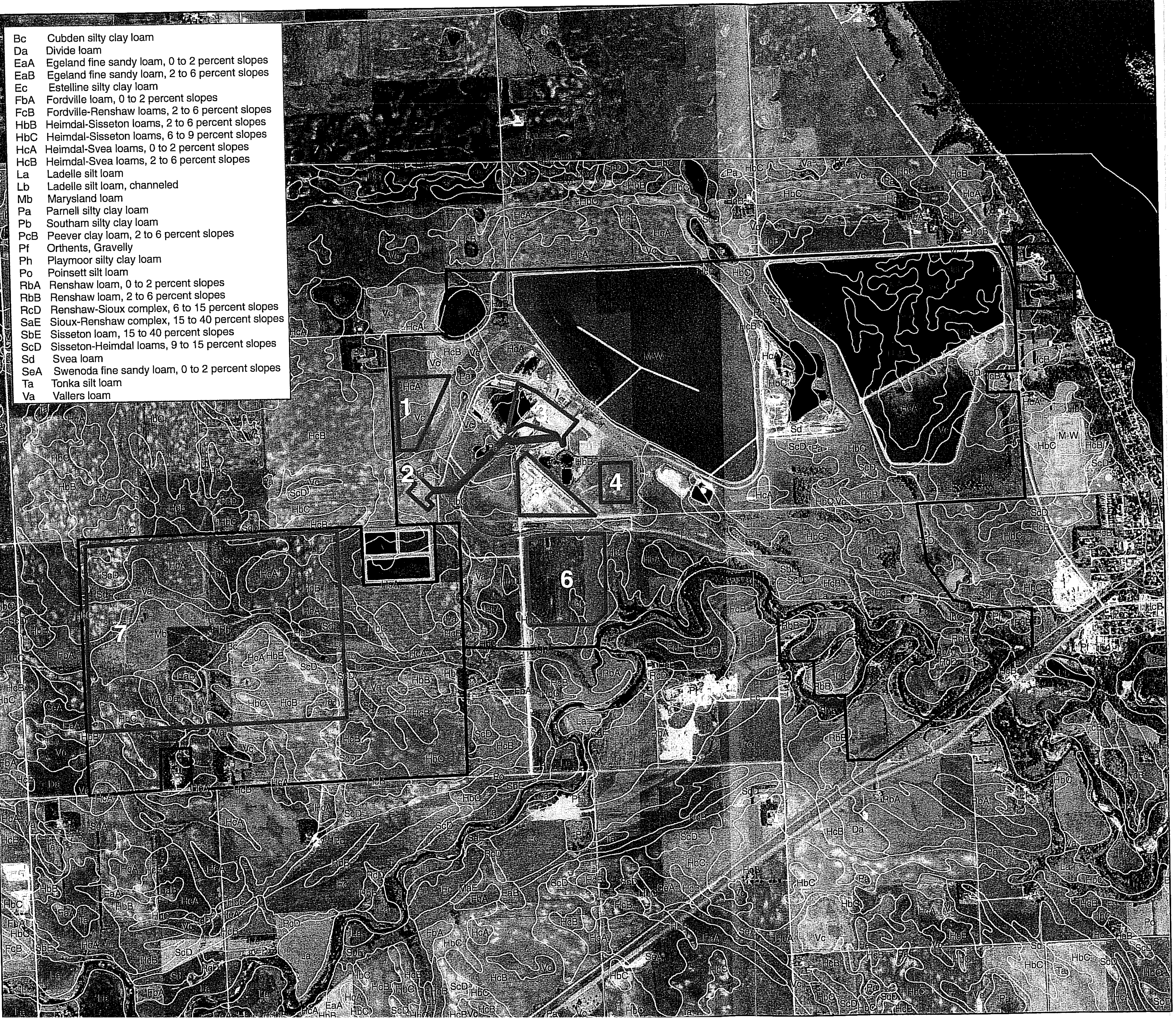
2 0 2 4
Miles

2 0 2 4 6 8
Kilometers

Exhibit 4-3

BEDROCK GEOLOGY
Big Stone II Project
Big Stone II Co-owners

Geologic data from Tomhave and Schulz, 2004, "Bedrock Geologic Map Showing Configuration of the Bedrock Surface in South Dakota East of the Missouri River", South Dakota Department of Enivronment and Natural Resources - Geological Survey



Property Boundary

Project Features

ID

1 Cooling Tower Blowdown Pond
2 Cooling Tower
3 New Plant
4 Construction Parking
5 Ethanol Plant
6 Construction Laydown
7 Makeup Storage Pond

Soils

Data Source: USDA NRCS
Soil Survey Geographic (SSURGO)

N

2,000 0 2,000 4,000
Feet

1,000 0 1,000
Meters

Exhibit 4-4

SOILS
Big Stone II Project
Big Stone II Co-owners

Property Boundary

Project Features

ID

1 Cooling Tower Blowdown Pond
2 Cooling Tower
3 New Plant
4 Construction Parking
5 Ethanol Plant
6 Construction Laydown
7 Makeup Storage Pond

Hydric Soils

Data Source: USDA NRCS
Soil Survey Geographic (SSURGO)

N

2,000 0 2,000 4,000
Feet

1,000 0 1,000
Meters

Exhibit 4-5

HYDRIC SOILS
Big Stone II Project
Big Stone II Co-owners

Property Boundary

Project Features

ID

- 1 Cooling Tower Blowdown Pond
- 2 Cooling Tower
- 3 New Plant
- 4 Construction Parking
- 5 Ethanol Plant
- 6 Construction Laydown
- 7 Makeup Storage Pond

Subwatershed Divides

Watershed Boundaries

10ft Contours

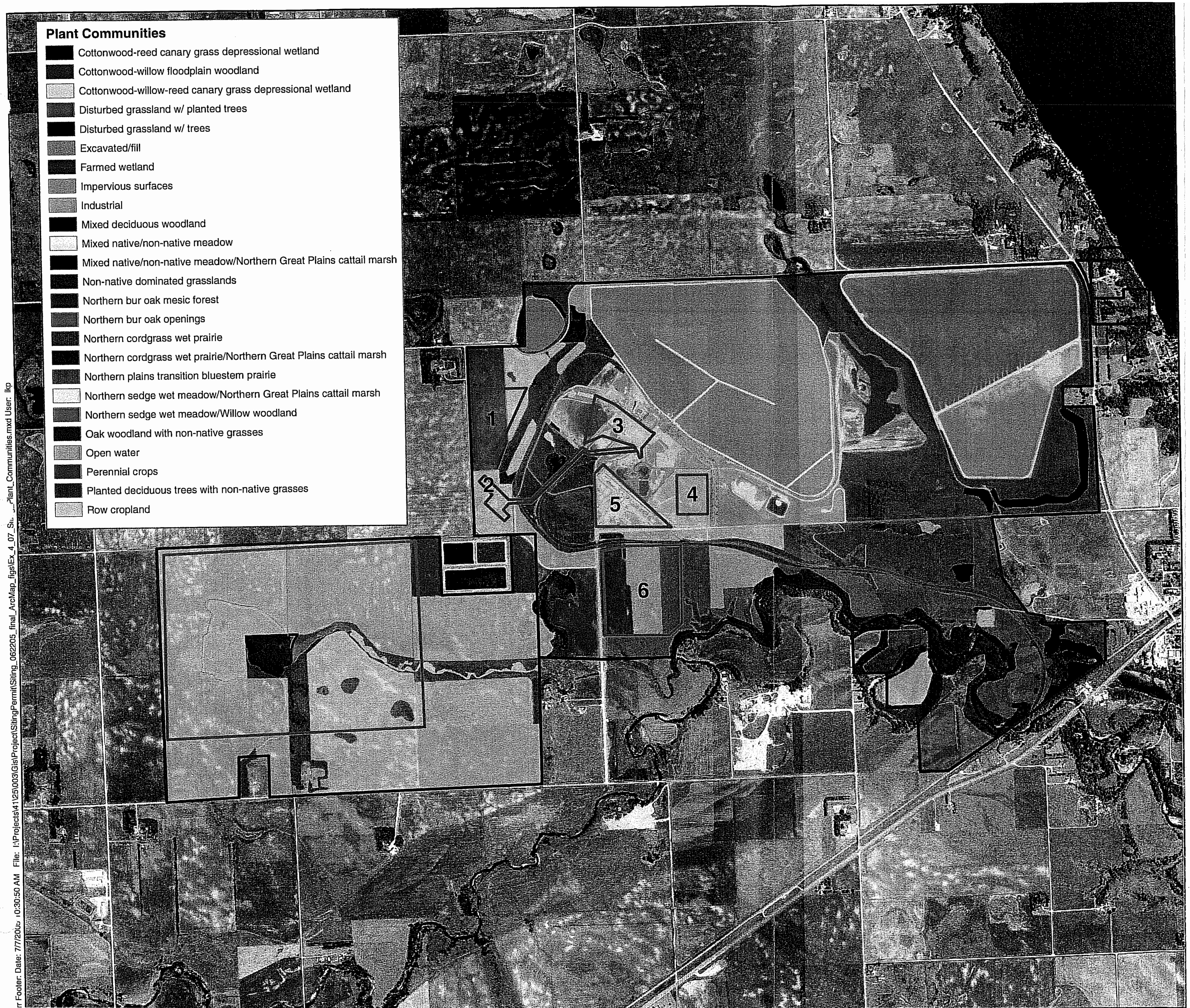
Streams

2,000 0 2,000 4,000
Feet

1,000 0 1,000
Meters

Exhibit 4-6

STREAM NETWORK &
WATERSHED DIVIDES
Big Stone II Project
Big Stone II Co-owners



Property Boundary

Project Features

ID

1 Cooling Tower Blowdown Pond
2 Cooling Tower
3 New Plant
4 Construction Parking
5 Ethanol Plant
6 Construction Laydown
7 Makeup Storage Pond

Plant community data collection by Barr Engineering Company in September 2004.

N

2,000 0 2,000 4,000
Feet

1,000 0 1,000
Meters

Exhibit 4-7

PLANT COMMUNITIES
Big Stone II Project
Big Stone II Co-owners

Property Boundary

Project Features

ID

1 Cooling Tower Blowdown Pond
2 Cooling Tower
3 New Plant
4 Construction Parking
5 Ethanol Plant
6 Construction Laydown
7 Makeup Storage Pond

Plant Communities

Quality

Low
Medium
High

Plant community data collection by Barr Engineering Company in September 2004.

N

2,000 0 2,000 4,000
Feet

1,000 0 1,000
Meters

Exhibit 4-8

PLANT COMMUNITY QUALITY
Big Stone II Project
Big Stone II Co-owners

Property Boundary
Extended Study Area

Project Features

ID

1 Cooling Tower Blowdown Pond
2 Cooling Tower
3 New Plant
4 Construction Parking
5 Ethanol Plant
6 Construction Laydown
7 Makeup Storage Pond
Bald Eagle Nest

Field observations made by Barr Engineering Company. South Dakota Natural Heritage Database query completed on September 24, 2004 by the SD Department of Game, Fish and Parks.

N

0.5 0 0.5 1 1.5
Miles

0 0.5 1 1.5 2 2.5
Kilometers

Exhibit 4-9

WILDLIFE
Big Stone II Project
Big Stone II Co-owners

Delineated wetlands
NWI Wetlands
Watershed Boundaries
Property Boundary

Project Features

ID

1 Cooling Tower Blowdown Pond
2 Cooling Tower
3 New Plant
4 Construction Parking
5 Ethanol Plant
6 Construction Laydown
7 Makeup Storage Pond
10ft Contours

Data Sources: USFWS National Wetlands Inventory. Wetlands delineation and data collection within property boundary by Barr Engineering Company.

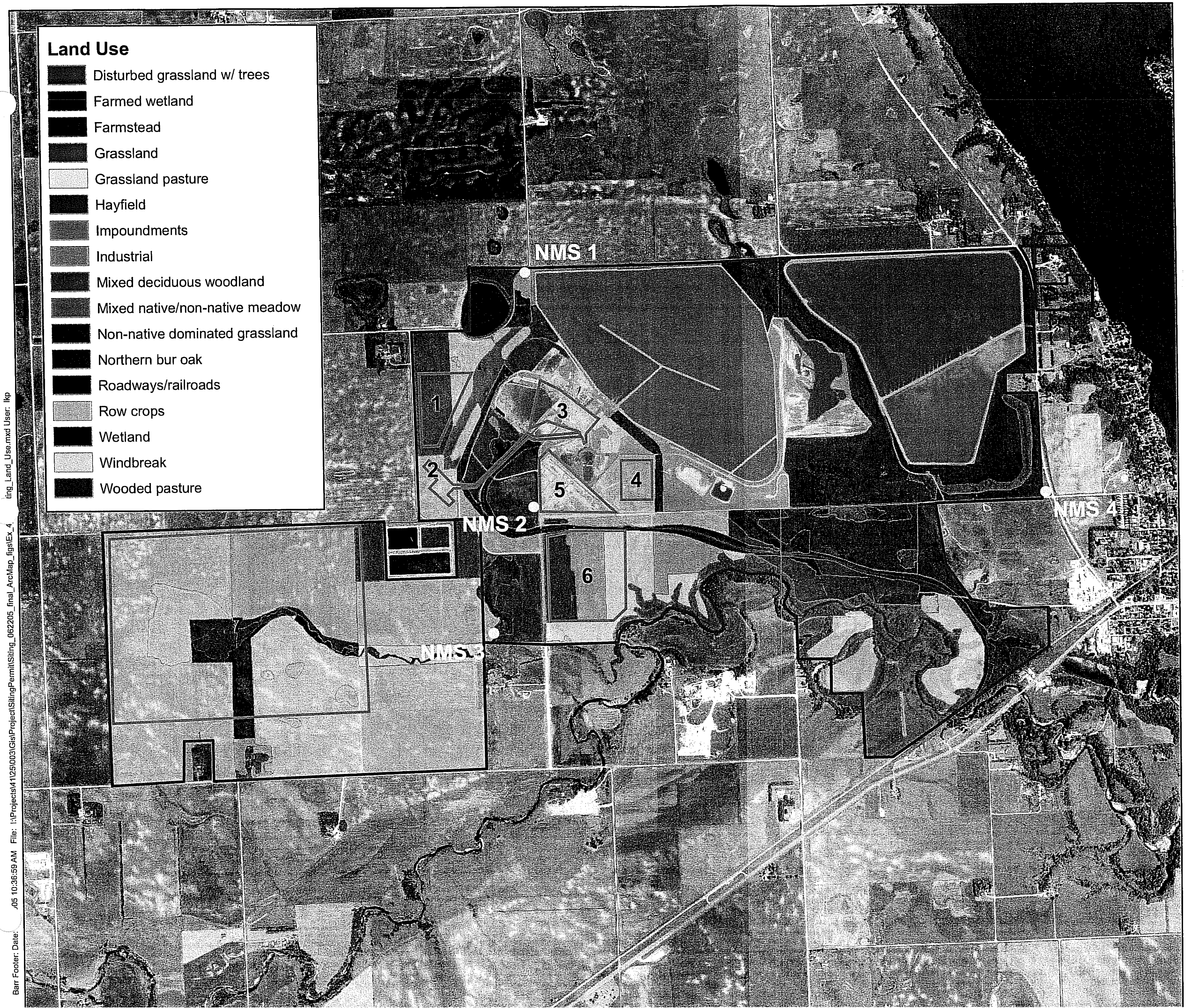
N

2,000 0 2,000 4,000
Feet

1,000 0 1,000
Meters

Exhibit 4-10

DELINEATED WETLANDS
Big Stone II Project
Big Stone II Co-owners



Property Boundary

Project Features

ID

1 Cooling Tower Blowdown Pond
2 Cooling Tower
3 New Plant
4 Construction Parking
5 Ethanol Plant
6 Construction Laydown
7 Makeup Storage Pond

Noise Monitoring Site

Plant community data collection by Barr Engineering Company. Simplified version of NCLD created by Barr Engineering Company.

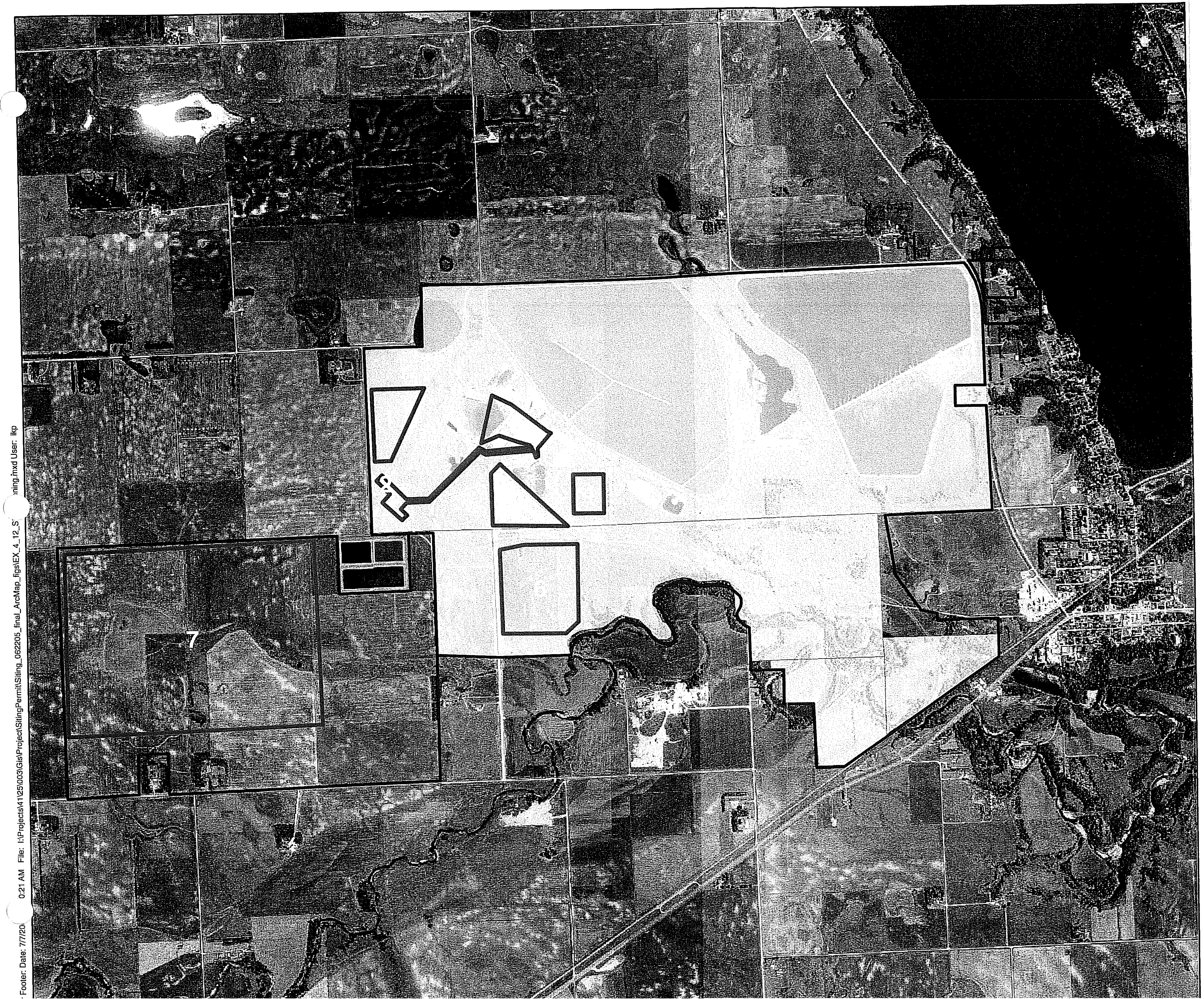
N

2,000 0 2,000 4,000
Feet

1,000 0 1,000
Meters

Exhibit 4-11

LAND USE
Big Stone II Project
Big Stone II Co-owners



Property Boundary

Project Features

ID

- 1 Cooling Tower Blowdown Pond
- 2 Cooling Tower
- 3 New Plant
- 4 Construction Parking
- 5 Ethanol Plant
- 6 Construction Laydown
- 7 Water Storage Pond
- Zoned Commercial

Data Source: 1st District Watertown GIS
Grant County, SD.

N

2,000 1,000 0 2,000 4,000
Feet

1,000 500 0 1,000
Meters

Exhibit 4-12

BIG STONE PROPERTY CURRENTLY
ZONED COMMERCIAL
Big Stone II Project
Big Stone II Co-owners

Section 5

5 Community Impact

The potential impacts to the community due the construction, operation, and maintenance of Big Stone II were identified and analyzed by obtaining readily available data from public sources, conducting telephone and/or direct contact surveys with identified community entities with knowledge of the community service or infrastructure, and from Otter Tail Power Company sources. The study area included communities within a 20-mile radius of the Big Stone Plant. The communities were located within Roberts and Grant counties in South Dakota and Big Stone and Lac qui Parle counties in Minnesota. The community impact study area is shown on Exhibit 5-1.

The communities that provided the specific basis and data for this analysis are:

South Dakota

- Big Stone City, SD (Grant County)
- LaBolt, SD (Grant County)
- Milbank, SD (Grant County)
- Stockholm, SD (Grant County)
- Summit, SD (Roberts County)
- Wilmot, SD (Roberts County)
- Corona, SD (Roberts County)
- Marvin, SD (Grant County)
- Revillo, SD (Grant County)
- Strandburg, SD (Grant County)
- Twin Brooks, SD (Grant County)

Minnesota

- Barry, MN (Big Stone County)
- Bellingham, MN (Lac qui Parle County)
- Correll, MN (Big Stone County)
- Louisburg, MN (Lac qui Parle County)
- Odessa, MN (Big Stone County)
- Beardsley, MN (Big Stone County)
- Clinton, MN (Big Stone County)
- Graceville, MN (Big Stone County)
- Nassau, MN (Lac qui Parle County)
- Ortonville, MN (Big Stone County)

During the late winter and early spring of 2005, First District Association of Local Governments (First District) collected data and conducted surveys with the identified communities regarding specific community impacts that may potentially be realized as a result of the Big Stone II facility.

5.1 Economic Impacts

This section summarizes the expected impacts of the Project to the regional economy. Key Project economic projection data are summarized in Table 5-1. These data are based on a Stuefen Research & Business Research Bureau economic study, included as Exhibit C.

Table 5-1 Key Economic Data

Economic Factor	Construction Phase		Operation and Maintenance Phase	
	Direct	Support	Direct	Support
Local Economic Impact	Not estimated	$675 Million	Not estimated	$3.6 Million/Year
South Dakota Economic Benefit	Not estimated	$788 Million	Not estimated	$3.6 Million/Year
Job Creation	2,550	1,997	35	29
Labor Income	$92.9 Million	$51.9 Million	$2.5 Million/Year	$3.1 Million/Year
Property Tax Revenues	Not estimated	Not estimated	Not estimated	$4.7 Million/Year
Land Values	Not estimated	Not estimated	Not estimated	No Anticipated Impact
Agricultural Production	Not estimated	No Anticipated Impact	Not estimated	No Anticipated Impact

5.1.1 Employment/Labor Market

5.1.1.1 Construction Labor

During the construction phase of Big Stone II, the labor force is expected to peak at approximately 1,400 workers onsite. The duration of the peak 1,400 onsite workers could possibly be up to, but probably not exceeding, one year. This projected peak of 1,400 construction personnel is anticipated to occur on about the middle of the third year of construction. This anticipated labor peak of 1,400 workers for the anticipated one-year duration would equate to approximately 3.1 million construction labor-hours and represent about 60 percent of the Project's total labor-hour estimate of 5.1 million labor-hours. The estimated labor requirements distribution by month for the construction phase of the Project is shown in Exhibit 5-2.

The average number of onsite workers for the duration of the Project (2007-2011) is estimated to be approximately 625. During any phases of the construction project, there is expected to be a heterogeneous profile of the workforce. This profile would include: unskilled labor, skilled labor, technical, and advanced technical. The unskilled labor for the Project will constitute approximately 5 percent of the estimated labor requirement. The projected range for unskilled labor during the various stages of the construction project is from 3.5 to 70 positions.

5.1.1.2 Local Labor Needs and Benefits

The proposed construction project would offer opportunities for local contractors and vendors, and new service jobs will be created to support the influx of workers. The local job growth is estimated at 2,550 full time equivalent positions during the construction phase of Big Stone II for the local four counties (1,997 full- and part-time jobs in the communities for an average of 1,378 per year for four years).

In 2008 dollars, the estimated value added by all labor (2,550 jobs) on the Project over a four-year period is $211 million. It is estimated that the labor income for businesses in the four-county area selling goods and services to the Project is $93 million, which will employ 2,059 people either full- or part-time. Assuming 50 percent of estimated induced expenditures are local, $51.9 million and 1,263 full- and part-time jobs is the estimated value added by people providing goods and services to the households of the workers on the construction site and in the local businesses identified as indirectly supporting the construction effort.

The wage scales at this juncture are not determined but typically, the nature of construction work is such that the wage scales are competitive. The Big Stone II construction phase should have a wide range of applicants from which to choose. It is expected that the local labor pool would supply a portion of the semi-skilled and skilled project labor personnel.

Long-term local labor benefits are projected to be 35 full-time equivalents employed in the operations. Twenty-nine full-time and part-time positions are projected to be created in the communities. The operation of the Big Stone II will begin in 2011. Otter Tail Power Company estimates that Big Stone II will require an additional 35 employees at a cost in payroll including benefits of approximately $2.5 million at 2004 wage levels. The 35 new power plant jobs are estimated to create another 28.8 jobs locally. The associated $2.5

million payroll for the additional Big Stone II employees is expected to result in a total economic activity increase of $3.1 million as these new households purchase goods and services in the area and the money makes its way through the economy.

5.1.1.3 Local Labor Resources

Although many of the full-time employees of Big Stone II will be new residents to the area, much of the plant's operation and maintenance labor force will be hired locally. Five facets of the local and county population will be available to meet the plant's employment needs—those who are currently unemployed, those who are currently underemployed, farmers who are in need of additional seasonal income, and those who are currently not in the workforce but, by the nature of the timeline of the construction, may opt to rejoin the workforce or become chronologically eligible to join the workforce.

Other labor contingencies not included in the survey data are those labor personnel available from areas and communities that are not included in the 20-mile Project radius study, 4-county area. Some of these larger communities would include: Sisseton, South Dakota, Watertown, South Dakota, Webster, South Dakota, Madison, Minnesota, and Benson, Minnesota.

5.1.1.4 Historical Labor Impacts

The existing Big Stone Plant unit I was constructed between 1971 and 1975. The construction of that facility brought a peak of 900 temporary workers into the area. The surrounding communities accommodated the influx of temporary residents by quickly providing low-cost rental housing. The operational phase of Big Stone Plant unit I created different challenges, including the need for a permanent labor supply. Initially, the power plant's labor force was transferred into the area from other plants. However, since that time, approximately half of the operational labor force has been hired locally. The Big Stone Plant unit I manager states that they have never had a problem finding qualified employees to hire.

5.1.2 Agriculture

A total of 3,115 acres will comprise the Big Stone property area. The current Big Stone Plant unit I site comprises approximately 2,200 contiguous acres. Otter Tail Power Company owns a 295-acre parcel adjacent to the existing site and has under option to purchase, on behalf of the Project, an additional 620 acres. Big Stone unit I utilizes approximately 1,000 of these acres for operations. The majority of the remaining area is currently being used for agricultural purposes; primarily row crops, hayfields, and pasture. Section 4.5.1 provides details on the land types present within the property area.

The construction of Big Stone II will take agricultural land out of production, some areas temporarily and other areas permanently. Agricultural land impacts associated with specific Big Stone II features are summarized in Table 5-2.

Table 5-2 Agricultural Land Impacts

Proposed Big Stone II Project Feature	Approx. Land Requirements (Acres)	Current Land Use	Comments
Cooling Tower Blowdown Pond	32	Pasture/hay, Row Crops	Permanent Impact
Coal Delivery Facility	5	Grasslands/Herbaceous	Existing Coal Delivery Facility will be used.
Power Generation Facility	30	Commercial/Industrial/Transportation	Permanent Impact
Construction Parking Area	12	Pasture/Hay, Row Crops	Temporary (construction) Impact
Construction Laydown Area	76.8	Pasture/Hay, Row Crops	Temporary (construction) Impact
Makeup Storage Pond	500	Grasslands/Herbaceous, Emergent Herbaceous Wetlands, Pasture/Hay, Row Crops	Permanent Impact (Wetland Mitigation Area Proposed)

Big Stone II would require an approximate additional of 530 acres of land to be taken out of agricultural use permanently with an additional 90 acres to be taken out of agricultural use for the construction phase.

5.1.3 Commercial and Industrial Sectors

The construction phase of the Project would offer opportunities for the local commercial and industrial business sectors. In addition to direct construction expenditures contractors and vendors may benefit from, the commercial and service sectors will benefit from the influx of workers. The local job growth is discussed in Section 5.1.1.2.

5.1.4 Land Values

Otter Tail Power Company has already purchased or secured options for additional land necessary for the Project. At the present time, there appears not to be a significant requirement to purchase additional land for the proposed Big Stone II Project.

Otter Tail Power Company has displayed a proactive approach to land management and acquisition. With their current land "holdings" and options, immediate or near, land acquisitions appear to be remote. Otter Tail's present position on land holdings, plus an equitable equalization formula in place, forms the basis for stabilization and security in the future land market and a predictability of assessed valuations and taxes.

5.1.5 Taxes

The potential impacts to the primary taxing jurisdictions in the Project study area: The state of South Dakota; Grant County, South Dakota; Big Stone City, South Dakota; Milbank, South Dakota; and Ortonville, Minnesota, are discussed below.

5.1.5.1 South Dakota

The state of South Dakota anticipates an additional $11,000,000 in sales tax, use tax and contractor's excise tax during construction of Big Stone II. Once operational, Big Stone II will be paying approximately $4.7M in property taxes annually. It is estimated that this will reduce the amount of state aid required by the Milbank school district by about $1.4M. That money would then be available for other schools in the state.

5.1.5.2 Grant County, South Dakota

Once operational, Big Stone II will provide $300,000,000 of assessed value to the mill levy calculation for Grant County. Local property taxes may go down because the plant will be paying approximately $4.7M in local property taxes annually. Local property taxes could also go down during construction because the plant will start paying property tax on the plant as parts of it are completed.

5.1.5.3 Big Stone City, South Dakota

Big Stone City assesses a 1 percent city sales tax. During the construction phase of Big Stone II, they would anticipate additional revenues due to sales taxes on money spent by construction workers and long-term employees. City officials declined to estimate how much the city sales tax revenues would increase as a result of the project. Big Stone City will also benefit from their share of property tax levied against Big Stone II by Grant County.

5.1.5.4 Milbank, South Dakota

Milbank, South Dakota currently assesses a city sales tax of 2 percent. As in the case of Big Stone City, Milbank would also benefit from additional revenues due to sales taxes on money spent during the construction period. Milbank currently receives approximately $1,200,000 annually from sales tax revenue.

5.1.5.5 Ortonville, Minnesota

Ortonville does not have a city sales tax, so would not receive any direct tax benefit from increased business due to the proposed construction of Big Stone II. The State of Minnesota has a sales tax and should benefit from additional sales.

5.2 Infrastructure Impacts

5.2.1 Housing

5.2.1.1 Temporary Housing for Construction Staff

A survey of available accommodations to evaluate the impacts on housing due to this temporary need for additional housing was conducted in March 2005. The study area encompassed an approximate 60-mile radius from the Big Stone II unit.

South Dakota communities that provided responses to a motel accommodations survey and questionnaire included:

- Big Stone City,
- Milbank,
- Sisseton,
- Watertown,
- Waubay, and
- Webster

Minnesota communities that provided responses to a motel accommodations survey and questionnaire included:

- Appleton,
- Benson,
- Madison,
- Morris,
- Ortonville, and
- Wheaton

A total of 35 motels are located within these twelve communities. The surveyed motels have a total of 2,242 beds (1,653 beds in South Dakota and 589 beds in Minnesota).

The majority of the moteliers surveyed were receptive to the concept of long-term arrangements for large blocks of rooms. The moteliers surveyed were also eager to facilitate and accommodate the lodging requirements necessary for the influx of a new labor force for the construction of the Big Stone II facility. Most of the moteliers have worked with large construction companies in the past and they have a level of expertise and comfort in providing temporary housing accommodations for large construction operations. In the past, each of the individual moteliers has entered into negotiations and agreements with various contractors concerning blocks of rooms, duration, rates, and extras such as continental breakfasts. This negotiating strategy and agreement development process appears to work well for the moteliers and the various contractors and will likely be the method implemented to accommodate temporary housing for the labor influx associated with the construction of Big Stone II facility.

Seasonal availability of accommodations may present some short-term issues but these concerns will likely be managed due to the amount of motel beds available in the 60-mile radius study area.

5.2.1.2 Permanent Housing for Operations Staff and Temporary Housing for Contract Maintenance Workers

After Big Stone II is in operation, it is estimated that 35 additional permanent jobs will be created at the Big Stone facility. Big Stone II also anticipates needing periodic maintenance that will require the assistance of additional contract labor.

A survey of available housing was categorized into two categories Primary and Secondary Impact Areas. The primary impact areas include the communities of Big Stone City and Milbank, South Dakota, and Ortonville, Minnesota. The secondary impact areas include the communities of LaBolt, Stockholm, and Stranburg in South Dakota and Odessa, Clinton, Correll, and Graceville in Minnesota. Real estate agents, local chambers of commerce, resort owners, and local land developers and managers in the Primary and Secondary Impact Areas were surveyed to assess potential impacts from the Project.

A total of 122 houses were for sale in the Primary Impact Areas in March 2005. Homes for sale in the Primary Impact Areas ranged from two to six bedrooms within a price range of $20,000 for a two-bedroom home in Milbank, South Dakota to a four bedroom lake home for $250,000 in Big Stone City, South Dakota. The total number of houses for sale in the Secondary Impact Areas as of March 2005 was 18. Homes for sale in the Secondary Impact Areas were two and three bedroom homes in the $20,000 to $35,000 price range or with the selling price negotiable.

Rental units available as of March 2005 in the Primary Impact Areas included 15 homes and 83 apartments. Rental rates for homes in the Primary Impact Areas ranged between $400 and $600 per month. Apartment rental rates in the Primary Impact Areas ranged from $250to $650 per month. Rental units available as of March 2005 in the Secondary Impact Areas included 8 homes and 23 apartments. Rental rates for homes in the Secondary Impact Areas were listed as negotiable. Apartment rental rates in the Secondary Impact Areas range were in the $400 per month range or at a negotiable rate.

The total number of mobile homes for sale in the Primary Impact Areas as of March 2005 was 10. The sale prices for mobile homes in the Primary Impact Areas ranged from $18,000 to $45,000 or the sale price was negotiable. There does not appear to be any mobile homes for sale at this time in the Secondary Impact Areas.

The total number of mobile homes for rent as of March 2005 in the Primary Impact Areas was 17. Mobile home rental rates in the Primary Impact Areas ranged from $300 to $375 per month. One mobile home was available for rent (price negotiable) as of March 2005 in the Secondary Impact Areas.

The survey also included assessing the availability mobile home pad rentals, recreational vehicle (RV) pad rentals, and housing trailer campgrounds. The total number of mobile home pad rentals in the Primary Impact Areas as of March 2005 was 109. The rental for the mobile home pads was $160 per month. There were 83 pads available for rent as of March 2005 in the Primary Impact Areas. The rental rate ranged from $23.75 per day to $300 to $385 per month. The number of mobile home pads available for rent in the Secondary Impact Areas as of March 2005 was 10. The rental rate for the mobile home pads in the

Secondary Impact Area was stated as negotiable. There does not appear to be RV pad rentals available in the Secondary Impact Area. The fees for trailer campgrounds at all state parks in South Dakota included a $20 annual park user fee and electrical trailer hook-up pads for $13 per day. Non-electrified camping sites are available for $10 per day.

The costs of lots for new home construction in the community of Corona, South Dakota were free and also included 2 years of tax breaks to build a new home in Corona. Lake lots and property on Big Stone Lake are in the $85,000 range.

The temporary housing needs for contract workers performing maintenance activities at the Big Stone II appears to be easily accommodated by the available motels in the area around the facility. If accommodations are required on a more long-term basis, the apartment and home rental units could likely be leased by the contractors.

5.2.2 Energy

Big Stone II will not detract from the energy needs in the area. Big Stone II would only enhance power production and, thus, by the nature of the Project, enhance the regional energy setting. Section 3.1 discusses the demand for the Project in detail.

5.2.3 Sewer and Water

5.2.3.1 Sanitary Sewer

Big Stone Plant unit I utilizes an onsite sanitary sewer facility. The addition of 1,400 onsite construction personnel would put a "strain" on the existing sanitary sewer system. Portable toilets could be utilized for the warmer construction periods, but the current proposal is to add a temporary onsite sanitary sewer system to accommodate additional personnel during the construction period.

Any influx of additional labor personnel to communities in the study area would not, based on survey results, have an impact on existing sanitary sewer services.

5.2.3.2 Potable Water

The water needs and sources for the Big Stone unit I and proposed Big Stone II operation are discussed in Section 2.2.8.

Grant-Roberts Rural Water supplies all of the water needs for plant personnel and is expected to be able to accommodate the increased personnel during construction. Local municipal water systems, wells, aquifers, etc., will not be impacted.

5.2.4 Solid Waste Management

The construction of Big Stone II will require that materials be transported to regional landfills. The anticipated amount of waste from the construction project will be significant. Big Stone Plant unit I currently has a contract with a waste management firm, which is located in North Dakota. During the construction phase, all contractors will be required to remove their own solid waste materials and transport them to regional solid waste management sites.

Management of coal combustion by-products generated from Big Stone Plant unit I and Big Stone II is discussed in Section 2.2.7.1.

5.2.5 Transportation

The information described in this section regarding the increases in increased roadway traffic and rail traffic during the construction phase of Big Stone II was communicated to transportation representatives in the Primary Impact Areas. The Chiefs of Police in Milbank, South Dakota and Big Stone City, South Dakota and Ortonville, Minnesota; the Grant County, South Dakota Highway Superintendent; the Sheriff of Big Stone County, Minnesota; and the Traffic Facilitator for the Northern Lights Ethanol plant in South Dakota responded to the weighted questionnaire. The roadway and rail line corridors in the Study Area are shown on Exhibit 5-3.

5.2.5.1 State and County Roadways

During the construction phase of the Big Stone Plant unit I facility, which came online in 1975, the immediate road infrastructure to and from the facility consisted of a series of gravel roads. Since the construction of Big Stone Plant unit I, all the local and immediate ingress and egress corridors have been upgraded to hard-surface roadways.

Traffic counts were conducted in 2003 at two locations in Grant County near the Big Stone Plant unit I, specifically on U.S Highway 12 and County Road 109. The average daily traffic counts were 287 vehicles per day at the U.S. Highway 12 location and 40 vehicles per day at the County Road 109 location.

The Project Co-Owners are fully aware of the increased utilization of local roadways by construction workers' private vehicles to get to and from the Big Stone II construction site and will be providing off-road private parking in designated onsite parking areas.

Anticipated truck traffic to the Big Stone II construction site will vary during the various phases of construction. Additional truck traffic during construction would consist of periods of increased traffic over relatively shot time periods (days and weeks) rather than the approximately 50 trucks per 24-hour day, seven days per week experienced at the Northern Lights Ethanol plant (Electronic Communication with Northern Lights Ethanol, May 31, 2005). Construction timetable deliveries and drop-offs by contractors and vendors will ultimately flow with the progress of the construction project.

At the peak of the construction project (approximately May through June 2009), it is estimated that the worker force will reach 1,400 maximum personnel. One of the Project Co-Owners' initiatives to mitigate any possible parking impacts is to designate off-road onsite parking facilities to accommodate worker's private vehicles. It is also highly unlikely that 1,400 workers vehicles would arrive simultaneously at any given time. Work shift schedules will help diffuse traffic and parking problems. It is also likely that the labor force will practice some form of car-pooling, thus further mitigating any traffic or parking impacts.

Law enforcement will be more visible during the construction phase of the project and will increase patrol activities. Traffic counters could be temporarily installed on corridors that may present some transportation issues and provide law enforcement and other transportation specialists opportunities for proactive solutions to mitigate potential impacts. Portable radar signs to inform drivers of their speed or the presence of a South Dakota Motor Carrier Enforcement official are among the possible actions that could be taken to mitigate potential traffic problems.

In the unlikely event that worker traffic and parking becomes an issue, an independent private transportation vendor could provide transportation to and from the construction site.

Potential transportation issues or problems do not appear to be significant issues with law enforcement, the Grant County Highway Superintendent, or the Northern Lights Ethanol plant Traffic Facilitator. The transportation corridors are sound and have been significantly improved since the construction of Big Stone Plant unit I in 1975. County corridors have recently been improved, are being improved, and are scheduled for long-term maintenance and improvements

5.2.5.2 Railroad Traffic

Otter Tail Power Company currently utilizes railroads and the corridor of roads and highways to augment the operation of Big Stone Plant unit I. Currently, the Burlington Northern Santa Fe (BNSF) railroad provides three to four coal train deliveries per week to the Big Stone Plant unit I. Each of these coal train deliveries consist of approximately 115 coal cars. Increasing the number of coal cars per train to accommodate the operation of Big Stone II does not appear to be feasible. Therefore, the number of individual coal train deliveries per week will increase when Big Stone II comes on line in 2011. The Project Co-Owners estimate that there will be an increase from the current coal train deliveries (115 coal cars each) of three to four per week to six to eight deliveries per week to accommodate the additional fuel demands for Big Stone II.

The number of trains that pass through Milbank, South Dakota will increase from the current three to four per week to six to eight per week. The overpass and underpass system in Milbank mitigates any train transportation impacts.

5.3 Community Services

5.3.1 Health Services and Facilities

The nine surveyed health facilities within the 20-mile radius of Big Stone II provide a variety of total health services and technology for the area's citizens.

All health facilities, including satellite clinics operated by Milbank and Ortonville, provide a network of outreach physicians and technology to provide for services that may not be available at local health care facilities during the pre- and post-construction phase of the Big Stone Plant unit I. The medical advances that have been attained during the last 30 years (1975-2005) will provide and maintain an excellent level of health services through a series of proactive health facilities for the impact study area.

An interesting proposal suggested by the Ortonville, Minnesota medical community is the exploration and planning of a Big Stone II mobile, onsite outreach clinic. If this concept comes to fruition, it would be a tremendously valuable asset by providing immediate, emergency onsite medical services to project personnel.

There were no real or perceived health facilities impacts indicated from this survey. Any possible health facilities amelioration issues would possibly be categorized in the "insurance/workman's compensation" area. Current "state-of-the-art" computer technology, which was not available 30 years ago, provides instant and accurate data on patients' claims, processing and disbursements. Communications and accurate records would provide the foundation for resolution of most issues.

5.3.2 Schools

The seven South Dakota and two Minnesota school districts in the Project community study area are anticipating future growth and are looking forward to the opportunity of providing quality education to a possible influx of new students.

While it is difficult to determine the specific demographic and "family unit" data on the projected increased labor force, depending on geographical distribution and location, it would be prudent to assume that the majority of new students could be enrolled in one of the three following attendance centers: Milbank, Ortonville, and Big Stone City. Based upon information obtained via phone surveys to the respective superintendents of schools in March 2005, these three schools have the projected ability to accommodate an additional 510 new students. The projected new student maximum peak could be expected to be in the 300 range. These three schools alone should be capable of providing more than adequate educational opportunities and accommodations for new students.

All surveyed superintendents reported no recollection of Big Stone Plant unit I construction having had an impact on their school system.

5.3.3 Recreation

Northeastern South Dakota is blessed with a plethora of recreational opportunities including swimming, boating, open water fishing, ice fishing, hiking, camping, hunting, exploring, biking, sightseeing, photography. The area lakes provide yearly recreational opportunities to residents and visitors alike.

A variety of non-lake recreational opportunities are provided, not only in the primary study communities, but also in the secondary study communities. Many communities in the primary and secondary survey areas provide special events. There appears to be something happening—somewhere—most of the time.

There were few real or perceived recreational impacts indicated from a survey of community officials. The projected influx of temporary construction workers is not expected to overtax the many recreational facilities in the area.

5.3.4 Public Safety

5.3.4.1 Fire Protection

A total of 163 South Dakota volunteer firefighters and 150 Minnesota volunteer firefighters comprise the nucleus of fire services/fire protection for the regional community survey area. All of the fire services provided in the fire services impact survey are unpaid, volunteer firefighters.

The individual community volunteer fire departments work closely with one another and, through mutual aide agreements, have the ability to augment and "team" firefighting emergencies that would tax the resources and personnel of an individual agency. 62.30 percent of the total 313 firefighters in the survey area are trained firefighters.

A survey of the area fire departments indicated no real or perceived fire services impacts from the Project. Any fire services amelioration issues that might arise would ultimately be resolved by the local elected officials and the membership of the local fire district.

5.3.4.2 Law Enforcement

The seven surveyed law enforcement agencies in the community survey area include 36 full- and part-time law enforcement officers. The additional labor personnel required by Big Stone II will probably result in a minor short-term increase in workload.

5.4 Other Impacts

5.4.1 Population and Demographics

Big Stone II will be located immediately adjacent to Big Stone unit I in Grant County in northeast South Dakota. Milbank, South Dakota is the largest community in Grant County and had a population of 3,640 recorded for the 2000 census. The total population recorded for the 2000 census for Grant County was 7,847. The population of Roberts County, South Dakota was recorded at 10,016 according to the 2000 census. The largest community in Roberts County included in the study area is Wilmot, South Dakota with a population of 543 recorded in the 2000 census. The total population of Big Stone and Lac qui Parle Counties in Minnesota according to the 2000 census was 5,820 and 8,067, respectively. The largest community in Big Stone County included in the study area according to the 2000 census is Ortonville, Minnesota with a population of 2,158. The largest community in Lac qui Parle County included in the study area according to the 2002 census is Bellingham, Minnesota with a population of 205. A summary of the population by County and community within the study area is presented in Table 5-3.

Table 5-3 Regional Population Summary

Entity	Estimated Population
Grant County, SD	7,847
Roberts County, SD	10,016
Big Stone County, MN	5,820
Lac qui Parle County, MN	8,067
Big Stone City, SD	605
Corona, SD	112
LaBolt, SD	86
Marvin, SD	66
Milbank, SD	3,640
Revillo, SD	147
Stockholm, SD	105
Strandburg, SD	69
Summit, SD	281
Twin Brooks, SD	55
Wilmot, SD	543
Barry, MN	25
Beardsley, MN	262
Bellingham, MN	205
Clinton, MN	453
Correll,MN	47
Graceville, MN[1]	605
Louisburg, MN	26
Nassau, MN	83
Odessa, MN[2]	147

Entity	Estimated Population
Ortonville, MN[3]	2,158
Construction Work Force Peak/Including Families[4]	1,400/3,556
Full Time Employment Gain/Including Families[5]	35/108

[1]Graceville City only. Graceville Township has a population of 205.

[2]Odessa City only. Odessa Township has a population of 147.

[3]Ortonville City only. Ortonville Township has a population of 2,287.

[4]Assumes 50 percent of work force relocates with their families. North Dakota and Minnesota combined average family size is 3.08.

[5]Assumes that the full time Big Stone II employes relocate their families. North Dakota and Minnesota combined average family size is 3.08.

The increase in the population due to the influx of construction workers and their families and the full-time employees hired to operate Big Stone II and their respective families will be absorbed into the surrounding communities.

5.4.2 Cultural Resources

During March and April of 2005, The 106 Group Ltd. conducted a cultural resources survey of the Big Stone II Project area. The purpose of the cultural resources investigation was to determine whether the Project area contains previously recorded or unrecorded historic and/or archaeological properties that may be eligible for listing on the National Register of Historic Places (NRHP). The complete archaeological assessment and architectural history survey report prepared by The 106 Group is included as Exhibit D.

As an initial step in the assessment of cultural resources, the appropriate Area of Potential Effect (APE) is determined. The area of potential effect (APE) for archaeology is the same as the Project area, and it includes all areas of proposed construction activities or other potential ground disturbing activities associated with construction of the new components of the Big Stone II Project. The APE for architectural history accounts for any physical, auditory, or visual impacts to historic properties, and it includes an area that extends from one-half mile to one mile from Project components.

The archaeological investigation consisted of a review of documentation of previously recorded sites and an assessment (windshield survey) of the Project area. The architectural history investigation consisted of a review of documents of previously inventoried properties and of previously conducted surveys that included the Project area, as well as a field survey to identify and document properties that are 49 years of age or older within the APE. The architectural history survey area includes approximately 3,599 acres (1,456 hectares).

The archaeological assessment results are presented in Exhibit 5-4. The Level I archaeological assessment identified two areas of high potential, only one of which is recommended for Level III Survey *if* it will be impacted by future development. The architectural history survey results are presented in Exhibit 5-5. During the Phase I architectural history survey, The 106 Group identified three properties 49 years in age or older within the APE. Two buildings, the Rabe Round Barn (GT-004-00001) and the Rabe Livestock and Hay Barn (GT-004-00002), are recommended as eligible for listing on the NRHP.

The effects of the Big Stone II Project on two properties recommended as eligible for listing on the NRHP was analyzed. The 106 Group recommends a finding of *no adverse effect* for the Big Stone II Project on the Rabe Round Barn (GT-004-00001) and the Rabe Livestock and Hay Barn (GT-004-00002).

5.5 Amelioration of Potential Adverse Community Impact

Amelioration of potential adverse community impacts are discussed in this Section 5, in Section 2, and throughout the remainder of this application. In general, community impacts are expected to be positive and any potential adverse effects will be ameliorated through thoughtful design, construction execution and operation.

Section 5 Exhibits

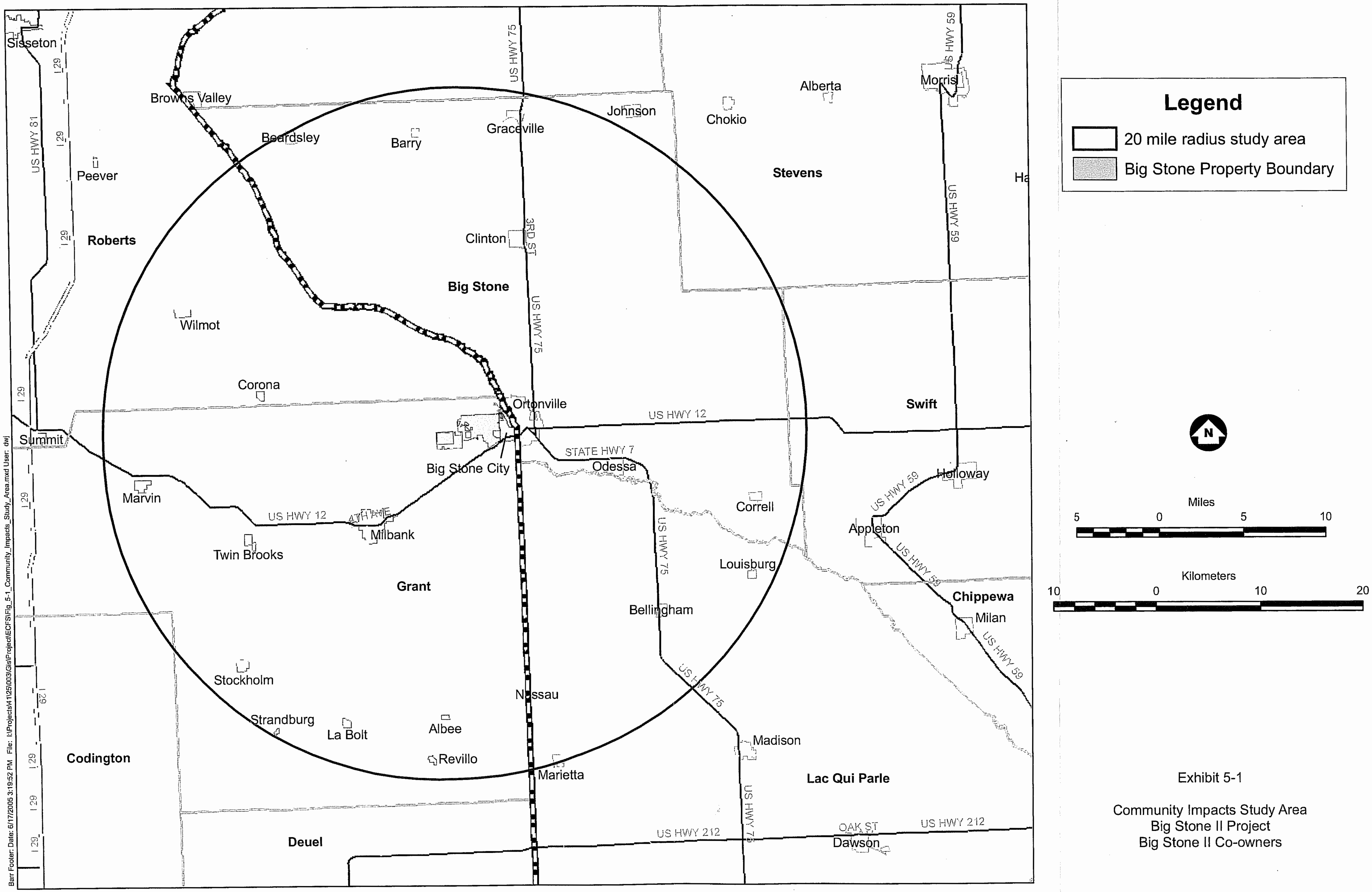
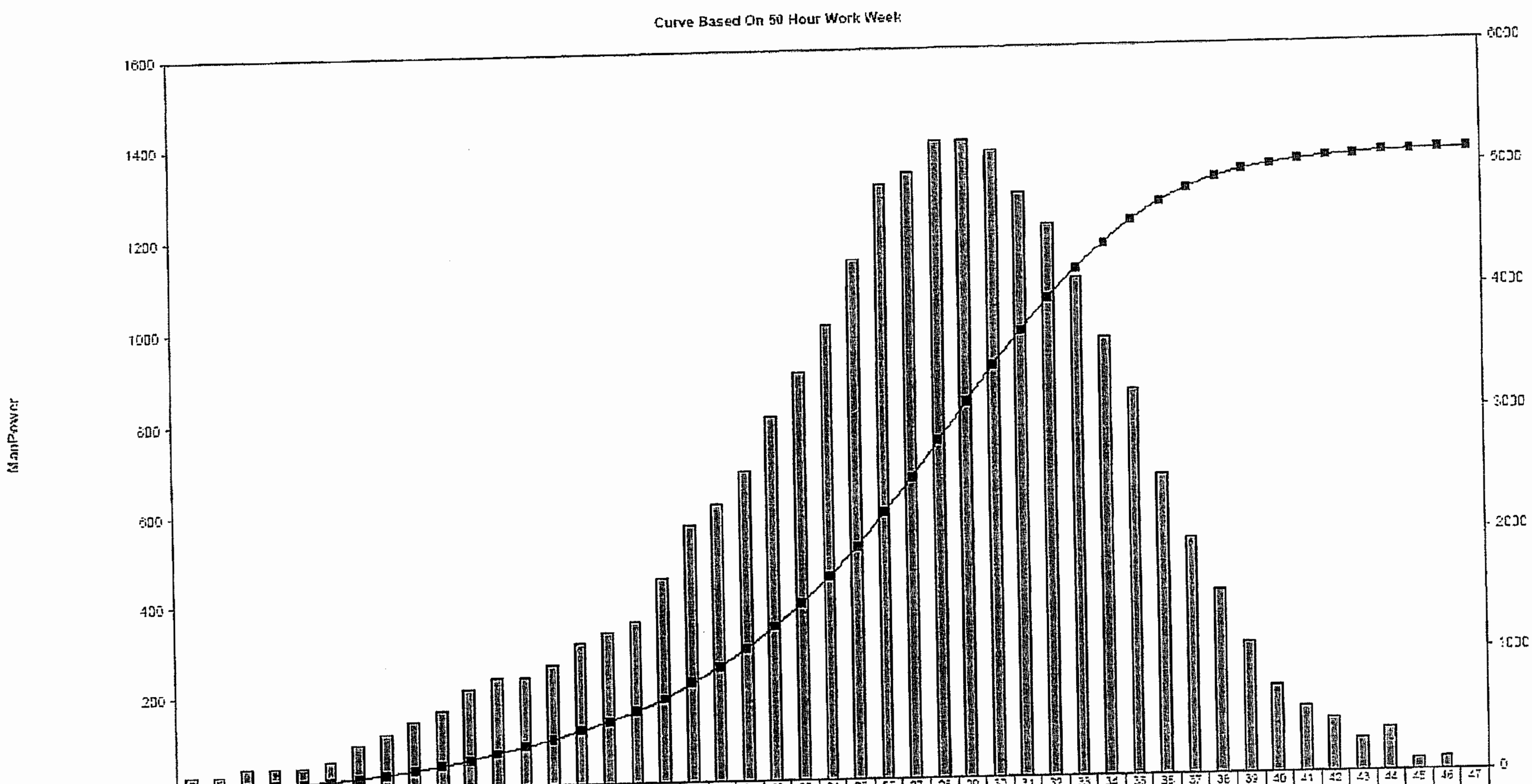


Exhibit 5-1

Community Impacts Study Area
Big Stone II Project
Big Stone II Co-owners



Months	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Man Power	25	39	41	44	44	58	84	118	141	165	212	235	235	259	306	329	353	447	565	612	653	800	894	995
Man-Hours (1000's)	5	12	22	32	41	54	74	100	130	155	212	253	214	370	436	506	584	681	804	935	1084	1257	1451	1657

Months	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47
Man Power	1158	1302	1325	1396	1395	1373	1275	1203	1090	952	847	659	518	420	282	168	141	113	71	54	24	26	0
Man-Hours (1000's)	1914	2196	2482	2786	3083	3356	3653	3935	4151	4370	4552	4656	4803	4895	4956	4997	5027	5053	5068	5081	5094	5100	5100

Exhibit 5-2

ESTIMATED CONSTRUCTION LABOR REQUIREMENT
Big Stone II Project
Big Stone II Co-owners

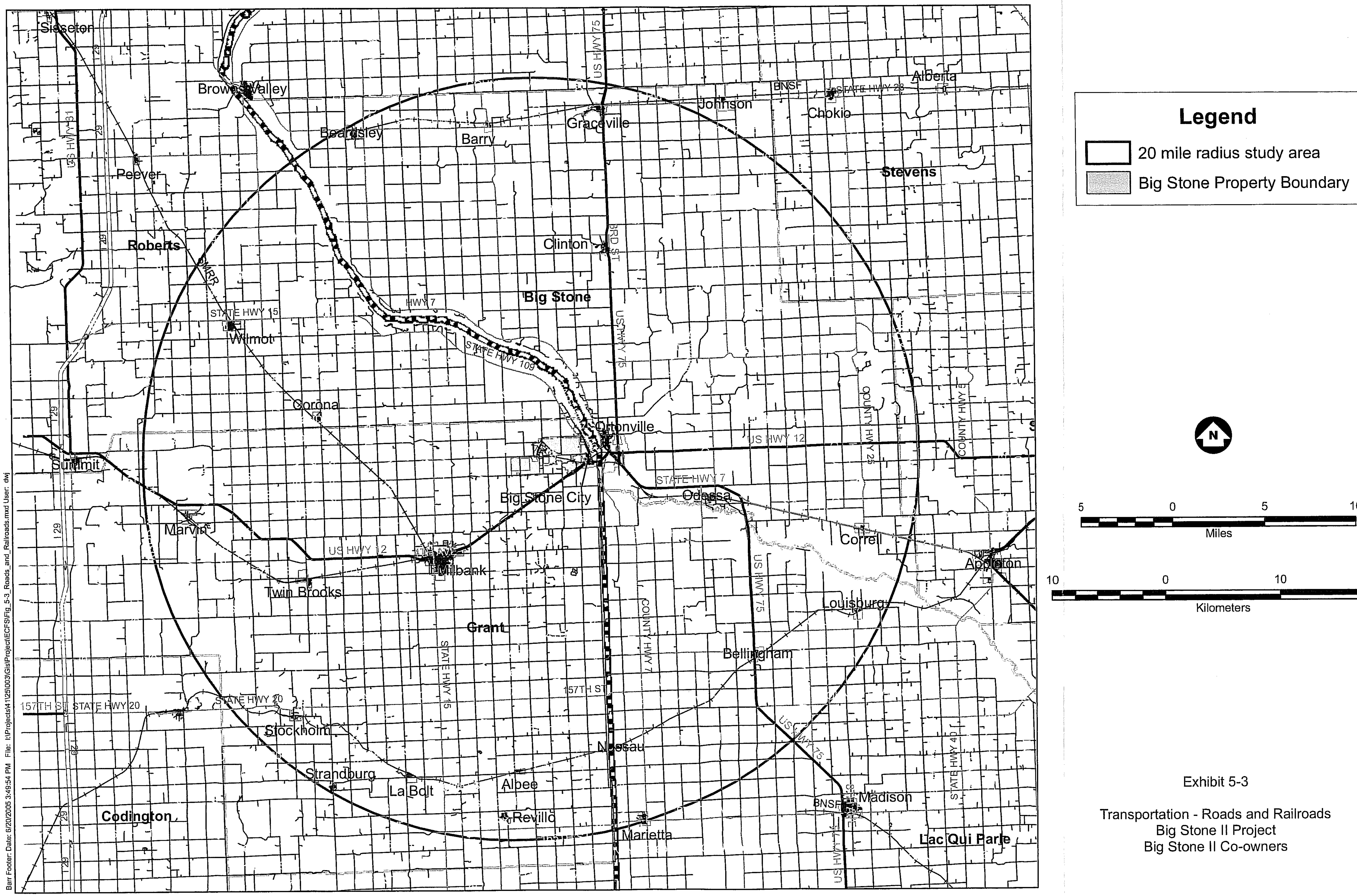


Exhibit 5-3

Transportation - Roads and Railroads
Big Stone II Project
Big Stone II Co-owners

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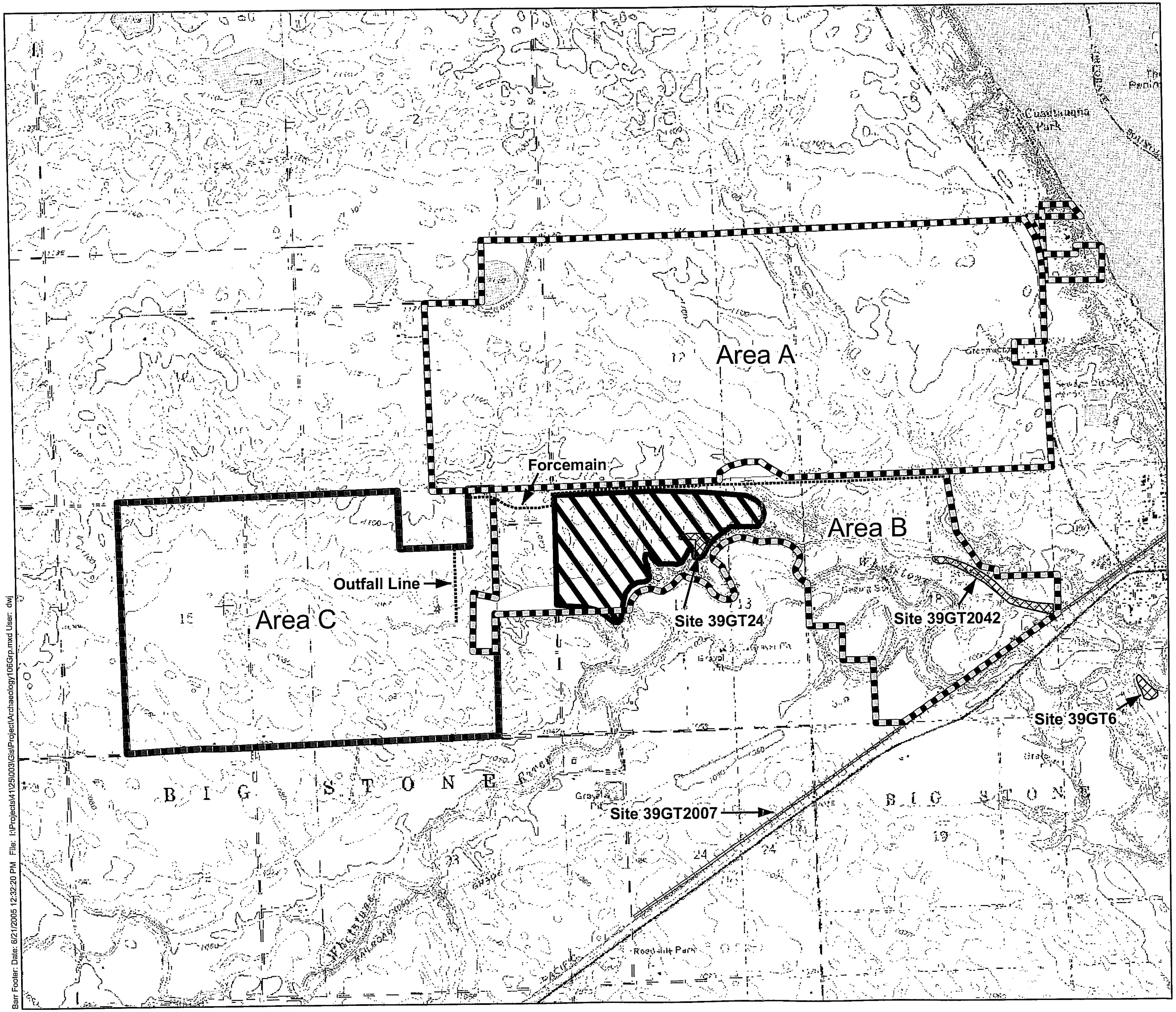


Site Boundary

High Potential

1994 Survey

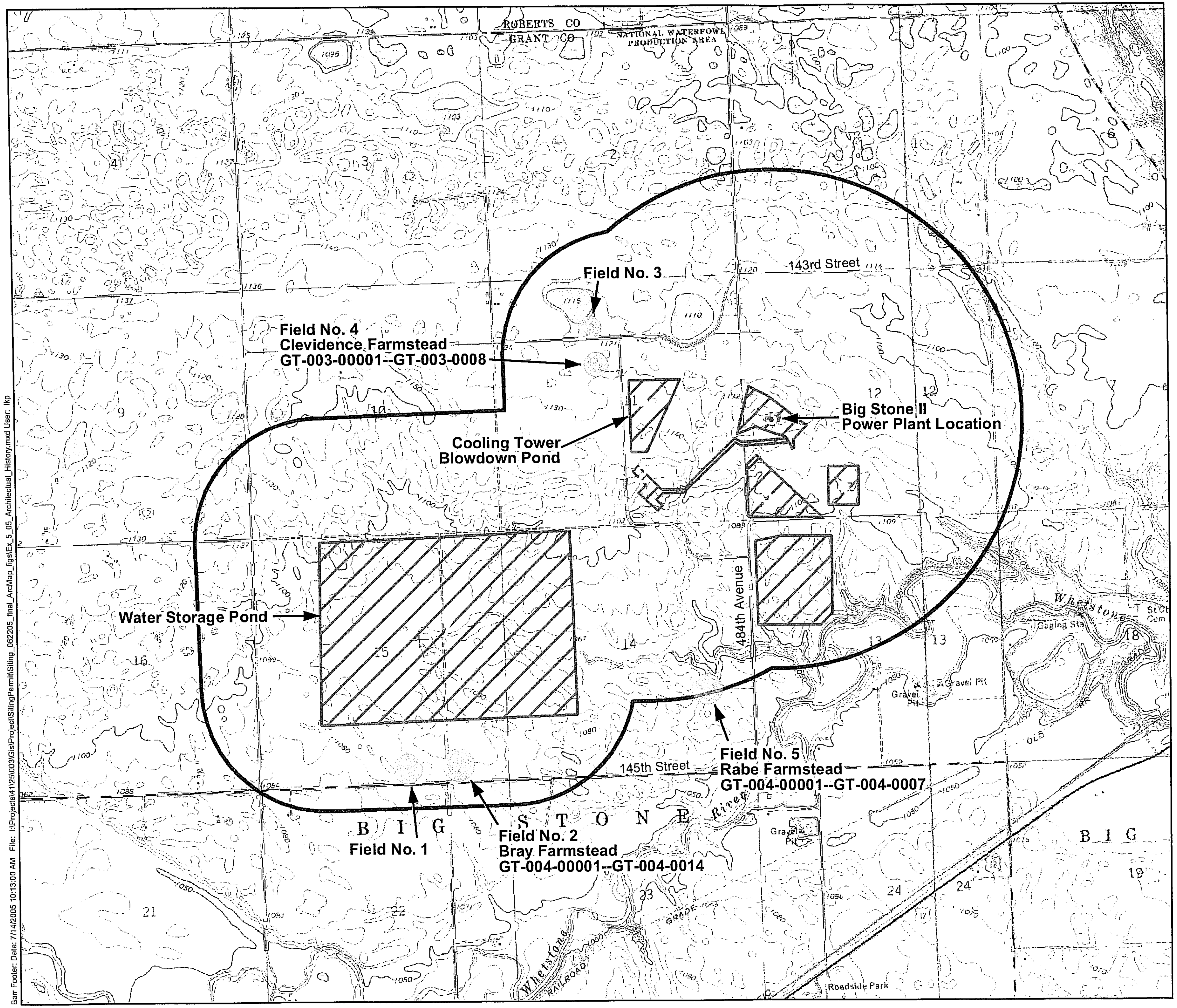
1996 Survey

1,000 0 1,000 2,000 3,000 4,000 5,000
Feet

500 0 500 1,000
Meters

Exhibit 5-4

ARCHAEOLOGY ASSESSMENT RESULTS
Big Stone II Project
Big Stone II Co-owners



Architectural History Surveyed Properties

Project Features

Architectural History Area of Potential Effect

1,000 0 1,000 2,000 3,000 4,000 5,000

Feet

500 0 500 1,000

Meters

Exhibit 5-5

ARCHITECTURAL HISTORY SURVEY RESULTS
Big Stone II Project
Big Stone II Co-owners

Section 6

6 Other Information

The Big Stone II Project has strong community support as evidenced by Resolutions of Support passed by the following area units of government:

Governmental Unit	Resolution No.	Date
City of Big Stone City, South Dakota	2004-12	December 6, 2004
County of Grant, South Dakota	2005-03	February 7, 2005
City of Milbank, South Dakota	--	February 7, 2005
School Board of Milbank School District, South Dakota	--	February 7, 2005

Copies of these resolutions are included as Exhibits E, F, G and H.

Section 7

VERIFIED APPLICANT'S SIGNATURE

STATE OF South Dakota)
:SS
COUNTY OF Grant)

Mark Rolfes, being duly sworn, deposes and says that he is Project Manager of Big Stone II and is the authorized agent of Otter Tail Corporation d/b/a Otter Tail Power Company and is also authorized to sign this application on behalf of the Big Stone II Co-Owners: Central Minnesota Municipal Power Agency, Great River Energy; Heartland Consumers Power District; Montana-Dakota Utilities Co., a Division of MDU Resources Group, Inc.; Otter Tail Corporation d/b/a Otter Tail Power Company; Southern Minnesota Municipal Power Agency, and Western Minnesota Municipal Power Agency.

He states that he does not have personal knowledge of all of the facts recited in the foregoing application, but the information in the application has been gathered by and from employees, contractors of the owners of Big Stone II; and that the information in the application is verified by him as being true and correct on behalf of Big Stone II.

Dated this 20th day of July, 2005.

[signature]
Mark Rolfes

[signature]
DENNIS MEARS
SEAL NOTARY PUBLIC SOUTH DAKOTA SEAL
My Commission Expires 9-10-2010

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Other Exhibits

Exhibit A

Power Plant Site Evaluation Study for Otter Tail Power Company
Burns & McDonnell Engineering Company, Inc.
May 2005

Report on the

Power Plant Site Evaluation Study

OTTERTAIL POWER COMPANY

2005

Burns & McDonnell SINCE 1898

POWER PLANT SITE EVALUATION STUDY

prepared for

OTTER TAIL POWER COMPANY
FERGUS FALLS, MINNESOTA

prepared by

Burns & McDonnell Engineering Company, Inc.
Kansas City, Missouri

Project 38648

May 2005

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EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

This report section presents an executive summary of the Power Plant Site Evaluation Study. This study was completed by Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) for Otter Tail Power Company (OTP). The goals, methodology and results of this study are described in the following sections.

ES.1 PROJECT BACKGROUND AND STUDY OBJECTIVES

OTP and other local utilities (collectively referred to as the Participants) have completed resource planning studies that indicate each utility will need additional baseload generating resources in the near future. Because of economies of scale, the Participants recognize that development of a large, jointly-owned generating facility will be more cost effective than construction of several smaller units. For this reason, the Participants have contracted with Burns & McDonnell to perform a review of available generating technologies, evaluate prospective plant locations, and complete other planning studies.

OTP is the lead developer of this power project with the other potential participants including Central Minnesota Municipal Power Agency, Great River Energy, Heartland Consumers Power District, Hutchinson Utilities Commission, Missouri River Energy Services, MDU Resources Group, and Southern Minnesota Municipal Power Agency. Each of these potential project co-owners will determine their individual participation after all of the necessary planning studies are complete.

From previous analyses, OTP's existing Big Stone Plant has been identified as the most likely site for the proposed new generating unit. This unit would be coal-fired, have a nominal capacity of 600 megawatts (MW), and come online in 2011. The decision by OTP and the other project participants to locate this generating unit at Big Stone is based upon review of past siting studies and recent strategic analyses. Because some of the past siting studies used in this review are many years old, OTP has commissioned this site evaluation study to take a fresh look at the factors that influence power plant siting decisions.

This site evaluation study was completed by a multi-disciplinary team of professionals from OTP and Burns & McDonnell. The members of the project team included individuals with expertise in the planning, permitting, design and operation of electric generating facilities.

In this study, prospective power plant sites were identified within a project area that included the entire states of Minnesota, North Dakota and South Dakota. This three-state area includes the service territories of the majority of the potential project participants.

ES.2 SELECTION OF CANDIDATE SITE AREAS

The first step in the site selection process was to identify candidate site areas. Candidate site areas are general locations that possess the necessary infrastructure and other characteristics that may make them suitable power plant sites. The candidate sites must also be of sufficient size to accommodate plant development plus allow sufficient buffer area to mitigate some of the impact on surrounding areas.

Before specific sites could be identified, it was necessary to map locations within the project study area where power plant siting may be impractical for institutional or social reasons, and where the required infrastructure is available.

There are certain land classifications that are considered undesirable for siting a power plant or other large industrial facility. These include such areas as residential or urban areas; national, state and local parks, monuments, recreation areas, forests and wildlife refuges; and wetlands. However, the only constraint areas mapped on a regional scale were Class I areas and certain designated use areas. Also mapped for the entire study area were the locations of infrastructure critical to economical power plant development: electric transmission lines with voltage of 230 kilovolts (kV) or higher, rail lines, and major rivers and lakes.

The Class I areas, designated use areas, and infrastructure locations were overlaid to help identify specific areas with better potential for development as power plant sites. From this composite map and available topographic maps and aerial photographs, 38 specific site areas were identified. These areas were designated preliminary site areas. The locations of the 38 preliminary site areas are shown on Figure ES-1.

Following identification of the preliminary site areas, these areas were subjected to a desktop screening to eliminate those sites with more obvious development constraints. Through this process, 30 of the 38 preliminary site areas were eliminated. These sites were eliminated for two primary reasons: limited water supply potential or nearby residential development. The remaining eight site areas are listed below:

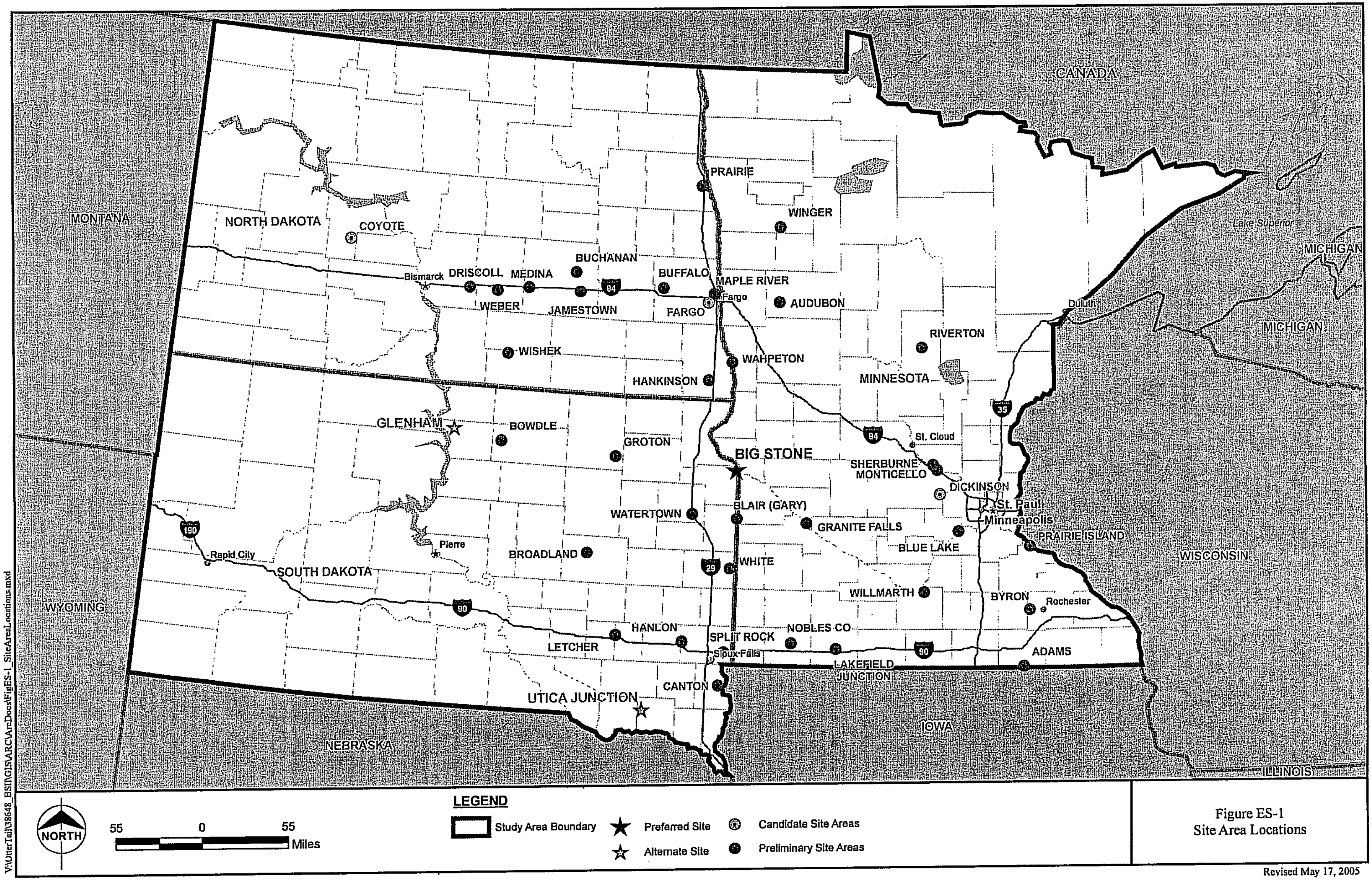


Figure ES-1
Site Area Locations

Revised May 17, 2005

Source: ESRI Data

- Big Stone – Grant County, South Dakota
- Coyote – Mercer County, North Dakota
- Dickinson – Wright County, Minnesota
- Fargo – Cass County, North Dakota
- Glenham – Walworth County, South Dakota
- Maple River – Cass County, North Dakota
- Split Rock – Minnehaha County, South Dakota
- Utica Junction – Yankton County, South Dakota

A field reconnaissance of these eight site areas was conducted in early March 2005. This reconnaissance consisted of an automobile survey along public roads in the vicinity of each site area. During the field reconnaissance, information was collected on the amount of available land, local land use, number of nearby residences and other structures, suitability of terrain, and the condition of local transportation systems.

Following completion of this reconnaissance, two of the eight sites were recommended for elimination. These were the Maple River and Split Rock site areas. Maple River was eliminated because it has relatively more nearby residences and other development than the nearby Fargo site. The Split Rock site was eliminated because it lacks sufficient developable land area and because of encroaching residential development. The remaining six site areas were designated candidate site areas (Figure ES-1) and retained for continued evaluation.

ES.3 CANDIDATE SITE EVALUATION

After their selection, the six candidate site areas were evaluated using a numerical decision analysis process to help further screen and rank these sites. The first step in using such a process is to identify the objectives or criteria to use in evaluating these sites. These criteria vary in their importance to the decision-making process so each criterion was also assigned a weight. Criteria with the highest weights are considered to be the most significant factors. These weights were assigned by first organizing the evaluation criteria into major categories. These major categories were then assigned weights totaling 100 percent. Within each major category, the individual evaluation criteria were assigned subweights to define their relative importance within that category. The major category weights and subweights were combined to yield a composite weight for each criterion (Table ES-1).

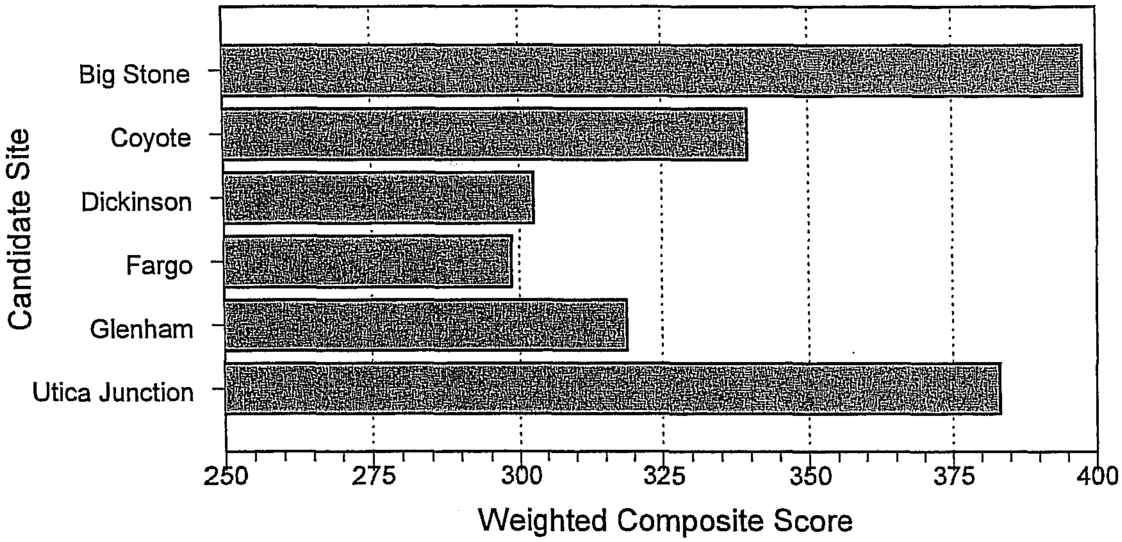
Table ES-1: Candidate Site Evaluation Criteria

Major Category	Category Weight	Criterion	Subweight	Composite Weight
Air Impacts	15%	Class I Areas	10	10.71%
		Airspace Restrictions	4	4.29%
		Category Totals:	14	15.00%
Water Supply	20%	Surface Water Proximity	5	6.67%
		Water Supply Potential	10	13.33%
		Category Totals:	15	20.00%
Environmental	15%	Socioeconomics	5	2.68%
		Land Use Compatibility	4	2.14%
		Protected Species Impacts	2	1.07%
		Noise Impacts	10	5.36%
		Wetlands	7	3.75%
		Category Totals:	28	15.00%
Fuel Supply	20%	Rail Line/Mine Proximity	10	11.11%
		Fuel Delivery Competition	6	6.67%
		Reagent Delivery	2	2.22%
		Category Totals:	18	20.00%
Transmission	20%	Proximity to Interconnection Point	2	2.67%
		Expected System Impacts	13	17.33%
		Category Totals:	15	20.00%
Other	10%	Highway Access	2	1.05%
		Land Availability	10	5.26%
		Common Facilities/Staff	7	3.68%
		Category Totals:	19	10.00%

Each of the six candidate sites was assigned a relative score between one and five for each of the 17 evaluation criteria. These scores were combined with the composite weights listed in Table ES-1 to yield a weighted composite score for each candidate site area. These scores are shown graphically in Figure ES-2. The highest ranked site in this evaluation was Big Stone with a score of 397.7 and the lowest ranked site was Fargo with a composite score of 298.7.

The sensitivity of the evaluation scores to varying weights was also tested. The base weights assigned to each major category are considered to be an appropriate balance between these factors but each major category was emphasized in turn to determine what impact these changes may have on the overall

Figure ES-2: Candidate Site Evaluation Scores for Base Case



ranking. The weight for the category that was emphasized was doubled and the other weights adjusted downward so the category weights still totaled 100 percent. The composite weights for each category and weighted composite scores for each site were then recalculated. The resulting site rankings generally showed that a site's rank was not very sensitive to the assigned category weights. Most importantly, the Big Stone site area maintained its top ranking for each of the cases in the sensitivity analysis.

ES.4 SELECTION OF PREFERRED AND ALTERNATE SITE AREAS

After completion of the site evaluations, these results along with consideration of other intangible and strategic factors were used to identify a preferred site and alternate sites for the proposed generating unit. The relative strengths and weaknesses of each candidate site are summarized below.

- Big Stone Site Area: The principal advantage of the Big Stone site is that it is located at an existing power plant. During the original design of this plant, it was laid out to accommodate a second generating unit and some of the existing facilities, such as coal handling, are already sized for this additional unit. For the base case, the Big Stone site received the highest evaluation score by a significant margin and maintained this number one ranking for three of the six sensitivity cases. For the other three sensitivity cases, this site was ranked second.

- Coyote Site Area: Like Big Stone, the Coyote site area is located at an existing power plant that was initially designed to accommodate a second generating unit; however, this site has a couple of distinct disadvantages that are not present at Big Stone. These disadvantages relate to air quality and transmission.

  The Coyote Plant is located only about 73 miles from Theodore Roosevelt National Park and 94 miles from Lostwood National Wildlife Refuge, which are both Class I areas. In the vicinity of the Coyote Plant, there are also six other lignite-fired power plants. The close proximity of these existing emissions sources and Class I areas will make permitting a new generating unit at the Coyote site very challenging.

  The existing transmission system at the Coyote site does not have capacity to accommodate additional power exports out of the North Dakota lignite mining area. Upgrading this system to allow location of another 600 MW of generation in this same area would be very expensive.

  The Coyote site received a base evaluation score of 339.6, giving it a third-place ranking. For the sensitivity analyses, this site's ranking ranged from second to sixth and averaged 3.86. Although these rankings place the Coyote site near the middle of the six candidate sites, the air quality and transmission issues discussed above are serious flaws that justify eliminating this site from further consideration at this time.

- Dickinson Site Area: The Dickinson site area was the fifth-ranked site under the base case and its ranking ranges from fourth to sixth under the various sensitivity cases, with an average ranking of 5.00. Although this site is located at a major substation and close to load centers in eastern Minnesota, the transmission system that serves this substation is currently operating near capacity. Therefore substantial new transmission investments would still be required to develop the proposed generating unit at this site. Because this site is located less than 25 miles outside of the Twin Cities metropolitan area and surrounded by rural residential development, the population densities near this site are easily the highest of any of the six candidate sites. This factor makes the potential for significant public opposition to power plant development here rather high. Because of concerns about intense public opposition, it is recommended that this site not be considered further.

- Fargo Site Area: This site area is located in a rural agricultural area outside of Fargo. The evaluation scores for this site area are consistently among the lowest of all the six candidate sites for the base case and the sensitivity cases. The chief disadvantage of this site is its water supply potential. Because of its low evaluation scores and questionable water supply potential, this site was eliminated from further consideration.

- Glenham Site Area: The Glenham site area is located in north-central South Dakota near the Missouri River and has an excellent water supply potential. The sparse population of the area also reduces the potential for impacts to neighbors at this site. The chief concern at this site is transmission capacity because this site is relatively close electrically to the lignite fields of North Dakota and the existing transmission constraints from this region. For the base case, the Glenham site area was ranked fourth. These rankings ranged from third to fifth for the various sensitivity cases and averaged 4.00.

- Utica Junction Site Area: Like the previous site, the Utica Junction site area is located near the Missouri River and has an excellent water supply potential. In fact, these two South Dakota sites share many similarities. Transmission capacity is also a potential concern at this site but it is farther from the congested area in North Dakota than Glenham and other planned transmission additions in Nebraska and Iowa should help alleviate transmission constraints to the south. The Utica Junction site area is ranked second under the base case and from first to third for the various sensitivity cases. The average ranking of this site was 1.73.

- Final Site Ranking: Based on evaluation scores and the other factors discussed above, it is recommended that three of the six candidate site areas be dropped from further consideration at this time. These less-attractive site areas are Coyote, Dickinson and Fargo. Of the remaining three sites, the Big Stone site consistently ranked at or near the highest and is therefore identified as the preferred location for the proposed generating unit. The other two site areas, Glenham and Utica Junction, share many similarities but the Utica Junction site ranks higher than Glenham for the base case and all of the six sensitivity cases. Therefore, Utica Junction is identified as the first alternate location and Glenham as the second alternate site. The preferred and alternate site areas are also indicated on Figure ES-1.

ES.5 CONCLUSIONS

The conclusions reached as a result of the investigations and evaluations conducted during this study are listed below.

ES.5.1 General

- Subject to the limitations that may be imposed by regulatory and permitting agencies, there are sites available within the project study area that can accommodate the development of the proposed baseload generating unit.

ES.5.2 Environmental

- There are no designated nonattainment areas within the project study area so all of the six candidate site areas are located in counties that are in attainment for all criteria pollutants.
- In the western portions of North and South Dakota and in northern Minnesota there are several national parks, national wildlife refuges, and wilderness areas that are designated Class I. Construction of the proposed generating unit in or near these regions would be problematic from an air emission permitting perspective. Further development at the Coyote site area would be most directly affected by Class I area issues.
- Although there are reported occurrences of threatened, endangered or otherwise protected species in the vicinity of all of the candidate site areas, actual impacts to any protected species from plant development are unlikely given the type of habitat available at these sites.
- There is a potential that plant development could result in wetland impacts at each of the candidate sites. These potentials are smallest at the Fargo site area and highest for the Dickinson site. However, any wetland impacts that cannot be avoided can usually be successfully mitigated so wetland issues should not be a significant impediment to plant development.
- Cultural resources have not been specifically evaluated in this study because on-site surveys are generally required to assess impact potentials; however, there is nearly always some potential that cultural resource sites could be encountered. The potentials for adverse impacts to cultural resources are lowest at the Big Stone and Coyote sites which have already been disturbed by power plant development. Each of the other four candidate sites has been disturbed by agricultural practices so the potentials for significant cultural resources impacts at these sites are considered to be only moderate.

ES.5.3 Electric Transmission

- Each of the six candidate sites is located in relative close proximity to existing high-voltage transmission facilities. However, some of these existing facilities will require substantial upgrades in order to transmit an additional 600 MW of power from the proposed generating unit.
- The ability of the existing transmission system to accommodate the proposed generating unit is generally better in the eastern portion of the study region and worse in the west.

ES.5.4 Water Supply

- Groundwater development potentials vary considerably across the project study area; however, regardless of the development potential, groundwater usage exceeds natural recharge so water levels are declining in most areas. For this reason, development of a groundwater supply to serve the proposed generating unit is not considered to be very feasible. A groundwater source may however be developed to supply low-volume plant needs or to supplement surface sources during occasional dry periods.
- A surface water source is considered to be the most viable water supply for the proposed generating unit. Only the largest rivers located within the study region, the Missouri and Mississippi rivers, are likely to have sufficient flows to supply this generating unit without development of a large reservoir to provide carryover storage. Therefore, the best sites from a water supply perspective are Coyote, Dickinson, Glenham, and Utica Junction.

ES.5.5 Fuel Supply

- The Coyote site area is the only candidate site located within the North Dakota lignite mining area where it is practical to deliver coal by truck. At the five other candidate sites, rail is the only practical delivery mode for coal. Each of these sites is located in relatively close proximity to an active rail line.
- Only one of the candidate sites, Dickinson, is located relatively close to a rail line operated by a second, competing rail carrier. The presence of competing carriers can help reduce coal delivery costs.

ES.5.6 Preferred and Alternate Site Areas

- The Coyote site area is not considered to be a good candidate for location of the proposed generating unit because of transmission capacity limitations and potential air permitting concerns.
- The high population density in the vicinity of the Dickinson site, and corresponding potential for significant public opposition, is the primary reason this site is not recommended for continued consideration.
- The Fargo site area was ranked consistently as one of the least attractive of the six candidate sites, largely because of it limited water supply potential. In comparison to the other candidate sites, the Fargo site is not considered to be a good development option.
- Through the investigations conducted in this study, the Big Stone site area was determined to be the best choice for location of the proposed generating unit; therefore the Big Stone site should be

designated the preferred site for this new generating unit. In order of preference, the Utica Junction and Glenham site areas are designated alternate sites.

* * * * *

1.0 INTRODUCTION

1.0 INTRODUCTION

Burns & McDonnell Engineering Company, Inc. (Burns & McDonnell) was retained by Otter Tail Power Company (OTP) to perform a site evaluation study to investigate potential locations for a new baseload generating facility. This introduction presents a discussion of the project background, study objectives, and an overview of the methodology used in the study.

1.1 PROJECT BACKGROUND

OTP and other local utilities (collectively referred to as the Participants) have completed resource planning studies that indicate they will each need additional baseload electric generating resources to supply their customers in the near future. The Participants recognize that, because of economies of scale, it will be more cost effective for them to pursue development of a large, jointly-owned generating facility then to construct several smaller units. For this reason, they have contracted with Burns & McDonnell to perform a review of available generating technologies, evaluate prospective plant locations, and complete other planning studies. The potential partners in this new generating unit are listed below:

- Otter Tail Power Company (lead project developer)
- Central Minnesota Municipal Power Agency
- Great River Energy
- Heartland Consumers Power District
- Hutchinson Utilities Commission
- Missouri River Energy Services
- MDU Resources Group
- Southern Minnesota Municipal Power Agency

The Participants will determine their individual participation in the proposed jointly-owned generating unit after all of the necessary studies are complete.

From previous analyses, OTP's existing Big Stone Plant has been identified as the most likely site for the proposed new generating unit. There is currently a single 450-megawatt (MW) coal-fired generating unit at this plant. The proposed second unit at this plant, tentatively named Big Stone II, would have the following general characteristics:

- Come online in 2011 to serve the participating utilities' customers
- Have a generating capacity of approximately 600 MW
- Burn coal as its primary energy source
- Employ the best available emission control technologies, as prescribed by the U.S. Environmental Protection Agency (EPA)

1.2 SITE EVALUATION STUDY OBJECTIVES

The decision by OTP and the other potential project participants to identify the Big Stone Plant as the prime site for the new generating unit is based upon review of past siting studies and recent strategic analyses. Because some of the past siting studies used in this review are many years old, OTP has commissioned this site evaluation study to take a fresh look at the factors that influence power plant siting decisions. The primary purpose of this site evaluation study is to independently evaluate prospective power plant sites and identify the best site or sites for the proposed baseload generating unit. The preferred sites identified in this study will be those that can accommodate the proposed 600-MW coal-fired generating unit and best meet the following general criteria:

- Satisfy the requirements and guidelines of the applicable regulatory bodies
- Allow for economical construction and operation of the proposed generating unit
- Minimize adverse environmental and social impacts to the extent practicable
- Possess the necessary physical attributes such as size, topography, and access to adequate fuel and water supplies, and transmission facilities.

1.3 PROJECT TEAM AND STUDY AREA

This study was completed by a multi-disciplinary team of professionals from OTP and Burns & McDonnell. This team included individuals with expertise in the planning, permitting, design and operation of electric generating facilities.

The study area for this site evaluation study is defined as the entire states of Minnesota (MN), North Dakota (ND) and South Dakota (SD). These three states were selected as the project study area because they include all of the OTP service area plus the majority of the collective service territories of the other Participants. The project study area is shown on Figure 1-1 along with the service areas for the potential project participants.

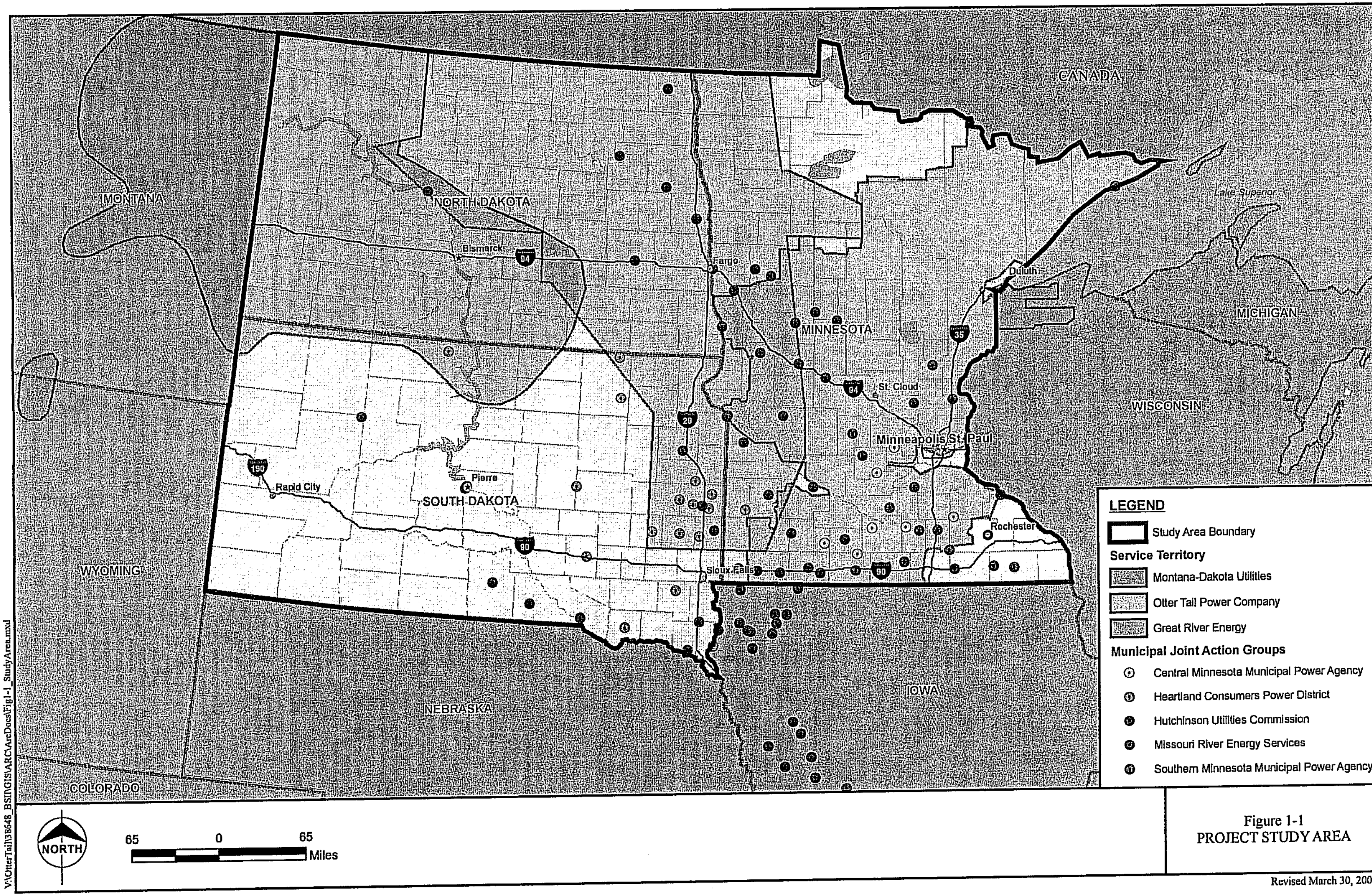


Figure 1-1
PROJECT STUDY AREA

Revised March 30, 2005

Source: ESRI Data

1.4 STUDY METHODOLOGY

The work performed by Burns & McDonnell in this study included completion of the major tasks listed below:

- Identify general areas within the study region that may be less attractive for power plant siting because of environmental reasons
- Map locations within the project study area of the necessary electrical transmission infrastructure, fuel delivery infrastructure, and potential water supplies
- Identify preliminary site areas from review of environmental constraint and infrastructure maps
- Screen preliminary site areas using readily available topographic mapping and aerial photography, and designate the remainder candidate site areas
- Perform a field reconnaissance of the candidate site areas
- Collect relevant information on the candidate site areas to prepare a narrative description of each one
- Develop evaluation criteria for the candidate site areas
- Evaluate and rank the candidate site areas to identify the most favorable locations for the proposed generating unit
- Formulate conclusions reached during the study

1.5 ORGANIZATION OF REPORT

This report on the Power Plant Site Evaluation Study is organized into several separate chapters and supporting appendices. These individual sections are listed below along with a brief description of their contents:

- Executive Summary: An executive summary of the Site Evaluation Study
- Chapter 1.0 – Introduction: A description of the study's background, objectives, study area, and methodology
- Chapter 2.0 – Selection of Candidate Site Areas: A description of the methods used to identify candidate site areas
- Chapter 3.0 – Candidate Site Descriptions: Narrative descriptions and maps of each of the candidate site areas
- Chapter 4.0 – Candidate Site Evaluation: A discussion of criteria used in the evaluation of candidate site areas and the results of this evaluation

- Chapter 5.0 – Selection of Preferred and Alternate Site Areas: Contains a discussion of the rationale used to identify the preferred and alternate site areas
- Chapter 6.0 – Conclusions: The conclusions reached during the study
- Chapter 7.0 – References: Complete citations for the references cited in this report

* * * * *

2.0 SELECTION OF CANDIDATE SITE AREAS

2.0 SELECTION OF CANDIDATE SITE AREAS

The first step in the site selection process was the identification of candidate site areas. Candidate site areas are general locations, which may be much larger than the amount of land actually required for plant development, that possess the necessary infrastructure and other characteristics that may make them suitable power plant sites. As discussed in this report chapter, the investigations completed to identify candidate site areas included the following major tasks:

1. Map locations within the project study area of infrastructure that is critical to power plant development and where plant location may be restricted for environmental, regulatory or social reasons
2. Identify preliminary site areas with consideration of the necessary infrastructure, environmental constraints and other development factors
3. Screen preliminary site areas using readily available maps and other resources

The methodology and results of these investigations are described in the following sections.

2.1 REGIONAL ENVIRONMENTAL AND REGULATORY CONSTRAINTS

Environmental and regulatory constraint areas are areas where power plant siting is impracticable or less desirable for institutional or social reasons, or because the potential environmental impacts are considered excessive. A number of different types of constraints must be considered in siting a baseload generating unit. These constraint areas can range from extremely small, localized areas of less than an acre to regions of a hundred square miles or more. For the initial screening efforts, only the largest environmental constraint areas were mapped. The other environmental constraint types were considered after specific site areas were selected for evaluation. These constraint areas are discussed in the following paragraphs.

2.1.1 Nonattainment Areas

Nonattainment areas are regions were ambient ground-level concentrations of one or more criteria pollutants are higher than the National Ambient Air Quality Standards (NAAQS). The criteria pollutants are ozone (O_3), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter (PM), and lead (Pb). Permitting a new emissions source within or near a nonattainment area is possible but may require additional control equipment or emissions offsets.

Review of the EPA's website shows there are no nonattainment areas located within the project study area (EPA, no date). However, portions of Sheridan County, Wyoming, and Rosebud County, Montana, are nonattainment for particulate matter less than 10 microns in diameter (PM_{10}). Sheridan County is located in northeastern Wyoming and Rosebud County is located in southeastern Montana. Both of these counties are approximately 100 miles west of the South Dakota state line. At these distances, it is unlikely that a generating unit located within the study area would contribute to adverse air quality impacts within these nonattainment areas.

2.1.2 Class I Areas

The Clean Air Act Amendments of 1977 resulted in establishment of the Prevention of Significant Deterioration (PSD) regulations. Under these regulations, maximum pollutant concentration increases (increments) were established for each criteria pollutant. These allowable increments are smallest for Class I areas. Congress designated several national parks and monuments initially as Class I areas. Since then, several more wilderness and similar areas have been designated Class I by act of Congress. There are several Class I areas within or near the project study area. These include areas that are managed by the National Park Service (NPS), U.S. Fish & Wildlife Service (USFWS), and U.S. Forest Service (USFS) plus some Native American lands. The Class I areas that are within or close enough to the study area to be significant are shown on Figure 2-1 and listed below:

- NPS Class I Areas
  - Badlands National Park (South Dakota)
  - Isle Royal National Park (Michigan)
  - Theodore Roosevelt National Park (North Dakota)
  - Voyageurs National Park (Minnesota)
  - Wind Cave National Park (South Dakota)
- USFWS Class I Areas
  - Lostwood National Wildlife Refuge (North Dakota)
  - Medicine Lake National Wildlife Refuge (Montana)
- USFS Class I Areas
  - Boundary Waters Canoe Area (Minnesota)
  - Rainbow Lake Wilderness Area (Wisconsin)

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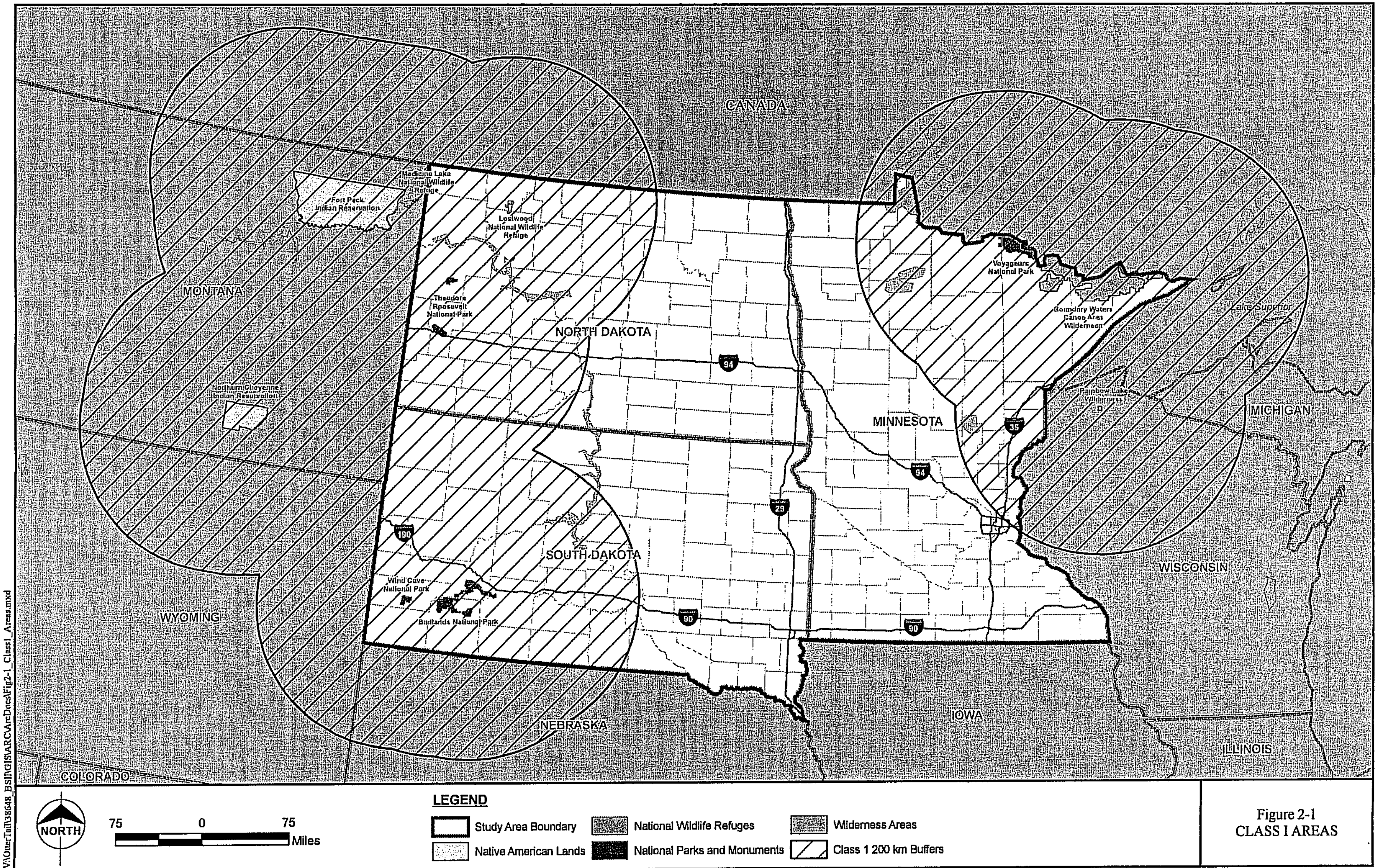

Figure 2-1
CLASS I AREAS

Source: NationalAtlas, ESRI Data.

Revised March 11, 2005

- Native American Class I Areas
  - Fort Peck Indian Reservation (Montana)
  - Northern Cheyenne Indian Reservation (Montana)

The presence of a Class I area near a proposed emission source can complicate permitting. Not only are the allowable increases in pollutant concentrations small but there are also visibility concerns. Recent regulatory changes have established the goal to return the visual range from Class I areas to pre-industrial conditions. There are many factors that determine whether a new emission source will significantly impact the visual range at a Class I area but some of the major factors are listed below:

- Type and Quantity of Emissions: Visibility impacts result primarily from fine particulate matter in the air that acts to scatter light. This fine particulate matter (PM) can result from emission of particulate matter itself plus sulfur oxides (SO_x) and nitrogen oxides (NO_x). SO_x and NO_x can react chemically in the atmosphere to form fine particulates. A coal-fired generating unit will emit all three of these pollutants: PM, SO_x, and NO_x.
- Distance: The farther an emission source is from a Class I area, the lesser the visual impact. However, because the particulates that contribute most of these impacts are so small, they can be carried on the wind long distances.

As a general rule, visibility impacts for emissions sources over 200 kilometers (km), approximately 124 miles, from a Class I area are not significant. Therefore, to facilitate permitting of the proposed baseload generating station, areas within 200 km of a Class I area were not considered for location of greenfield sites. Existing power plant sites (brownfield sites) located within 200 km of a Class I area were not excluded in this early study stage. The 200-km buffer areas around each Class I area are shown on Figure 2-1.

2.1.3 Designated Use Areas

Several of the potential constraint areas are often referred to as designated use areas. These are areas, which are typically publicly owned, that have been set aside for a particular purpose (that is, a designated use) that is usually not compatible with power plant construction. The following is a list of some of the types of environmental or regulatory constraints that occur within the project study area:

- National parks, monuments, and recreation areas
- National forests, grasslands and wildlife refuges

- Military reservations
- State and local parks, forests and recreation areas
- Wildlife management areas

Native American lands also fall into the category of designated use areas. While power plant construction may not be prohibited within an Indian reservation, these reservations were established by treaties between the respective tribe and the U.S. Government so they have a unique political status that would complicate the permitting process. Therefore, Native American reservations were also excluded in the search of prospective power plant sites. The larger designated use areas that occur within the study area are shown on Figure 2-2.

2.2 REGIONAL INFRASTRUCTURE

In order to minimize the potential environmental impacts, social impacts and costs of plant development, prospective site areas should be located as near as practicable to the necessary infrastructure or physical resources. The most significant of these infrastructure types or physical resources are discussed below.

2.2.1 Fuel Supply

In general, there are two types of coal that can be utilized by a new generating unit located within the project study area: lignite and subbituminous coal. Lignite is geologically the youngest of the four coal ranks and has the lowest heat content, which ranges from about 4,000 to 8,300 British thermal units (Btu) per pound (Btu/lb). The next higher coal rank is subbituminous coal, which has a heat content that ranges from about 8,300 to 13,500 Btu/lb.

There are lignite reserves located throughout much of western North and South Dakota, and extreme eastern Montana but the largest active lignite mines are clustered in three North Dakota counties: McLean, Mercer and Oliver (Figure 2-3). The active mines in these three counties are listed below along with the power plants or similar facilities that they supply:

- Beulah Mine (Dakota Westmoreland Corporation) – Coyote Station (Otter Tail Power Company, Montana-Dakota Utilities Co., et al.) and Heskett Station (Montana-Dakota Utilities Co.)
- Center Mine (BNI Coal, Ltd.) – Milton R. Young Station (Minnkota Power Cooperative)
- Falkirk Mine (Falkirk Mining Company) – Coal Creek Station (Great River Energy)

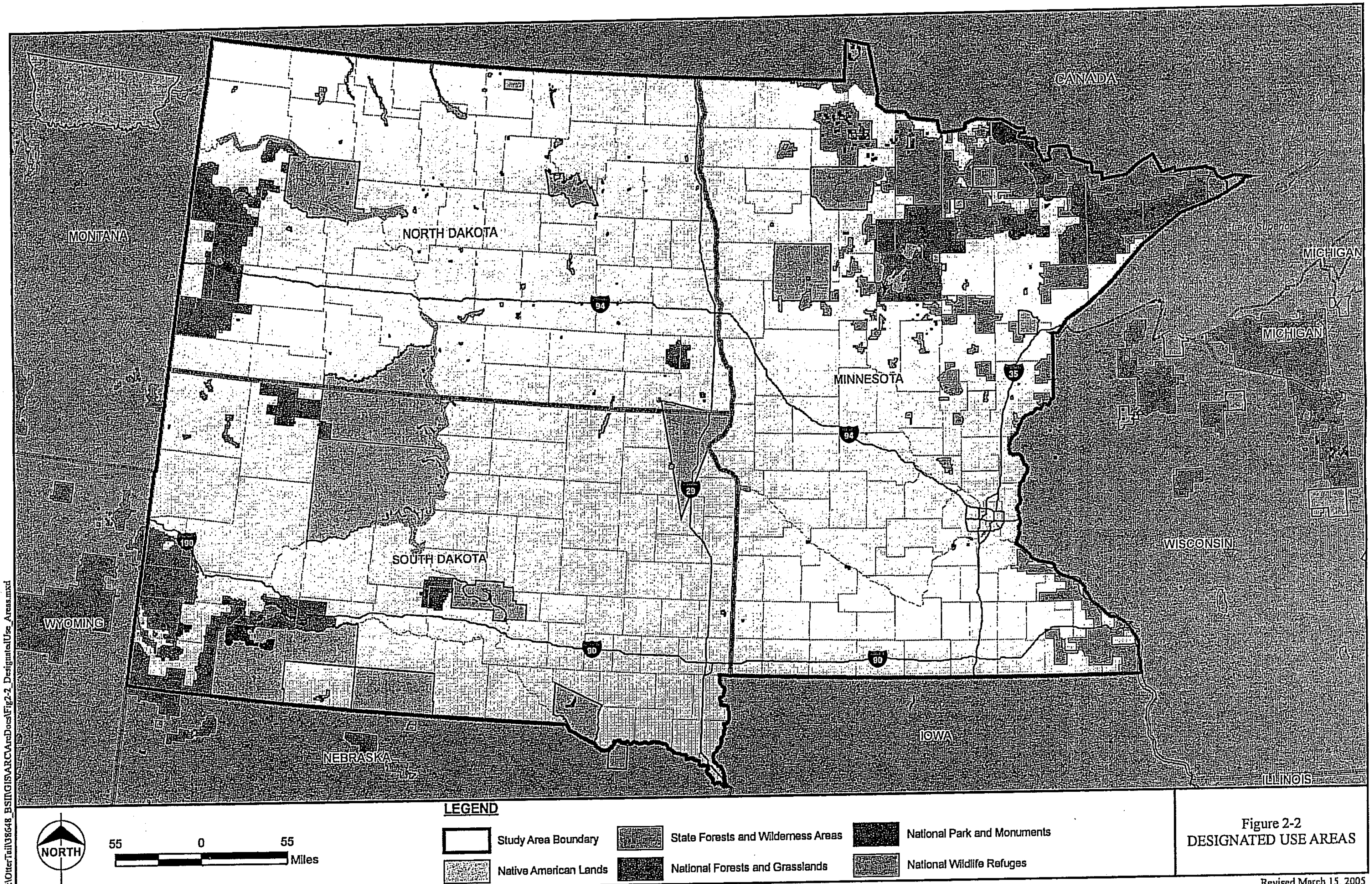

Figure 2-2
DESIGNATED USE AREAS

Revised March 15, 2005

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Source: NationalAtlas, ESRI Data.

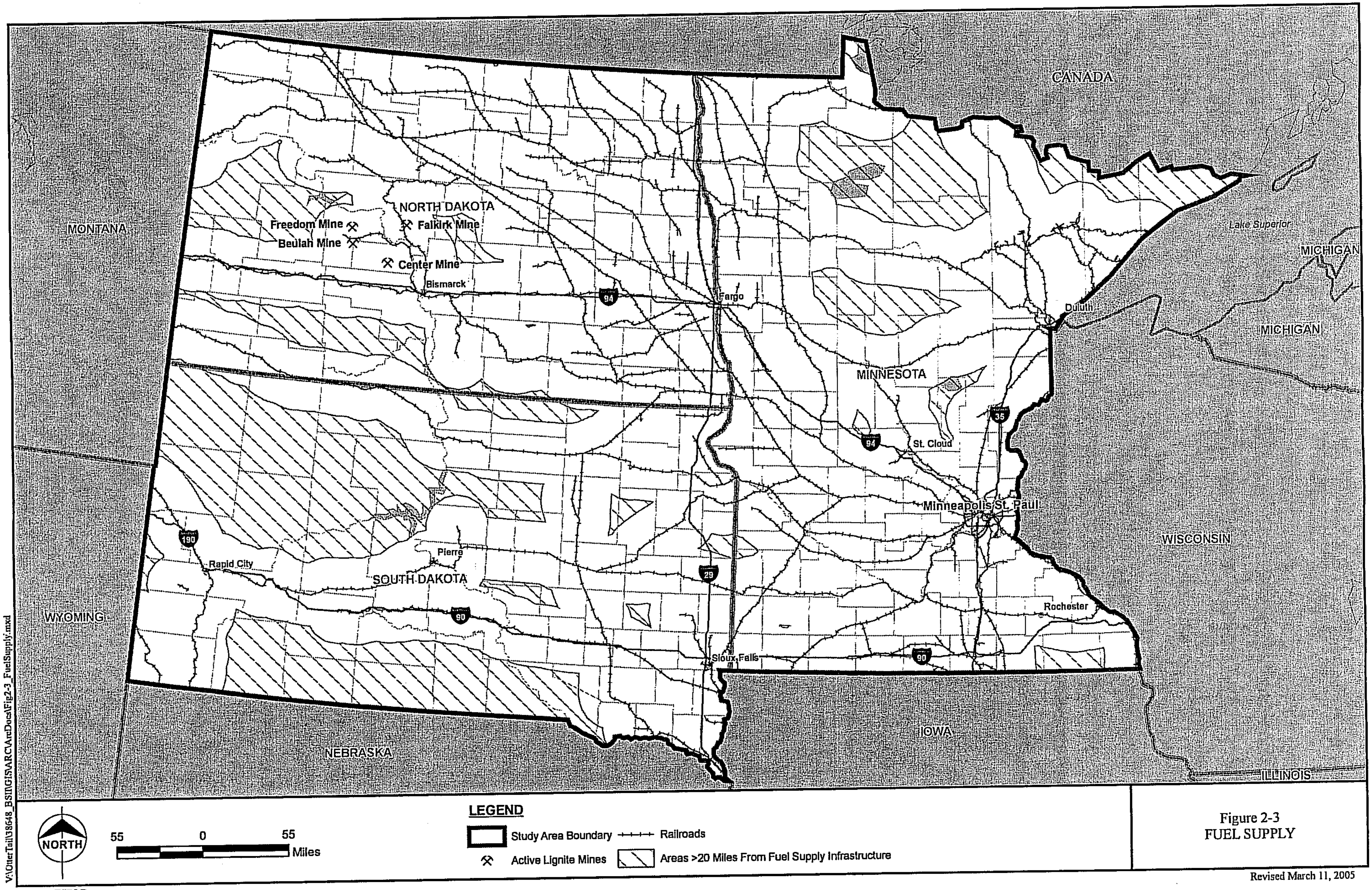

Figure 2-3
FUEL SUPPLY

Revised March 11, 2005

Source: ESRI Data

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- Freedom Mine (Coteau Properties) – Antelope Valley Station (Basin Electric Power Cooperative), Great Plains Synfuels Plant (Dakota Gasification Company), and Leland Olds Station (Basin Electric Power Cooperative)

Because the heat content of lignite is less than that of subbituminous coals, a power plant must burn much larger quantities of lignite — on the order of a third more — to yield an equivalent amount of heat energy. This characteristic makes it less economical to transport lignite for long distances as compared to subbituminous coal. Therefore, most lignite-fired power plants are located very near the mine that supplies them. Lignite is sometimes delivered to nearby power plants by rail but, over short distances, trucks or conveyors are more often the most economical transportation mode.

Most subbituminous coal is mined in the Powder River Basin (PRB) of Wyoming and Montana. The only practical means of delivering large quantities of PRB coal to a power plant located within the study area is by rail. Truck or conveyor delivery, which was discussed above for mine-mouth lignite plants, is generally only practicable over short distances. The Mississippi and Missouri rivers are navigable at the extreme eastern and southern ends of the study area, respectively, but barges would not be a practical delivery mode for PRB coal. The locations of existing rail lines that could deliver PRB coal to a generating station within the project area are shown in Figure 2-3.

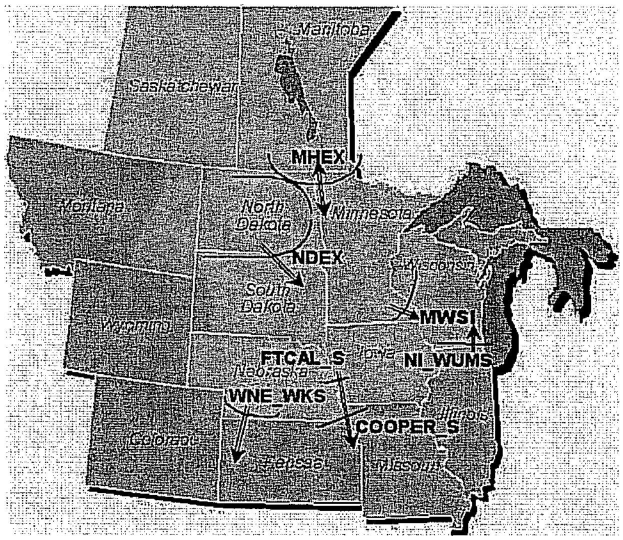
To help limit the potential costs and impacts of trucking lignite or from rail spur construction, the search for prospective plant sites was limited to areas within 20 miles of an active rail line or lignite mine. Constraint areas more than 20 miles from both an active rail line and lignite mine are also shown on Figure 2-3. The constraint areas on this map and the infrastructure maps that follow were only used as guidelines. In special cases, some of the identified site areas may fall within these constraint areas.

Although the proposed baseload generating unit will burn coal as its primary fuel, a natural gas supply may also be advantageous for startup and flame stabilization. Fuel oil can also be used for startup but with the disadvantages of being generally more expensive and having higher emission rates. Therefore, the locations of larger natural gas pipelines (8 inches or more in diameter) were also noted during site identification but not used for site screening.

2.2.2 Electrical Transmission

The project study area is located within the Mid-Continent Area Power Pool (MAPP) region. The northern portion of this region has traditionally been characterized by having large amounts of coal-fired generation in western North Dakota and hydroelectric generation in northern Manitoba. Since this generation is geographically far from the major metropolitan areas of the Red River Valley and the Twin Cities, there are long, high-voltage transmission lines stretching across the northern MAPP area. These long transmission lines make for a very unique system in this Region. As a result of these long transmission lines, the northern MAPP area has been known to have transient stability issues that currently limit maximum power transfers out of North Dakota, Manitoba, and Minnesota. Power transfers out of a specific area are determined by adding up the real power flows on each transmission line that crosses a known interface. The maximum power transfers across the Manitoba Export interface (MHEX), North Dakota Export interface (NDEX), and the Minnesota – Wisconsin Stability Interface (MWSI) are currently defined by the transient stability performance of the transmission system. These interfaces, along with other known constrained interfaces within the MAPP region are shown in Figure 2-4.

Figure 2-4
Constrained Interfaces within the MAPP Region



The generating units at the proposed power plant must be connected into the regional transmission network in order to deliver electrical power from these facilities to the Participants' customers. Figure 2-5 shows the locations of existing transmission lines within the project study area that operate at a voltage of 230 kilovolts (kV) or above. Lower voltage transmission lines were excluded during the site identification process because a 600-MW power plant would have to be connected to several of these lower-voltage lines to transmit the power it produces. Connection to one or more of these existing higher-voltage transmission lines does not guarantee that additional system improvements would not be needed.

In an attempt to limit the costs and impacts resulting from potential transmission line construction, the search for prospective plant sites was concentrated in areas within 20 miles of existing 230-kV or higher voltage transmission lines. The shaded areas on Figure 2-5 show constraint areas that are more than 20 miles from a high-voltage transmission line.

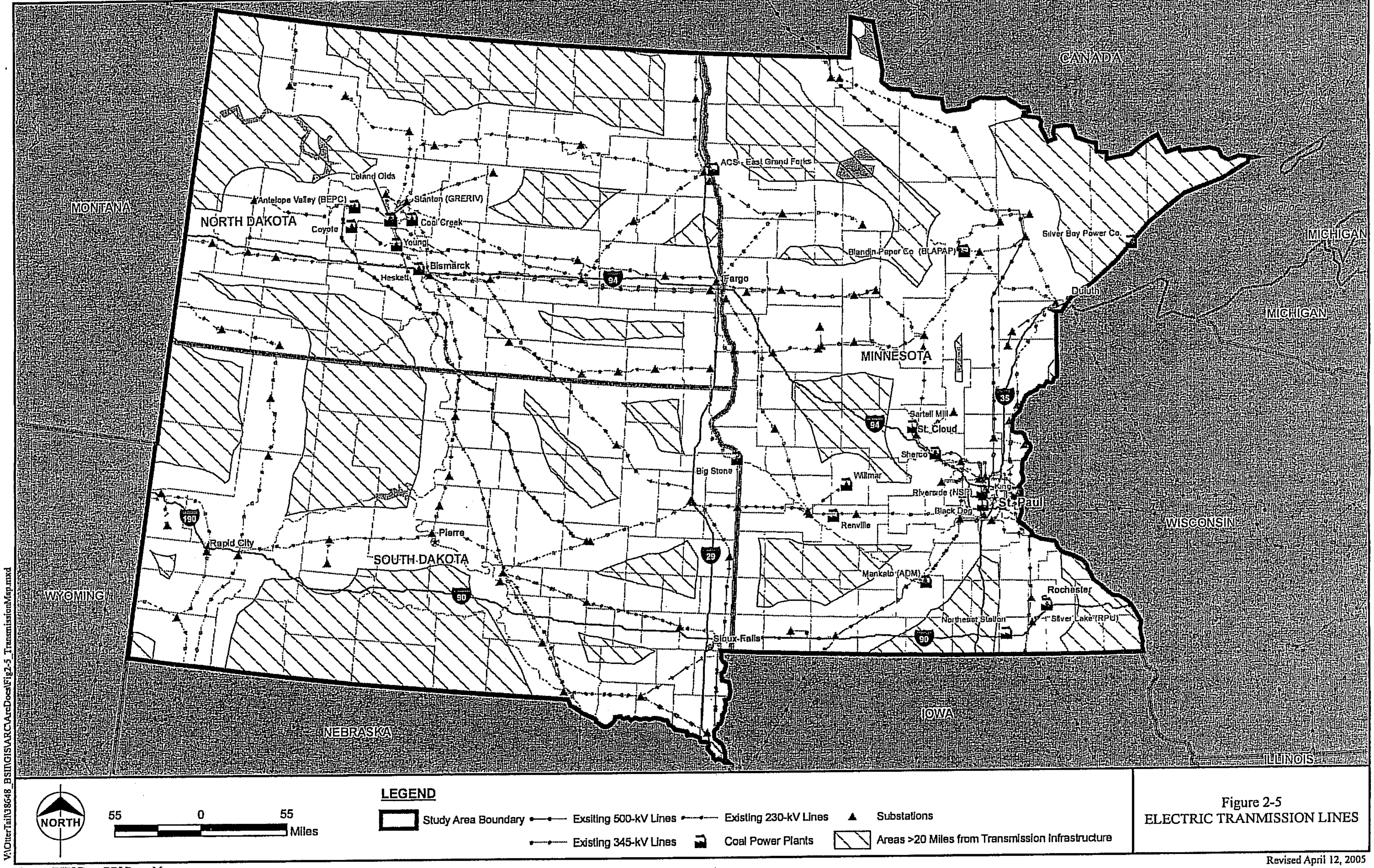


Figure 2-5
ELECTRIC TRANMISSION LINES

Revised April 12, 2005

Source: ESRI Data; RDI PowerMap

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2.2.3 Water Supply

The proposed coal-fired generating unit will require water for steam condensation and other plant uses. Therefore, an adequate, reliable water supply is essential for plant operation. Because the relative abundance of water resources varies greatly across the study area, locating a reliable water supply becomes an important criterion for plant siting.

The average annual water requirements for the proposed 600-MW generating unit are estimated to be 12,000 acre-feet. This annual water volume equates to an average makeup rate of approximately 16.6 cubic feet per second (cfs) or about 7,500 gallons per minute (gpm).

2.2.3.1 Surface Water

The climate of the study area varies from semi-humid in eastern Minnesota to semi-arid for western Minnesota and the Dakotas. The average annual precipitation for the region ranges from over 30 inches in southeastern Minnesota to less than 20 inches for much of the Dakotas. Average annual runoff varies from over 12 inches in northeastern Minnesota to less than an inch for much of the Dakotas. Runoff is that portion of the precipitation that falls on an area, expressed as an areal average, that ends up as flow in area streams.

The supply potential of area streams depends on a number of factors. The major factors are discussed below:

- Runoff: Runoff to area streams will vary temporally and spatially depending on precipitation amounts, whether that precipitation falls as rain or snow, land use, and antecedent conditions.
- Contributing Watershed: For given average runoff amounts, the flows in area streams are largely a function of the size of a stream's contributing watershed.
- Available Storage: If there is an upstream reservoir, or potential to develop a reservoir, to provide carryover storage during droughts, the supply potential of a stream can be greatly enhanced over natural conditions.
- Water Rights: Water users must have sufficient rights to appropriate water. The existence of senior water rights, those acquired earlier in time, may limit a user's ability to withdraw water during dry periods when demands may exceed the available supply.

For the three-state study region, integrating all of these factors to determine the realistic supply potential at any point becomes a daunting task. Therefore, the fairly simplistic approach was used. The supply potential for area streams was based on the estimated 7-day average, 10-year low flow (7Q10). On average, a weekly flow less than the 7Q10 should occur no more than once every ten years. As a rule of thumb, withdrawals up to 10 percent of the 7Q10 are often considered reasonable without causing undue hardship to other downstream water users or aquatic species and wildlife. Using this criterion, only those streams with a 7Q10 of at least 166 cfs (10 times the average makeup rate of 16.6 cfs) were considered to be potential water supply sources.

The 7Q10 for area streams was estimated from historic streamflow records collected by the U.S. Geological Survey (USGS) at the gauging stations shown on Figure 2-6 (USGS, no date). These gauging stations and their respective contributing watershed areas and 7Q10 estimates are listed in Table 2-1. Review of this table shows that only five of these stream gauges have a 7Q10 of at least 166 cfs. These gauges and their respective station numbers are listed below:

- St. Louis River at Scanlon, MN (Station 04024000)
- Rainy River at Manitou Rapids, MN (Station 05133500)
- Mississippi River near Royalton, MN (Station 05267000)
- St. Croix River near Rush City, MN (Station 05339500)
- Missouri River at Bismarck, ND (Station 06342500)

With one exception, the Missouri River, all of these rivers are located in extreme northern or eastern Minnesota. Not surprisingly, these four streams with higher 7Q10 values are all located in the portion of the study area with the highest average runoff. The Missouri River has such a large 7Q10 value both because of its very large drainage area and because the flow at this location is moderated by large upstream reservoirs (Lake Sakakawea and Fort Peck Reservoir).

The water supply for the existing Big Stone plant comes from Big Stone Lake, which is located on the Little Minnesota River. Immediately below the lake, the Minnesota River is formed at the confluence of the Little Minnesota and Whetstone rivers. Big Stone Lake has a surface area of about 12,500 acres at pool elevation 964.7 feet. The lake has a drainage area of 1,160 square miles and an average annual flow of 97,770 acre-feet (Barr Engineering, 2002). Big Stone Lake helps regulate flows in this river and provides some carryover storage for dry periods. Therefore, Big Stone Lake is also considered to be a viable water source for the proposed generating unit even though the 7Q10 in the Minnesota River below the lake is estimated to be zero.

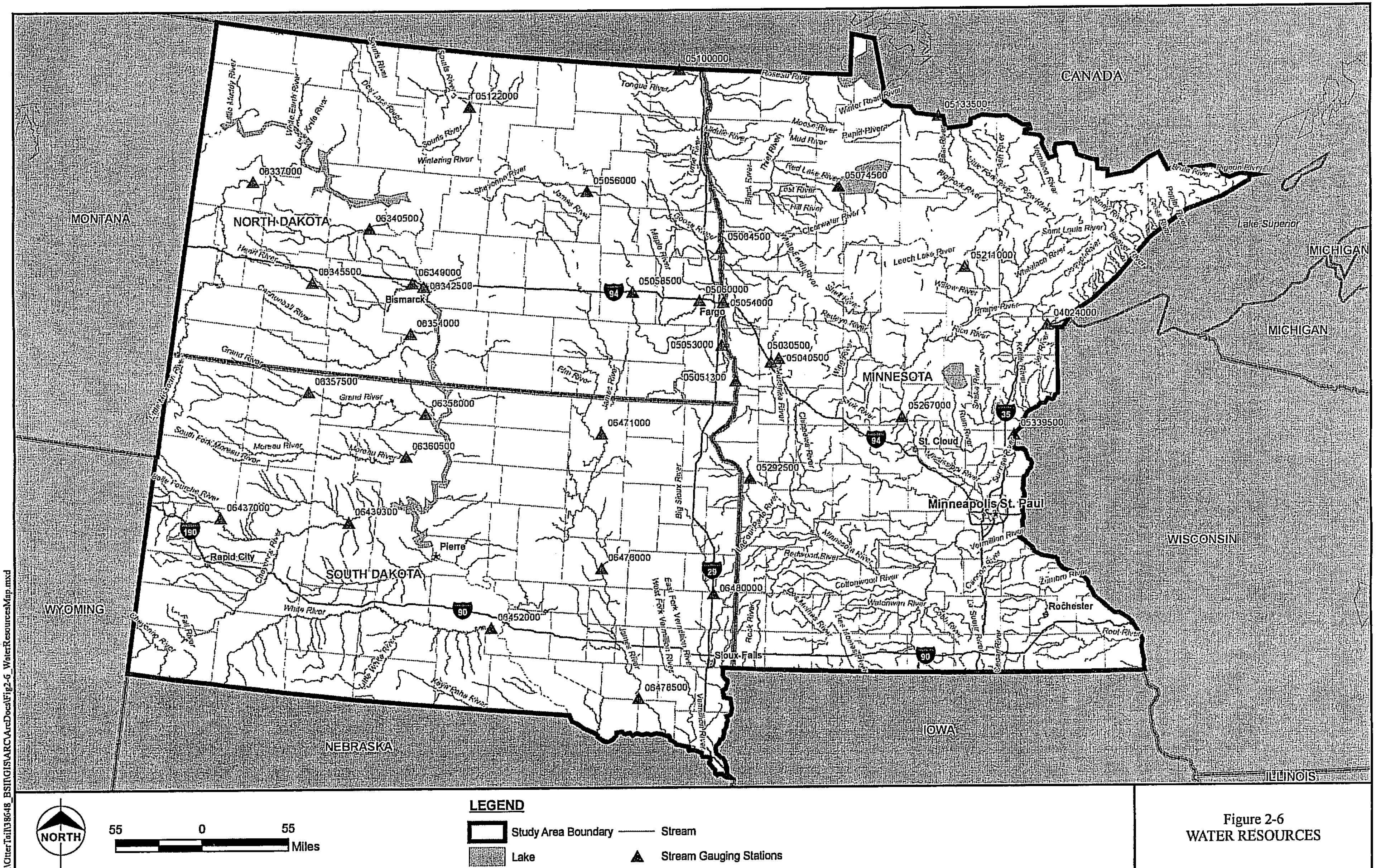

Figure 2-6
WATER RESOURCES

Revised April 12, 2005

Source: ESRI Data

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Table 2-1: 7Q10 for Project Area Streams

Station Number	Station Name	Drainage Area (sq. miles)	7Q10 (cfs)
04024000	ST. LOUIS RIVER AT SCANLON, MN	3,430	337.5
05030500	OTTER TAIL RIVER NEAR ELIZABETH, MN	1,230	85.7
05051300	BOIS DE SIOUX RIVER NEAR DORAN, MN	1,880	0.0
05054000	RED RIVER OF THE NORTH AT FARGO, ND	6,800	8.7
05056000	SHEYENNE RIVER NR WARWICK, ND	760	0.1
05058500	SHEYENNE RIVER AT VALLEY CITY, ND	2,110	0.4
05060000	MAPLE RIVER NR MAPLETON, ND	1,379	0.0
05064500	RED RIVER OF THE NORTH AT HALSTAD, MN	3,800	95.7
05074500	RED LAKE RIVER NEAR RED LAKE, MN	1,950	10.6
05100000	PEMBINA RIVER AT NECHE, ND	3,410	0.0
05122000	SOURIS RIVER NR BANTRY, ND	4,700	1.2
05133500	RAINY RIVER AT MANITOU RAPIDS, MN	19,400	3,396.8
05211000	MISSISSIPPI RIVER AT GRAND RAPIDS, MN	3,370	136.2
05267000	MISSISSIPPI RIVER NEAR ROYALTON, MN	11,600	811.8
05292500	MINNESOTA RIVER NEAR ODESSA, MN	1,340	0.0
05339500	ST. CROIX RIVER NEAR RUSH CITY, MN	5,400	906.2
06337000	L MISSOURI RIVER NR WATFORD CITY, ND	8,310	0.0
06340500	KNIFE RIVER AT HAZEN, ND	2,240	3.2
06342500	MISSOURI RIVER AT BISMARCK, ND	186,400	4,233.4
06345500	HEART RIVER NR RICHARDTON, ND	1,240	0.0
06349000	HEART RIVER NR MANDAN, ND	3,310	0.1
06354000	CANNONBALL RIVER AT BREIEN, ND	4,100	0.0
06357500	GRAND R AT SHADEHILL SD	3,120	0.1
06358000	GRAND R NEAR WAKPALA SD	5,510	0.0
06360500	MOREAU R NEAR WHITEHORSE SD	4,880	0.0
06437000	BELLE FOURCHE R NEAR STURGIS SD	5,870	4.7
06439300	CHEYENNE RIVER AT CHERRY CREEK,SD	23,900	19.8
06452000	WHITE R NEAR OACOMA SD	9,940	2.7
06471000	JAMES R AT COLUMBIA SD	2,481	0.0
06476000	JAMES R AT HURON SD	11,721	0.0
06478500	JAMES R NEAR SCOTLAND SD	16,505	1.4
06480000	BIG SIOUX RIVER NEAR BROOKINGS SD	2,419	0.2

2.2.3.2 Groundwater

Generally, there are two major aquifer systems found within the study area: the surficial aquifer system and a lower system of bedrock aquifers. The surficial aquifer system overlies most all of the three-state study area but the composition of the underlying consolidated aquifers varies by location. The principal characteristics of each aquifer system are described below.

The surficial aquifer system is the top and most extensive aquifer system in the three-state area. This system consists primarily of material deposited by continental glaciers during their multiple advances from the north and subsequent retreats. These glaciers impacted most of the study area, missing only the southwestern corner of North Dakota and western half of South Dakota — generally those areas west or south of the Missouri River. The massive ice sheets planed off and churned the loose soil and rock fragments and deposited these materials — as valley fill, as outwash (similar to a river delta), or in large meltwater lakes — when they melted and retreated. These materials consisted largely of sand and gravel but also included clay, silt, cobbles and large boulders. In many areas, these materials are highly permeable and can yield large volumes of water to wells. Although the surficial aquifer system is the most extensive across the study region, it is by no means continuous. Only about half of Minnesota, a third of South Dakota and a quarter of North Dakota contain this aquifer system. (Whitehead, 1996; Olcott, 1992).

In those areas where it is present, the surficial aquifer system is underlain by consolidated (bedrock) aquifers. For areas where the surficial aquifer is not present, these bedrock aquifers are the only available source of groundwater. The various consolidated aquifers that may be present are listed below:

- Tertiary aquifers: These aquifers are present near the surface over most of the western half of North Dakota and south-central South Dakota. These aquifers consist of semiconsolidated to consolidated sedimentary rocks, with the best water-yielding zones comprised principally of sandstones.
- Cretaceous aquifers: Cretaceous aquifers underlie much of the project area but are deeply buried under younger deposits in many areas. These aquifers are located at or near the surface only in western Minnesota, extreme eastern North and South Dakota, and in an oval shaped area surrouding the Black Hills. The Cretaceous aquifers generally consist of consolidated sandstones with some shale and siltstone, and are divided into upper and lower zones that are separated by a layer of shale that forms a confining unit.
- Paleozoic aquifers: These aquifers are exposed at the surface in small irregular areas in South Dakota, northeastern North Dakota, and southeastern Minnesota. The Paleozoic aquifers consist of sandstone, dolomite and limestone, with limestone formations the most productive aquifers.

Well yields vary greatly across the study area. Where the surficial aquifer system is present to a significant depth, yields over 500 gpm are typical; however, in some areas wells yield less than 50 gpm, amounts generally suitable only for domestic supplies or for livestock watering. Deep wells drilled into the bedrock aquifers may also yield significant quantities of water but water quality typically decreases with increasing depth. Groundwater obtained from depths approaching 1,000 feet is often highly mineralized.

Not surprisingly, the aquifers with the best supply potential and water quality within the study area are also the most developed. The biggest groundwater uses are for irrigation and public supplies. Unfortunately, regardless of the source aquifer or use, groundwater levels are declining in most areas, which indicate that withdrawals exceed natural recharge. For this reason, the water regulatory agencies in each state have acted to limit new groundwater development.

Developing a new groundwater supply for the proposed generating unit may not be practicable unless this supply were to come from a deep aquifer with poor quality water, water that is generally undesirable for potable use or irrigation. Development of a poor-quality water source would likely necessitate extensive pretreatment. Also, because the cycles of concentration could be reduced, much larger quantities of water may be required.

The other potential option for securing a groundwater supply would be to purchase and retire irrigated farmland with existing water rights. With typical application rates between one and two feet per year, this option would require purchase of between 6,000 and 12,000 acres of irrigated farmland. Because of the potential costs to purchase farmland or for extensive water treatment, groundwater supplies were generally considered to be unavailable within the project study area.

Although developing a groundwater source to supply all of the water requirements of the proposed generating unit is not considered practicable for the reasons stated above, groundwater may still be used to supply lower-volume demands, such as potable water or demineralizer makeup, or to supplement a surface water source during droughts.

2.3 PRELIMINARY SITE AREAS

Preliminary site areas for the proposed baseload generating resource were identified primarily through consideration of the necessary physical resources and proximity to regional environmental constraints. The first step in this process was to develop a composite constraint map that overlays all of the less desirable areas on one map. This map is included as Figure 2-7. The crosshatched areas on this map are the areas that are too distant from one or more of the required physical resources or considered too close to a Class I area. The identification of preliminary site areas focused on the remaining unshaded areas, although areas with favorable conditions for one or more resources but not for others were also considered for site location. The following process was used to identify the preliminary site areas.

1. Identify locations with favorable access to transmission facilities. These locations included existing substations with two or more transmission circuits with operating voltages of 230 kV or more and areas where two or more such transmission lines may intersect or come in close proximity of one another.
2. Eliminate areas identified in Step 1 that are within 200 km of a Class I area to help avoid problems with air emissions permitting. Existing generating stations were not excluded for this reason because they have many favorable characteristics that may justify the potentially more complicated permitting process.
3. Screen out any remaining areas that are more than 20 miles from an existing rail line for coal delivery or active lignite mine.

Thirty-eight preliminary site areas were identified through this process. These site areas are distributed almost evenly across the three-state study area with 14 located in Minnesota and 12 each in North and South Dakota (Figure 2-8). The preliminary site areas are listed in Table 2-2 along with information on the identity of and distance to transmission lines or substations (230 kV or higher), rail lines, lignite mines, and natural gas pipelines (8 inches or larger) located within 20 miles of each site.

2.4 DESKTOP SCREENING OF PRELIMINARY SITE AREAS

The 38 preliminary site areas were then subjected to a desktop screening analysis to eliminate those site areas with more obvious development constraints. A brief description of the eliminated sites, organized by state, and the reasons they were eliminated are included below.

2.4.1 Minnesota Site Areas

Fourteen preliminary sites were identified in Minnesota. All but one of these sites was eliminated during the screening analysis. The 13 eliminated site areas are discussed below:

- Adams: The Adams site area is located near the Iowa border in Mower County. This site area was eliminated from contention because there does not appear to be a viable surface water source nearby.

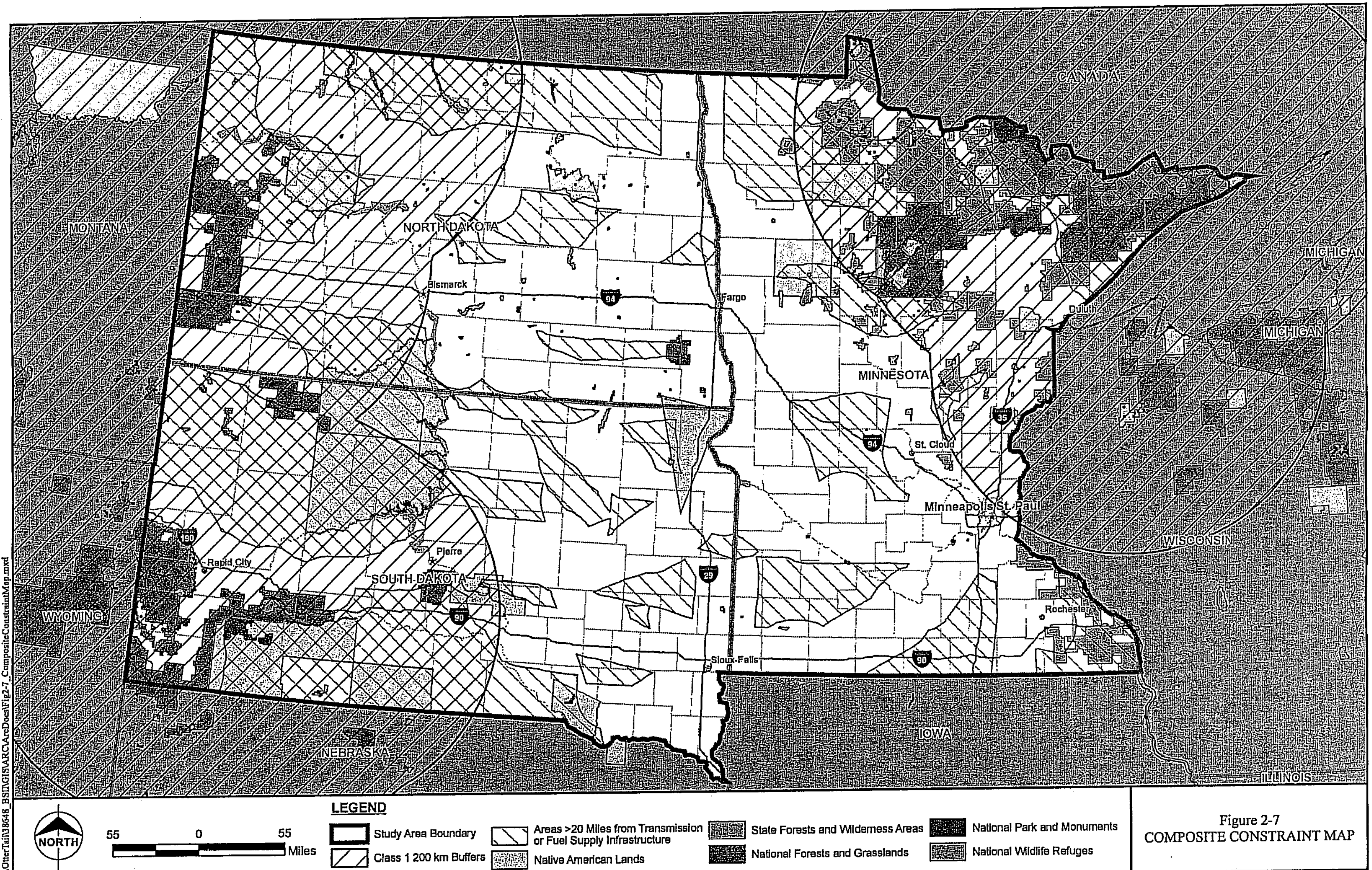

Figure 2-7
COMPOSITE CONSTRAINT MAP

Revised April 12, 2005

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Source: ESRI Data.

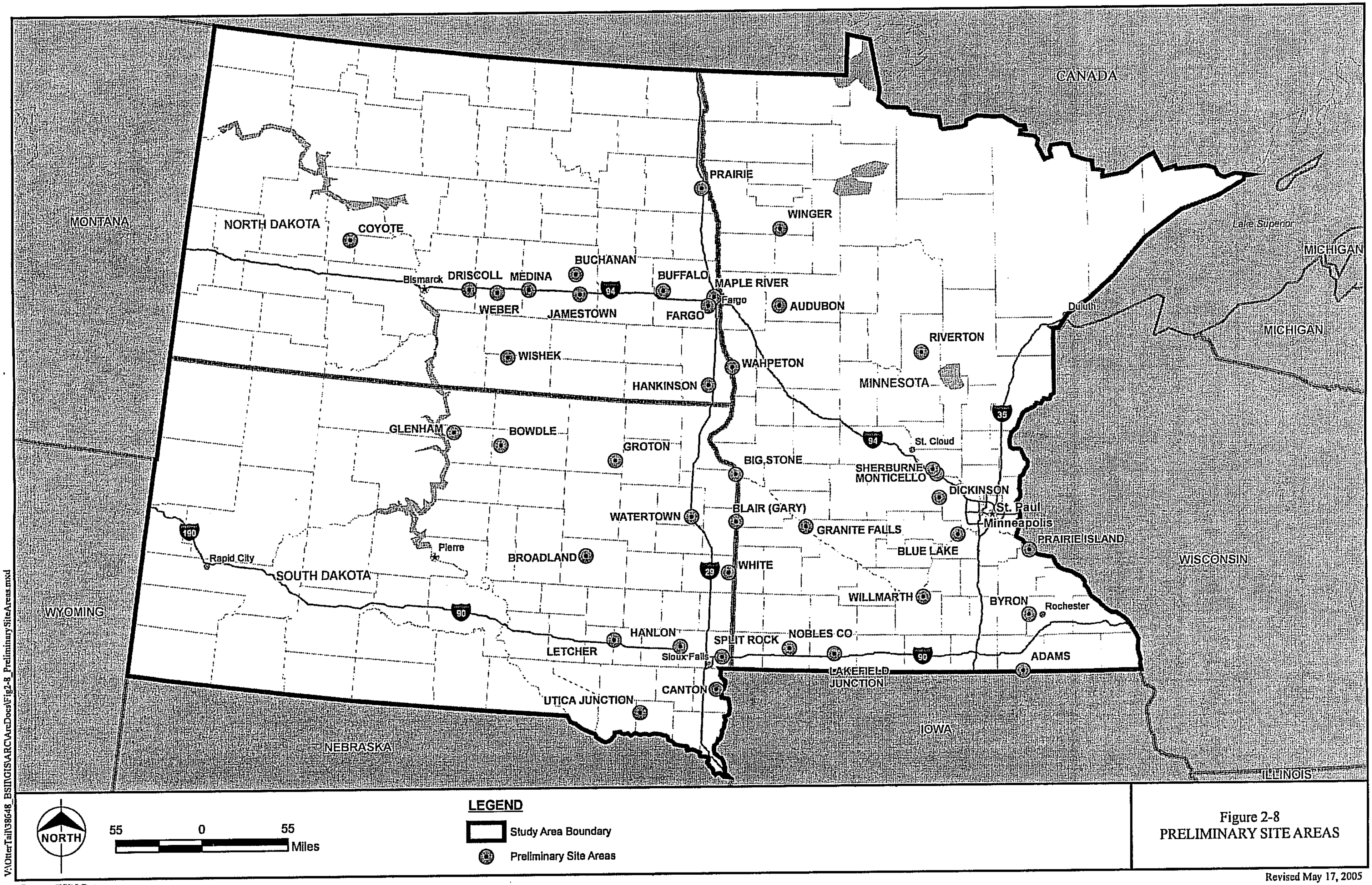

Figure 2-8
PRELIMINARY SITE AREAS

Revised May 17, 2005

Source: ESRI Data

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Table 2-2: Preliminary Site Area Matrix

Name	County, State	Electrical Interconnection						Fuel Supply						
		Substation			Line Tap			Rail Line		Lignite		Natural Gas		
		Name	Dist. (miles)	Voltage (kV)	Name	Dist. (miles)	Voltage (kV)	Owner	Dist. (miles)	Mine Name	Dist. (miles)	Pipeline Owner	Dist. (miles)	Diam. (in.)
Minnesota														
Adams	Mower, MN	Adams	0	345	---	---	---	IMPL CP	12 18	---	---	Alliance	10	36
Audubon	Becker, MN	Audubon	0	230	---	---	---	CP BNSF	6 7	---	---	Viking Gas	2	24
Blue Lake	Scott, MN	Blue Lake Excelsior Black Dog Parkers Lake	0 8 16 16	345 345 230 345	Panther-Black Dog	6	230	UP CP IMRL BNSF	4 6 11 15	---	---	Northern Natural	5	12
Byron	Olmstead, MN	Byron Silver Lake Pleasant Valley	0 11 16	345 345 345	---	---	---	DME	0	---	---	Northern Natural	4	16
Dickinson	Wright, MN	Dickinson Monticello Parkers Lake	0 15 15	345 345 345	Monticello-Parkers Lake	11	345	CP BNSF	0 4	---	---	---	---	---
Granite Falls	Chippewa, MN	Granite Falls Minnesota Valley	0 0	230 230	---	---	---	CP BNSF	0 0	---	---	---	---	---
Lakefield Junction	Jackson, MN	Lakefield Junction	0	345	---	---	---	IMRL UP	8 11	---	---	Northern Natural Northern Border	2 16	10 42
Monticello	Wright, MN	Monticello Sherburne Elk River Dickinson	0 4 14 15	345 345 230 345	---	---	---	BNSF CP	2 10	---	---	---	---	---
Nobles Co.	Nobles, MN	Nobles Co.	0	345	---	---	---	UP	9	---	---	Northern Natural	7	10
Prairie Island	Pierce, MN	Prairie Island	0	345	---	---	---	BNSF CP	4 10	---	---	Northern Natural	4	10
Riverton	Crow Wing, MN	Riverton Mud Lake	0 9	230 230	---	---	---	BNSF	6	---	---	Northern Natural	3	10
Sherburne	Sherburne, MN	Sherburne Monticello Benton Elk River Dickinson	0 4 17 17 19	345 345 345 230 345	---	---	---	BNSF CP	5 12	---	---	---	---	---
Willmarth	Blue Earth, MN	Willmarth	0	345	---	---	---	DME UP	1 1	---	---	Northern Natural	2	16
Winger	Polk, MN	Winger	0	230	---	---	---	CP BNSF	7 8	---	---	---	---	---
North Dakota														
Buchanan	Stutsman, ND	Center Jamestown	0 13	345 345	Pickert-Jamestown	17	230	BNSF CP	10 15			Williston Basin	14	8

Table 2-2: Preliminary Site Area Matrix

		Electrical Interconnection						Fuel Supply						
		Substation			Line Tap			Rail Line		Lignite		Natural Gas		
Name	County, State	Name	Dist. (miles)	Voltage (kV)	Name	Dist. (miles)	Voltage (kV)	Owner	Dist. (miles)	Mine Name	Dist. (miles)	Pipeline Owner	Dist. (miles)	Diam. (in.)
Buffalo	Cass, ND	Buffalo	0	345	Fargo-Jamestown	17	345	BNSF CP	6 17	---	---	Williston Basin	4	8
Coyote	Mercer, ND	Coyote Antelope Valley	0 12	345 500	---	---	---	BNSF	0	Beulah Freedom	3 12	Northern Border	19	42
Driscoll	Burleigh, ND	---	---	---	Groton-Leland Olds Weber-Bismarck	0 10	345 230	BNSF CP	0 12	---	---	Williston Basin	0	8
Fargo	Cass, ND	Fargo Maple River Moorhead	0 7 11	230 345 230	Winger-Maple River	9	230	BNSF	4	---	---	Williston Basin Viking Gas	3 8	8 8
Hankinson	Richland, ND	Hankinson	0	230	---	---	---	CP BNSF	3 11	---	---	Alliance	2	36
Jamestown	Stutsman, ND	Jamestown Center	0 13	345 345	---	---	---	BNSF	2	---	---	Williston Basin	4	8
Maple River	Cass, ND	Maple River	0	345	---	---	---	BNSF	3	---	---	Viking Gas	4	8
Medina	Stutsman, ND	---	---	---	Center-Heskett Bismarck-Jamestown Jamestown-Weber Young-Center	0 0 3 12	345 230 230 345	BNSF	0	---	---	Williston Basin	0	8
Prairie	Grand Forks, ND	Prairie	0	230	---	---	---	BNSF CP	1 20	---	---	Viking Gas	4	24
Wahpeton	Richland, ND	Wahpeton Hankinson	0 19	230 230	---	---	---	BNSF CP	2 16	---	---	Alliance	18	36
Wishek	McIntosh, ND	Wishek	0	230	Groton-Leland Olds	8	345	CP	1	---	---	Northern Border	17	42
South Dakota														
Big Stone	Grant, SD	Big Stone	0	230	---	---	---	CP BNSF	0 0	---	---	---	---	---
Blair	Deuel, SD	Blair	0	230	---	---	---	BNSF	15	---	---	Northern Border	19	42
Bowdle	Edmunds, SD	---	---	---	Broadland-Antelope Valley Huron-Antelope Valley	0 0	500 345	BNSF	0	---	---	---	---	---
Broadland	Beadle, SD	Broadland Huron	0 3	500 345	---	---	---	DME BNSF	6 6	---	---	Northern Natural	10	8
Canton	Lincoln, SD	---	---	---	Sioux City #2-Split Rock Split Rock-Sioux City #2 Utica Jct-Sioux Falls	0 0 10	345 345 230	BNSF	0	---	---	---	---	---
Glenham	Walworth, SD	Glenham	0	230	Leland Olds-Ft Thompson	0	345	BNSF	0	---	---	---	---	---
Groton	Brown, SD	Groton	0	345	---	---	---	BNSF	6	---	---	Northern Natural Northern Border	1 10	10 42
Letcher	Sanborn, SD	---	---	---	Sioux Falls-Ft Thompson Hanton-Storia	0 0	230 230	BNSF	0	---	---	Northern Natural	12	8
Split Rock	Minnehaha, SD	Split Rock Sioux Falls	0 4	345 230	---	---	---	BNSF	7	---	---	Northern Natural	10	14
Utica Junction	Yankton, SD	Utica Junction	0	230	---	---	---	BNSF	9	---	---	Northern Natural	8	8
Watertown	Cokington, SD	Watertown	0	345	---	---	---	BNSF	12	---	---	Northern Natural Northern Border	6 7	8 42
White	Brookings, SD	White	0	345	---	---	---	DME	10	---	---	Northern Border	11	42

- Audubon: The Audubon site area is located in west-central Minnesota in Becker County. The nearest potential water source, the Pelican River, is a tributary of the Otter Tail River and does not have sufficient flow during dry periods to support a generating unit. This site area was eliminated because of its limited water supply potential.
- Blue Lake: The Blue Lake site area is located southwest of the Twin Cities in Scott County. This site was eliminated because of encroaching residential development and because it is located remote from the OTP service area and the service areas for the majority of the potential project participants.
- Byron: The Byron site area is located near Rochester in Olmstead County. The nearest large surface water source is the Mississippi River, which is located more than 30 miles away. The questionable water supply potential of this site was the reason it was eliminated.
- Granite Falls: The Granite Falls site area is located in west-central Minnesota in Chippewa County. This site is located near the Minnesota River but this river does not have sufficient flow during dry periods to support the proposed generating unit at this site.
- Lakefield Junction: The Lakefield Junction site area is located in southwestern Minnesota in Jackson County. This site was eliminated because of its low water supply potential.
- Monticello: The Monticello site area is located at the existing Monticello Generating Plant, a nuclear power plant located in Wright County. The Monticello site area was eliminated because there would be few synergies between this nuclear power plant and the proposed coal-fired plant, and the plant's owner, Xcel Energy, is not a potential project participant.
- Nobles County: The Nobles County site area is located near Worthington at the 345-kV substation of the same name. This site was eliminated because of its apparent low water supply potential.
- Prairie Island: The Prairie Island site area is located at the existing Prairie Island Generating Plant, a nuclear power plant located in Pierce County. The Prairie Island site area was eliminated because there would be few synergies between this nuclear power plant and the proposed coal-fired plant, and the plant's owner, Xcel Energy, is not a potential project participant.
- Riverton: The Riverton site area is located in Crow Wing County near the upper reaches of the Mississippi River. The general area is characterized by former taconite mine areas and wetlands, which would make locating a suitable power plant site in this area challenging. This site area was eliminated for this reason.
- Sherburne: This site area is located at Xcel Energy's Sherburne County (Sherco) plant. Because the existing site is highly congested and owned by a utility that is not a potential project participant, this site was eliminated from further consideration.
- Willmarth: The Willmarth site area is located in Blue Earth County near Mankato. This site area was eliminated primarily because of its limited water supply potential.

- Winger: The Winger site area is located in northwestern Minnesota in Polk County. This site was also eliminated because of its limited water supply potential.

2.4.2 North Dakota Site Areas

There are 12 preliminary site areas located in North Dakota. Nine of these preliminary site areas were eliminated during this screening process. These nine site areas and the reasons they were eliminated are discussed below:

- Buchanan: The Buchanan site area is located at the Center substation near Jamestown in Stutsman County. This site was eliminated because of its low water supply potential.
- Buffalo: The Buffalo site area is located near Buffalo in western Cass County. This site was eliminated because it lacks an identifiable water supply with potential for development.
- Driscoll: The Driscoll site area is located near Driscoll in Burleigh County. This site was eliminated because it is more than 25 miles from the Missouri River, the nearest large surface water source.
- Hankinson: The Hankinson site area is located in the southeastern corner of North Dakota in Richland County. The nearest stream is the Wild Rice River, a tributary of the Red River. This river does not have sufficient flows in this area to support the proposed generating unit.
- Jamestown: The Jamestown site area is located near Jamestown in Stutsman County, in the upper reaches of the James River watershed. At this location, the James River is considered to have a low potential to supply the proposed generating unit so this site was eliminated from further consideration.
- Medina: The Medina site area is located in western Stutsman County, North Dakota. The nearest large stream is the Missouri River, which is located more than 60 miles west of this site area. This site was eliminated because of it low water supply potential.
- Prairie: The Prairie site area is located in the vicinity of Grand Forks in Prairie County. This site was eliminated because of the existing residential development in the vicinity of this substation site and concern over the viability of a water supply from the Red River.
- Wahpeton: The Wahpeton site area is located in southeastern North Dakota in Richland County. This site is located in the upper reaches of the Red River watershed and does not appear to have a high potential to develop a water supply. This site area was eliminated because of its low water supply potential.
- Wishek: The Wishek site area located in McIntosh County, nearly 50 miles east of the Missouri River. Because of the distance to this river, this site area was eliminated from contention.

2.4.3 South Dakota Site Areas

Twelve preliminary sites were identified in South Dakota. Eight of these site areas were subsequently eliminated during this screening analysis. The eight eliminated site areas are discussed below.

- Blair: The Blair site area is located near the Minnesota border in Deuel County. This site area was eliminated from contention because there does not appear to be a viable water source nearby.
- Bowdle: The Bowdle site area is located in west-central Edmunds County, about 30 miles east of the Missouri River. This site was eliminated because it lacks a nearby water source.
- Broadland: The Broadland site area is located near Huron in Beadle County. This site was eliminated because of its low water supply potential.
- Canton: The Canton site area is located south of Sioux Falls in Lincoln County. This site is located relatively close to the Big Sioux River but there are already concerns about finding additional public supplies in this area, from surface water or groundwater sources, to satisfy growing demands. Therefore this site was eliminated because development of a large industrial water supply in this area is likely to be controversial.
- Groton: The Groton site area is located in north-central South Dakota in Brown County. Although this site is relatively near the James River, this river does not have sufficient flows at this location to support a large industrial water user such as a power plant. This site area was eliminated because of water supply concerns.
- Letcher: The Letcher site area is located near Mitchell in Sanborn County. The nearest large water source is the Missouri River, which is located almost 60 miles southwest of the site area. This site was eliminated because of it low water supply potential.
- Watertown: The Watertown site area is located near the city of the same name in Codington County. The site is in the upper reaches of the Big Sioux River watershed and the river does not have sufficient flows to support the proposed generating unit at this location so this site was also eliminated because of water supply.
- White: The White site area is located on the Minnesota border in Brookings County, South Dakota. The nearest major stream is the Big Sioux River but this river does not have sufficient flows at this location to support the proposed generating unit. This site was eliminated because development of a water source at this site, from either surface water or groundwater, would be contentious.

2.5 FIELD RECONNAISSANCE

Following the desktop screening, it was recommended that 30 of the 38 preliminary site areas be eliminated from further consideration, primarily because of water supply concerns. A field reconnaissance of the remaining eight site areas was then conducted in early March 2005. This reconnaissance was made by project team members from Burns & McDonnell and consisted of an automobile survey along public roads in the vicinity of each site area.

The purpose of the field reconnaissance was to obtain first-hand information about each site area and surrounding areas to confirm, or update as necessary, the information collected during prior desktop studies. To the extent possible, each of the remaining site areas was assessed for its acceptability as a site for the proposed baseload generating station. Information on the following factors was collected:

- Amount and orientation of available, undeveloped land areas
- Number and relative location of nearby residences, businesses, and public facilities (parks, schools, churches, etc.)
- Suitability of terrain and soils
- Existing land use of site area and adjoining areas
- Locations of wetlands or other environmentally sensitive areas
- Potential for adverse visual and noise impacts
- Condition of transportation systems serving site area
- Existing land use within potential linear corridors for transmission lines, gas pipelines and rail lines

From information collected during the field reconnaissance, the reconnaissance team has recommended that two additional site areas be eliminated from further consideration: Maple River and Split Rock. The reasons for these recommendations are discussed below:

- Maple River: The Maple River site area is located in the northern part of Fargo in Cass County, North Dakota. Although the current land use in the immediate site vicinity can be characterized as light industrial and agricultural, the main body of Fargo is located about two miles east of this site area. There is also a residential subdivision located less than a mile north of the site area, scattered rural residences to the west, and an equestrian park to the south. There are many similarities between the Maple River site area and the Fargo site area, which is located just southwest of Fargo proper, but there are relatively fewer residences at this alternate site area. Therefore, the Maple River site area was recommended for elimination in favor of the Fargo site area.

- Split Rock: The Split Rock site area is located in Minnehaha County, immediately northeast of Sioux Falls. The site area has excellent electrical interconnections with several 345-kV transmission lines terminating at the two substations in this area. There is also an existing gas-fired combustion turbine generating station in this area. Unfortunately, there is little undeveloped land at this location that would accommodate a large, coal-fired power plant. Also the Sioux Falls suburb of Brandon is located only about two miles west of this site area so there is encroaching residential development from west, east and south at this site. Interstate 90 is located just north of the site, which not only constraints expansion of the site area in this direction but also ensures any development at this site will be highly visible to local travelers. For these reasons, and the aforementioned water supply concerns in the Big Sioux River basin, it was recommended that the Split Rock site area be eliminated from further consideration.

2.6 CANDIDATE SITE AREAS

As a result of the desktop screening analysis and field reconnaissance, it was recommended that 32 of the 38 preliminary site areas be eliminated from further consideration. The remaining six site areas were referred to as candidate site areas. The six candidate site areas are shown on Figure 2-9 and listed alphabetically below along with the county where they are located:

1. Big Stone – Grant County, South Dakota
2. Coyote – Mercer County, North Dakota
3. Dickinson – Wright County, Minnesota
4. Fargo – Cass County, North Dakota
5. Glenham – Walworth County, South Dakota
6. Utica Junction – Yankton County, South Dakota

A narrative description of each candidate site area is provided in the Chapter 3 and these site areas are evaluated in Chapter 4.

* * * * *

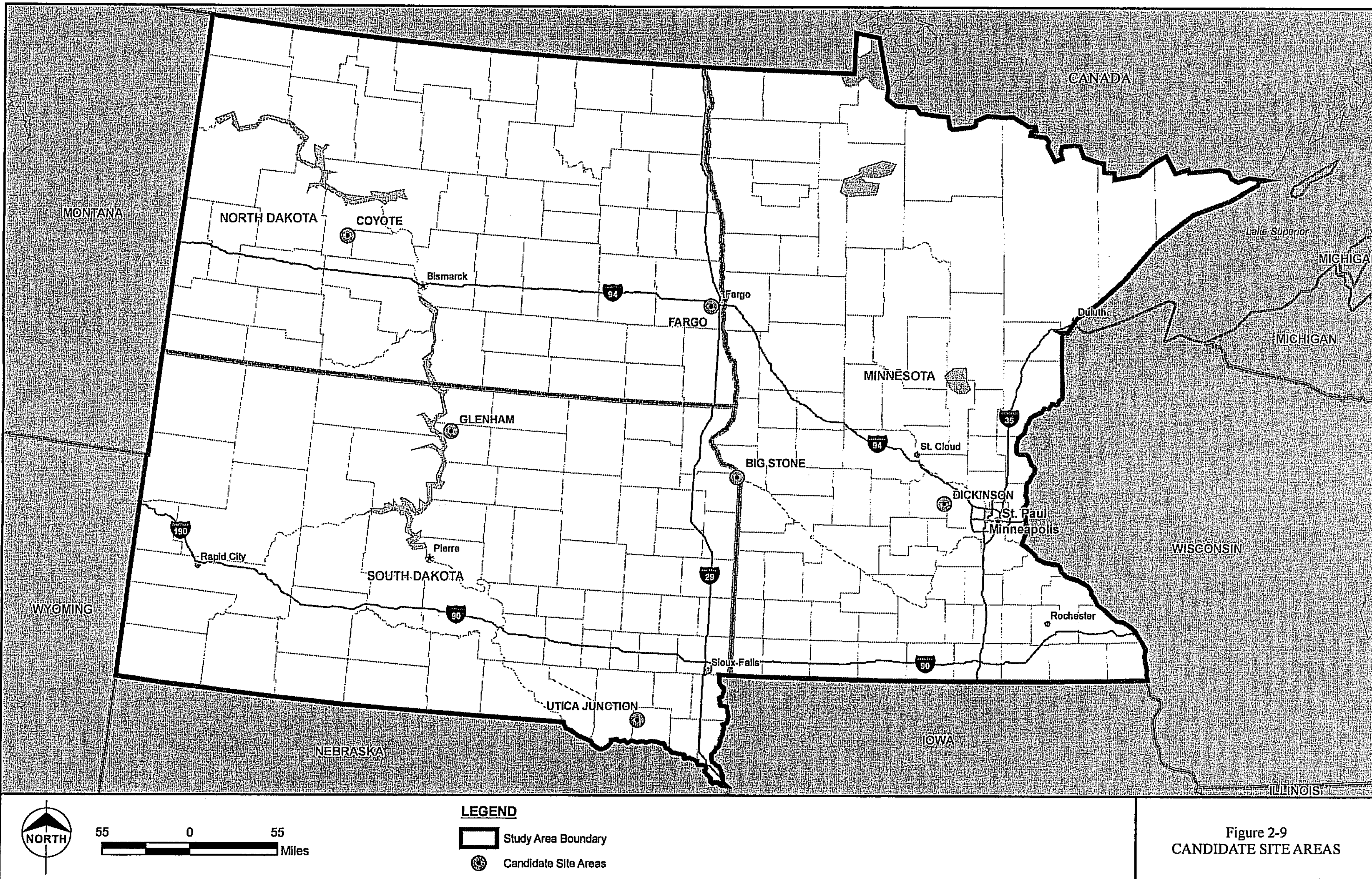

Figure 2-9
CANDIDATE SITE AREAS

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Source: ESRI Data

Revised April 12, 2005

3.0 Candidate Site Area Descriptions

3.0 CANDIDATE SITE AREA DESCRIPTIONS

This report chapter contains narrative descriptions and maps of the six candidate site areas, with an emphasis on characteristics that are important in the subsequent evaluation process. The locations shown on these site maps are considered to be representative of areas available in the general site vicinity but were identified only to aid in the site evaluation process. Based on real estate considerations and further analyses, the site boundaries at any site selected for eventual development could be modified significantly from those shown on the enclosed site maps.

3.1 BIG STONE SITE AREA

The Big Stone site area is located in the northeast corner of Grant County, SD. Big Stone City, SD is located less than a mile southeast and Milbank, SD is approximately seven miles southwest of the site area. Because it is located at an existing power plant, this site area is classified as a previously developed or brownfield site. A map of this site area is included as Figure 3-1.

3.1.1 Current Site Conditions and Land Use

The existing Big Stone Plant occupies a significant portion of this site area. Currently, this power plant has a single coal-fired generating unit with a nominal capacity of 450 MW. OTP is the majority owner and operator of the Big Stone Plant with the balance of the plant owned by Northwestern Public Service Company and Montana-Dakota Utilities Co. Also adjacent to the existing power station is an ethanol production plant owned by Northern Lights Ethanol, LLC.

Some of the nearest communities, their distances and directions from the site area, and 2000 populations are listed below (U.S. Census Bureau, 2000):

- Big Stone City, SD (1.9 miles east) – population 605
- Ortonville, MN (3.1 miles east) – population 2,158
- Milbank, SD (7.4 miles southwest) – population 3,640
- Odessa, MN (9 miles east-southeast) – population 113
- Corona, SD (12 miles west) – population 112

The nearest large cities, with populations of at least 25,000, are Aberdeen and Sioux Falls. These cities are approximately 109 and 136 miles away by road.

Source: NAIP Aerial Photography: Grant County (2003).

NORTH

0 3,000 Feet

1 inch equals 3,000 feet

LEGEND

Approximate Site Boundary

Railroad

Transmission Line

Burns & McDonnell SINCE 1898

Figure 3-1
BIG STONE SITE AREA

Revised Ma[illegible] [illegible]8, 2005

Road access to the site is provided by County Road 2 (144th Street), 148th Street and 484th Avenue. These local roads connect with State Highway (SH) 109 to the east and U.S. Highway 12 to the south of the site.

As defined in Figure 3-1, this site area includes approximately 1,514 acres. The topography of the site is predominantly flat and it has little tree cover. Review of floodplain mapping for the area shows this site is not located within a 100-year floodplain. The nearest flood-prone areas are located south of the site along the Whetstone River. There are also numerous small ponds in the vicinity that have formed in local depressions (that is, prairie potholes) which are also considered to be flood hazard areas. [Federal Emergency Management Agency (FEMA), no date].

The areas surrounding the site area are primarily devoted to agricultural use or rangeland. The exception to this general statement occurs to the east and southeast in Big Stone City, where there are residential and commercial areas, and the recreational areas associated with Big Stone Lake itself.

Based on available National Wetland Inventory (NWI) maps from the USFWS, the site contains approximately 724.8 acres of wetlands. Most of these wetlands (688.4 acres) are of the open water type associated with the cooling ponds and nearby prairie pothole ponds. There are also 17.1 acres of palustrine aquatic bed wetlands and 19.3 acres of palustrine emergent wetlands (USFWS, no date-d). Although the total acreage of wetlands at this site is substantial, the existing man-made cooling ponds that comprise most of these wetlands are not subject to regulation and would likely not be disturbed from development of a second generating unit at this site.

According to the USFWS (no date-b), there is one threatened bird species, the bald eagle (*Haliaeetus leucocephalus*) that is know to occur in Grant County, SD. The bald eagle's primary food source is fish so it nests and roosts in large trees near open water bodies, such as Big Stone Lake. There is an existing bald eagle nest located approximately 1.5 miles northeast of the plant; however, because these eagles coexist with current plant operations, it is unlikely they would be disturbed by construction and operation of a second generating unit at this station. Also, Grant County has portions of rivers and tributaries known to contain historic habitat for an endangered fish, the Topeka shiner (*Notropis topeka*), but none have been documented in this county. The Western prairie fringed orchid (*Platanthera praeclara*), is a threatened plant species, which prefers wet prairies and sedge meadows, that may also occur in this county but there are no known populations in South Dakota. Given the preferred habitats of these species and the previously disturbed nature of this site area, there is little potential that this development would impact any threatened or endangered species.

Sensitive noise receptors are defined as locations where increased noise resulting from plant operation may be objectionable. Generally, most sensitive receptors are residences but may also include schools, hospitals, parks and similar public facilities. Noise created by construction or operation of a second generating unit at this site will be similar in character to existing sources, with only a moderate increase in amplitude. Review of aerial photographs indicates there are four residences within one mile of the main power block area for the existing generating unit. One of these residences is located south of the plant and the other three to the west. The primary residential areas of Big Stone City are located more than two miles east of the plant.

3.1.2 Air Impacts

Grant County is classified as an attainment area for all criteria pollutants. In fact, there are no designated nonattainment areas anywhere in South Dakota or nearby Minnesota. The nearest Class I areas are Rainbow Lake Wilderness Area, located in northwestern Wisconsin, and the Boundary Waters Canoe Area, located in northeastern Minnesota. Both of these Class I areas are located approximately 260 miles (416 km) from the site area. At this distance, adverse impacts to these Class I areas are unlikely. Also, this site area is located only about two miles from the Minnesota border. Because of the close proximity to Minnesota, regulatory personnel from this state would be afforded the opportunity to comment during the air emissions permitting process for the new unit at this site; however, this situation is not expected to significantly complicate this process or change its outcome.

The nearest public airports are Ortonville Municipal (Martinson Field) and Milbank Municipal, which are located approximately 4.2 miles east and 5.3 miles southwest, respectively. Given the orientation of the runways at these airports and the presence of the existing generating facilities, it is unlikely there would be any airspace restrictions at this site that would limit the height of additional tall structures such as chimneys.

3.1.3 Fuel Supply

PRB coal is delivered to the existing generating unit at this site by the BNSF Railway Company (BNSF), which was formerly known as the Burlington Northern Santa Fe Railway. The existing rail and coal unloading facilities are expected to be capable of supporting a new generating unit. The nearest rail line owned by a competing carrier is a Canadian Pacific (CP) line located more than 40 miles north of the site.

Depending on the flue gas desulferization (FGD) process selected for the proposed generating unit, this system could require lime or limestone reagent. The nearest lime supplier is located in Superior, Wisconsin (WI), approximately 266 miles from the site by road (National Lime Association, no date).

3.1.4 Water Supply

The Big Stone Plant obtains is water supply from nearby Big Stone Lake via a short delivery pipeline. Water is pumped from the lake to provide makeup to the plant's cooling pond. Condenser cooling for the existing generating unit is provided by circulating water from this pond, through the unit's condenser, and then back to the pond. For the proposed new generating unit, condenser cooling could be provided by expanding the existing cooling pond or by installation of wet, evaporative cooling towers.

Although much of the existing water supply system could be utilized to supply a new generating unit at this site, OTP may need to secure a new withdrawal permit from Big Stone Lake to cover the additional water quantities needed (estimated to be 12,000 acre-feet per year). Currently, OTP can appropriate up to 110 cfs from Big Stone Lake whenever water levels are above elevation 964.7 feet. When the lake level is below this elevation, no appropriations are allowed from May through September and up to 35 cfs between October and April. With lower lake levels between October and April, allowable withdrawals reduce to 10 cfs at elevation 963.7 feet and zero at 962.7 feet. Maintaining this appropriations schedule, OTP will need to provide on-site storage for up to 22,000 acre-feet of water to provide carryover storage during droughts (Barr Engineering Company, 2002).

Glaciers deposited relatively thick deposits of sand and gravel in eastern South Dakota, leaving a surficial aquifer system up to 400 feet thick in some areas. This system or deeper bedrock aquifers may provide significant well yields in the site vicinity but groundwater levels have been declining throughout much of eastern South Dakota (Whitehead, 1996). Therefore, it is unlikely that groundwater could be relied on to supply all or a major portion of the new unit's total water requirements. Groundwater is however, a potential source for lower-volume water uses or as a short-term, supplemental source during dry periods when surface water supplies may be inadequate.

3.1.5 Electric Transmission

A second generating unit located at this site would be interconnected to the electric transmission system at the existing plant substation. There are currently four transmission circuits that terminate at this substation. These lines are listed below along with their corresponding voltage and end points:

- Big Stone to Blair 230-kV line
- Big Stone to Hankinson 230-kV line
- Big Stone to Canby 115-kV line
- Big Stone to Ortonville 115-kV line

The existing plant at Big Stone is able to deliver its full capacity only when both of the 230-kV lines and the 230/115-kV transformer are in-service. During an outage of any 230-kV line or the 230/115-kV transformer, the existing generator would need to reduce its output to eliminate the possibility of overloading the remaining transmission lines out of the plant in the event another transmission facility goes out of service.

Recent transmission studies specific to the Big Stone site have been conducted through the Midwest ISO generation interconnection and delivery service request process. Preliminary results from the studies have identified two alternatives for outletting additional generation from this site. Both alternatives identify additional high-capacity 230-kV lines. Existing 115-kV transmission lines from Big Stone to Ortonville and from Big Stone to Canby would be excellent candidates for increasing their operating voltage from 115 kV to 230 kV.

The geographic location of Big Stone relative to the large generation units in the North Dakota coal fields and the large load centers in the Twin Cities proves to serve as a "balancing agent" to the transmission system response during a major disturbance on the transmission system. From a transient stability standpoint, Big Stone has been shown to be a good location for adding generation because it can provide significant dynamic reactive support in the region. This reactive support provided during transient stability situations typically would allow for greater exports out of North Dakota with a second generating unit added at Big Stone. Additional stability analysis would be necessary to fully assess the system impacts resulting from a large generation addition at this site.

Current transmission studies completed for a second generating plant at the Big Stone site indicate that having four 230-kV lines at Big Stone would allow for reliable power delivery during system intact as well as single contingency conditions.

3.2 COYOTE SITE AREA

The Coyote site area is located in Mercer County, ND, approximately two miles south of Beulah. This is a brownfield site because of the existence of the existing generating station at this location. A map of this site area is included as Figure 3-2.

3.2.1 Current Site Conditions and Land Use

The existing Coyote Station occupies a significant portion of this site area. Currently, this power plant has a single lignite-fired generating unit with a nominal capacity of 420 MW. OTP is the operator of this generating unit but shares ownership with Montana-Dakota Utilities Co., Northern Municipal Power Agency, and Northwestern Public Service Company.

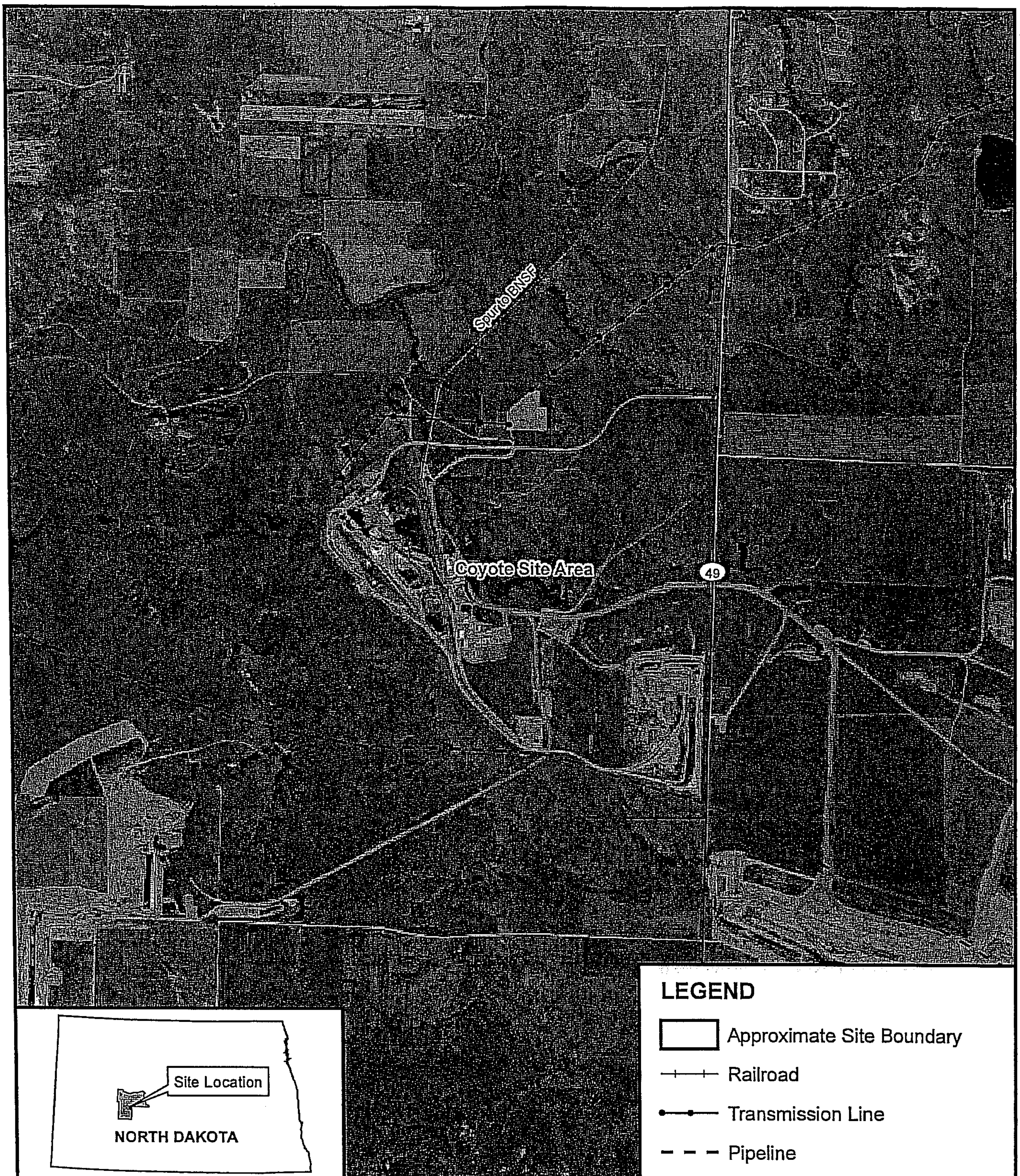
Some of the nearest communities, their distances and directions from the site area, and 2000 populations are listed below (U.S. Census Bureau, 2000):

- Beulah (2 miles northeast) – population 3,152
- Zap (6.2 miles northwest) – population 231
- Hazen (9 miles northeast) – population 2,457
- Stanton (20.7 miles northeast) – population 345
- Center (24.6 east-southeast) – population 678
- Golden Valley (12.5 miles west-northwest) – population 183

The nearest large city, with a population of at least 25,000, is Bismarck. By road, Bismarck is about 73 miles from this site area.

Road access to the site is provided by SH 49, which forms the eastern boundary of the site area. Via this highway, Interstate 94 is accessible about 25 miles south of the Coyote Station.

As defined in Figure 3-2, this site area includes approximately 1,475 acres. The existing generating plant occupies the top of a ridge that overlooks the Knife River valley to the west of the plant. Within this valley there is significant relief but the topography of the area in general can be described as rolling. Unlike the eastern part of the state, where glaciers worked to grind off topographic highs and formed the level plains areas, the topography of this region is much more varied. Because of the limited precipitation, the predominant vegetation is grasses with very few trees. Review of floodplain mapping for the area shows the site proper is not located within a 100-year floodplain but there are broad floodplains within the



Source: NAIP Aerial:
Mercer County (2003).

0 3,000
Feet

1 inch equals 3,000 feet

NORTH

Burns & McDonnell
SINCE 1898

Figure 3-2
COYOTE SITE AREA

Revised March 28, 2005

Knife River valley to the northwest and small floodplains along Brush Creek to the south (FEMA, no date).

Much of the immediate area surrounding this site is devoted to mining. The Dakota Westmoreland Corporation has active lignite mining areas to the east and southwest of the site. These mine areas are in various stages from undisturbed reserve areas to active pits to already reclaimed areas.

Based on available NWI maps, there are four classes of palustrine wetlands within the Coyote site area. These classes are aquatic bed (9.4 acres), emergent (0.5 acres), unconsolidated bed (13.4 acres), and unconsolidated shore (0.4 acres) (USFWS, no date-d). It is unlikely these wetlands would be disturbed by additional development at this site.

According to the USFWS (no date-c), there are six threatened or endangered species that may occur within Mercer County. These species are listed below along with their status and a brief discussion of their preferred habitats:

- Bald eagle: The bald eagle is a threatened species that nests and roosts in trees near open water. There are few trees and no large water bodies in the immediate site vicinity that are likely to attract eagles.
- Black-footed ferret: The black-footed ferret (*Mustela nigripes*) is an endangered species that feeds almost exclusively on prairie dogs and lives in abandoned prairie dog burrows. In 1987, the last members of the only known black-footed ferret colony were captured and placed in a captive breeding program. Since that time, ferrets have been successfully bred in captivity and are now being reintroduced in the wild. The most successful of these populations are in South Dakota. Given the previously-disturbed nature of this site, it is unlikely that any prairie dog colonies or black-footed ferrets would exist.
- Interior least tern: The endangered interior least tern (*Sterna antillarum atholassos*) is a small migratory bird that nests on sand bars and similar open areas along streams. The populations of these birds have declined primarily because of flood control efforts that have reduced high spring flows and the formation of sand bars. It is unlikely that these terns would chose to nest along streams in the site area.
- Pallid sturgeon: The pallid sturgeon (*Scaphirhynchus albus*) is a large, endangered fish that once existed throughout the Missouri and Mississippi rivers and their major tributaries. However, changes caused by construction of dams for flood control and water supply, have drastically reduced the

available habitat for these fish. None of the small rivers or creeks in the immediate site area are likely to be suitable for this fish species.

- Piping plover: A threatened bird species, the piping plover (*Charadrius melodus*), has also been found historically in Mercer County. These birds nest on open sand bars much like the least terns discussed above, and are not likely to be present within the immediate site vicinity.
- Whooping crane: The whooping crane (*Grus americana*) is a large wading bird that migrates from breeding grounds in Canada to wintering areas in Texas and New Mexico. With adults reaching about five feet tall, this endangered bird is one of the tallest birds in North America. Like most wading birds, their preferred habitat is wetlands and marshes. It is unlikely that the habitat available at this site would be attractive to whooping cranes during their annual migration.

Review of aerial photographs indicates there is only one residence within one mile of the main power block area for the existing generating unit. This residence is located west of the plant across the Knife River valley. Noise associated with construction and operation of a second generating unit at this site would be similar in character to existing noise emissions with a moderate increase in amplitude. Because there are few nearby residences, potential noise impacts are not considered to be a significant concern.

3.2.2 Air Impacts

Mercer County is classified as an attainment area for all criteria pollutants. In fact, there are no designated nonattainment areas anywhere in North Dakota. The nearest Class I areas are the two units of Theodore Roosevelt National Park. Both of these units are approximately 73 miles from this site. The north unit is located west-northwest of the site and the south unit west-southwest. Lostwood National Wildlife Refuge, another Class I area, is located approximately 94 miles north-northwest of the site. The presence of these Class I areas within 100 miles of the site area plus several existing power plant emissions sources nearby (Coyote, Antelope Valley, Coal Creek, Stanton, etc.), would make permitting a new generating unit at this site problematic.

The nearest public airport is Beulah, which is located approximately 1.8 miles north. Other regional airports or strips are Mercer County Regional (11.5 miles northeast) and Brecht (15.4 miles northwest). Given the nearly east-west orientation of the runway at the Beulah airport and the presence of the existing generating facilities, it is unlikely there would be any airspace restrictions at this site that would limit the height of additional tall structures such as chimneys.

3.2.3 Fuel Supply

Lignite is delivered to the existing generating unit at this site by large, off-road trucks from Dakota Westmoreland's adjacent Beulah Mine. For this analysis, it is assumed that the Beulah Mine or other nearby mines have sufficient recoverable reserves to serve a second unit at this site. There is also a rail spur to this site from a BNSF rail line in Beulah so coal from a remote location could also be delivered to this site. There are no rail lines owned by a competing carrier in the vicinity of this site.

Depending on the FGD process selected for the proposed generating unit, this system could require lime or limestone reagent. The nearest lime supplier is located in Rapid City, SD, approximately 291 miles from the site by road (National Lime Association, no date).

3.2.4 Water Supply

The Coyote Plant obtains its water supply via a 26-mile supply pipeline from the Missouri River below Lake Sakakawea. This lake, which is a man-made reservoir on the main stem of the Missouri River, is located approximately 18 miles north of the site at its nearest point. The supply pipeline to the Coyote Plant has sufficient capacity to serve a second unit at this location although additional pumping capacity would likely be required. The existing generating unit uses a wet cooling tower for condenser cooling. A new unit at this site would likely utilize a similar arrangement.

The Missouri River at Lake Sakakawea has a very large flow volume that is many, many times the water requirements of the proposed generating unit. Therefore, assuming there are no legal impediments to obtaining additional water from the lake, this supply would be adequate to supply the proposed unit without significant impacts to other water users.

The Coyote site area is located in an unglaciated portion of North Dakota. As such, there are few unconsolidated surficial aquifers except for narrow alluvial aquifers along streams. In general, the only potential groundwater sources in the area are from consolidated bedrock aquifers. These bedrock aquifers can be sufficient to supply domestic needs and for livestock watering but are unlikely to be a viable water source for the proposed generating unit (Whitehead, 1996).

3.2.5 Electric Transmission

A second generating unit located at this site would be interconnected to the electric transmission system at the existing plant substation. There are currently three transmission circuits that terminate at this substation. The lines are listed below along with their corresponding voltage and endpoints:

- Coyote to Center (Young) 345-kV line
- Coyote to Beulah 115-kV line
- Coyote to Dickinson 115-kV line

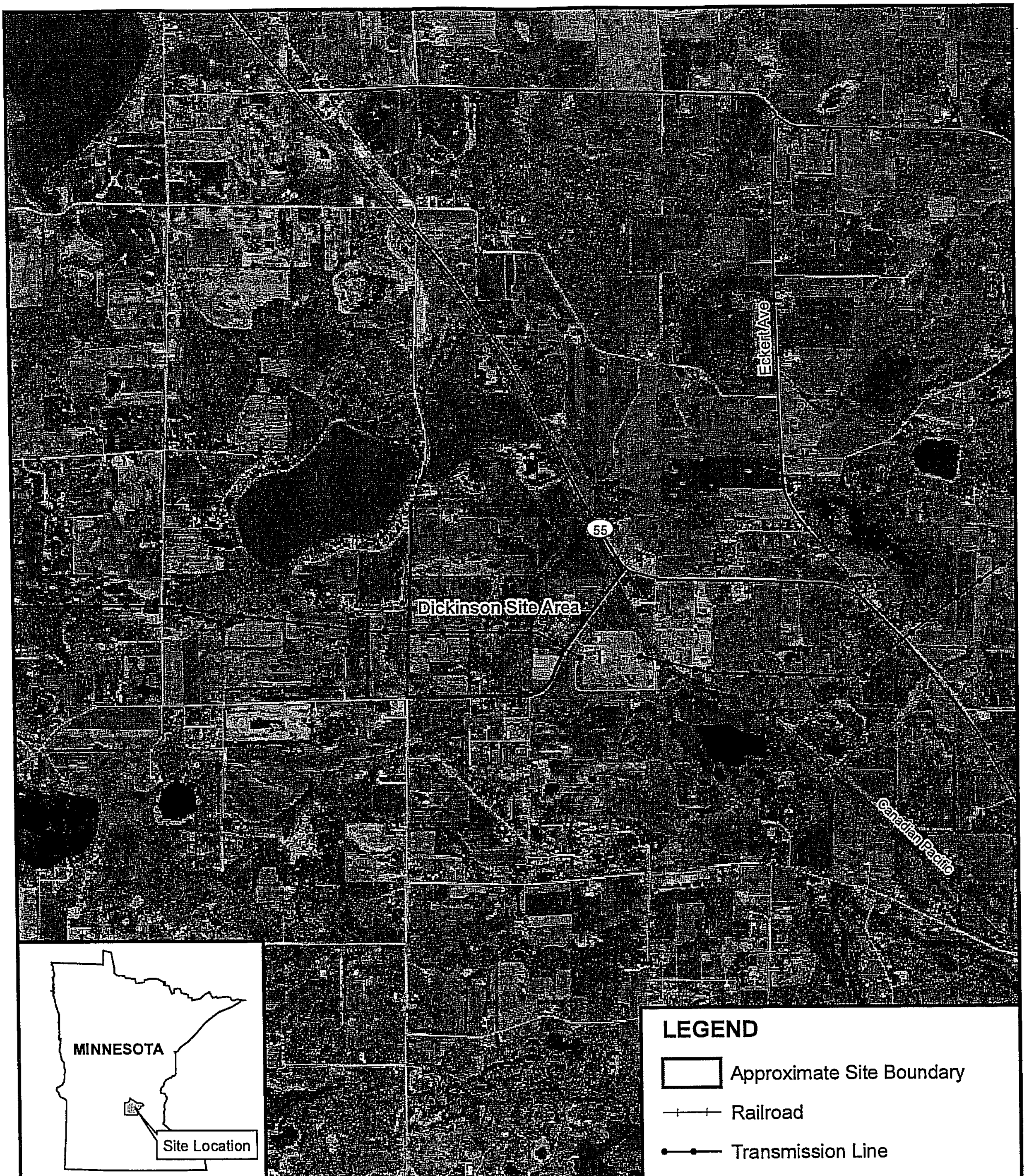
If the 345-kV line between Coyote and Center is out of service, the existing generating unit at Coyote is not able to deliver its full capacity to the transmission grid. When this line is out of service, the existing plant is limited to a much lower generation level that the 115-kV system can handle.

The location of the existing Coyote plant relative to other generation in the northern MAPP region aggravates the existing stability problems known within this region. Adding more generation yet in western North Dakota has the potential to further aggravate transient voltage swings on the existing transmission system during major system disturbances. Based on the results of a past study that was performed for this region, large-scale transmission additions would be needed to accommodate new generation in this area of North Dakota. As noted above, the existing Coyote generating unit has experienced operating restrictions during transmission outages so the addition of a new unit at this site would certainly not be feasible without substantial transmission additions. One solution to this problem would be to construct a new transmission line from the North Dakota coal fields east into central Minnesota.

The transmission upgrades required at Coyote for a second unit of 600 MW would include at least one new high-voltage transmission line out of the plant. The existing 115-kV circuits from Coyote to Beulah and from Coyote to Dickinson would not be good candidates for voltage upgrades because they exit the plant in the wrong direction. The natural tendency is for power to flow in an easterly direction out of the North Dakota coal fields, into an already congested transmission system. The additional transmission needed for a second generator at the Coyote plant would likely include two high-capacity, 230-kV transmission lines or a single 345-kV line. A transmission plan that includes a single 345-kV transmission line or two 230-kV lines would likely be adequate to provide the needed capacity for the new generator during system intact as well as single contingency conditions.

3.3 DICKINSON SITE AREA

The Dickinson site area is located in Wright County, MN, approximately 2.5 miles west of Rockford. This site area is considered to be a greenfield site. A map of this site area is included as Figure 3-3.



Source: NAIP Aerial:
Wright County (2003).

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1 inch equals 3,000 feet

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Figure 3-3
DICKINSON SITE AREA

Revised March 28, 2005

3.3.1 Current Site Conditions and Land Use

The Dickinson site area is adjacent to the substation of the same name. Land use within the site area is primarily agricultural. For the surrounding areas, land uses include rural residential, agricultural and light industrial.

Some of the nearest communities, their distances and directions from the site area, and 2000 populations are listed below (U.S. Census Bureau, 2000):

- Rockford (3.5 miles east-southeast) – population 3,484
- Delano (3.7 miles south) – population 3,837
- Buffalo (4 miles northwest) – population 10,097
- Montrose (5.5 miles southwest) – population 1,143
- Hanover (6.3 miles northeast) – population 1,355

The Dickinson site area is less than 25 miles from the western suburbs of the Twin Cities metropolitan area. Another large city (population greater than 25,000) in the vicinity is St. Cloud, which is approximately 43 road miles from the site.

Road access to the site is provided by Deadrick Avenue, which forms the southeast border of the site area and by County Road 14 on the west. Both of these local roads connect with State Highway 55, which is located immediately northeast of the site.

As defined in Figure 3-3, this site area includes approximately 357 acres. Review of floodplain mapping for the area shows the site proper is not located within a 100-year floodplain. The nearest flood-prone areas are located about 1.3 miles south of the site along the North Fork Crow River (FEMA, no date).

Based on available NWI maps, there are several wetland areas on this site, totaling approximately 82.7 acres (USFWS, no date-d). These areas consist of palustrine emergent (75.6 acres), palustrine forested (6.8 acres), and palustrine scrub/shrub (0.2 acre) wetlands but much of these areas appear to be farmed currently. Development at this site may require mitigation for wetland losses.

According to the USFWS (no date-a), there is only one threatened species that may occur within Wright County, the bald eagle. These eagles prefer to nest and roost in large trees along rivers and lakes. Given the disturbed nature of this site area, bald eagles are not likely to frequent this area.

From aerial photographs of the site area, there appear to be three farmsteads located within the designated site area. There are also between 40 and 45 additional residences located within one mile of the site.

3.3.2 Air Impacts

Wright County is classified as an attainment area for all criteria pollutants. In fact, there are no designated nonattainment areas anywhere in Minnesota. The nearest Class I areas are the Rainbow Lake Wilderness, Boundary Waters Canoe Area and Voyageurs National Park. These areas are located approximately 151 miles northeast, 207 miles north-northeast, and 230 miles north of the site area, respectively. At these distances, impacts at these Class I areas from air emissions at this site should be minimal.

The nearest public airport is Buffalo Municipal, which is located approximately 2.3 miles north-northwest. The runway at this airport is oriented north-south so approach paths to this airport may cross over or near this site. Additional analysis would be required to determine if tall structures at this site, such as chimneys, would interfere with air operations at this airport. There are also airstrips located about 4.0 miles south and 5.1 miles northeast of the site.

3.3.3 Fuel Supply

Coal for a baseload generating unit at this site would be delivered from the CPc rail line that is adjacent to the site on the northeast. This line carries regular freight traffic so it should be capable of delivering unit coal trains to this site without significant upgrades. The nearest rail line operated by a competing rail carrier is a BNSF line located about 3.7 miles south of the site area.

Depending on the FGD process selected for the proposed generating unit, this system could require lime or limestone reagent. The nearest lime supplier is located in Superior, WI, approximately 164 miles from the site by road (National Lime Association, no date).

3.3.4 Water Supply

The most likely water supply for generating units located at this site would by the Mississippi River. At its nearest point, this river is located approximately 13 miles north-northeast of the site area. At a stream gauge located about 60 miles upstream of the site area, the Mississippi River has an estimated 7Q10 of 811.8 cfs (Table 2-1). This dry-period flow is nearly 50 times larger than the average water requirements of the proposed generating unit so withdrawals from this stream are not likely to adversely impact other downstream water users.

The Dickinson site area is located in an area underlain by relatively productive surficial and bedrock aquifers. These aquifers may be capable of supplying some of the water requirements of a generating station at this location but not without potential impacts to other local groundwater users (Olcott, 1992). Therefore, the Mississippi River is considered to be the best option to satisfy the major water uses of a generating unit at this site.

3.3.5 Electric Transmission

Generating units located at this site would be interconnected to the electric transmission system at the existing Dickinson substation. This substation is the eastern termination of a 410-kV direct current (DC) transmission line that delivers power from Great River Energy's (GRE) Coal Creek generation station, located near Underwood, ND, to the GRE service area in Minnesota. Besides the DC termination at the Dickinson substation, there are also five alternating current (AC) transmission lines that originate at the Dickinson substation. These lines are listed below, along with their corresponding voltage and end points:

- Dickinson to Parkers Lake 345-kV line
- Dickinson to Coon Creek 345-kV line
- Dickinson to Crow River 115-kV line
- Dickinson to Monticello 115-kV line
- Dickinson to St. Bonifacious 115-kV line

The Dickinson substation does not currently have any on-site generation, but does have injection of approximately 1100 MW of power from a DC line that originates at Coal Creek. The Parkers Lake and Coon Creek 345-kV lines that originate at this substation currently share the same towers upon leaving the substation. Because these two circuits have common towers, the MAPP region considers this a single outage because failure of one of these towers would take both 345-kV circuits out of service. With both of these 345-kV circuits out of service, the power flowing across the DC line from Coal Creek ramps to zero, which causes one of the Coal Creek generating units to trip. Depending on the status of the transmission system at the time the DC line goes to 0 MW, the second generator at Coal Creek may also trip off-line or inject its full output into the AC system near Coal Creek. Therefore, it is apparent that the existing transmission outlet out of the Dickinson substation is fully utilized with the injection from the DC line.

The injection of an additional 600 MW into this substation would likely require the need for a new 345-kV line. In order to make sure that the new generator would not be prone to output reductions during outage of a single transmission line, a second 345-kV line would probably be necessary. An alternative transmission solution out of the Dickinson substation would be to construct one new 345-kV line with installation of a new 345/115-kV transformer and a new 115-kV line. This configuration would be robust enough to be able to deliver the output from the new generator during all single contingencies.

The Dickinson substation is relatively close to the large load center of the Twin Cities metropolitan area so the addition of a new generator at this substation is not likely to have detrimental impacts to the known stability issues in the northern MAPP region. However, the existing generation at Monticello has some local stability concerns that may prove to have some coupling with a new generator at the Dickinson substation because of their proximity. It is likely that some system additions or enhancements would be necessary with a generation addition at Dickinson to mitigate local stability concerns.

The addition of a new generator at Dickinson would not likely have significant impacts to the constrained interfaces in the northern MAPP region; namely the Minnesota-Wisconsin Stability Interface (MWSI). The planned addition of the Arrowhead to Weston 345-kV line will further reinforce the available capacity between Minnesota and Wisconsin, which should help unload the existing constraint across this interface.

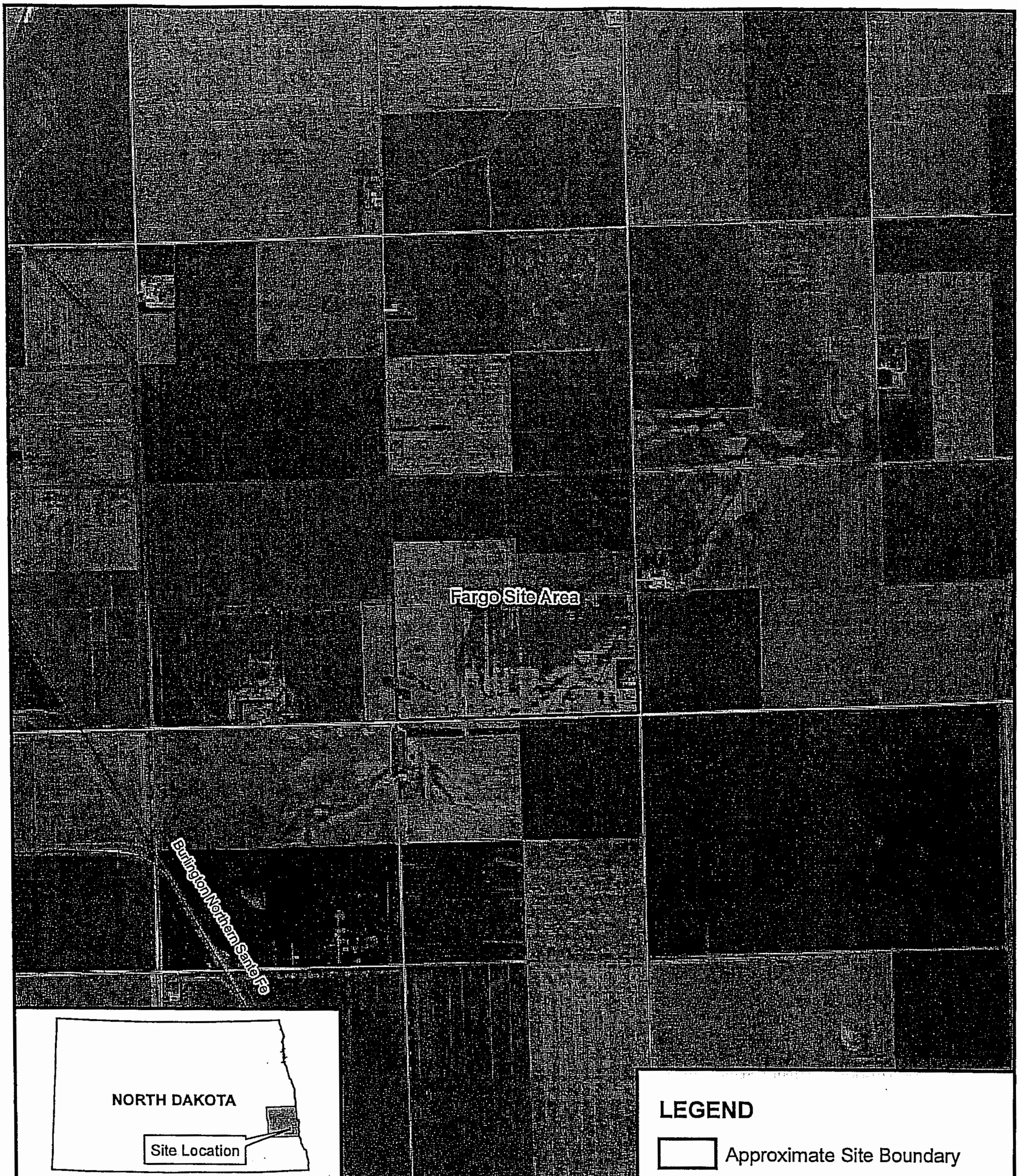
3.4 FARGO SITE AREA

The Fargo site area is located in Cass County, ND, approximately 10 miles southwest of Fargo. This site area is a greenfield site. A map of this site area is included as Figure 3-4.

3.4.1 Current Site Conditions and Land Use

The Fargo site area and surrounding areas are primarily agricultural with only scattered farmsteads. Some of the nearest communities, their distances and directions from the site area, and 2000 populations are listed below (U.S. Census Bureau, 2000):

- Davenport (4 miles south) – population 261
- Mapleton (6.5 miles north) – population 606
- West Fargo (9.8 miles northeast) – population 14,940
- Fargo (10.5 miles northeast) – population 90,599



Source: NAIP Aerial:
Cass County (2003).

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1 inch equals 3,000 feet

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Figure 3-4
FARGO SITE AREA

Revised March 28, 2005

Road access to the site is provided by rural roads that form the site borders on all four sides: 43rd Street on the north, 44th Street on the south, 161st Avenue on the west and 162nd Avenue on the east. Via these roads, Interstate 94 is accessible six miles north of the site.

As defined in Figure 3-4, this site area includes approximately 631 acres. Review of floodplain mapping for the area shows the site proper is not located within a 100-year floodplain. The nearest flood prone areas located about 1.6 miles northwest of the site along the Maple River (FEMA, no date).

Based on available NWI maps, there are no wetland areas on this site (USFWS, no date-d). An actual wetland delineation would have to be conducted to determine the presence of wetlands at this site but the potential for wetland impacts is likely to be minimal.

According to the USFWS (no date-c), there is only one threatened species that may occur within Cass County, the bald eagle. Eagles prefer to nest and roost in large trees along rivers and lakes. Given the lack of both trees and open water at this site, bald eagles are not likely to frequent this area.

According to the USFWS (no date-c), there is only one threatened species that may occur within Cass County, the bald eagle. Eagles prefer to nest and roost in large trees along rivers and lakes. Given the lack of both trees and open water at this site, bald eagles are not likely to frequent this area.

From aerial photographs of the site area, there appears to be only one farmstead located within the designated site area and approximately five more located within one mile of the site.

3.4.2 Air Impacts

Cass County is classified as an attainment area for all criteria pollutants. There are no Class I areas within 200 miles of the site area. The closest Class I areas are Voyageurs National Park (217 miles northeast), Boundary Waters Canoe Area (234 miles east-northeast), Lostwood National Wildlife Refuge (275 miles northwest), and Theodore Roosevelt National Park (294 miles west). At these distances, impacts at these Class I areas from air emissions at this site should be minimal.

The nearest large airport is Hector International (Fargo), which is located approximately 15 miles northeast of the site. However, there are several smaller municipal airports and private airstrips in the vicinity of the site as listed below.

- Kraft – 2 miles northeast
- Schroeder – 4.7 miles south
- Plath Farms – 5.6 miles southwest
- Casselton Regional – 6.8 miles northwest
- Hamry Field – 9 miles south-southeast
- Leonard Municipal – 11 miles southwest

Additional analysis would be required to determine if tall structures at this site, such as chimneys, would interfere with air operations at any of these airfields but significant airspace restrictions at this site are not anticipated.

3.4.3 Fuel Supply

Coal for a baseload generating unit at this site would be delivered from a BNSF line that is located just over a mile west of this site. Depending on the actual routing, a rail spur from this line to the site would likely be between two and three miles long. The nearest rail line operated by a competing rail carrier is a CP line located about 25 miles southwest of the site area.

Depending on the FGD process selected for the proposed generating unit, this system could require lime or limestone reagent. The nearest lime supplier is located in Superior, WI, approximately 250 miles from the site by road (National Lime Association, no date).

3.4.4 Water Supply

At a stream gauge located about 30 miles downstream (north) of Fargo, the Red River has an estimated 7Q10 of 95.7 cfs. This flow rate is approximately 5.75 times the projected average water requirements of the proposed generating unit. Developing a surface water source from this river may be possible hydrologically but is likely restricted by senior water rights and international compact. For example, the City of Fargo derives the majority of its water supply from this same river.

There are some relatively small areas in Cass County that are underlain by surficial aquifers but development of a groundwater supply at this site would likely require tapping deeper, bedrock aquifers. Unless these deep aquifers contain poorer quality water, there is likely to be significant competition for these supplies, resulting in declining water tables (Whitehead, 1996). Additional investigation would be required to determine if a groundwater supply is feasible at this location.

3.4.5 Electric Transmission

Generating units located at this site could be interconnected to the electric transmission system at two different major transmission substations. The Western Area Power Administration's (WAPA) Fargo substation is located about 7.5 miles northeast of the site area. There are seven transmission circuits that connect to this substation. These lines are listed below with their corresponding voltage and end points:

- Fargo to Jamestown 230-kV line #1
- Fargo to Jamestown 230-kV line #2
- Fargo to Moorhead 230-kV line
- Fargo to Sheyenne 230-kV line
- Fargo to Sheyenne 115-kV line
- Fargo to Moorhead 115-kV line
- Fargo to Caledonia 115-kV line

A second substation, the Maple River 345-kV substation is located 13.6 miles northeast of the site. This substation includes the following transmission circuits:

- Maple River to Jamestown 345-kV line
- Maple River to Winger 230-kV line
- Maple River to Wahpeton 230-kV line
- Maple River to Sheyenne 230-kV line
- Maple River to Red River 115-kV line
- Maple River 115/69-kV transformer

Both of these substations make Fargo a relatively good site for a new generator from a transmission perspective. There is no existing large-scale generation in the site vicinity and a relatively high load density, which would make the Fargo site a good candidate for adding new generation; however, during the off-peak spring and fall seasons when local loads in the Fargo area are less, some of the output from a new generator at this location would have to be delivered to the south or east. With existing transmission lines to the east and south at or near capacity, construction of new transmission facilities would likely be required. In order to accommodate the new generation, this new transmission would need to connect to another large load center, most logically the Twin Cities metropolitan area. Building a transmission line across the North Dakota – Minnesota border would allow for higher transfers of power between the two regions, opening up the opportunity for improved system reliability as well as providing an outlet for additional generation.

A regional transmission planning study determined that a 345-kV line from the Maple River substation to St. Cloud, MN would be one possible transmission line that would offer the needed capacity for new generation in North Dakota as well as improving the load serving requirements of the Red River Valley (Wahpeton, Fargo, Moorhead and Grand Forks). A new 345-kV line between Fargo and St. Cloud would likely follow a route generally parallel to an existing interstate highway (I-94). A route within this corridor would be likely to have significant resource impacts as well as social impacts to numerous cities and communities along the route.

Because both of these substations offer close access to large load centers, it would be foreseeable that a generator at Fargo could improve transient stability issues in the northern MAPP area. In addition, the construction of a new 345-kV line from Maple River to St. Cloud would also improve transient voltage performance while offering more capability to export power out of the North Dakota region.

3.5 GLENHAM SITE AREA

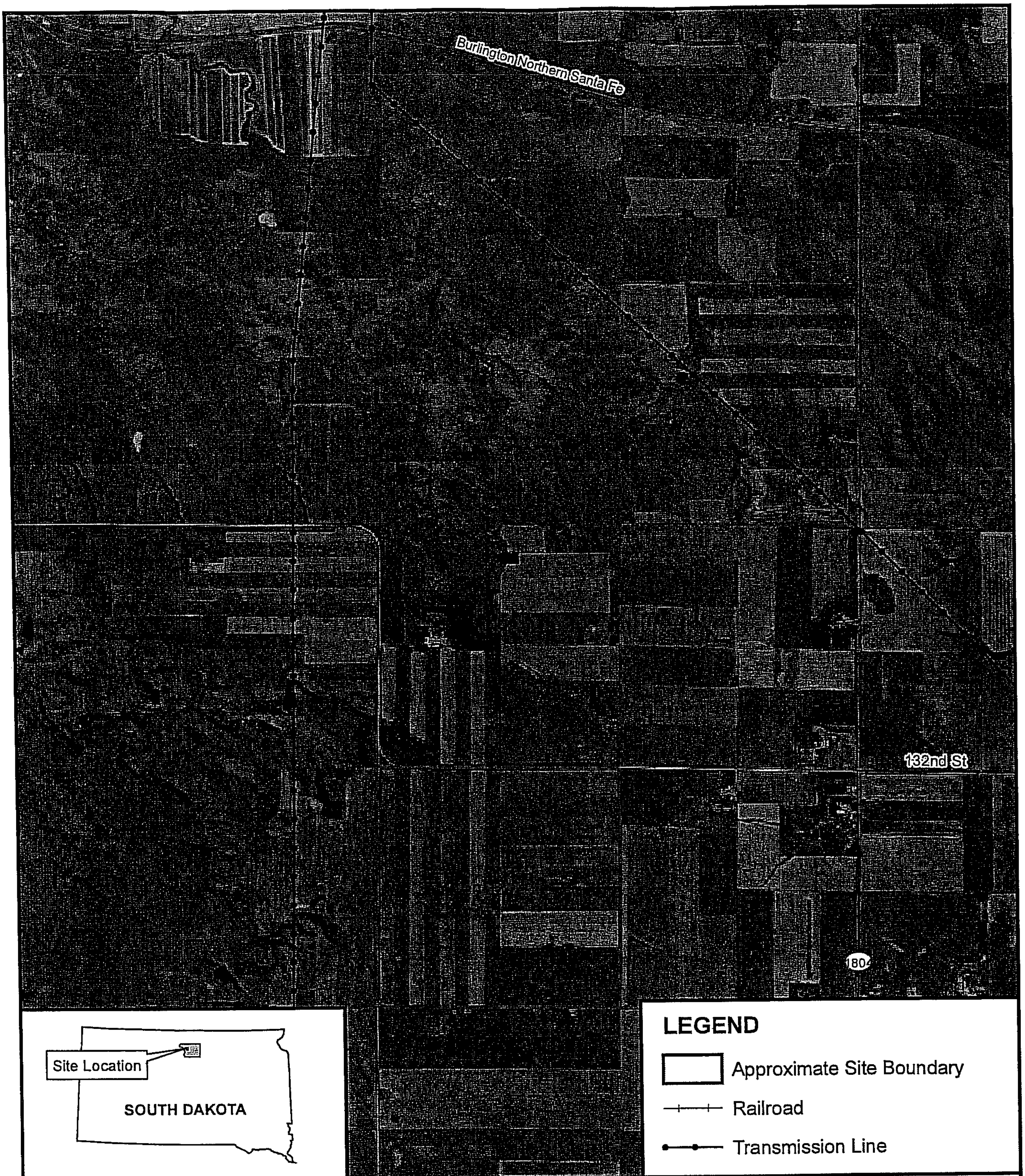
The Glenham site area is located in northwest Walworth County, SD, approximately 11 miles east-southeast of Mobridge. This site area is classified as a greenfield site. A map of this site area is included as Figure 3-5.

3.5.1 Current Site Conditions and Land Use

Current land use at the Glenham site is principally agricultural with surrounding areas also used for agriculture or rangeland. Some of the nearest communities, their distances and directions from the site area, and 2000 populations are listed below (U.S. Census Bureau, 2000):

- Glenham (4.8 miles northwest) – population 139
- Selby (8.5 miles east) – population 736
- Akaska (10.1 miles southeast) – population 31
- Mobridge (10.5 miles west-northwest) – population 3,574

The nearest large cities, with populations of at least 25,000, are Aberdeen, SD, and Bismarck, ND. These cities are approximately 89 and 125 road miles, respectively, from this site.



Source: USGS DOQ: Akaska NW (1997), Selby SW (1997).

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Figure 3-5
GLENHAM SITE AREA

Revised March 28, 2005

Road access to the site is provided by 132nd Street and 297th Avenue, which are adjacent to the site on the north and west, respectively. These local roads connect with U.S. Highway 12, which in four miles north of the site.

As defined in Figure 3-5, this site area includes approximately 638 acres. The topography of the site is relatively flat but there is considerably more relief near drainages where the streams have become incised. Review of floodplain mapping for the area shows this site is not located within a 100-year floodplain (FEMA, no date).

Based on available NWI maps, the site contains 24.6 acres of palustrine emergent wetlands (USFWS, no date-d).

According to the USFWS (no date-b), there are five threatened or endangered species that may occur within Walworth County. These species are listed below along with their status and a brief discussion of their preferred habitats:

- Bald eagle: The bald eagle is a threatened species that nests and roosts in trees near open water. There are no trees at this site and the nearest large water body is Lake Oahe (Missouri River), which is located about four miles southwest of the site. It is unlikely that bald eagles would be attracted to the immediate site vicinity.
- Interior least tern: The endangered interior least tern is a small migratory bird that nests on sand bars and similar open areas along streams. The population of these birds has declined primarily because of flood control efforts that have reduced high spring flows and the formation of sand bars. It is unlikely that these terns would chose to nest along any of the small drainages in the site area.
- Pallid sturgeon: The pallid sturgeon is a large, endangered fish that once existed throughout the Missouri and Mississippi rivers and their major tributaries. However, changes caused by construction of dams for flood control and water supply, have drastically reduce the available habitat for these fish. None of the small drainages in the immediate site area are likely to be suitable for this fish species. Presence of the pallid sturgeon in Lake Oahe is unlikely but this possibility would have to be considered in designing a water supply intake for the proposed generating unit.
- Piping plover: A threatened bird species, the piping plover, has also been found historically in Walworth County. These birds nest on open sand bars much like the least terns discussed above, and are not likely to be present within the immediate site vicinity.

- Whooping crane: The whooping crane is a large wading bird that migrates from breeding grounds in Canada to wintering areas in Texas and New Mexico. With adults reaching about five feet tall, this endangered bird is one of the tallest birds in North America. Like most wading birds, their preferred habitat is wetlands and marshes. It is unlikely that the habitat available at this site would be attractive to whooping cranes during their annual migration.

Review of aerial photographs indicates there are no residences located within the designated site area and only three residences within one mile of the site.

3.5.2 Air Impacts

Walworth County is classified as an attainment area for all criteria pollutants. The nearest Class I areas are listed below along with their approximate distances and directions from the Glenham site area:

- Badlands National Park (147 miles southwest)
- Wind Cave National Park (200 miles southwest)
- Theodore Roosevelt National Park – South Unit (178 miles northwest)
- Theodore Roosevelt National Park – North Unit (207 miles northwest)

Given the considerable distances of these Class I areas from the Glenham site, adverse impacts to these Class I areas are unlikely but will require further analysis.

The nearest airports or airstrips to this site are Mobridge Municipal (10.3 miles northwest), Beaman (8.5 miles east), and Fiedler (10.2 miles east-northeast). At these distances, it is unlikely there would be any airspace restrictions at this site that would limit the height of tall structures such as chimneys.

3.5.3 Fuel Supply

Coal to fuel a baseload generating unit at this site would be delivered by the BNSF. There is an existing BNSF rail line located about 2.9 miles north of the site. A rail spur from this main line into the site would be approximately four miles long. The nearest rail line owned by a competing carrier is a Dakota, Minnesota and Eastern Railroad Corporation (DM&E) line located more than 50 miles south of the site.

Depending on the FGD process selected for the proposed generating unit, this system could require lime or limestone reagent. The nearest lime supplier is located in Rapid City, SD, approximately 246 miles from the site by road (National Lime Association, no date).

3.5.4 Water Supply

A generation unit at the Glenham site would obtain its water supply from Lake Oahe (Missouri River). This lake is located approximately 4.5 miles west of the site. Condenser cooling for this generating unit would be provided by installation of a wet, evaporative cooling tower. Flows in the Missouri River are much, much larger than the quantities required for the proposed generating unit so no impacts to downstream water users are anticipated.

It is unlikely there are any highly-productive surficial aquifers in the site vicinity; however, some deeper bedrock aquifers may have significant well yields. Groundwater supplies in this area, except for wells developed in alluvial aquifers along major streams, are likely suitable only for domestic supplies and for livestock watering (Whitehead, 1996).

3.5.5 Electric Transmission

Generating units at this site would likely be interconnected to the electric transmission system at the existing Glenham substation. This substation is located approximately four miles north of the site area on U.S. Highway 12. There are currently four transmission circuits that terminate at this substation. These lines are listed below along with their corresponding voltage and end points:

- Glenham to Whitlock 230-kV line
- Glenham to Bismarck 230-kV line
- Glenham to Mobridge 115-kV line
- Glenham to Bowdle 115-kV line

The 115-kV circuits out of the Glenham substation are radial lines that only serve load in the immediate area around Glenham. These 115-kV lines do not connect back to other substations on the existing transmission system so they could not serve as outlet lines for new generation at Glenham. Therefore, the Glenham substation only provides two 230-kV outlets which connect back to the existing transmission system. The availability of only two 230-kV lines out of the Glenham substation would not allow for adequate outlet for a new 600-MW generator at Glenham. Furthermore, having one of these 230-kV lines out-of-service would result in major plant reductions. The addition of at least one additional 230-kV line at Glenham would be needed to insure that adequate transmission capacity is available during system intact and single contingency conditions. The radial 115-kV lines out of the Glenham substation would not be good candidates for a voltage upgrade unless they are extended to connect to other substations on the existing transmission system.

The Glenham substation is electrically close to the North Dakota coal fields. Thus, the transient stability performance of the existing transmission system when adding generation at the Glenham site would likely be similar to that for adding generation at the Coyote site. Because of the geographic location of the Glenham site relative to other generating units within the northern MAPP region, adding generation at Glenham would tend to add to the already known problems that currently exist for generators in the North Dakota coal fields.

Additions to the transmission system would be necessary for both thermal and stability reasons if generation were located at the Glenham substation. One option for increasing the generation outlet capacity at Glenham would be to tap the Leland Olds to Fort Thompson 345-kV line that passes less than a mile east of the Glenham substation. Tapping into this 345-kV transmission line could provide an additional transmission outlet from the Glenham site.

3.6 UTICA JUNCTION SITE AREA

The Utica Junction site area is located in Yankton County, SD, approximately 13 miles northwest of Yankton. This site area is classified as a greenfield site. A map of this site area is included as Figure 3-6.

3.6.1 Current Site Conditions and Land Use

Current land use at the Glenham site is principally agricultural with surrounding areas also used for agriculture. Some of the nearest communities, their distances and directions from the site area, and 2000 populations are listed below (U.S. Census Bureau, 2000):

- Lesterville (1 miles south) – population 158
- Utica (6.2 miles southeast) – population 86
- Tabor (7.6 miles southwest) – population 417
- Scotland (8 miles northwest) – population 891
- Yankton (13 miles southeast) – population 13,528

The nearest large cities (population over 25,000) to this site area are Sioux Falls, SD and Sioux City, Iowa. By available roads, these cities are about 76 and 83 miles, respectively, from this site.

Road access to the site is provided by rural gravel roads that border the site on all four sides: 298th Street on the north, 299th Street on the south, 430th Avenue on the west and 431st Avenue on the east. These

Source: NAIP Aerial:
Yankton County (2003).

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1 inch equals 3,000 feet

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Figure 3-6
UTICA JUNCTION SITE AREA

Revised March 28, 2005

local roads connect with SH 46, located a mile north of the site area and U.S. Highway 81, which is nine miles east of the site.

As defined in Figure 3-6, this site area includes approximately 628 acres. The topography of the site is flat with little relief except along streams, which are generally incised. Review of floodplain mapping for the area shows this site is not located within a 100-year floodplain (FEMA, no date).Based on available NWI maps, the site contains 0.6 acre of palustrine aquatic bottom wetlands and 64.6 acres of palustrine emergent wetlands (USFWS, no date-d).

According to the USFWS (no date-b), there are eight threatened or endangered species that may occur within Yankton County. These species are listed below along with their status and a brief discussion of their preferred habitats:

- Bald eagle: The bald eagle is a threatened species that nests and roosts in trees near open water. There are no trees at this site, except those that surround farmsteads, and the nearest large water body is Lewis and Clark Lake (Missouri River), which is located about 13 miles south of the site. It is unlikely that bald eagles would be attracted to the immediate site vicinity.
- Interior least tern: The endangered interior least tern is a small migratory bird that nests on sand bars and similar open areas along streams. The population of these birds has declined primarily because of flood control efforts that have reduced high spring flows and the formation of sand bars. It is unlikely that these terns would chose to nest along any of the small drainages in the site area.
- Pallid sturgeon: The pallid sturgeon is a large, endangered fish that once existed throughout the Missouri and Mississippi rivers and their major tributaries. However, changes caused by construction of dams for flood control and water supply have drastically reduced the available habitat for these fish. None of the small drainages in the immediate site area are likely to be suitable for this fish species. Presence of the pallid sturgeon in Lewis and Clark Lake is unlikely but this possibility would have to be considered in designing a water supply intake for the proposed generating unit.
- Piping plover: A threatened bird species, the piping plover, has also been found historically in Yankton County. These birds nest on open sand bars much like the least terns discussed above, and are not likely to be present within the immediate site vicinity.
- Eskimo curlew: The Eskimo curlew (*Numenius borealis*) is a small grayish-brown bird that nests on tundra in the Artic and migrates to South America each year. These birds are listed as endangered and extremely rare. There have been no confirmed sightings of these birds for decades and it is believed

that few individuals survived into the twentieth century. The latest population estimate (1994) is that there are only 23 to 100 individuals of this species left.

- Higgins' eye: The endangered Higgins' eye (*Lampsilis higginsii*) is a medium-sized freshwater mussel with a smooth, yellow to brown shell with green rays. These mussels are adapted to large river habitats, with the largest known population located in the Mississippi River near Prairie du Chien, WI. If this species exists in the area, it would be in the Missouri River. A freshly dead shell of a Higgins' eye was found in the Missouri River below Gavins Point Dam (Lewis and Clark Lake) in the fall of 2004.
- Scaleshell mussel: The scaleshell mussel (*Leptodea leptodon*) is an endangered freshwater mussel species that once occupied rivers throughout much of the Mississippi River basin but the only known populations are currently in Arkansas, Missouri and Oklahoma. The preferred habitat for this species is medium to large rivers with low to medium gradients and stable riffles. Construction of reservoirs and stream channelization has disturbed the habitat for this species in many areas. These species are not likely to exist in the site vicinity (Roberts, 2004).

Review of aerial photographs indicates there are 2 residences located within the designated site area and 11 more residences within one mile of the site.

3.6.2 Air Impacts

Yankton County is classified as an attainment area for all criteria pollutants. The nearest Class I areas are listed below along with their approximate distances and directions from the Utica Junction site area:

- Badlands National Park (221 miles west-northwest)
- Wind Cave National Park (292 miles west)

Given the considerable distances of these Class I areas from the Utica Junction site, adverse impacts to these Class I areas are unlikely.

The nearest airports or airstrips to this site are Chan Gurney Municipal (Yankton), Menno, and Plihal Farms. These airfields are located approximately 13 miles southeast, 12.3 miles north and 14 miles west-southwest, respectively. At these distances, it is unlikely there would be any airspace restrictions at this site that would limit the height of tall structures such as chimneys.

3.6.3 Fuel Supply

Coal to fuel a baseload generating unit at this site would be delivered by the BNSF. There is an existing BNSF rail line located about 1.2 miles south of the site. A rail spur from this main line into the site would be approximately two miles long. The nearest rail line owned by a competing carrier is a Union Pacific Railroad Company (UP) line located more than 70 miles southeast of the site near Sioux City, Iowa.

Depending on the FGD process selected for the proposed generating unit, this system could require lime or limestone reagent. The nearest lime supplier is located in Rapid City, SD, approximately 335 miles from the site by road (National Lime Association, no date).

3.6.4 Water Supply

A generation unit at the Utica Junction site would obtain its water supply from Lewis and Clark Lake (Missouri River). This lake is located approximately 13.5 miles south of the site. Condenser cooling for this generating unit would be provided by installation of a wet, evaporative cooling tower. Flows in the Missouri River are much, much larger than the quantities required for the proposed generating unit so no impacts to downstream water users are anticipated.

There may be productive surficial aquifers in the site vicinity plus some deeper bedrock aquifers may have significant well yields. However, given the proximity of the Missouri River, a surface water source for cooling tower makeup and other large water demands is more practicable. Groundwater may be relied on for potable supplies and some other low-volume needs such as demineralizer makeup (Whitehead, 1996).

3.6.5 Electric Transmission

Generating units located at this site would likely be interconnected to the electric transmission system at the existing Utica Junction switching station. This substation is owned by WAPA and is located within the designated site area. There are currently three 230-kV transmission lines that terminate at this switching station. These lines are listed below with their corresponding voltage and endpoints:

- Utica Junction to Rasmussen 230-kV line
- Utica Junction to Fort Randall 230-kV line
- Utica Junction to Sioux Falls 230-kV line

The Utica Junction site does not currently have any generation present and it appears this site could accommodate new generation.

In the southern area of the MAPP region, past studies have indicated that stability concerns are not as prevalent as within the northern area of MAPP. Sioux Falls is a very large load center that would likely help transient stability performance for the Utica Junction site. Therefore, no adverse impacts on the existing transmission system would be expected when adding generation at this site.

The presence of flowgates (constrained interfaces) in the southern area of MAPP (namely Fort Calhoun South and Cooper South) has historically been a limiting constraint on the existing transmission system. However, two new generation projects at Nebraska City and Council Bluffs are currently underway. The addition of these generation projects along with their planned transmission upgrades will help alleviate many of the flowgate issues traditionally experienced within the southern MAPP region. Based on the recent capacity available on the Fort Calhoun South and Cooper South flowgates along with the generation project planned at Nebraska City and Council Bluffs, adding generation at Utica Junction will not likely have any flowgate impacts in the MAPP region.

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4.0 CANDIDATE SITE EVALUATION

4.0 CANDIDATE SITE EVALUATION

A numerical decision analysis process was used to rank the candidate site areas. The focus of the candidate site evaluation, and of the criteria discussed below, was to assess the relative advantages and disadvantages of each candidate power plant site area.

The evaluation criteria used to judge the relative attractiveness of the candidate site areas cover a number of specific attributes. The attributes represented by these evaluation criteria are those that can help differentiate one site from another; attributes considered roughly equivalent for all sites were not included as evaluation criteria although they may be important considerations. For example, critical facilities like a power plant should not be built in flood-prone areas so the presence of floodplains is often used as an evaluation criterion; however, because none of the candidate sites is located in a floodplain, this criterion would not help to distinguish one site from another so it was not used as an evaluation criterion in this study.

Each of these attributes represents an important characteristic in the evaluation of prospective sites. These evaluation criteria are not equivalent in their importance to the decision-making process. Therefore, each criterion was also assigned a weight indicative of its relative importance to the decision process. The assignment of weights to the evaluation criteria was a subjective process based on the collective professional judgment of the OTP and Burns & McDonnell staff who participated in this study.

In total, 17 different criteria were used to evaluate the candidate site areas. These criteria were first organized into six major categories and these major categories were allocated weights that totaled 100 percent. For example, the Air Impacts category was assigned a weight of 15 percent so that 15 percent of the overall evaluation scores were based on air impacts criteria. Within each major category, the criteria were assigned subweights from one to ten that indicate each criterion's relative importance. For example, a criterion assigned a subweight of five would be considered half as important within its category as one assigned a subweight of ten. The composite weight for each individual criterion was then calculated as its subweight divided by the total of the subweights within its major category times the major category weight. The evaluation categories, category weights, criteria, criteria subweights, and composite weights are summarized in Table 4-1. A detailed discussion of each of these criteria, which includes the rationale used to assign the ratings for each criterion and the resulting scores for each of the six candidate site areas, follows this table.

Table 4-1: Candidate Site Evaluation Criteria

Major Category	Category Weight	Criterion	Subweight	Composite Weight
Air Impacts	15%	Class I Areas	10	10.71%
		Airspace Restrictions	4	4.29%
		Category Totals:	14	15.00%
Water Supply	20%	Surface Water Proximity	5	6.67%
		Water Supply Potential	10	13.33%
		Category Totals:	15	20.00%
Environmental	15%	Socioeconomics	5	2.68%
		Land Use Compatibility	4	2.14%
		Protected Species Impacts	2	1.07%
		Noise Impacts	10	5.36%
		Wetlands	7	3.75%
		Category Totals:	28	15.00%
Fuel Supply	20%	Rail Line/Mine Proximity	10	11.11%
		Fuel Delivery Competition	6	6.67%
		Reagent Delivery	2	2.22%
		Category Totals:	18	20.00%
Transmission	20%	Proximity to Interconnection Point	2	2.67%
		Expected System Impacts	13	17.33%
		Category Totals:	15	20.00%
Other	10%	Highway Access	2	1.05%
		Land Availability	10	5.26%
		Common Facilities/Staff	7	3.68%
		Category Totals:	19	10.00%

4.1 AIR IMPACTS CRITERIA

The Air Impacts category, which was assigned a total weight of 15 percent, is comprised of two component evaluation criteria. These criteria are described in the following paragraphs.

4.1.1 Proximity to Class I Area

The presence of a Class I area near a proposed emissions source can complicate the permitting process. The scores for this criterion were assigned based on the distance of the site area from the nearest Class I area using the scoring criteria listed below:

- Distance ≤ 50 miles → Score = 1
- 50 miles < Distance ≤ 100 miles → Score = 2
- 100 miles < Distance ≤ 150 miles → Score = 3
- 150 miles < Distance ≤ 200 miles → Score = 4
- Distance > 200 miles → Score = 5

The name of and distance to the closest Class I area at each candidate site and the subsequent ratings are listed below:

1. Big Stone – Rainbow Lake Wilderness and Boundary Waters Canoe Area, both 260 miles – 5
2. Coyote – Theodore Roosevelt National Park, 73 miles – 2
3. Dickinson – Rainbow Lake Wilderness, 151 miles – 4
4. Fargo – Voyageurs National Park, 217 miles – 5
5. Glenham – Badlands National Park, 147 miles – 3
6. Utica Junction – Badlands National Park, 221 miles – 5

4.1.2 Potential Airspace Restrictions

Location of a power plant near an airport could result in interference between the chimney(s) and other tall plant structures, and aircraft traffic. The distance from the airport, orientation of the airport's runways relative to the site, and the runway classification are all important factors to review in determining potential airspace restrictions; however, the ratings for this criterion were based simply on the distance to the nearest airport using the scoring criteria listed below:

- Distance ≤ 2 miles → Score = 1
- 2 miles < Distance ≤ 4 miles → Score = 2
- 4 miles < Distance ≤ 6 miles → Score = 3
- 6 miles < Distance ≤ 8 miles → Score = 4
- Distance > 8 miles → Score = 5

The distance to the closest airport/airfield and subsequent rating for each site area are listed below:

1. Big Stone – Ortonville Municipal, 4.2 miles east – 3
2. Coyote – Beulah, 1.8 miles north – 1
3. Dickinson – Buffalo Municipal, 2.3 miles north – 2

4. Fargo – Kraft, 2 miles northeast – 1
5. Glenham – Beaman, 8.5 miles east – 5
6. Utica Junction – Menno, 12.3 miles north – 5

4.2 WATER SUPPLY CRITERIA

The Water Supply category, which was assigned a total weight of 20 percent, is comprised of two component evaluation criteria. These criteria are described in the following paragraphs.

4.2.1 Surface Water Proximity

The water supply for the proposed generating station will most likely come from surface water sources. Therefore, the ideal site area will be located close to a large river or lake. The ratings for this criterion were assigned based on the distance from the site area to a potential water source using the scoring criteria listed below:

- Distance ≤ 5 miles → Score = 5
- 5 miles < Distance ≤ 10 miles → Score = 4
- 10 miles < Distance ≤ 15 miles → Score = 3
- 15 miles < Distance ≤ 20 miles → Score = 2
- Distance > 20 miles → Score = 1

The potential surface water sources for each candidate site area, their distances from the sites and the resulting scores are listed below:

1. Big Stone – Big Stone Lake, 2 miles east – 5
2. Coyote – Lake Sakakawea (Missouri River), 26 miles north – 1
3. Dickinson – Mississippi River, 13 miles north – 3
4. Fargo – Red River of the North, 14 miles east – 3
5. Glenham – Lake Oahe (Missouri River), 4.5 miles west – 5
6. Utica Junction – Lewis and Clark Lake (Missouri River), 13.5 miles south – 3

4.2.2 Surface Water Supply Potential

The reliability of a proposed surface water source will depend on its flow characteristics and whether or not there are upstream reservoirs that can provide carryover storage for extended dry periods. As discussed in Section 2.2.3.1, surface water sources were evaluated based on their 7-day average, 10-year low flow (7Q10). The minimum desired 7Q10 for a water source is ten times the average plant makeup rate of 16.6 cfs or 166 cfs. With the exception of the Big Stone site, the candidate sites were rated for this criterion based on the scoring criteria listed below:

- 7Q10 $\leq$ 166 cfs $\rightarrow$ Score = 1
- 166 cfs < 7Q10 $\leq$ 500 cfs $\rightarrow$ Score = 2
- 500 cfs < 7Q10 $\leq$ 1000 cfs $\rightarrow$ Score = 3
- 1000 cfs < 7Q10 $\leq$ 1500 cfs $\rightarrow$ Score = 4
- 7Q10 > 1500 cfs $\rightarrow$ Score = 5

The water supply for the Big Stone Plant comes from Big Stone Lake. The expansion of this water supply to supply a second unit at this site has been thoroughly evaluated by Barr Engineering (2002).

The potential surface water source for each candidate site area, its 7Q10 and the resulting scores are listed below:

1. Big Stone – Big Stone Lake – 3
2. Coyote – Lake Sakakawea (Missouri River), 4,233 cfs – 5
3. Dickinson – Mississippi River, 812 cfs – 3
4. Fargo – Red River of the North, 96 cfs – 1
5. Glenham – Lake Oahe (Missouri River), 4,233 cfs – 5
6. Utica Junction – Lewis and Clark Lake (Missouri River), 4,233 cfs – 5

4.3 ENVIRONMENTAL CRITERIA

The Environmental category, which was assigned a total weight of 15 percent, is comprised of five component evaluation criteria. These criteria are described in the following paragraphs.

4.3.1 Socioeconomics

The construction and operation of a power plant can stimulate the demand for temporary and permanent lodging, schools, medical care, and other goods and services. In a relatively rural area, this economic development can strain available resources while larger cities and towns may be able to readily accommodate these changes. Also, larger cities are more likely to have an available supply of construction workers who will be needed during plant construction. The ratings for this criterion were based on the distance of the site area from a city with a population of at least 25,000 persons, using the scoring criteria listed below:

- Distance $\leq$ 25 miles → Score = 5
- 25 miles < Distance $\leq$ 50 miles → Score = 4
- 50 miles < Distance $\leq$ 75 miles → Score = 3
- 75 miles < Distance $\leq$ 100 miles → Score = 2
- Distance > 100 miles → Score = 1

The nearest large city and its distance are listed below for each candidate site along with the associated score for this criterion:

1. Big Stone – Aberdeen, 109 miles – 1
2. Coyote – Bismarck, 73 miles – 3
3. Dickinson – Minnetonka, <25 miles – 5
4. Fargo – Fargo, 11 miles – 5
5. Glenham – Aberdeen, 89 miles – 2
6. Utica Junction – Sioux Falls, 76 miles – 2

4.3.2 Land Use Compatibility

This criterion assesses the compatibility of a power plant with existing land use on and around each candidate site area. The ratings for these criteria were based on a subjective evaluation of compatibility, with a score of one assigned for sites that are the least compatible ranging up to a score of five for the most compatible.

The predominant land use of each site area and the resulting scores for the Land Use Compatibility criterion are listed below:

1. Big Stone – Existing power plant – 5
2. Coyote – Existing power plant – 5
3. Dickinson – Site area is mostly agricultural but is surrounded by rural and low-density residential development – 1
4. Fargo – Agriculture – 3

5. Glenham – Agriculture – 3
6. Utica Junction – Agriculture – 3

4.3.3 Protected Species Impacts

Actual impacts to a threatened, endangered or otherwise protected species would be considered very serious and probably represent a fatal flaw to site development; however, such impacts are not likely at any of the candidate sites so this criterion was assigned a low relative weighting. Potential impacts to protected species of plants and animals were estimated from county-wide information on species occurrence obtained from the USFWS and review of the habitat available at each candidate site. The scores for this criterion were then assigned based on a qualitative assessment of potential impacts.

The scores assigned for this criterion and basis for these scores are listed below:

1. Big Stone – Potential protected species impacts are very small because of existing disturbance – 5
2. Coyote – Potential protected species impacts are very small because of existing disturbance – 5
3. Dickinson – There are relatively more trees and water bodies near this site that may be attractive to bald eagles but there is also residential development in these same areas – 3
4. Fargo – There are no trees or water bodies at or near this site that would attract bald eagles – 4
5. Glenham – Potential impacts to terrestrial protected species is low because the site area is used for agriculture. Though low, the potential for impacts to protected species may be highest in the vicinity of a water supply intake on Lake Oahe – 3
6. Utica Junction – Potential impacts to terrestrial protected species is low because the site area is used for agriculture. Though low, the potential for impacts to protected species may be highest in the vicinity of a water supply intake on Lewis and Clark Lake – 3

4.3.4 Noise Impacts

There are a number of factors that will determine whether the noise from construction or operation of the proposed generating station will significantly impact any sensitive receptors in the vicinity but the number of such receptors close by is one variable that can be easily measured. The ratings for this criterion were assigned based on an estimate of the number of sensitive receptors within one mile of each site area using the scoring criteria listed below:

- Number of receptors $\leq$ 5 $\rightarrow$ Score = 5
- 5 < Number of receptors $\leq$ 10 $\rightarrow$ Score = 4

- 10 < Number of receptors ≤ 15 → Score = 3
- 15 < Number of receptors ≤ 20 → Score = 2
- Number of receptors > 20 → Score = 1

The number of receptors (residences) within one mile of each candidate site are listed below along with the associated scores for this criterion:

1. Big Stone – 4 residences – 5
2. Coyote – 1 residence – 5
3. Dickinson – 45 residences – 1
4. Fargo – 6 residences – 4
5. Glenham – 3 residences – 5
6. Utica Junction – 13 residences – 3

4.3.5 Wetlands

Wetlands are a protected resource and any impacts to wetlands must generally be mitigated by creation of a like or greater amount of wetlands at a nearby location. Wetland permitting is administered by the U.S. Army Corps of Engineers (Corps) under Section 404 of the Clean Water Act. The criteria used by the Corps to delineate wetlands is different from that used by USFWS in creation of the NWI maps; therefore the wetland acreages listed in Chapter 3 and below for each site, which are based on NWI maps, may not be indicative of the amounts of wetland that would be subject to 404 permitting. Also, the candidate sites are large enough that small wetlands can often be avoided during plant development so the amount of wetland impacts will generally be much less than the total wetlands at each site. For simplicity, the potential for wetland impacts at each site was assumed to be proportional to the total acreage of NWI wetlands located within each site. The rating criteria used to assign scores for the Wetlands criterion are detailed below:

- Wetlands ≤ 5 acres → Score = 5
- 5 acres < Wetlands ≤ 25 acres → Score = 4
- 25 acres < Wetlands ≤ 50 acres → Score = 3
- 50 acres < Wetlands ≤ 75 acres → Score = 2
- Wetlands > 75 acres → Score = 1

The amount of wetlands on each candidate site is listed below along with the associated scores for this criterion:

1. Big Stone – 36.1 acres (excludes cooling ponds) – 3
2. Coyote – 23.7 acres – 4
3. Dickinson – 82.7 acres – 1
4. Fargo – None – 5
5. Glenham – 24.6 acres – 4
6. Utica Junction – 65.2 acres – 2

4.4 FUEL SUPPLY CRITERIA

The Fuel Supply category, which was assigned a total weight of 20 percent, is comprised of three component evaluation criteria. These criteria are described in the following paragraphs.

4.4.1 Rail Line/Mine Proximity

With the exception of the Coyote site, rail is the only practicable delivery mode for coal. Therefore, the distance to the nearest rail line was used as an evaluation criterion using the scoring criteria listed below:

- Existing on-site rail spur → Score = 5
- Distance ≤ 1 mile → Score = 4
- 1 mile < Distance ≤ 2 miles → Score = 3
- 2 miles < Distance ≤ 3 miles → Score = 2
- Distance > 3 miles → Score = 1

The estimated length of a rail spur from the railroad mainline to the site is listed below along with the associated scores for this criterion:

1. Big Stone – Rail spur on site – 5
2. Coyote – Mine-mouth plant with rail spur also on site – 5
3. Dickinson – Adjacent – 4
4. Fargo – 2.5 miles – 2
5. Glenham – 4 miles – 1
6. Utica Junction – 2 miles – 3

4.4.2 Fuel Delivery Competition

In order to secure the most competitive delivery rates for coal, it is advantageous to locate a generating station where it can be served by more than one rail carrier or multiple delivery modes. The scores for this criterion were assigned based on the distance from the site to the second closest delivery option. Sites with multiple delivery modes or a second rail carrier within a mile were assigned a score of five for this criterion. If a site has a second rail carrier located within a reasonable distance, defined as not more than 10 miles, it was rated three for this criterion and all other sites were assigned a score of one.

The potential for delivery competition is discussed and the associated scores are listed below for each site:

1. Big Stone – BNSF is only rail carrier within reasonable distance – 1
2. Coyote – Mine-mouth plant with existing spur for potential rail delivery – 5
3. Dickinson – Alternate rail carrier (BNSF) within four miles of site – 3
4. Fargo – BNSF is only rail carrier within reasonable distance – 1
5. Glenham – BNSF is only rail carrier within reasonable distance – 1
6. Utica Junction – BNSF is only rail carrier within reasonable distance – 1

4.4.3 Reagent Delivery

A FGD system will be included as a component of any coal-fired power plant built by the Participants. This FGD system will use either lime or limestone as a reagent. The scores for this criterion were based on the delivery distance from a known source of lime to the site, using the rating criteria listed below:

- Distance $\leq$ 150 miles $\rightarrow$ Score = 5
- 150 miles < Distance $\leq$ 200 miles $\rightarrow$ Score = 4
- 200 miles < Distance $\leq$ 250 miles $\rightarrow$ Score = 3
- 250 miles < Distance $\leq$ 300 miles $\rightarrow$ Score = 2
- Distance > 300 miles $\rightarrow$ Score = 1

The distance to the nearest lime supplier is listed below for each candidate site along with the associated score for this criterion:

1. Big Stone – 266 miles – 2
2. Coyote – 291 miles – 2
3. Dickinson – 164 miles – 4

4. Fargo – 250 miles – 3
5. Glenham – 246 miles – 3
6. Utica Junction – 335 miles – 1

4.5 ELECTRIC TRANSMISSION CRITERIA

The Electric Transmission category, which was assigned a total weight of 20 percent, is comprised of two component evaluation criteria. These criteria are described in the following paragraphs.

4.5.1 Proximity to Interconnection Point

It has been assumed that the proposed generating unit would be connected to the regional transmission grid at the nearest existing substation. Therefore, the distance to these probable interconnection points is an important evaluation criterion. The candidate site areas were rated for this criterion using the scoring criteria listed below:

- Distance ≤ 1 mile → Score = 5
- 1 mile < Distance ≤ 4 miles → Score = 4
- 4 miles < Distance ≤ 7 miles → Score = 3
- 7 miles < Distance ≤ 10 miles → Score = 2
- Distance > 10 miles → Score = 1

The distance to the probable interconnection point is listed below for each candidate site along with the associated score for this criterion:

1. Big Stone – On-site substation – 5
2. Coyote – On-site substation – 5
3. Dickinson – Adjacent to Dickinson substation – 5
4. Fargo – 7.5 miles from Fargo substation – 2
5. Glenham – 4 miles from Glenham substation – 4
6. Utica Junction – Utica Junction switching station on site – 5

4.5.2 Transmission System Upgrades

The transmission system assessments developed for this study represent high-level qualitative assessments based on the professional experience of OTP's transmission planning staff. From these assessments, a relative score for each site was developed. A brief discussion of the transmission situation at each candidate site and resulting scores are shown below:

1. Big Stone – Existing power plant with adequate transmission capacity during system intact conditions. Installation of additional generation at this site may help dampen large power swings during transient events. New transmission would be needed to accommodate a second generating unit at this site. – 4
2. Coyote – Transmission export capacity from North Dakota coal fields is limited at present and location of additional generation in this area would exacerbate current stability problems. Large-scale transmission additions would be required to alleviate existing system constraints and provide for enough outlet capability for a new generator at this site. – 1
3. Dickinson – Existing transmission system is currently at its limit. New transmission will be needed to outlet the power of a new generator. Transient stability performance in the local area may be an issue with other generators in close proximity to the existing substation – 3
4. Fargo – Electrically similar to Big Stone plant but would be located within higher load density area. Existing transmission system is congested, which may require addition of a new 345-kV transmission line into the northern end of the Twin Cities to handle increased easterly flow from a new generator at this site. – 4
5. Glenham – This site is electrically close to the North Dakota coal fields and transient stability concerns would likely be similar to those discussed above for the Coyote site. New transmission would be required to alleviate transient stability and steady-state thermal issues. – 2
6. Utica Junction – This site has existing transmission facilities that should be adequate for a new generator. The proximity of large load centers in the area should not degrade transient stability performance especially because transient stability issues are not as prevalent in the southern MAPP area. – 5

4.6 OTHER EVALUATION CRITERIA

The Other category, which was assigned a total weight of 10 percent, is comprised of three component evaluation criteria. These criteria are described in the following paragraphs.

4.6.1 Highway Access

The proposed generating station will require access to all-weather roads for access by construction and operating personnel, and for delivery of equipment and supplies. Some of the equipment components of the proposed generating units will be large and/or heavy. For the largest and heaviest components, rail delivery is preferred. However, for many components truck delivery may be the most practical. Therefore, the ratings for this criterion were based on the distance to a major highway, which is defined as either a U.S. or interstate highway. The rating criteria for the Highway Access criterion are listed below:

- Distance ≤ 2 mile → Score = 5
- 2 mile < Distance ≤ 5 miles → Score = 4
- 5 miles < Distance ≤ 10 miles → Score = 3
- 10 miles < Distance ≤ 15 miles → Score = 2
- Distance > 15 miles → Score = 1

The distance to the nearest U.S. or interstate highway is listed below for each candidate site along with the associated score for this criterion:

1. Big Stone – U.S. 12, 2 miles – 5
2. Coyote – Interstate 94, 25 miles – 1
3. Dickinson – U.S. 12, 4 miles – 4
4. Fargo – Interstate 94, 6 miles – 3
5. Glenham – U.S. 12, 5 miles – 4
6. Utica Junction – U.S. 81, 10 miles – 3

4.6.2 Land Availability

The Land Availability criterion was assigned based on the amount of land included in each site area, as designated on the maps included in Chapter 3. The goal in defining these site areas was to identify an area approximately one square mile (640 acres) in size unless a site's size was limited by incompatible land uses or topography. Sites containing at least 600 acres were rated five for this criterion. Sites with between 300 and 600 acres were rated three. The amount of land in each designated site area and resulting scores are listed below:

1. Big Stone – 1,514 acres – 5
2. Coyote – 1,475 acres – 5
3. Dickinson – 357 acres – 3
4. Fargo – 631 acres – 5
5. Glenham – 638 acres – 5
6. Utica Junction – 628 acres – 5

4.6.3 Common Facilities

Location of a new generating unit adjacent to an existing facility has the potential to allow sharing of common facilities and operations staff. Common facilities may include fuel and reagent handling and storage; water supply and treatment; solid waste and wastewater treatment, handling and disposal; administrative offices; maintenance shops; and spare parts and supplies warehouses. For this criterion, sites located at existing power plants were rated five and all other sites were rated one for this criterion. These ratings are summarized below:

1. Big Stone – Existing power plant – 5
2. Coyote – Existing power plant – 5
3. Dickinson – Greenfield site – 1
4. Fargo – Greenfield site – 1
5. Glenham – Greenfield site – 1
6. Utica Junction – Greenfield site – 1

4.7 EVALUATION SUMMARY

The individual scores for each candidate site and criterion are summarized in Table 4-2. These scores were used along with the corresponding weights to calculate a weighted composite score for each site. These composite scores are calculated as the sum of the products of each individual score and criterion weight. Composite scores were developed for a base case and for several sensitivity analyses.

To further illustrate how the composite scores are calculated, the Big Stone site is used as an example. This site received a score of five for the Proximity to Class I Area criterion, which has a weight of 10.71% (for the base case). Multiplying these two values gives a product of 53.55. For the Potential Airspace Restrictions, the site score, weight and their product are respectively 3, 4.29% and 12.87. A similar calculation is then made for each of the 15 remaining criteria. The 17 score-weight products that result are then summed yielding a total composite score for the Big Stone site of 397.7.

4.7.1 Base Case

For the base case, the weighted composite scores for each site were calculated using the base weights for each major evaluation category (Table 4-1). In the collective judgment of the project team, these base category weights represent an appropriate balance between these factors. All of the individual criterion scores and composite weights for the base case are summarized in Table 4-2. Because the individual criterion scores range from one to five and the criteria weights total 100 percent, the minimum possible

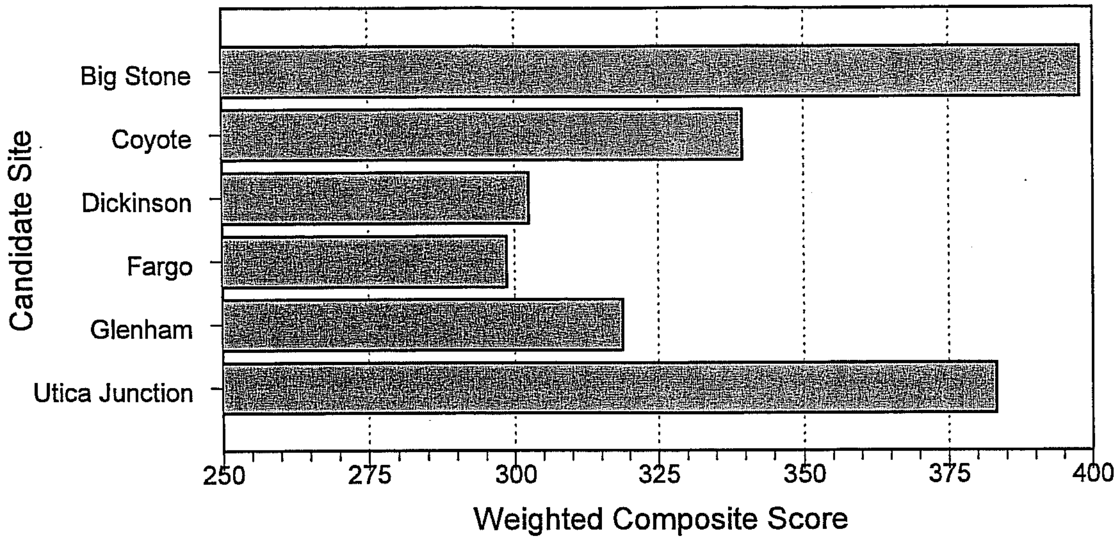
Table 4-2: Candidate Site Evaluation Summary

Major Category/Criterion	Weight	Big Stone	Coyote	Dickinson	Fargo	Glenham	Utica Junction
Air Impacts	**15%**						
Proximity to Class I Area	10.71%	5	2	4	5	3	5
Potential Airspace Restrictions	4.29%	3	1	2	1	5	5
Water Supply	**20%**						
Surface Water Proximity	5.71%	5	1	3	3	5	3
Surface Water Supply Potential	14.29%	3	5	3	1	5	5
Environmental	**15%**						
Socioeconomics	2.22%	1	3	5	5	2	2
Land Use Compatibility	3.33%	5	5	1	3	3	3
Protected Species Impacts	1.11%	5	5	3	4	3	3
Noise Impacts	5.56%	5	5	1	4	5	3
Wetlands	2.78%	3	4	1	5	4	2
Fuel Supply	**20%**						
Rail Line/Mine Proximity	11.11%	5	5	4	2	1	3
Fuel Delivery Competition	6.67%	1	5	3	1	1	1
Reagent Delivery	2.22%	2	2	4	3	3	1
Electric Transmission	**20%**						
Proximity to Interconnection Point	2.67%	5	5	5	2	4	5
Expected System Impacts	17.33%	4	1	3	4	2	5
Other	**10%**						
Highway Access	1.25%	5	1	4	3	4	3
Land Availability	6.25%	5	5	3	5	5	5
Common Facilities/Staff	2.50%	5	5	1	1	1	1
Weighted Total Score	**100%**	**397.7**	**339.6**	**302.5**	**298.7**	**318.8**	**383.3**

composite score is 100 and the maximum possible composite score is 500. Figure 4-1 is a graphical presentation of the composite scores for the base case.

Review of Figure 4-1 and Table 4-2 shows that the base composite evaluation scores range from a low of 298.7 for the Fargo site area to a high of 397.7 for the Big Stone site area. The average and median scores are respectively 340.1 and 329.2. These composite evaluation scores should not be used as an absolute measure of each site's suitability for the proposed baseload generating station but can be used as an effective tool for screening and ranking.

Figure 4-1: Candidate Site Evaluation Scores for Base Case



4.7.2 Sensitivity Analyses

Once the base evaluation was completed, a number of sensitivity analyses were performed to test the sensitivity of the composite evaluation scores to changes in criteria weighting. For these sensitivity analyses, only the weights assigned to the six major evaluation categories were adjusted. The subweights for the criteria within their respective categories and the individual scores assigned to the sites for each criterion were not changed. Six different sensitivity cases were executed, one for each of the major evaluation categories. Within each of these sensitivity cases, the base category weight for the category being emphasized was doubled and the weights for each of the remaining five categories were lowered so the sum of all the category weights still totaled 100 percent. For example, in the sensitivity case that emphasizes air issues, the weight for the Air Impacts category was doubled from 15 to 30 percent. To balance out this increase of 15 percentage points, 3 percent (15 percent / 5) was then subtracted from the weights for each of the remaining five categories. Table 4-3 contains a schedule of the category weights used in the sensitivity analyses.

The results of the sensitivity analyses were summarized by comparing each site's ranking under the various cases. A site's rank is determined by sorting the sites based on their composite evaluation scores and then numbering them sequentially, with a rank of one assigned to the site with the highest score. These ranks are summarized in Table 4-4. In this table, the sites are listed in order of their ranking under the base case, with the Big Stone site listed first and the Fargo site last. The shaded cells in this table

Table 4-3: Category Weights for Sensitivity Analyses (percent)

Major Category	Base Case	Sensitivity Case Emphasis Area					
		Air	Water	Environ-mental	Fuel	Trans-mission	Other
Air Impacts	15	30	11	12	11	11	13
Water Supply	20	17	40	17	16	16	18
Site Environmental	15	12	11	30	11	11	13
Fuel Supply	20	17	16	17	40	16	18
Transmission	20	17	16	17	16	40	18
Other	10	7	6	7	6	6	20

Table 4-4: Candidate Site Rankings for Sensitivity Analyses

Site	Base Case	Sensitivity Analysis Emphasis Area						Average Rank
		Air	Water	Environ-mental	Fuel	Trans-mission	Other	
Big Stone	1	2	2	1	1	2	1	1.43
Utica Junction	2	1	1	2	3	1	2	1.71
Coyote	3	6	4	3	2	6	3	3.86
Glenham	4	3	3	4	5	5	4	4.00
Dickinson	5	5	5	6	4	4	6	5.00
Fargo	6	4	6	5	6	3	5	5.00

indicate those instances where the ranking changed by two or more places from the base case. Two was selected because it represents a third of the sites.

Review of Table 4-4 shows that the Big Stone site maintains its top base ranking for three of the six sensitivity cases, finishing second for the other three cases. The second-ranked Utica Junction site moves into first place for three categories — Air, Water and Transmission — but falls to third for the Fuel sensitivity case. The relative ranking for the other four sites tend to be more volatile.

The average ranks shown in Table 4-4 were calculated from the rankings for the base case and all six sensitivity cases. These average rankings are consistent with the base rankings for each site except that the two lowest-ranked sites, Dickinson and Fargo, have the same average ranking. The shaded cells in the table show those sites whose rankings changed by two or more positions from the base case as a result of

5.0 SELECTION OF PREFERRED AND ALTERNATE SITE AREAS

5.0 SELECTION OF PREFERRED AND ALTERNATE SITE AREAS

This report chapter discusses the selection of the preferred site and alternate sites for the proposed 600-MW generating unit. This discussion relies on the evaluations completed in Chapter 4 plus consideration of other intangible and strategic factors. In the following sections, the relative strengths and weaknesses of each candidate site are discussed followed by identification of the preferred site and alternate sites for this project.

5.1 BIG STONE SITE AREA

The principal advantage of the Big Stone site is that it is located at an existing power plant. During the original design of this plant, it was laid out to accommodate a second generating unit and some of the existing facilities, such as coal handling, are already sized for this additional unit. For the base case, the Big Stone site received the highest evaluation score by a fair margin and maintained this number one ranking for three of the six sensitivity cases. For the other three sensitivity cases, this site was ranked second and has an average ranking of 1.43.

5.2 COYOTE SITE AREA

Like Big Stone, the Coyote site area is located at an existing power plant that was initially designed to accommodate a second generating unit; however, this site has a couple of distinct disadvantages that are not present at Big Stone. These disadvantages relate to air quality and transmission.

The Coyote Plant is located only about 73 miles from the north and south units of Theodore Roosevelt National Park, a Class I PSD area. Another Class I area, Lostwood National Wildlife Refuge is located approximately 94 miles away. At all of the other candidate sites, the nearest Class I area is located at least twice as far away, between 147 and 221 miles. In the vicinity of the Coyote Plant, there are also six other lignite-fired power plants. The close proximity of these existing emissions sources and Class I areas will make permitting a new generating unit at the Coyote site very challenging. With existing PSD increments largely consumed, it may be necessary to create emissions offsets to permit a new source. This could require that additional emissions controls be installed on the existing Coyote unit or other nearby generating units.

The other significant concern at this site is transmission capacity. The existing transmission system does not have capacity to accommodate additional power exports out of the North Dakota lignite mining area.

Upgrading this system to allow location of another 600 MW of generation in this same area would be very expensive.

The Coyote site received a base evaluation score of 339.6, giving it a third place ranking. For the sensitivity analyses, this site's ranking ranged from second (Fuel) to sixty (Air and Transmission) and averaged 3.86. Although these rankings place the Coyote site near the middle of the six candidate sites, the air quality and transmission issues discussed above are serious flaws that justify eliminating this site from further consideration at this time.

5.3 DICKINSON SITE AREA

The Dickinson site area is the fifth-ranked site under the base case and its ranking ranges from fourth to sixth under the various sensitivity cases, with an average ranking of 5.00. The principal advantage of this site is that it is located in the eastern portion of the study area where construction of additional generation may help alleviate existing transmission congestion, offsetting the predominate flow of power from west to east; however, construction of new transmission lines would still be necessary to accommodate a new generator at this site.

While the location of this site area has some advantages from a transmission perspective, it is a problem when considering potential public impacts. The Dickinson site area is located less than 25 miles outside of the Twin Cities metropolitan area and the predominate land use of the surrounding area is rural residential. Population densities near this site are easily the highest of any of the six candidate sites, which makes the potential for significant public opposition to power plant development or transmission line construction here rather high. The generally high population density in the area also reduces any flexibility in site location. Because of concerns about intense public opposition, it is recommended that this site not be considered further.

5.4 FARGO SITE AREA

This site area is located in a rural agricultural area outside of Fargo. The evaluation scores for this site area consistently rank it in the lower half of all six candidate sites for the base case and sensitivity cases. The chief disadvantage of this site is its water supply potential. The presumed water source for this site is the Red River. The flows in this river are less than the specified criterion (7Q10 > 166 cfs) and there is likely to be significant competition for this supply source. The Red River serves as the principal water source for several downstream cities, including Fargo, Grand Forks and Winnipeg, Manitoba. Because of its low evaluation scores and questionable water supply potential, this site should be eliminated from further consideration.

5.5 GLENHAM SITE AREA

The Glenham site area is located in north-central South Dakota near the Missouri River. As such, it has an excellent water supply potential. The sparse population of the area also reduces the potential for impacts to neighbors at this site. The chief concern at this site is transmission capacity. Electrically, this site is relatively close to the lignite fields of North Dakota and the existing transmission constraints in this region.

For the base case, the Glenham site area was ranked fourth. These rankings ranged from third to fifth for the various sensitivity cases and averaged 4.00.

5.6 UTICA JUNCTION SITE AREA

Like the previous site, the Utica Junction site area is located near the Missouri River and has an excellent water supply potential. In fact, these two South Dakota sites share many similarities but transmission capacity is much less of a concern at this site.

The Utica Junction site area is ranked second under the base case and from first to third for the various sensitivity cases. The average ranking of this site was 1.73.

5.7 FINAL SITE RANKING

Based on evaluation scores and the other factors discussed above, it is recommended that three of the six candidate site areas be dropped from further consideration at this time. These less-attractive site areas are Coyote, Dickinson and Fargo. Of the remaining three sites, the Big Stone site is consistently ranked at or near the top and is therefore identified as the preferred location for the proposed generating unit. The other two site areas, Glenham and Utica Junction, share many similarities but the Utica Junction site ranks higher than Glenham for the base case and all of the six sensitivity cases. Therefore, Utica Junction is identified as the first alternate location and Glenham as the second alternate site.

* * * * *

6.0 CONCLUSIONS

6.0 CONCLUSIONS

This chapter presents the conclusions reached as a result of the investigations and evaluations conducted during this study. For convenience, these conclusions are organized by their primary subject matter.

6.1 GENERAL

- Subject to the limitations that may be imposed by regulatory and permitting agencies, there are sites available within the project study area that can accommodate the development of the proposed baseload generating unit.

6.2 ENVIRONMENTAL

- There are no designated nonattainment areas within the project study area so all of the six candidate site areas are located in counties that are in attainment for all criteria pollutants.
- In the western portions of North and South Dakota and in northern Minnesota there are several national parks, national wildlife refuges, and wilderness areas that are designated Class I. Construction of the proposed generating unit in or near these regions would be problematic from an air emission permitting perspective. Further development at the Coyote site area would be most directly affected by Class I area issues.
- Although there are reported occurrences of threatened, endangered or otherwise protected species in the vicinity of all of the candidate site areas, actual impacts to any protected species from plant development are unlikely given the type of habitat available at these sites.
- There is a potential that plant development could result in wetland impacts at each of the candidate sites. These potentials are smallest at the Fargo site area and highest for the Dickinson site. However, any wetland impacts that cannot be avoided can usually be successfully mitigated so wetland issues should not be a significant impediment to plant development.
- Cultural resources have not been specifically evaluated in this study because on-site surveys are generally required to assess impact potentials; however, there is nearly always some potential that cultural resource sites could be encountered. The potentials for adverse impacts to cultural resources are lowest at the Big Stone and Coyote sites which have already been disturbed by power plant development. Each of the other four candidate sites has been disturbed by agricultural practices so the potentials for significant cultural resources impacts at these sites are considered to be only moderate.

6.3 ELECTRIC TRANSMISSION

- Each of the six candidate sites is located in relative close proximity to existing high-voltage transmission facilities. However, some of these existing facilities will require substantial upgrades in order to transmit an additional 600 MW of power from the proposed generating unit.
- The ability of the existing transmission system to accommodate the proposed generating unit is generally best in the eastern portion of the study region and worst in the west.

6.4 WATER SUPPLY

- Groundwater development potentials vary considerably across the project study area; however, regardless of the development potential, groundwater usage generally exceeds natural recharge so water levels are declining in most areas. For this reason, development of a groundwater supply to serve the proposed generating unit is not considered to be very feasible. A groundwater source may however be developed to supply low-volume plant needs or to supplement surface sources during occasional dry periods.
- A surface water source is considered to be the most viable water supply for the proposed generating unit. Only the largest rivers located within the study region, the Missouri and Mississippi rivers, are likely to have sufficient flows to supply this generating unit without development of a large reservoir to provide carryover storage. Therefore, the best sites from a water supply perspective are Coyote, Dickinson, Glenham, and Utica Junction.

6.5 FUEL SUPPLY

- The Coyote site area is the only candidate site located within the North Dakota lignite mining area where it is practical to deliver coal by truck. At the five other candidate sites, rail is the only practical delivery mode for coal. Each of these sites is located in relatively close proximity to an active rail line.
- Only one of the candidate sites, Dickinson, is located relatively close to a rail line operated by a second, competing rail carrier. The presence of competing carriers can help reduce coal delivery costs.

6.6 PREFERRED AND ALTERNATE SITE AREAS

- The Coyote site area is not considered to be a good candidate for location of the proposed generating unit because of transmission capacity limitations and potential air permitting concerns.

- The high population density in the vicinity of the Dickinson site, and corresponding potential for significant public opposition, is the primary reason this site is not recommended for continued consideration.
- The Fargo site area was ranked consistently as one of the least attractive of the six candidate sites, largely because of its limited water supply potential. In comparison to the other candidate sites, the Fargo site is not considered to be a good development option.
- Through the investigations conducted in this study, the Big Stone site area was determined to be the best choice for location of the proposed generating unit so the Big Stone site should be designated the preferred site for this new generating unit. In order of preference, the Utica Junction and Glenham site areas are designated alternate sites.

* * * * *

7.0 References

7.0 REFERENCES

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Exhibit B

Supplement to the June 2002 Evaluation of Water Supply for Increased Power Generation
Barr Engineering Co.
March 2005

Supplement to the June 2002 Evaluation of Water Supply for Increased Power Generation

Big Stone Power Plant
Otter Tail Power Company

March 2005

BARR

Supplement to the June 2002 Evaluation of Water Supply for Increased Power Generation
Big Stone Power Plant
Otter Tail Power Company
March 2005

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Summary

Otter Tail Power Company previously commissioned Barr to develop a simulation model of water supply at the Big Stone Power Plant. This work is described in the report entitled "Evaluation of Water Supply for Increased Power Generation (June 2002)." This report describes additional work that has been completed, using the model to address two remaining questions pertaining to a 12,000 acre-ft/year consumption rate.

1. What is the likelihood of a dry week in the water storage pond under several different water storage pond capacities at the 12,000 acre-ft/year level of consumption?

   Although a statistical approach to this question was not possible, looking at the number of times a hypothetical water storage pond would go dry (for a period up to one week) under climatological and water usage conditions observed during the last several decades lends some insight into this question.

   In summary, if the historical climatological and water usage record from 1930 to 2000 is used in the model, a 38,000 acre-ft water storage pond would be required if all dry pond weeks are to be avoided. If the drought of the 1930s is excluded from the historical record, a 16,000 acre-ft water storage pond would be required if all dry pond weeks are to be avoided. Other water storage pond volumes were also evaluated with the model (9,000, 12,000, 20,000 and 25,000 acre-ft).

2. What is the duration and seasonality of the dry pond weeks under several different water storage pond capacities at the 12,000 acre-ft/year level of consumption?

   The duration of the dry pond weeks varies from 0 (no dry pond weeks) to 2.3 years (120 dry pond weeks), depending on the capacity of the water storage pond and whether or not the 1930s are included in the analysis. It is important to note the magnitude of these dry periods when evaluating the performance of each water storage pond.

   Whether or not the 1930s drought data is included, the seasonality of the dry pond weeks is the same. Dry pond weeks are least prevalent in the spring, and are most prevalent in September and during the winter months (December, January, February and March).

Background

Otter Tail Power Company previously commissioned Barr to develop a simulation model of water supply at the Big Stone Power Plant. This model works on quarter-monthly (weekly) time steps and simulates the operation of the Big Stone dam and the Big Stone water storage ponds. It appears to have simulated lake levels well and produces results that appear reliable. However, the model results have raised additional questions that need to be addressed, especially in light of Otter Tail Power Company's evaluation of an expansion of the plant that would result in a significant increase in consumptive water use.

Current annual consumptive use at the Big Stone plant is approximately 4,200 acre-ft. Otter Tail Power is proposing a plant expansion that is projected to increase consumptive use to 12,000 acre-ft per year (285 percent of the current use). Six different water storage pond capacities, from 9,000 acre-ft to 38,000 acre-ft, were evaluated in this study, to determine the frequency of dry pond weeks using a 70-year period of climatological and water usage record.

A dry pond week is defined as a seven- to eight-day interval during which the water storage pond is completely drained of water. In reality, these dry stretches may be shorter than seven or eight days; however, this is the shortest interval that can be tracked by the current version of the model.

Pond Storage Modeling

Figures 1 through 6 show the storage level in each hypothetical water storage pond over time, using the 70 years of climatological and water usage data. In these figures, pond storage is plotted on a weekly time step. When the water in the storage pond dips to zero, the pond is dry.

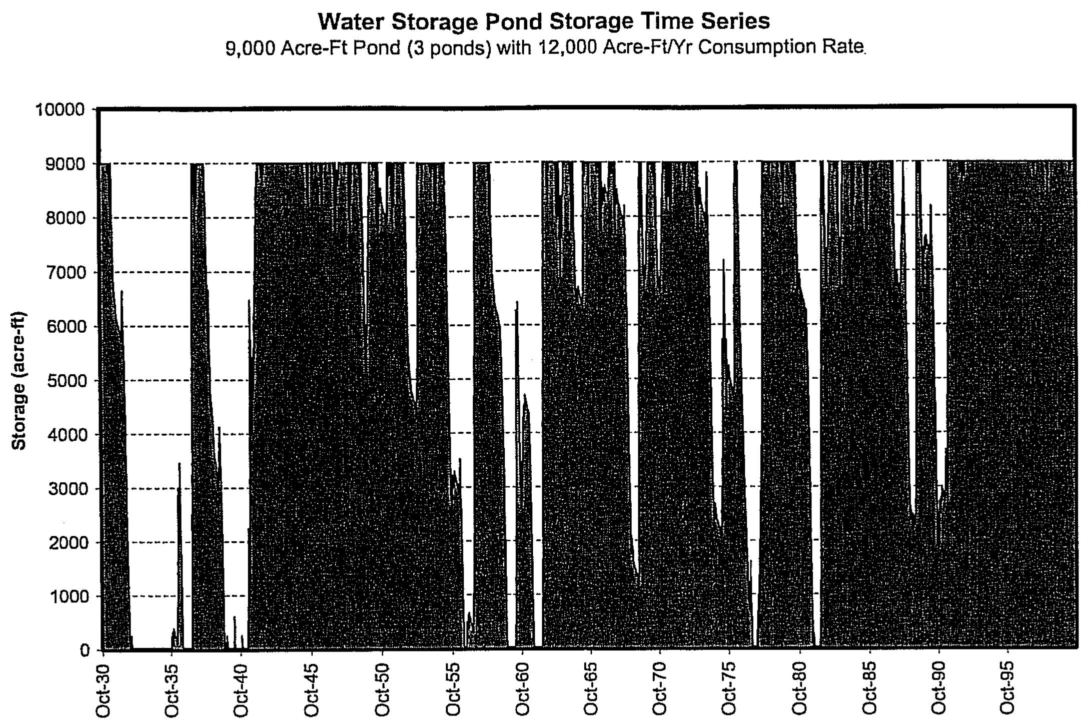

Figure 1: Water Storage Pond Storage Time Series: 9,000 Acre-Ft Pond with 12,000 Acre-Ft/Yr Consumption Rate

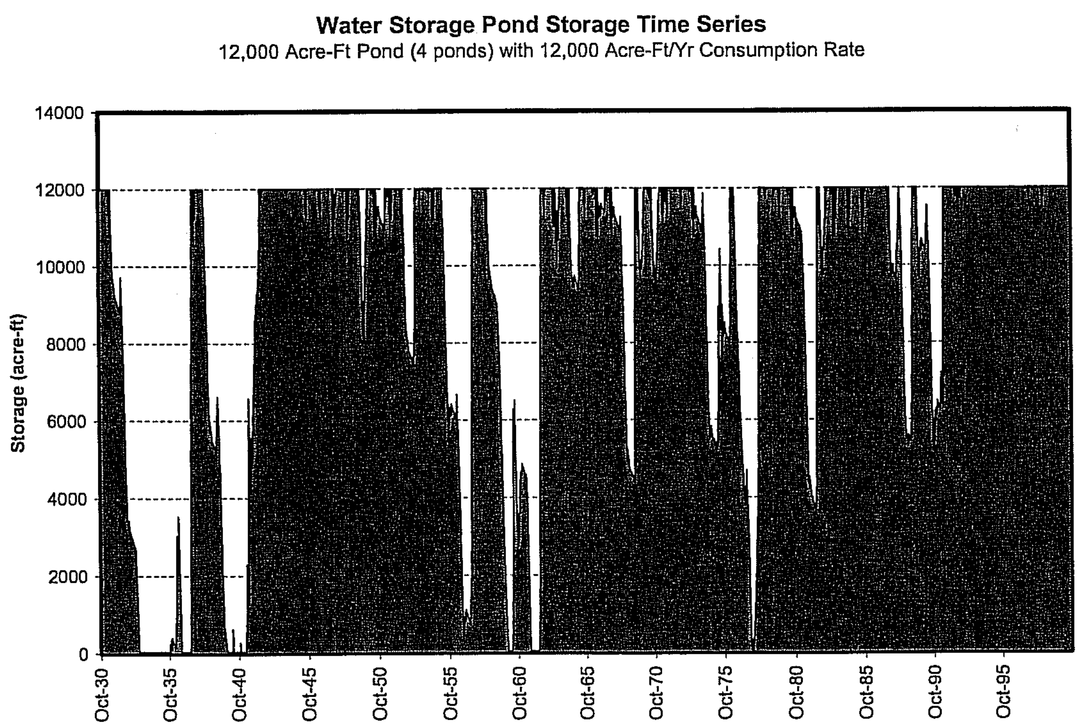

Figure 2: Water Storage Pond Storage Time Series: 12,000 Acre-Ft Pond with 12,000 Acre-Ft/Yr Consumption Rate

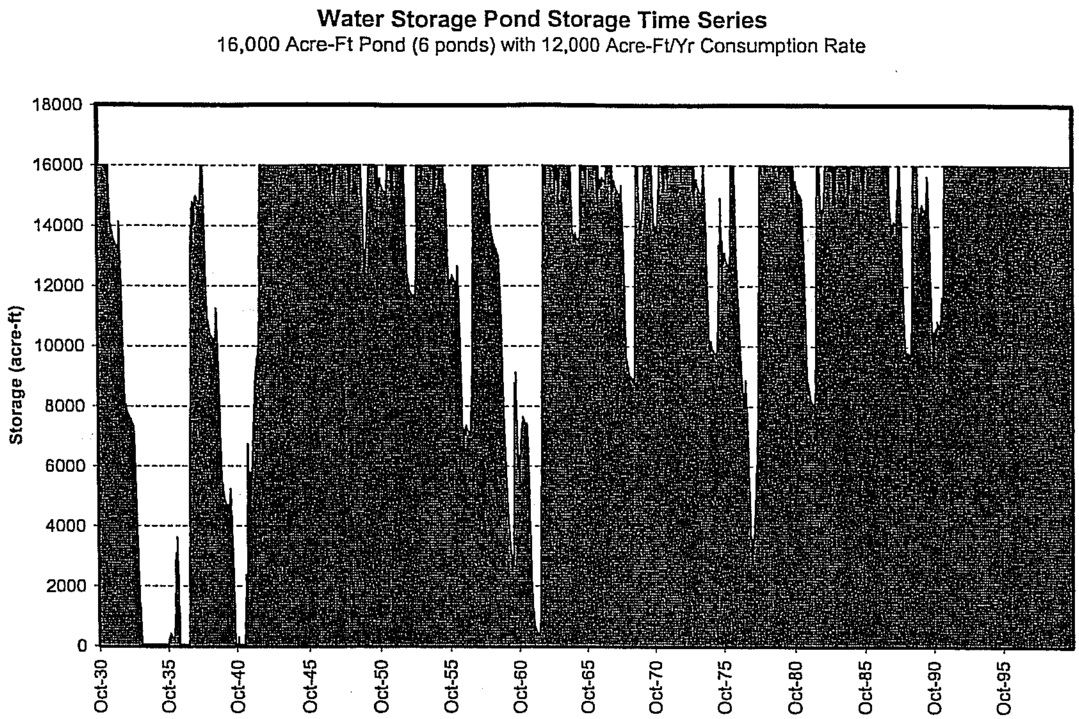

Figure 3: Water Storage Pond Storage Time Series: 16,000 Acre-Ft Pond with 12,000 Acre-Ft/Yr Consumption Rate

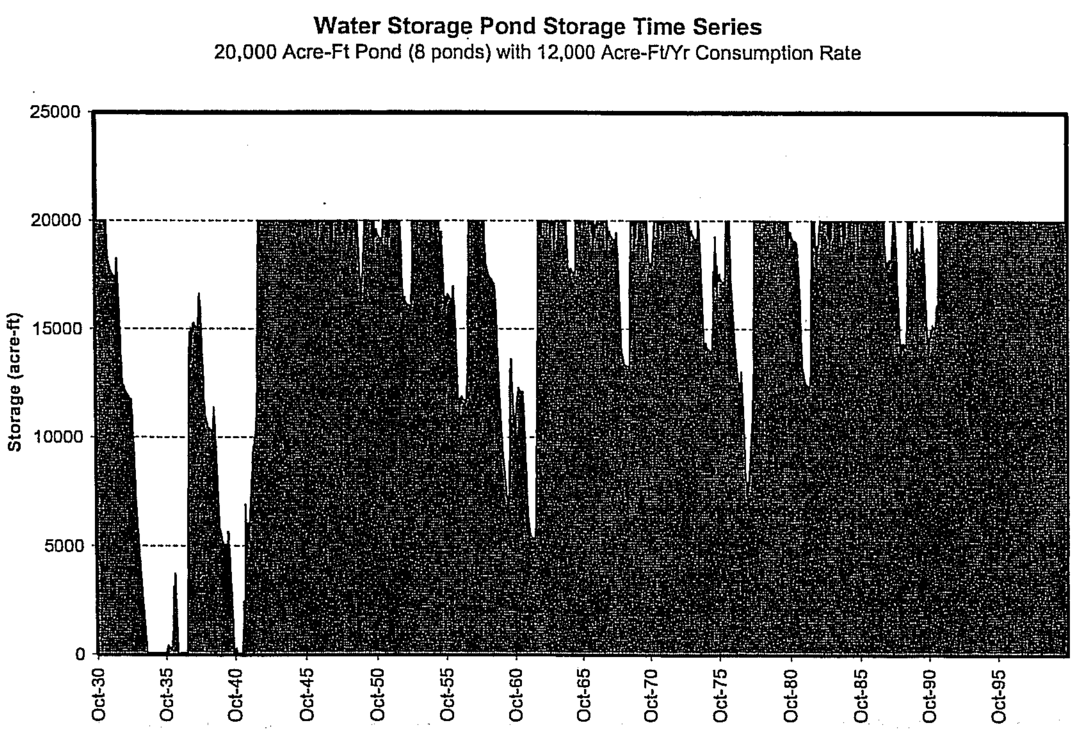

Figure 4: Water Storage Pond Storage Time Series: 20,000 Acre-Ft Pond with 12,000 Acre-Ft/Yr Consumption Rate

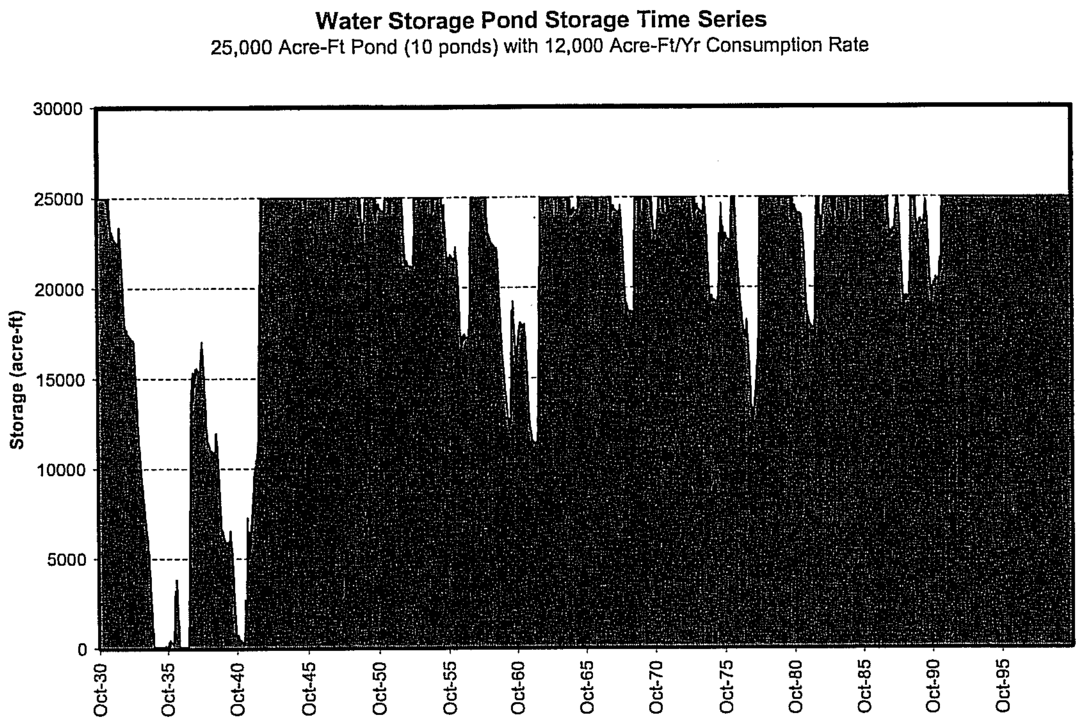

Figure 5: Water Storage Pond Storage Time Series: 25,000 Acre-Ft Pond with 12,000 Acre-Ft/Yr Consumption Rate

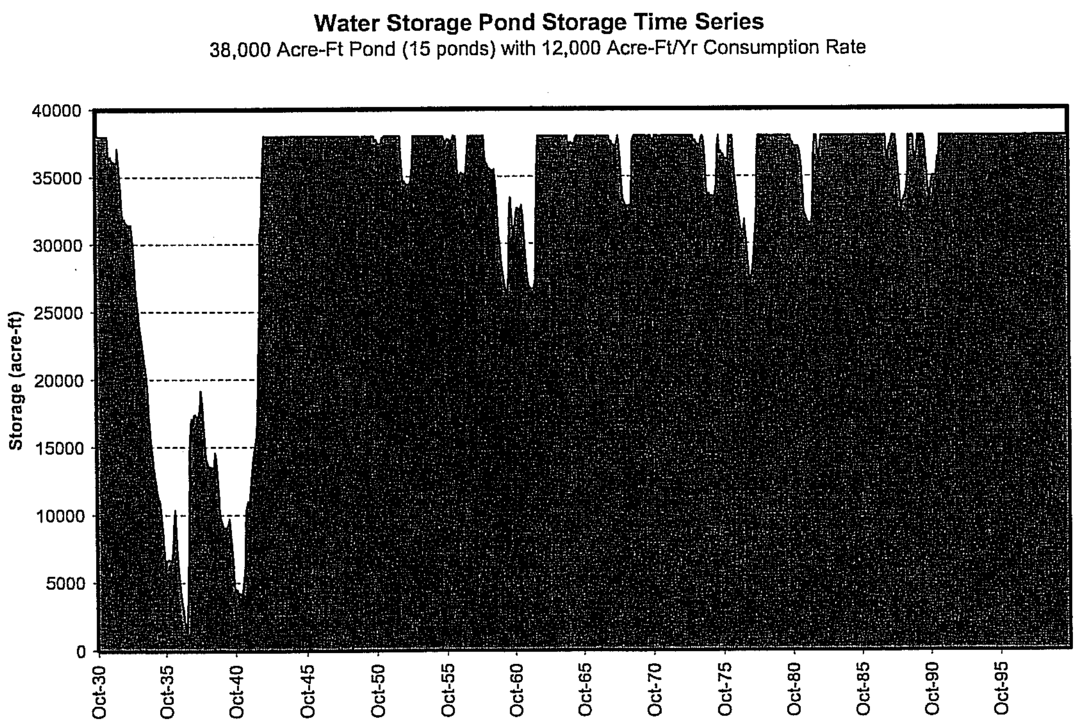

Figure 6: Water Storage Pond Storage Time Series: 38,000 Acre-Ft Pond with 12,000 Acre-Ft/Yr Consumption Rate

If the 1930s climatological and water usage data is included in the model, only the largest pond capacity (38,000 acre-ft) can support the 12,000 acre-foot level of consumption all of the time. However, if the 1930s data is excluded, a 16,000 acre-foot pond is large enough to support the 12,000 acre-foot level of consumption.

Table 1 compares the water storage pond capacities required for the 12,000 acre-ft annual consumptive use to those required for other levels of consumption. This information is presented graphically on Figure 7.

Table 1: Required Water Storage Pond Capacity for Different Annual Consumptive Use Levels

Annual Consumptive Use (Acre-Ft)	**Required Water Storage Pond Capacity**	
	Including 1930s (Acre-Ft)	**Excluding 1930s** (Acre-Ft)
9,000	25,000	9,200
10,000	29,000	11,000
11,000	34,000	13,000
12,000	38,000	16,000
13,000	44,000	20,000

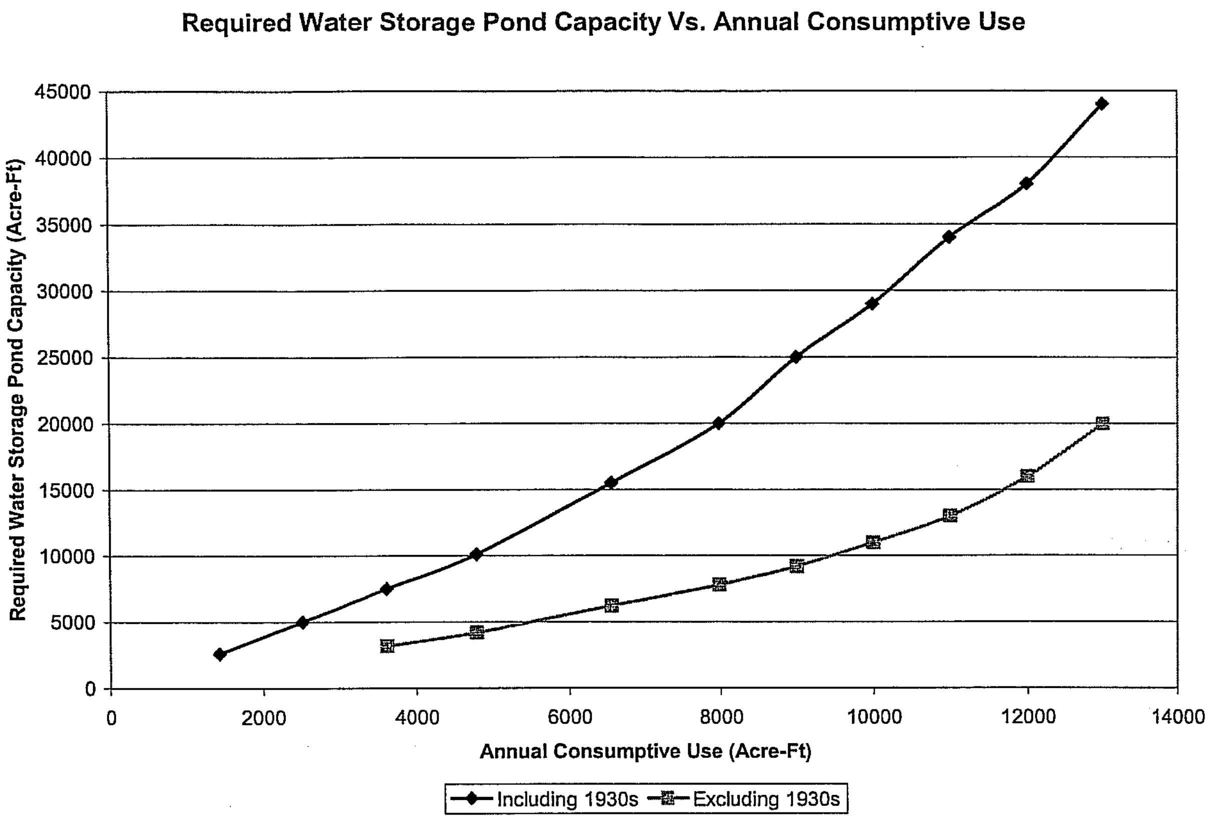

Figure 7: Required Water Storage Pond Capacity as a Function of Annual Consumptive Use

Below approximately an annual consumptive use of 12,000 acre-ft, the required water storage pond capacity increases at a relatively constant rate. Above 12,000 acre-ft level, however, the required water storage pond capacity increases at a faster rate. This change is because the water storage pond must bridge longer periods of drought. Water storage capacity can be thought of as demand times duration of demand. As demand increases, the periods when the pond is drawn down increase in duration. Subsequent water allocations to the pond during drought-stressed periods take even longer to meet the higher consumptive demands on the water storage ponds' capacity.

Dry Pond Frequency and Duration

Table 2, below, shows detailed information about the dry pond weeks that each water storage pond would experience over the 70-year (or 50-year, if the 1930s are excluded) period at the 12,000 acre-ft annual consumptive use level. Table 3 lists the dry pond weeks and their durations from 1930 to 2000. Table 4 shows the percentage of time each hypothetical water storage pond would be dry over the 70-year (or 50-year, if the 1930s are excluded) period. In all of these tables, it should be noted that the dry pond weeks in 1940 and 1941 are not counted in the dataset that excludes the 1930s; the water storage ponds are still recovering from the drought of the 1930s in these years.

Table 2 Dry Pond Weeks for Different Water Storage Pond Capacities (at the 12,000 Acre-Ft Annual Consumptive Use Level)

		Total Number of Weeks that the Pond is Dry (Not Necessarily Consecutive Weeks)		Number of Times the Pond is Dry for More than One Week		Longest Duration of Consecutive Dry Pond Weeks (Number of Weeks)	
Case	Water Storage Pond Capacity (Acre-Ft)	Includes the 1930s	Excludes the 1930s	Includes the 1930s	Excludes the 1930s	Includes the 1930s	Excludes the 1930s
U	9,000	327	97	15	7	120	28
V	12,000	235	46	10	4	108	22
W	16,000	142	0	5	0	91	0
X	20,000	112	0	7	0	57	0
Y	25,000	75	0	4	0	29	0
Z	38,000	0	0	0	0	0	0

Table 3 Dry Pond Weeks and Their Durations for Different Water Storage Pond Capacities (at the 12,000 Acre-Ft Annual Consumptive Use Level)

Case	Water Storage Pond Capacity (Acre-Ft)	Dry Pond Periods	Duration
U	9,000	12/'32-3/'33	16 weeks
		4/'33-10/'35	120 weeks
		-8/'36-4/'37	31 weeks
		-8/'39-9/'39	7 weeks
		11/'39-2/'40	16 weeks
		3/'40	3 weeks
		5/'40-10/'40	22 weeks
		12/'40-3/'41	15 weeks
		7/'56-9/'56	9 weeks
		9/'59-4/'60	28 weeks
		8/'61-1/'62	23 weeks
		2/'62-3/'62	5 weeks
		6/'77-9/'77	14 weeks
		9/'81	1 week
		11/'81-3/'82	17 weeks
V	12,000	7/'33-10/'35	108 weeks
		8/'36-4/'37	31 weeks
		2/'39-2/'40	10 weeks
		3/'40	3 weeks
		/'40-10/'40	22 weeks
		12/'40-3/'41	15 weeks
		12/'59-4/'60	14 weeks
		8/'61-1/'62	22 weeks
		2/'62-3/'62	4 weeks
		8/'77-9/'77	6 weeks
W	16,000	11/'33-10/'35	91 weeks
		8/'36-3/'37	30 weeks
		9/'40-10/'40	8 weeks
		12/'40	2 weeks
		1/'41-3/'41	11 weeks

Case	Water Storage Pond Capacity (Acre-Ft)	Dry Pond Periods	Duration
X	20,000	5/'34-7/'35	57 weeks
		8/'35-10/'35	8 weeks
		8/'36-3/'37	30 weeks
		9/'40	2 weeks
		10/'40	3 weeks
		12/'40	1 week
		1/41-3/41	11 weeks
Y	25,000	10/'34-3/'35	23 weeks
		4/'35-7/'35	15 weeks
		8/'35-10/'35	8 weeks
		8/'36-3/'37	29 weeks
Z	38,000	Zero Dry Pond Weeks	--

Table 4 Percentage of Time Each Water Storage Pond is Dry over the 70- and 50-Year Span (at the 12,000 Acre-Ft Annual Consumptive Use Level)

Case	Water Storage Pond Capacity (Acre-Ft)	Percentage of Time the Pond is Dry (over 70-year span, including the 1930s)	Percentage of Time the Pond is Dry (over 50-year span, excluding the 1930s)
U	9,000	9.7	3.5
V	12,000	7.0	1.6
W	16,000	4.2	0.0
X	20,000	3.3	0.0
Y	25,000	2.2	0.0
Z	38,000	0.0	0.0

As pond capacity increases, the total number of weeks that the pond is dry decreases. Likewise, as pond capacity increases, the longest duration of consecutive dry pond weeks decreases. For the most part, pond capacity and the number of times the pond is dry for more than one week have the same inverse relationship, with one exception. As the pond capacity increases from 16,000 to 20,000 acre-ft, the number of times the pond is dry for more than one week (using the dataset that includes the 1930s) increases from five to seven because two of the longer dry pond week groupings have been broken up into four shorter dry pond week groupings.

Figure 8 is an expanded view of the 9,000 acre-ft pond from 1976 to 1983, showing two periods where the pond is dry for multiple weeks (14 weeks from July to September 1977, and 17 weeks from November 1981 to March 1982).

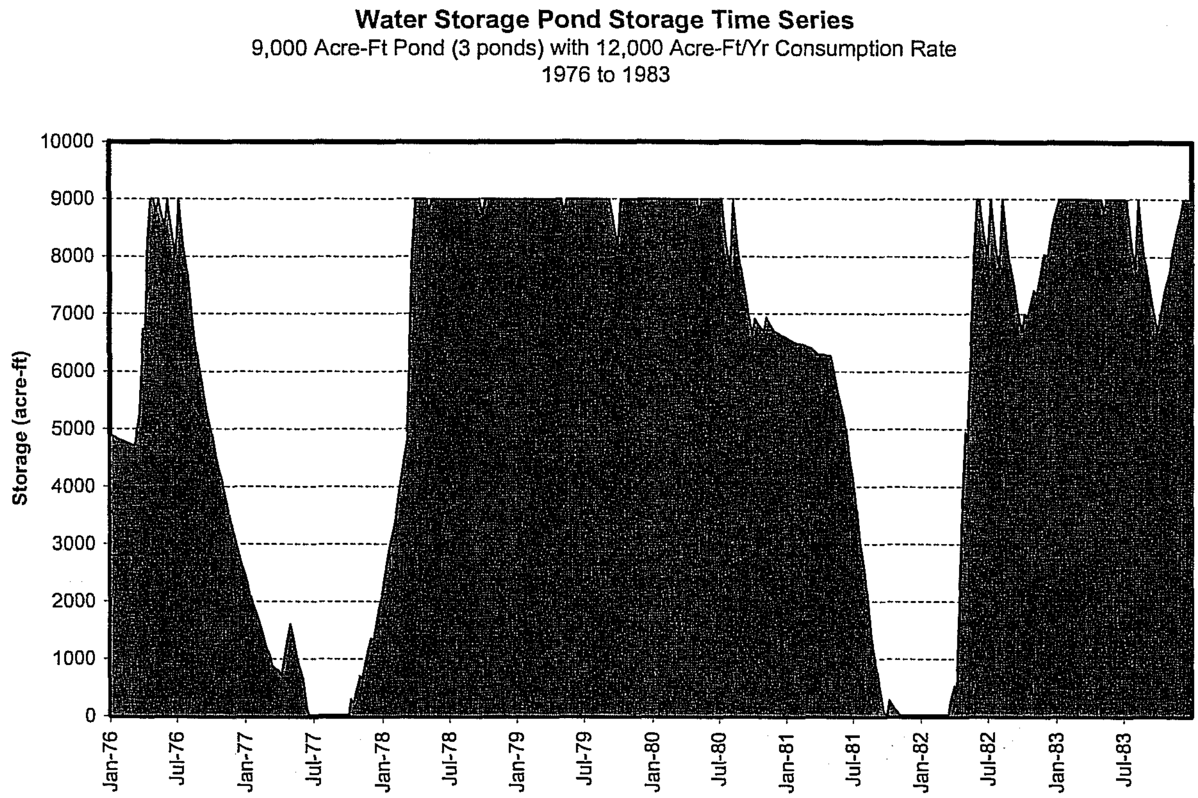

Figure 8 Water Storage Pond Storage Time Series: 9,000 Acre-Ft Pond with 12,000 Acre-Ft/Yr Consumption Rate, 1976 to 1983

Dry Pond Seasonality

It is interesting to note when the dry pond weeks occur in each of the hypothetical water storage ponds (Figure 9).

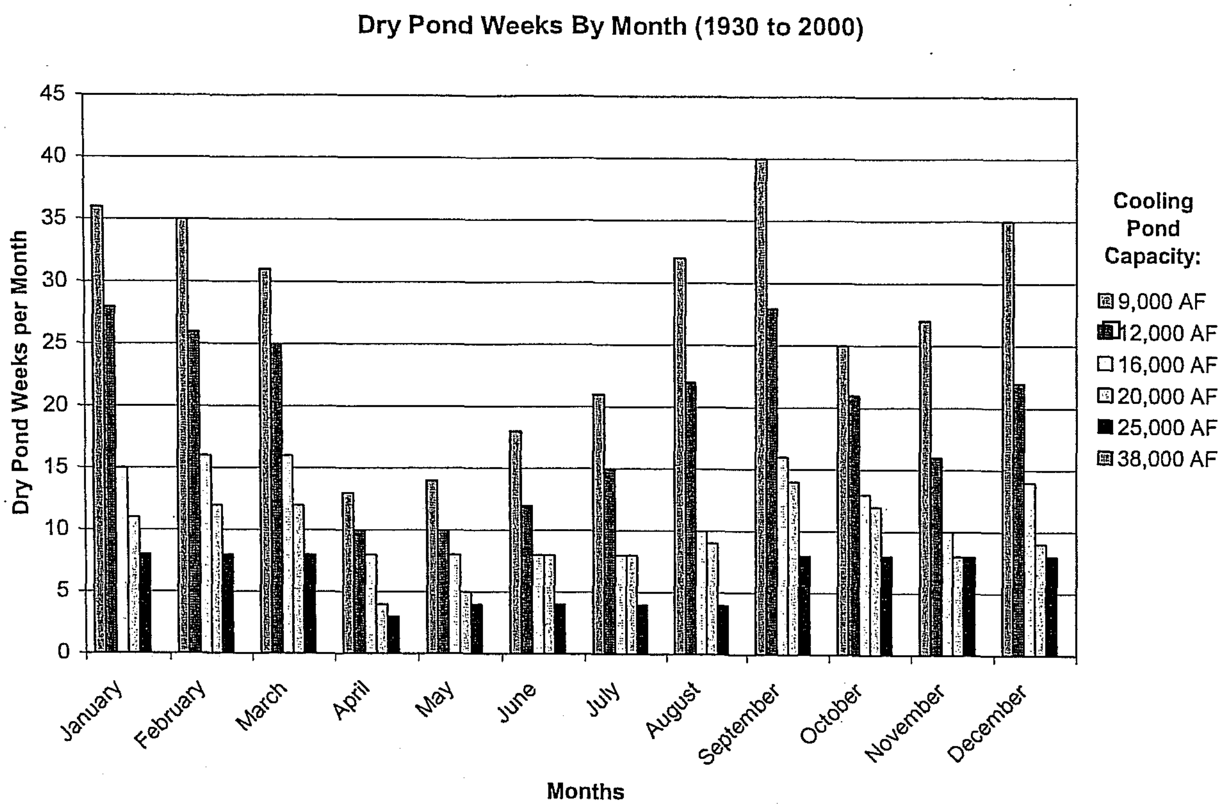

Figure 9: Dry Pond Weeks by Month (1930 to 2000)

Dry pond weeks are least prevalent in the spring (April and May) when water generally is more abundant. Dry pond weeks are most likely in September, followed closely by winter months (December through March). The same trend appears if the drought in the 1930s is excluded from the analysis (Figure 10). However, if the 1930s are excluded from the analysis, only the 9,000 acre-ft and the 12,000 acre-ft water storage ponds experience dry pond weeks (also illustrated on Figures 1 through 6).

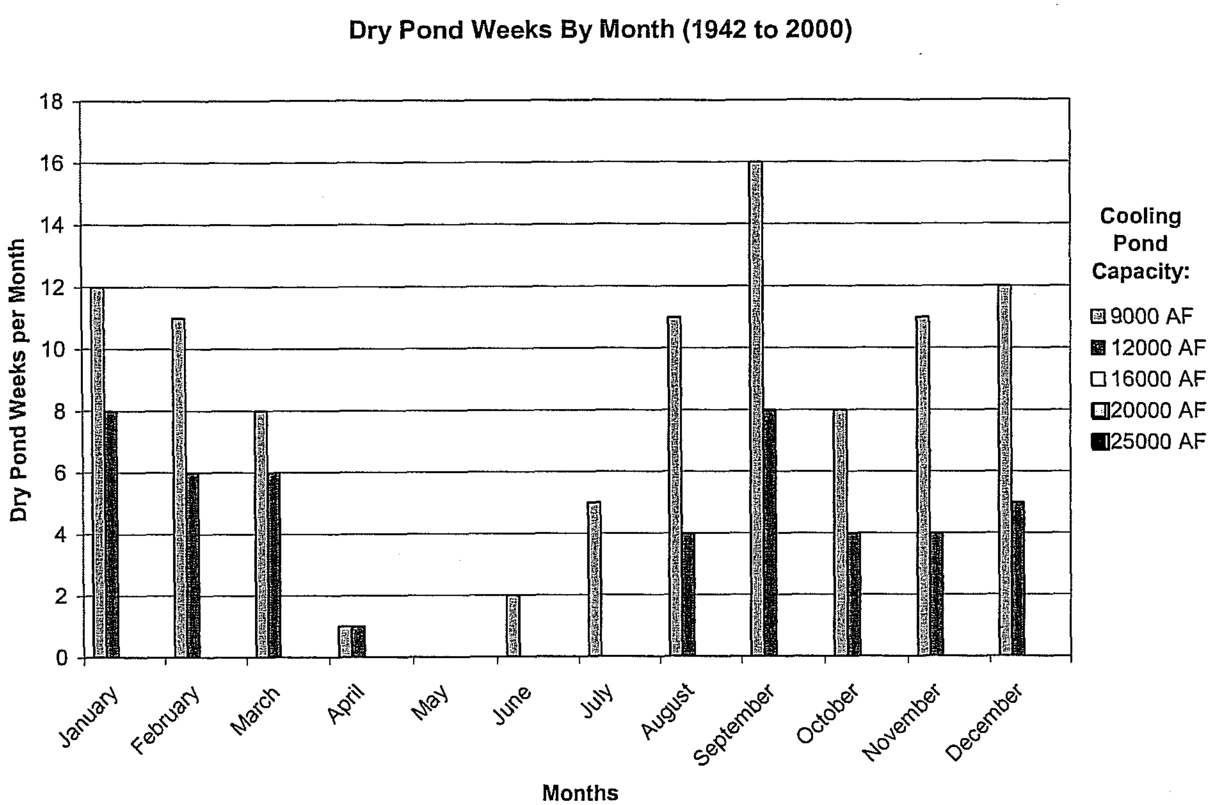

Figure 10: Dry Pond Weeks per Month (1942 to 2000)

Exhibit C

Economic Impact of Constructing the
Big Stone II Power Plant
Stuefen Research & Business Research Bureau
2004

ECONOMIC IMPACT HIGHLIGHTS OF BIG STONE II POWER PLANT CONSTRUCTION [1]

General Model Inputs

Project Construction Period: April 2007 – April 2011

Total Project Cost: Approximately $1 billion

Direct Construction Costs: Approximately $531.7 million

Local Four County Benefit During Construction *(2008 dollars)*

Local Economic Impact: $675 million during construction

Local Job Growth: 2,550 Full Time Equivalent positions during construction
1,997 Full and part time jobs in the communities
An average of 1,137 per year for four years

State Benefit During Construction *(a broader perspective in 2008 dollars)*

South Dakota Economic Impact: $788 million during construction

State Job Growth: 2,550 Full Time Equivalent positions during construction
3,322 Full and part time jobs in the communities
An average of 1,468 per year for four years

Long-Term Local Benefit *(2004 dollars)*

Long term local job growth: 35 Full Time Equivalents employed in operations
29 Full and part-time positions in the communities

Long term local economic impact: $3.6 million / year of new income to four county area
Not including on-going contractor support for plant activities

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[1] Summary on page 13

Economic Impact of Constructing the Big Stone II Power Plant

The Big Stone Power Plant near Milbank, South Dakota is a 450-megawatt coal fired generation facility. The plant is jointly owned by Montana-Dakota Utilities, Northwestern Energy, and the Ottertail Power Company. The plant became operational in 1975 and has provided reliable electric power to customers in Minnesota, North Dakota and South Dakota for nearing thirty years. This is the largest coal fired electricity generation facility in the State of South Dakota.

The proposed Big Stone II Power Plant will be a 600-megawatt coal fired generation unit. In addition to being a larger plant, the public is assured that the new plant will "employ state-of-the-art coal-burning and environmental-control technologies."[2] The partners point to the near thirty year history of Big Stone I as evidence of the generation facility being a good neighbor in addition to being a reliable and efficient source of electric power to the three-state area.

Big Stone II

The Big Stone II generation facility will be located in Grant County in Northeast South Dakota immediately adjacent to the existing Big Stone I plant. Milbank is the largest community in Grant County and is the county seat of this predominantly rural area. Grant County had a population of 7,847 in 2000[3] and Milbank's population during that census was recoded at 3,640.[4] The most significant retail trade center for the population of Grant County is Watertown, South Dakota. Watertown is approximately 55 miles away from Milbank in adjacent Codington County. Watertown is that county's seat of government and has a population of approximately 20,300. Grant County is the focus of this analysis because of the power plant's location within its borders and Codington County is included because of Watertown's economic prominence in the area.

Two Minnesota counties are included in the analysis: Big Stone and Lac Qui Parle counties. Both jurisdictions intersect not more than five miles from the Big Stone

[2] Chuck MacFarlane, Otter Tail Power Company President, News Release, October 11, 2004
[3] US Census Bureau, SF3 Online, www.census.gov
[4] Ibid.

generation facilities and are expected to benefit from the economic activity created by the construction of Big Stone II.

Burns & McDonnell (B&M) of Kansas City, Missouri is an internationally recognized engineering, architectural, and design build enterprise and is the consulting firm on the Big Stone II facility. The cost data provided by Burns and McDonnell (B&M) is the information base for the following economic impact analysis.

Not all expenditures identified by B&M as investments in the proposed near one billion dollar power plant will have a direct economic impact in the economies of the four-county area or the state of South Dakota. The power plant will require the purchase of costly machinery and mechanisms that are built outside our geographic area of interest. The money for their manufacture and assembly is spent in other states and countries to be delivered to South Dakota for installation. These purchases are identified as procurement costs. These costs are substantial and are discussed in the following section but are assumed to have no significant impact on the local economies.

Project Procurement Costs

Procurement dollars are identified to provide information and perspective regarding the investment being made in the project but little economic impact benefiting any part of South Dakota is expected from these expenditures. Nearly one-quarter of the money invested in the near one billion dollar project, 226 million dollars, will be spent to procure pieces of equipment that are component parts of the generation facility. An additional 13.9 million dollars of money is set aside for escalation in procurement costs. All procurement money will be spent elsewhere or in economic terminology leaked from South Dakota with no significant direct or indirect benefit to the state's economy or the two counties in Minnesota. Procurement expense is not considered further in the analysis.

Construction Costs

From the Burns and McDonnell (B&M) data, it is estimated that construction costs associated with the project are 616.3 million dollars.[5] All construction costs for the project are included in this amount. Two items included in that 616.3 million dollar total that should be netted out before calculating the local economic impact are project management engineering fees and reserve monies for escalations in cost. These amounts are 38.0 and 46.5 million dollars, respectively. The items are both netted out but for different reasons.

The Engineering and Management fee of 38.0 million will be spent outside the borders of South Dakota and the two counties in Minnesota. For that reason, this amount will be treated in a like manner to the procurement costs. The expenditures are recognized as ingredients in the construction of the power plant but the expenditures are made outside

[5] All references to money are in 2008 dollars.

the state or the Minnesota counties. The expenditure will not directly benefit the local economy.

Escalation funds are excluded because the expenditure of this money doesn't directly result in construction activity. The 46.5 million dollars are held in reserve to pay for construction expenses resulting from inflation or errors in the estimated cost of an activity over the life of the project. This money is not spent to create additional jobs or construction activity but rather insures there isn't a budgetary shortfall resulting from inflation or cost estimation errors. Escalation funds are not considered when calculating the number of jobs that the project creates. It only increases the direct and indirect expenditures in the amount and to the extent that it corrects for inflation and cost under-estimates.

The direct construction cost for the project in 2008 dollars is 531.7 million dollars. Over the four year time period, the 531.7 million dollar project may cost an additional 46.5 million for a total of 578.3 million dollars. The adjustment of expenditures from the 531.7 to 578.3 million dollar amount assumes all escalation dollars are spent over the four year period on inflation and cost estimation errors. The percentage of the escalation funds that will be spent on the project can only be estimated. The 531.7 million and the 578.3 million dollar amounts should be viewed as cost bookends for the project with the actual cost expected to fall between these amounts.

Economic Impact

The multiplier estimation product used in the analysis is IMPLAN (IMpact Analysis for PLANning). IMPLAN was developed at the University of Minnesota over a period of years in conjunction with the U.S. Forest Service's Land Management Planning Unit in Fort Collins. Governmental agencies and leading universities across the nation use this product for estimating economic impacts.

IMPLAN is an input-output (I-O) estimation model. The versatility of this model enables specific analysis for each area of interest, including county, multi-county regions, a state or a group of states. Naturally, some estimation error will remain. The I-O technique describes an enterprise based on average ingredient and performance measures and therefore best predicts the impact of an average enterprise. While the I-O modeling technique has been designed and refined to minimize error, estimation error does occur because of our inability to distinguish the specific enterprise from the average.

Three multiplier effects are presented: the *output*, *value-added*, and *employment* effects. Each of these in turn reflects three components: the *direct* effect, the *indirect* effect, and the *induced* effect. The output multiplier is the change in the economy required to deliver an additional dollar of construction services to demand. The initial response in final demand is the direct effect, always with a multiplier of 1. The construction contractors will in turn buy goods and services from other industries to produce the dollar's worth of construction, and these industries buy inputs themselves, creating a whole series of additional purchases that are captured by the indirect effect component. Finally, there will be additional purchases motivated by the income generated for households in these transactions; these are called induced effects. All three effects combine to create the output multiplier.

The output multiplier measures the economic activity that will occur as a result of the initial stimulus. It will rise as more inputs are purchased and more income is spent in the region in question. If most inputs are purchased and most income is spent outside the region, the output multiplier will be relatively small. Small counties, for example, will have smaller output multipliers than counties with large wholesale and retail operations, and county multipliers will be smaller than the state multipliers.

The output multiplier is appropriate for sizing up the total economic activity that will occur in an area as a result of a project. The value-added effect is a better measure of the income created for people and the government by the project. Payments for raw materials continue through the system, but payments for labor, or proprietors' income, or distributed corporate profits represent added wealth for people, and thus value-added. Payments for input materials are referred to as "leakages" from the stream of payments. Eventually a dollar spent on the final product ends up split among many income recipients, some of whom live outside the region under consideration. As a result, the value-added multiplier effect is expected to be below one. Like the output multiplier, the value-added effect will typically be larger for the state than for individual counties.

Value-added is decomposed into the same three parts as the output multiplier: direct effects, indirect effects, and induced effects. The direct component will be income generated over and above the cost of resources in the immediate enterprise. The indirect multiplier effect similarly measures net income created in the upstream industries that supply inputs for the final good. The induced component reflects the on-going effect of the income created directly and indirectly: income that is spent on goods and services creates demand for additional goods and services, thus creating a repeating cycle of expenditures. The sum of the three parts creates the value-added multiplier effect.

Finally, the analysis in this report provides an employment multiplier, showing the estimated number of jobs created by one million dollars of output. Again, the multiplier is comprised of three parts. The direct component shows the number of jobs created by the immediate enterprise, power plant construction. The indirect again refers to jobs created in supporting industries, and the induced component reflects jobs created by additional demand throughout the area's economy.

Four-County Economic Impact

Table 1 shows the economic impact of power plant construction activity in the four-county geographic area identified as our area of interest. For every dollar spent on power plant construction at this location, 39.7 cents (0.3969) of income will be generated. The direct expenditure of one million dollars in the construction of the plant is estimated to directly result in 4.8 jobs and the creation of 396,900 dollars of income. The difference between the initial delivery of 1 million dollars of construction services and the 396,900 dollar increase (1,000,000 x .3969) in income is that money spent on other non-labor construction costs.

The indirect output includes those services and goods purchased from other businesses in the four-county area to complete that one million dollars of construction. It is estimated that for every one million dollars of construction completed, 174,600 dollars of goods and services will be purchased from businesses in the four-county area and those expenditures will result in an additional 90,300 dollars of income for these businesses and result in 2.5 people being employed.

Induced output is the spending of households in the economy by people employed directly in the construction of the plant and the businesses benefited indirectly by purchases related to the construction of the power plant. People taking their paychecks from work directly and indirectly related to the construction of the power plant, result in 190,800 dollars of spending for each million dollars worth of construction.

The multipliers in Table 1 are used in the analysis with an adjustment to induced spending. It is assumed that not all workers will move to the four-county area for this work. Those workers having households to support located outside the four-county area will be spending some portion of their paychecks outside our area of interest. That economic impact is not taking place in these four counties and may not be taking place in South Dakota. It is assumed that 50 percent of the induced expenditures do not take place in our areas of interest and the induced multipliers in Tables 2 and 3 are reduced to 50 percent of the measure in Table 1.

Table 1
Four County Economic Impact Multipliers for Power Plant Construction
Full and Partial Induced Impact

	Total Output[6]	Value Added	Employment[7]
Direct	1.0000	0.3969	4.8
Indirect	0.1746	0.0903	2.5
Induced[8]	0.1908	0.1043	2.6
Total	***1.3654***	***0.5915***	***9.9***
Total Assuming 50% of Induced Spending	***1.2700***	***0.5393***	***8.6***

Source: IMPLAN regional input-output economic impact estimator, 2001 data.

[6] Output and value added in millions of dollars. 1.0000 represents one million dollars.
[7] Estimated number of jobs resulting from one million dollars of power plant construction activity.
[8] Induced Multipliers in the analysis is 50% of these figures.

The multiplier in Table 1 states that every dollars worth of power plant construction, the estimated total impact of that dollar is one dollar and twenty-seven cents ($1.27) in the economies of the four counties. That measure includes the economic activity resulting directly from construction, transactions of local businesses selling goods and services that support construction activities and the spending by the households of people employed at the construction site and the supporting businesses.

For every dollar spent on the construction of the power plant, the wealth in the four counties increases by nearly fifty-four cents ($0.539). There will also be eight and one-half (8.6) jobs created in the county for each million dollars worth of construction activity.

The total impact of the construction activity is presented in Tables 4 and 5. Table 2 presents the impact in 2008 dollars with no consideration given to inflation or cost overruns. Table 3 presents the expected impact with the budgeted escalation money (46.5 million) added to the output and the value added estimates. The difference is a description of the project in 2008 and 2008 plus escalation dollars with the distinction being consideration given to increasing costs or inflation. The actual impact is expected to be within the range between real dollar amounts and that number where all budgeted escalation dollars are included. Job numbers remain the same for both estimates.

In 2008 dollars, the value added by all labor (2,550 jobs) on the project over a four year period is 211.0 million dollars. The labor income for businesses in the four-county area selling goods and services to the project is 48.0 million dollars which will employ 1,308 people.[9] Assuming 50% of estimated induced expenditures are local, 27.7 million dollars and 689 jobs will be the value added by people providing goods and services to the households of the workers on the construction site and in the local businesses identified as indirectly supporting the construction effort.

Table 2
Economic Impact of Construction in 2008 Dollars
Assumes 50% of Induced Impact and No Escalation Money

	Total Output	Value Added	Employment
Direct	531,714,728	211,041,504	2,550
Indirect	92,832,032	48,003,852	1,308
Induced	50,719,183	27,733,042	689
Total	***675,265,943***	***286,778,398***	***4,547***

Source: IMPLAN regional input-output economic impact estimator, 2001 data.

[9] All direct is full time equivalents or 2080 hours. Indirect and Induced are full and part time jobs.

The estimates in Table 3 are the base estimates of Table 2 with escalation dollars added. Escalation dollars are added to the base cost estimates to provide for inflation and cost under estimates. The actual economic impact of the construction activities associated with the Big Stone II power plant is expected to be within a range having the 2008 dollar amounts on the low end and these base estimates plus escalation amounts on the high end.

Table 3
Economic Impact of Construction Activity
Assumes 50% of Induced Impact and 46.5 Million in Escalation Money

	Total Output	Value Added	Employment
Direct	578,261,643	237,369,070	2,550
Indirect	100,958,654	53,992,364	1,308
Induced	55,159,198	30,160,824	689
Total	***734,379,495***	***311,883,307***	***4,547***

Source: IMPLAN regional input-output economic impact estimator, 2001 data.

Other Considerations

There is an additional category of expenses in the description of the project identified as owner costs. This category consists largely of money for contingencies and internal transfers. There is a 15.7 million dollar provision for the purchase of engineering services from existing personnel. Task reassignment has no substantial economic impact to the area. The same can be said for the operations personnel budget and the money for startup and testing. Substantial economic impact to the area is not expected as a result of existing personnel being paid from a different source of money. Money required to purchase land for the new power plant is an internal transaction and is not expected to have a substantial impact on the economies of the four counties. The other significant amounts in the budget relate to owner escalation (4.2 million) and contingency (74.1 million). These amounts are in addition to the escalation and contingency amounts budgeted for the construction of the power plant. Whether this money will be necessary to the completion of the project or how it will be spent is not clear.

South Dakota Economic Impact

Multiplier analysis is an estimate of the business activity that takes place in a defined geography as a result of economic activity. One would expect more product offerings and business services in the larger geography of South Dakota than in the four-county area. Likewise, there will be more consumer products and services for the workers to purchase as well. These considerations suggest that the multipliers beyond the direct impact which cannot change will for the state be larger than for the four counties.

Table 4 shows the economic impact resulting from power plant construction activity for the state of South Dakota. The direct expenditure of one million dollars in the construction of the plant is estimated to directly result in 4.8 jobs and the creation of 400,100 dollars in income. The difference between the initial delivery of one million dollars of construction services and the 400,100 dollar increase in income is money spent on non-labor construction costs.

The indirect output includes those services and goods purchased from other businesses in the four-county area to conduct one million dollars of construction. It is estimated that for every one million dollars of construction, 305,600 dollars of goods and services will be purchased from businesses in the state and those expenditures will result in an additional 174,800 dollars of income for these businesses and result in 3.9 people being employed.

Induced output or household spending is estimated at 353,800 dollars of spending for each million dollars worth of construction. However, it is assumed that not all workers will be from South Dakota. Those workers having households to support located outside the state will continue to spend some portion of their paychecks in their home state. Conservatively and consistent with the county analysis, it is assumed that 50 percent of the induced expenditures do not take place in South Dakota and the induced multipliers in Tables 5 and 6 are reduced to 50 percent of the measure in Table 4.

Table 4
Economic Impact Multipliers for Power Plant Construction
Full and Partial Induced Impact

	Total Output[10]	Value Added	Employment[11]
Direct	1.0000	0. 4001	4.8
Indirect	0. 3056	0. 1748	3.9
Induced[12]	0. 3538	0. 1951	4.7
Total	*1. 6594*	*0. 7700*	*13.4*
Total Assuming 50% of Induced Spending in SD	*1.4825*	*0. 6725*	*11.1*

Source: IMPLAN regional input-output economic impact estimator, 2001 data.

The total impact of the construction activity is presented in Tables 5 and 6. Table 5 presents the impact in 2008 dollars with no consideration given to inflation or cost over-runs. Table 6 presents the expected impact with money budgeted for escalation added to the output and the value added estimates. The difference between these tables is a description of the project in 2008 dollars and 2008 plus escalation dollars. The actual impact is expected to be within the range between the 2008 dollar amounts and that number where all budgeted escalation dollars are included. Job numbers remain the same for both estimates.

In 2008 dollars, the value added by all labor (2,550 jobs) on the project over a four year period is 212.7 million dollars. The labor income for businesses in the four-county area selling goods and services to the project is 92.9 million dollars which will employ 2,059 people either full or part time. Assuming 50% of estimated induced expenditures are local, 51.9 million dollars and 1,263 jobs full and part time will be the value added by people providing goods and services to the households of the workers on the construction site and in the local businesses identified as indirectly supporting the construction effort.

[10] Output and value added in millions of dollars. 1.0000 represents one million dollars.
[11] Estimated number of jobs resulting from one million dollars of power plant construction activity.
[12] Induced Multipliers in the analysis is 50% of these figures.

Table 5
Economic Impact in 2008 Dollars
Assumes 50% of Induced Impact and No Escalation Money

	Total Output	Value Added	Employment
Direct	531,714,728	212,738,208	2,550
Indirect	162,510,094	92,918,086	2,059
Induced	94,058,038	51,856,488	1,263
Total	***788,282,860***	***357,512,782***	***5,872***

Source: IMPLAN regional input-output economic impact estimator, 2001 data.

The estimates in Table 6 are the base estimates of Table 5 with escalation dollars added. Escalation dollars are added to the base cost estimates to provide for inflation and cost under estimates. The actual economic impact of the construction activities associated with the Big Stone II power plant is expected to be within a range having the 2008 dollar amounts on the low end and these base estimates plus escalation amounts on the high end.

Table 6
Estimated Economic Impact including Escalation Funding
Assumes 50% of Induced Impact and 46.5 Million in Escalation Money

	Total Output	Value Added	Employment
Direct	578,261,643	231,361,554	2,550
Indirect	176,736,413	101,052,241	2,059
Induced	102,291,986	56,396,064	1,263
Total	***857,290,042***	***388,809,859***	***5,872***

Source: IMPLAN regional input-output economic impact estimator, 2001 data.

Four-County Generation Impact

The operation of the plant will begin in 2011. Ottertail Power Company estimates that the new plant will require an additional 35 employees at a cost in payroll including benefits of approximately 2.5 million dollars at 2004 wage levels. The estimated economic impact of employing these additional people on the four-county economy is presented in Table 7. The 35 new power plant jobs are estimated to create another 28.8 jobs. The associated 2.5 million dollar payroll is expected to result in a total economic activity increase of 3.1 million dollars as these new households purchase goods and services in the area and the money makes its way through the economy. The income generated in households outside those directly employed at the power plant is an additional 1.1 million dollars.

Table 7
Economic Impact in 2004 Dollars
Employing 35 People with Payroll of 2.5 Million

2004 Dollars	Total Output	Value Added	Employment
Induced Initial Impact	2,500,000	793,527	19.7
Induced Subsequent Impacts	603,864	314,460	9.1
Total	*3,103,864*	*1,107,987*	*28.8*

Source: IMPLAN regional input-output economic impact estimator, 2001 data.

In 2011, when the plant becomes operational, the number of people employed is assumed to be 35. The number of additional jobs in the economy will be that described in the table (28.8). The measure of total economic activity or output will increase by the percentage of inflation between 2004 and 20011 as will the value added to workers in local businesses as new income.

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Summary

The Big Stone II generation facility will be located in Grant County in Northeast South Dakota immediately adjacent to the existing Big Stone I plant. Grant County is the focus of this analysis because of the power plant's location within its borders and Codington County is included because of Watertown's economic prominence in the area. Two Minnesota counties are included in the analysis: Big Stone and Lac Qui Parle counties. Both jurisdictions intersect not more than five miles from the Big Stone generation facilities and are expected to benefit from the economic activity created by the construction of Big Stone II. The construction and operation of the proposed power plant will if constructed have a direct economic impact in the economies of the four-county area and the state of South Dakota.

Burns & McDonnell (B&M) of Kansas City, Missouri is an internationally recognized engineering, architectural, and design build enterprise and is the consulting firm on the Big Stone II facility. The cost data provided by Burns and McDonnell (B&M) is the information base for the economic impact analysis.

A power plant is a combination of design, procurement, construction and operation. The design of the facility and the purchase of machinery for installation in the facility have no substantive impact on the local economy or the economy of the state. These monies are spent throughout the country and the world outside the borders of our four-county area of interest or the state of South Dakota. The economic impact of money budgeted for these activities are not included in the economic impact analysis.

The budget for the construction of the power plant in 2008 dollars is 531.7 million. In addition to that amount there is 46.5 million dollars budgeted to cover cost estimation errors and the cost of inflation between the construction start date of 2008 and the plants completion in 2011 for a total of 578.3 million dollars. The cash expenditure on the construction of the plant is expected to fall between 531.7 million and 578.3 million dollars.

Four-County Multipliers

The estimated four-county[13] economic output multiplier for the construction of the power plant is 1.27 assuming 50% of money earned by workers is spent in communities outside the four-county area. For each one million dollars of construction activity 4.8 full time positions will be created at the site, and 3.8 people will be employed full time or part time in the local communities. The one million dollars of economic activity and the employment of the workers (8.6) will result in the wealth of the area being increased by more than one-half million dollars (0.5393 million).

[13] Four counties include Grant and Codington in South Dakota; Big Stone and Lac Qui Parle in Minnesota.

Induced spending is reduced to 50% recognizing that a substantial number of workers on the project will have residences outside the four-county area and a substantial portion of their earnings will be used to support their distant households. The same is true when looking at the induced spending associated with the state estimated impacts.

Summary Table 1
Four-County Construction Economic Impact Multipliers

	Total Output[14]	Value Added	Employment[15]
Direct	1.0000	0.3969	4.8
Indirect	0.1746	0.0903	2.5
Induced[16]	0.1908	0.1043	2.6
Total	*1.3654*	*0.5915*	*9.9*
Total Assuming 50% of Induced Spending	*1.2700*	*0.5393*	*8.6*

Source: IMPLAN regional input-output economic impact estimator, 2001 data.

State of South Dakota Multipliers

The estimated South Dakota economic output multiplier for the construction of the power plant is more inclusive than the four-county estimate. More businesses are expected to sell goods and services to the project and more workers are expected to be from South Dakota than from the four-county area. The state economic output multiplier is 1.48 assuming that 50% of money earned by workers is spent outside the state of South Dakota. For each one million dollars of construction activity, 11.1 people will be employed directly, indirectly or as a result of induced spending in the area. The direct employment is in full time equivalents assuming a full working year per position. Employment associated with indirect and induced impacts include both full and part-time positions. The result of a million dollars of economic activity and the employment of the workers (11.6) is an increase wealth or income of over three-quarters of a million dollars (0.770 million).

[14] Output and value added in millions of dollars. 1.0000 represents one million dollars.
[15] These are estimated number of full and part time jobs resulting from one million dollars of power plant construction activity. All direct on site jobs are in full-time equivalents.
[16] Induced Multipliers in the analysis is 50% of these figures.

Summary Table 2
South Dakota Construction Economic Impact Multipliers

	Total Output	Value Added	Employment
Direct	1.0000	0.4001	4.8
Indirect	0.3056	0.1748	3.9
Induced	0.3538	0.1951	4.7
Total	***1.6594***	***0.7700***	***13.4***
Total Assuming 50% of Induced Spending in SD	***1.4825***	***0.6725***	***11.1***

Source: IMPLAN regional input-output economic impact estimator, 2001 data.

Four-County Economic Impact

The construction economic impacts in 2008 dollars and with escalation money included are presented for the four-county area in Summary Table 3. The size of the construction project is defined by Burns and McDonnell as costing 531.7 million in 2008 dollars and requiring 2,550 worker years or jobs over the life of the project. The construction activity and worker spending will create an additional 1,997 full and part time jobs in the communities throughout the four-county area.

Summary Table 3
Total Four-County Construction Economic Impact
Assuming 50% Induced Spending

Direct Expenditures	Total Output	Value Added	Employment
In 2008 Dollars			
531,714,728	*675,265,943*	*286,778,398*	*4,547*
With Budgeted Escalation			
578,261,643	*734,379,495*	*311,883,307*	*4,547*

State of South Dakota Economic Impact

The construction economic impacts in 2008 dollars and with escalation money included are presented for the state of South Dakota in Summary Table 4. The size of the construction project is defined by Burns and McDonnell as employing 2,550 full time jobs over the life of the project and costing 531.7 million 2008 dollars. The construction activity and worker spending will create an additional 3,322 full and part time jobs in the communities throughout the state for a total of 5,872 jobs.

Summary Table 4
Total South Dakota Construction Economic Impact
Assuming 50% Induced Spending

Direct Expenditures	Total Output	Value Added	Employment
In 2008 Dollars			
531,714,728	*788,282,860*	*357,512,782*	*5,872*
With Budgeted Escalation			
578,261,643	*857,290,042*	*388,809,859*	*5,872*

Operation of Power Plant

The operation of the plant will begin in 2011. Ottertail Power Company estimates that the new plant will require an additional 35 employees at a cost in payroll including benefits of approximately 2.5 million dollars at 2004 wage levels. The estimated economic impact of employing these additional people on the four-county economy is presented in Summary Table 5. The 35 new power plant jobs are estimated to create another 28.8 jobs throughout the economy. The associated 2.5 million dollar payroll is expected to result in a total economic activity increase of 3.1 million dollars as these new households purchase goods and services in the area and the money makes its way through the economy. The income generated in households outside those directly employed at the power plant is an additional 1.1 million dollars.

Summary Table 5
Economic Impact in 2004 Dollars
Employing 35 People with Payroll of 2.5 Million

2004 Dollars	Total Output	Value Added	Employment
Induced Initial Impact	2,500,000	793,527	19.7
Induced Subsequent Impacts	603,864	314,460	9.1
Total	***3,103,864***	***1,107,987***	***28.8***

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Exhibit D

Archaeological Assessment and Architectural History Survey for the Big Stone II Project, Big Stone City, Grant County, South Dakota

The 106 Group Ltd.

May 2005

ARCHAEOLOGICAL ASSESSMENT AND ARCHITECTURAL HISTORY SURVEY FOR THE BIG STONE II PROJECT, BIG STONE CITY, GRANT COUNTY, SOUTH DAKOTA

Submitted to:
Barr Engineering Company

Submitted by:
The 106 Group Ltd.

May 2005

ARCHAEOLOGICAL ASSESSMENT AND ARCHITECTURAL HISTORY SURVEY FOR THE BIG STONE II PROJECT, BIG STONE CITY, GRANT COUNTY, SOUTH DAKOTA

Principal Investigator for Archaeology
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SHPO File No. [pending]
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May 2005

MANAGEMENT SUMMARY

During March and April of 2005, The 106 Group Ltd. (The 106 Group) conducted a cultural resources survey of the Big Stone II project area. These investigations were conducted under contract with Barr Engineering Company for the Big Stone II Co-owners. The proposed Big Stone II electric generating facility (the project) is to be located on a brownfield site adjacent to the existing Big Stone Plant Unit I and will include the construction of a plant, smoke stack, cooling tower, coal handling and storage equipment, a cooling tower blowdown pond, and a water storage pond. This undertaking is under the jurisdiction of the Western Area Power Administration, a subsidiary of the United States Department of Energy. It will require completion of an Environmental Impact Statement (EIS). This report is intended to provide preliminary cultural resources information for completion of the Big Stone II Plant Siting Permit Application, the EIS, and to assist in future compliance requirements under federal and state law. Because there is federal involvement in this project, consultation with the applicable federal agency and South Dakota State Historic Preservation Office (SHPO) will be required. The purpose of the cultural resources investigation was to determine whether the project area contains previously recorded or unrecorded historic and/or archaeological properties that may be eligible for listing on the National Register of Historic Places (NRHP).

The project area consists of approximately 2,545 acres (1,030 hectares) and is located in Sections 11 through 15, T121N R47W, and Sections 5, 7, 8, and 18, T121N, R46W, Big Stone Township, Grant County, South Dakota. The area of potential effect (APE) for archaeology is the same as the project area, and it includes all areas of proposed construction activities or other potential ground disturbing activities associated with construction of the new components of the Big Stone II project. The archaeological investigation consisted of a review of documentation of previously recorded sites and an assessment (windshield survey) of the project area. Anne Ketz, M.A., RPA served as Principal Investigator for archaeology.

The APE for architectural history accounts for any physical, auditory, or visual impacts to historic properties, and it includes an area that extends from one-half mile to one mile from project components. The architectural history investigation consisted of a review of documents of previously inventoried properties and of previously conducted surveys that included the project area, as well as a field survey to identify and document properties that are 49 years of age or older within the APE. The architectural history survey area includes approximately 3,599 acres (1,456 hectares). Betsy H. Bradley, Ph.D., served as Principal Investigator for architectural history.

The Level I archaeological assessment identified two areas of high potential, only one of which is recommended for Level III Survey *if* it will be impacted by future development. During the Phase I architectural history survey, The 106 Group identified 3 properties 49 years in age or older within the APE. Two buildings, the Rabe Round Barn (GT-004-

00001) and the Rabe Livestock and Hay Barn (GT-004-00002), are recommended as eligible for listing on the NRHP.

The effects of the Big Stone II project on two properties recommended as eligible for listing on the NRHP was analyzed. The 106 Group recommends a finding of *no adverse effect* for the Big Stone II project on the Rabe Round Barn (GT-004-00001) and the Rabe Livestock and Hay Barn (GT-004-00002).

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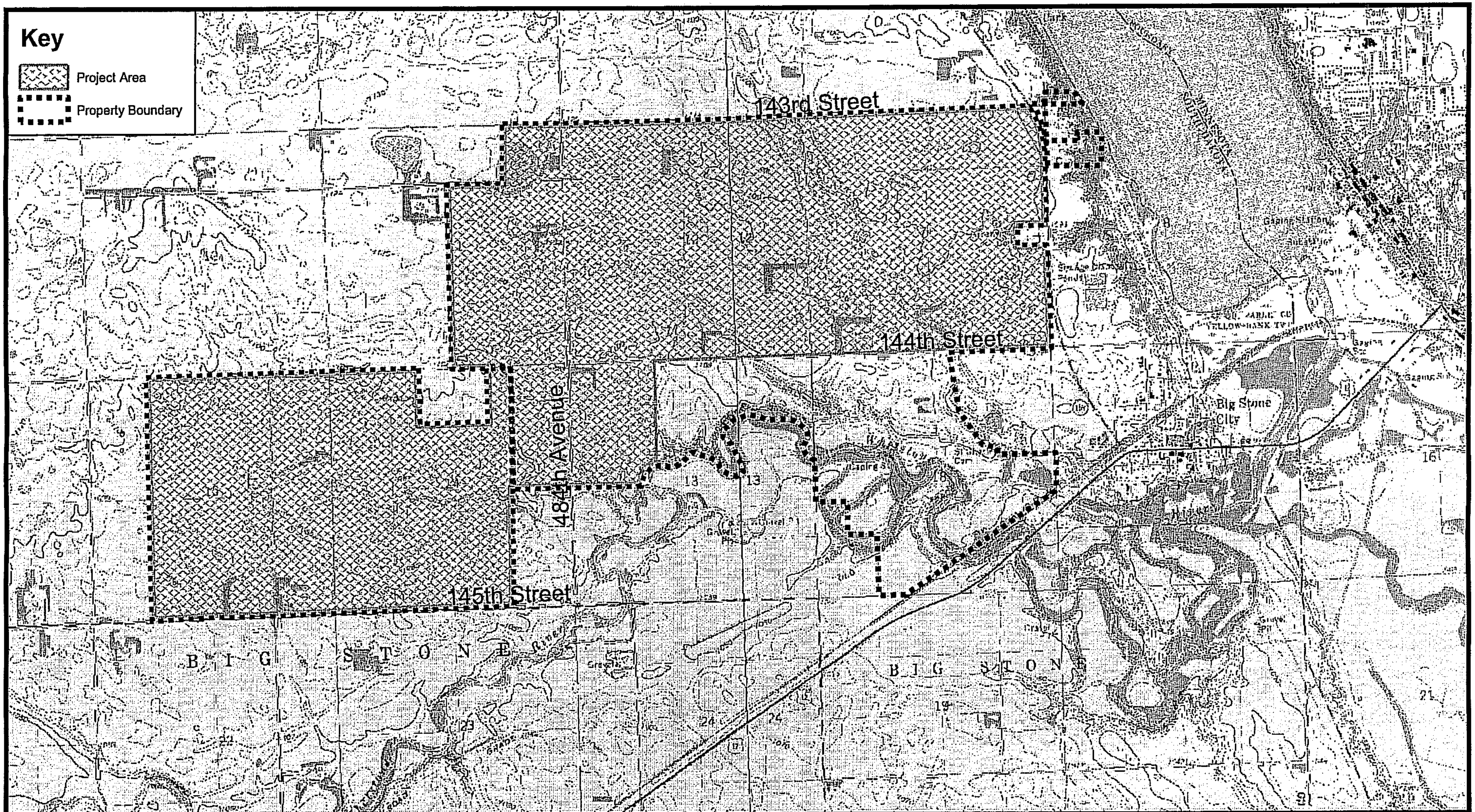
1.0 INTRODUCTION

During March and April of 2005, The 106 Group Ltd. (The 106 Group) conducted a cultural resources survey of the Big Stone II project area. These investigations were conducted under contract with Barr Engineering Company for the Big Stone II Co-owners. The project area is located in Sections 11 through 15, T121N R47W, and Sections 5, 7, 8, 18, T121N, R46W, Big Stone Township, Grant County, South Dakota (Figure 1). This undertaking is under the jurisdiction of the Western Area Power Administration, a subsidiary of the U. S. Department of Energy. It will require completion of an Environmental Impact Statement (EIS). This report is intended to provide preliminary cultural resources information for completion of the Big Stone II Plant Siting Permit Application, the EIS, and to assist in future compliance requirements under federal and state law. Because there is federal involvement in this project, consultation with the applicable federal agency and South Dakota State Historic Preservation Office (SHPO) will be required. This cultural resources survey is intended to provide the identification and evaluation of cultural resources required for compliance with Section 106 of the National Historic Preservation Act of 1966, as amended.

The purpose of this cultural resources survey was to address archaeological, historical, and architectural resources. For archaeological resources, a literature search identified previously recorded resources, a visual reconnaissance of the study area was undertaken, and additional information was gathered in order to make recommendations for further work that may be needed. A literature search was also conducted to identify any previously recorded historical and architectural properties in the project area. After the initial site visit and consultation with the SHPO, an Area of Potential Effect (APE) was established. During a subsequent field survey all historical and architectural properties within the APE over 49 years of age were recorded. The effects of the Big Stone Project on properties recommended as eligible for listing on the National Register of Historic Places (NRHP) were considered.

The study area for archaeological resources is approximately 3,189 acres (1,291 hectares). The architectural history APE is approximately 3,599 acres (1,456 hectares). Should the Big Stone II project be altered from the present proposal, the study areas will need to be adjusted as appropriate. This cultural resources investigation did not include any consultation with Native American tribes.

The following report describes project methodology, previous investigations, results, and recommendations for the Big Stone II project area. Because the archaeological assessment did not include field testing, no archaeological contexts are presented. An historical context is provided for the evaluation of architectural history properties. The appendices provide copies of the South Dakota Historic Sites Inventory Reconnaissance Forms completed for the survey and a list of project personnel.



Source: USGS Quadrangles, Big Stone Lake SE, South Dakota 1971; Ortonville, MN 1971

Big Stone II
Archaeological Assessment and Architectural History Survey
Grant County, South Dakota

Project Location

N W E S

0 0.25 0.5 0.75 1 Miles

1:24,000

Figure 1

1.1 PROJECT DESCRIPTION

The proposed Big Stone II electric power generating facility (the project) is to be located on a brownfield site adjacent to the existing Big Stone Plant Unit I (Figure 2) (Otter Tail Power Corporation 2005). The plant site is located in Grant County northeast of Milbank and northwest of Big Stone City, South Dakota, as shown in Figure 1. Construction of the project at the site of an existing facility reduces the construction cost of the new plant and enables the use of existing infrastructure such as the rail spur for coal delivery, coal unloading facilities, the cooling water intake, pumping, and delivery system, as well as solid waste disposal facilities. Current plans are to construct a single pulverized coal-fired steam generator (boiler) balanced-draft combustion and a single, reheat steam turbine. The unit would burn Powder River Basin sub-bituminous coal. The new unit will be designed to meet base load demand and will normally operate at its maximum continuous rating output. The new power plant will be approximately the same size as the existing plant, and will have a similar exterior appearance. The new 500-foot high chimney will be approximately the same height as the existing chimney (Otter Tail Power Corporation 2005:2, 41).

The Big Stone Plant currently owns an approximately 2,200-acre site. Otter Tail Power Corporation owns an additional parcel adjacent to the plant site and has an option to purchase another large parcel on behalf of the project. This combined area constitutes approximately 3,100 acres and corresponds to the property boundary shown on Figure 1. The project area is a portion of this property and is also shown on Figure 1. The existing plant road and rail spur would provide site access and no changes are expected to either of these features.

Treated cooling water for the water-cooled surface condenser will be provided from a closed loop circulating water system that includes a new mechanical draft cooling tower, circulating water pumps, and a cooling tower blowdown pond. Raw water for the cooling system will be supplied from the existing Big Stone Unit I cooling pond. The water for the cooling pond will be supplied from Big Stone Lake via an existing water line and lake intake structure. An additional makeup water storage pond (see Figure 2) for the Big Stone II unit, which will have a surface area of approximately 450 acres, will provide sufficient storage capacity for both units during most drought conditions. The water storage pond will be enclosed by an earthen berm. The berm will likely have a fence on top that may be as high as 20 feet above surrounding grade (Otter Tail Power Corporation 2005:3, 28, and 30).

The existing coal handling system will be upgraded and the improved system, to be shared by both plants, will include a new telescopic chute that will feed a new silo feed conveyor. A new emergency stock-out pile will be served by a new dual reclaim hopper, which will transfer coal to a new crusher house. Three new concrete storage silos will be constructed for coal storage; each silo will be 70 feet in diameter by approximately 196 feet tall; the new equipment will include a conical mass flow hopper. The new conveyors

Source: FSA Aerials 2003

Big Stone II
Archaeological Assessment and Architectural History Survey
Grant County, South Dakota

Project Features

Figure 2

and crusher house will be enclosed with corrugated roofing and siding (Otter Tail Power Corporation 2005:20).

Project components that could have effects on cultural resources include the new power plant and adjacent exterior equipment of the coal-fired steam generator, including a smoke stack; a cooling tower and adjacent cooling tower blowdown pond; and new coal handling and storage equipment, all to be positioned in close proximity to the existing Big Stone power plant. A water storage pond will be located west of the existing plant location. Additional areas to be used for construction parking and as a construction laydown yard are identified as additional project impact areas.

New transmission lines are projected to be part of this project. Their routes have not yet been identified and they are not addressed in this portion of the undertaking.

2.0 METHODS

2.1 OBJECTIVES

The primary objectives of the cultural resources investigation were to determine whether the area to be affected by the proposed project contains any historic or archaeological properties and if those resources are eligible for listing on the NRHP. The survey also considers the effects of the project to architectural properties recommended as eligible for listing on the NRHP. All work was conducted in accordance with *Guidelines for Cultural Resource Surveys and Survey Reports in South Dakota* (SHPO 2005), *South Dakota Historic Resource Survey Manual* (SHPO 2000), and *The Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation* [48 Federal Register 44716-44740] (National Park Service [NPS] 1983).

2.2 AREAS OF POTENTIAL EFFECT (APE)

2.2.1 Archaeology

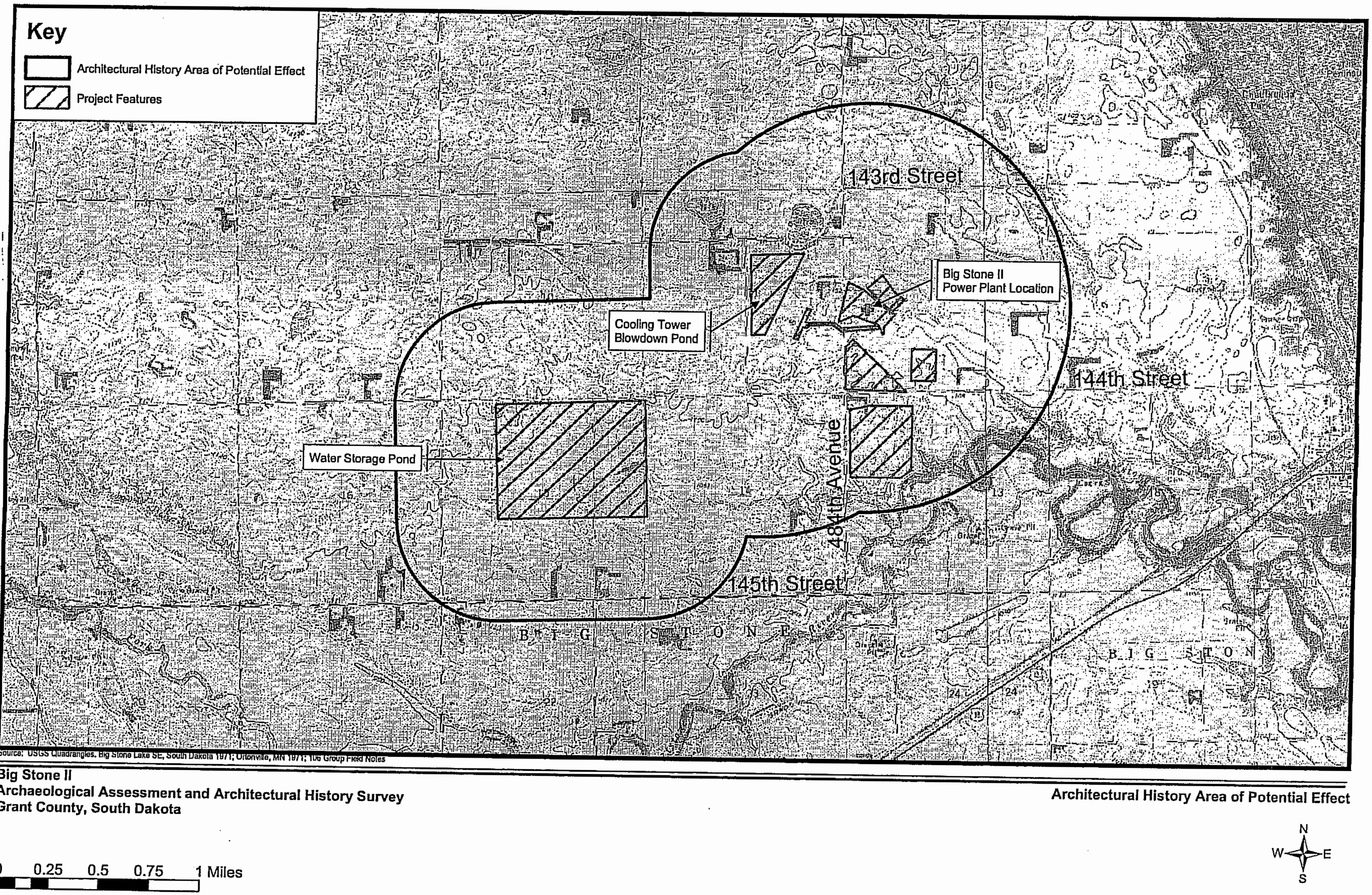
The APE for archaeology is the same as the project area and includes all areas of proposed construction activities or other potential ground-disturbing activities associated with the construction of the Big Stone II power plant (see Figure 2).

2.2.2 Architectural History

The APE for architectural history was set to account for any physical, auditory, or visual impacts to historic properties (Figure 3).

The initial study area for architectural history properties was the project area, which would encompass all direct effects. This area was expanded to include additional areas that might be visually affected by the project, based on the current project description (Otter Tail Power Corporation 2005). The APE used for this study was set after an initial field visit and conversations with the SHPO office. The portion of the property owned by the Otter Tail Power Corporation on which no portion of the Big Stone II project is located was excluded from the APE. The APE for architectural history resources (Figure 3) is based on the following factors in conjunction with the description of the project undertaking.

Land Acquisition. The project area, shown on Figure 2, encompasses a portion of the Big Stone II property. This includes land already owned and land optioned for purchase for the proposed project. All project components will be located within this area. The existing Big Stone power generating plant and the Northern Lights Ethanol Plant are located near the center of this area (see Figure 2, Features 3 and 5).



Big Stone II
Archaeological Assessment and Architectural History Survey
Grant County, South Dakota

Architectural History Area of Potential Effect

Figure 3

Visual Effects. The visual effects of the Big Stone II project would be due to the construction of a power plant building, an additional smoke stack, new coal handling equipment and storage silos, a cooling tower, and cooling tower blowdown pond in the immediate vicinity of the existing plant, as well as from the construction of an additional water storage pond (see Figure 2, Feature 7), which will be enclosed by an earthen berm that will likely have a fence on top that may be as high as 20 feet above surrounding grade. The cooling tower blowdown pond (see Figure 2, Feature 1) will be enclosed with dikes, the height of which is unknown at this time.

As determined in consultation with SHPO, the possibility for significant visual effects is projected to be within one mile of the new plant and smoke stack and within one-half mile of the two new ponds. Therefore, the visual effects APE encompasses these areas. After the initial field visit to the project area, the APE was adjusted to include a farmstead slightly more than one-mile from the Big Stone II power plant location on which a round barn stands. The visual effects APE is shown in Figure 3.

Changes in Access to Properties, Alteration in Traffic Patterns, and Noticeable Traffic Volume Increase. The Big Stone II project will make use of existing road and rail spur infrastructure. It is not anticipated to pose any changes in access to properties outside of, though near to, the project area, or cause altered traffic patterns. 144th Street is a paved road that provides most of the vehicular access to the existing plants in the project area. The plant is also accessible from 484th Avenue. Anticipated changes in traffic include a temporary increase during the plant construction period and, in the long term, a general increase in transportation service needs. It is projected that an additional 30 operational workers will be traveling daily to the site.

Change in Land Use and a Property's Setting. The expansion of the Big Stone Plant property to accommodate a third industrial facility will not introduce a new land use to the project vicinity. The water storage pond will, however, extend the power plant facility further to the west of the existing property and will enlarge the area of industrial land use. This has the potential to alter the setting of properties in the area encompassed by the visual effects APE.

Perceptible Increase in Noise, Vibration, and Change in Air Quality. At this time, it is assumed that due to the presence of the Big Stone Power Plant and the Northern Lights Ethanol Plant, the visual effects APE will encompass properties with effects, if any, from noise and vibration. The noise and vibration associated with construction activities will be buffered by the extensive plant-owned project property adjacent to construction sites.

The approximately 500-foot height of the existing chimney, as well as the one proposed as part of the Big Stone II project, is intended to disperse plant emissions and minimize any local impacts. The water in the new pond will be at ambient temperature, like that of nearby Big Stone Lake. It is not projected to have a significant impact on air moisture content in the vicinity of the Big Stone II project area. The Big Stone II project is not anticipated to significantly alter the air quality of the project area.

2.3 ARCHAEOLOGY

2.3.1 Background Research

On March 2 and 3, 2005, prior to fieldwork, The 106 Group conducted background research using files at the Archaeological Research Center and the South Dakota (SHPO). This research identified information on previously identified archaeological sites and architectural and historical properties within one mile (1.6 kilometer [km]) of the project area and on cultural resources surveys previously conducted within the project area. In addition, researchers examined historical maps and recent aerial photographs of the project area and searched county histories for information on one historic landowner.

2.3.2 Study Area

The study area for archaeology is the project area, and includes all areas where construction or other ground-disturbing activities related to the project might take place (see Figure 1). The project area is approximately 2,545 acres (1,030 hectares).

2.3.3 Field Methods

The project archaeologist conducted an assessment (windshield survey) of the project area to identify areas with moderate or high archaeological potential. Such areas were defined as the undisturbed portions of the project area:

- within 500 ft. (150 m) of an existing or former water source of 40 acres (19 hectares) or greater in extent, or within 500 ft. (150 m) of a former or existing perennial stream;
- located on topographically prominent landscape features;
- located within 300 ft. (100 m) of a previously reported site; or
- located within 300 ft. (100 m) of a former or existing historic structure or feature (such as a building foundation or cellar depression).

In addition, archaeologists compared historical documentation, such as plat maps and recent aerial photographs, with current field conditions to assess the potential within the survey area for intact historical archaeological sites.

Areas defined as having a relatively low potential for containing intact archaeological resources included inundated areas, former or existing wetland areas, poorly drained areas, and areas with a 20 percent or greater slope. Low potential areas and areas in which Holocene (less than 10,000 years old) deposits have been significantly disturbed are defined as having little or no potential for containing intact archaeological resources.

2.4 ARCHITECTURAL HISTORY

2.4.1 Background Research

On March 3, 2005, prior to the initial visit to the project area, staff from The 106 Group conducted background research at the SHPO for information on previously inventoried properties and on previously conducted surveys that included the project area. During a second visit to the SHPO office on April 6, 2005, The 106 Group acquired copies of the *South Dakota's Round and Polygonal Barns and Pavilions Multiple Property Documentation Form* (Ahrendt 1995), and survey information on individual round barns.

2.4.2 Other Research

The *Big Stone Headlight* newspaper for portions of 1915 and 1916 was reviewed for information on the Rabe farming operation and round barn construction project. Deed records for surveyed properties were examined at the Grant County Recorder's office at the Grant County Courthouse on April 5, 2005. The 106 Group interviewed Mrs. Vi Rabe, who lived on the Rabe property for 40 years. Mrs. Rabe provided information from the daily diaries kept by Lewis Rabe. The Bureau of Land Management General Land Office patent records were searched through the Bureau's website (http://www.glorecords.blm.gov/PatentSearch).

2.4.3 Field Methods

An initial drive-by survey of the buildings, structures, and landscape features in the APE was conducted in order to identify those properties that appeared to be 49 years in age or older during the initial visit to the project area. Each of these properties was subsequently surveyed and documented with field notes and digital photographs.

2.4.4 Inventory Forms

South Dakota Historic Sites Inventory Reconnaissance Forms were completed for each architectural history property 49 years in age or older.

2.5 EVALUATION

Upon completion of the fieldwork, the potential eligibility of each resource for listing on the NRHP was assessed based on the property's potential significance and integrity. The NRHP criteria, summarized below, were used to help assess the significance of each property:

- Criterion A – association with the events that have made a significant contribution to the broad patterns of our history;
- Criterion B – association with the lives of persons significant in our past;

- Criterion C – embodiment of the distinctive characteristics of a type, period, or method of construction; representation of the work of a master; possession of high artistic values; or representation of a significant and distinguishable entity whose components may lack individual distinction; or
- Criterion D – potential to yield information important to prehistory or history (NPS 1995).

The NPS has identified seven aspects of integrity to be considered when evaluating the ability of a property to convey its significance: location, design, setting, materials, workmanship, feeling, and association. The integrity of each property or site was assessed in regard to these seven aspects. The properties were also assessed to determine if they represent a type of property to be evaluated for the NRHP using Criteria Considerations (NPS 1995).

2.6 ANALYSIS OF EFFECTS

The analysis of effects for this project was based on criteria of adverse effect outlined in 36 CFR 800.5 (NPS 2004) and the project description included in the draft Big Stone II Siting Application Permit (Otter Tail Power Corporation 2005).

During the survey of the project area, the characteristics of historical properties that were identified as eligible for listing in the NRHP were considered. The general setting of those properties, the distance of the properties from the components of the Big Stone II project, and the visibility of the historic properties and the Big Stone II project components were considered. Observations were recorded and photographs were taken.

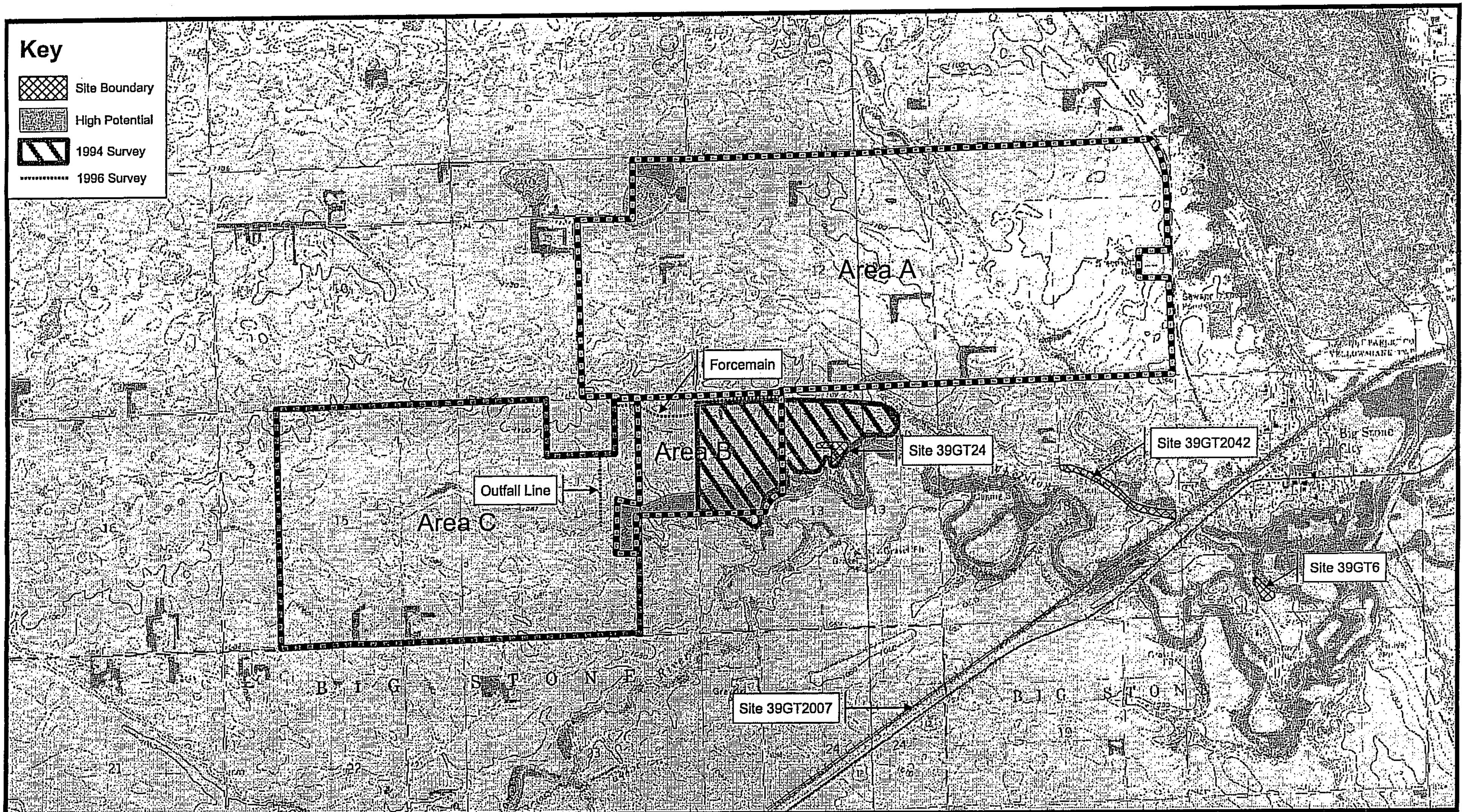
3.0 LITERATURE SEARCH

3.1 PREVIOUS ARCHAEOLOGICAL STUDIES

Research indicated that two archaeological surveys have been conducted within the project area. For ease of reference, the project area has been divided into three sections, designated A, B, and C (Figure 4). An archaeological survey was carried out in 1994 in Area B by the State Archaeological Research Center, prior to construction of the ethanol plant located on lands owned by Ottertail Power Company. Only a portion of this survey was conducted within the Big Stone II project area. During the survey, archaeologists conducted pedestrian surface reconnaissance on all prominent features with good visibility. A total of fourteen shovel tests were excavated in areas deemed to be of high potential with low visibility. Archaeological Site 39GT24 was located during this survey, which consisted of a precontact lithic scatter, and two historical artifacts, indicating that the site may have an historical component (Donohue and Williams 1994). Site 39GT24 is located outside the current project area.

A second archaeological survey was conducted in 1996 in advance of improvements for the Big Stone City wastewater treatment system. The survey was conducted by the Archaeology Laboratory at Augustana College for the City of Big Stone City, for the proposed construction of a lift station, outfall line, forcemain and a series of stabilization ponds. The proposed outfall line and portions of the forcemain run through the Big Stone II project area, and are therefore relevant to this study (see Figure 4). Both had a construction easement of 30 feet in width. The proposed forcemain runs west to east along the top of Area B and the easternmost part of Area C. The outfall line runs north to south from the stabilization ponds in Area C. The forcemain and outfall line were to be located in the existing road and railroad rights-of-way, and were visually determined to have no potential for intact cultural resources (Winham 1996).

No sites have been recorded (confirmed) or reported (not field checked) within the current study area. Four sites have been recorded (confirmed) and no sites have been reported (not field checked) within one mile of the current study area (Table 1; Figure 4). Site 39GT24 is approximately 7.9 acres (3.2 hectares) and was found in 1994 in an upland plowed field and pasture above Whetstone Creek. The site consists of a light, discontinuous artifact scatter of both precontact and historical artifacts. The precontact materials included a lithic scatter of flakes made from a variety of materials and a possible pebble hammerstone. The historical materials included a clear stopper type bottle finish and Bakelite handle straight razor fragment. The artifact density was found to be greater near the bluff edge. Artifacts found were not collected (Donohue and Williams 1994).



Source: USGS Quadrangles, Big Stone Lake SE, South Dakota 1971; Ortonville, MN 1971; 106 Group Field Notes

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Figure 4

Site 39GT2042 (see Figure 4) is the overgrown raised bed of abandoned railroad which runs approximately 80 meters east of St. Charles Cemetery (Hanson Engineers, Inc. 1995). The bed is dated as post-1861 in the archaeological site form, and likely dates from the 1880s (Mills 1998:2).

The site form for 39GT6 (see Figure 4), prepared in 1982, identifies the site as the "fortified site recorded by T. H. Lewis in 1883" (State Archaeological Research Center, County File Site Record, 39GT6, on file at the State Archaeological Research Center, Rapid City). Little additional information is provided on the form for this site.

Site 39GT2007 refers to the Chicago, Milwaukee, St. Paul and Pacific Railroad that marks the boundary of the southeastern part of Area B of the Big Stone II project (see Figure 4). As a railroad in South Dakota, it automatically receives a site number, but no specific documentation or site form exists (Jane Watts, Records Manager, State Archaeological Research Center, personal communication 2005).

TABLE 1. ARCHAEOLOGICAL SITES PREVIOUSLY IDENTIFIED WITHIN ONE MILE OF THE PROJECT AREA

Site No.	Within Project Area	T	R	S	¼ Sec.	Description
39GT24	No	121N	47W	13	NW-SW-NE NE-NE-SE-NW	Artifact Scatter
39GT2042	No	121N	46W	18	NE-SE-SE-NE SW-NE	Railroad Spur Raised Bed
39GT6	No	121N	46W	17	NE-SW-SE-SW	Earthwork
39GT2007	No					Railroad

3.2 PREVIOUS ARCHITECTURAL HISTORY STUDIES

One survey of architectural properties included the project area. In 2004 and 2005, The Louis Berger Group, Inc. completed a reconnaissance and intensive architectural survey in Grant County and 11 other counties in order to complete a larger Barns of Northeastern South Dakota survey project (Deiber and Rupnik 2005). The 2004 project recorded 11 barns on private farms and additional buildings on property known as the Grant County Farm. Two barns (GT-000-00030 and GT-000-00031) located north of Milbank and a few miles west of the project area were recorded, but none of the barns in the immediate vicinity of the project area were surveyed.

No properties in the APE have been inventoried. Within one-mile of the project property, three resources in Big Stone City have been inventoried and evaluated. The Big Stone City Hall (GT-000-00037) is listed on the NRHP. The Milwaukee Road Bridge O-262½ (GT-000-0006) at Second Avenue in Big Stone City is considered eligible for listing on the NRHP. The Big Stone City School (GT-000-00010) has been inventoried and is considered not eligible for NRHP listing.

3.3 ARCHITECTURAL HISTORY CONTEXT: AGRICULTURE IN BIG STONE TOWNSHIP, GRANT COUNTY, SOUTH DAKOTA

Grant County, adjacent to South Dakota's boundary with Minnesota, is located in the semi-arid portion of the state where diversified agriculture has flourished. The area that is now Grant County was included originally in the quite large Red River County, one of the divisions created when the government structure of Dakota Territory was established in 1861. Present-day Grant County was included subsequently in Deuel County, which was separated from Red River County in 1862. Grant County was separated from the northern part of Deuel County in 1873; its northern tier of townships became part of Roberts County when it was formed ten years later. The County Commissioners appointed for Grant County in 1873 failed to establish a local government (Black 1939:20-22).

Moses Mireau and Solomon Roberts (or Robar), French fur traders considered to be the first European residents of Grant County, settled at the southern end of Big Stone Lake in 1865. Mireau and Roberts (a nephew of the prominent St. Paul, Minnesota trader Louis Robert) turned from fur trading to farming after 1873, as other farmers began to move into the area. During the late 1870s, several farmers established properties in the Coteaux area further west in Grant County (Black 1939:21).

Larger numbers of settlers moved into eastern Dakota as part of the "Dakota Boom" period of 1878 to 1883. This period of settlement brought many farmers to the open plains of Grant County; the only timber was located along the Whetstone and Yellow Bank Rivers and in the western part of the county. The character of the eastern Grant County underwent a noticeable change as white settlers replaced a camp of Sioux on the Dakota side of Big Stone Lake. This transformation was aided by the extension of the Chicago, Milwaukee & St. Paul Railroad Company's rail service into the Dakota Territory. Its Hastings & Dakota Railway subsidiary built a line westward from Ortonville, Minnesota that was extended to Webster in 1880 and soon on to Aberdeen (Black 1939:26; Mills 1998:2).

The arrival of settlers and need to file land claims forced the formation of a county government in June 1878. The county seat, first located in Big Stone City, was relocated to Milbank in 1881. Townships were organized in the county in July 1881 and Big Stone Township encompassed the northeast corner of the county. Big Stone City remained a small town while the banks of Big Stone Lake were developed with Chataqua Park and other resorts. The first settlers in the Whetstone River valley in northeastern Grant County were mostly Irish-American and German-American farmers. A group of Dutch immigrants settled nearby on the north branch of the Whetstone River (Black 1939:23-25).

The rich black loam of eastern South Dakota, between the Coteaux on the west and Big Stone Lake, was fertile and well-watered; it was ideal for raising wheat. By the early 1880s, the county was noted for its higher than average yields of wheat per acre. In 1883, the county's total wheat acreage was 63,000 acres and the average yield per acre was 23 bushels. At that time, 23,000 acres were planted with oats there was also a small rye crop (Black 1939:63-64). There were 966 farms in the county in 1890, the average size of which was 209 acres. An 1899 plat map of the county indicates that there were several farm properties of over 300 acres, many of which were north of the Whetstone River. The sizes of the farms in Big Stone Township remained fairly constant through the first quarter of the twentieth century (Grant County Historical Society 1979:182; Peterson 1899; Brock & Company 1929).

Farmers developed more diversified farm operations after the panic of 1893 and the drought the following summer. The introduction of stock raising was accompanied by larger crops of corn, oats, and barley for use as stock feed. Native grass was used for hay, although clover was introduced. By 1904, dairying was common throughout the county (Peterson 1904:135). Hans Bundtzen named his property in Big Stone Township the "Whetstone Valley Stock Farm" (Geo. A. Ogle & Company 1910). Potatoes became a more common crop; while wheat lost its dominance after 1920, it remained a minor component of diversified farming. After World War I, farmers began to specialize in dairying or raising purebred beef cattle, hogs, or sheep. During the early twentieth century, fruit raising was an important component of Grant County agriculture (Black 1939:65-66).

During the mid twentieth century, the farming practices in Grant County evolved again. The corn crop increased significantly from the 1940s to the 1960s and in 1966 accounted for one-third of the total value of all farm crops in the county. Hay was the second most valuable crop and 36,000 acres were planted in alfalfa hay in 1966. The number of beef cattle in the county increased significantly during this same time as the number of dairy cattle decreased after the mid-1930s. Dairying again became an important component of agriculture and the Grant County's milk production peaked in 1973. Many eastern South Dakota farmers raised hogs, sheep and chickens; there has been a decrease in poultry and sheep production since the mid twentieth century (Grant County Historical Society 1979:181-183).

4.0 RESULTS

4.1 ARCHAEOLOGY

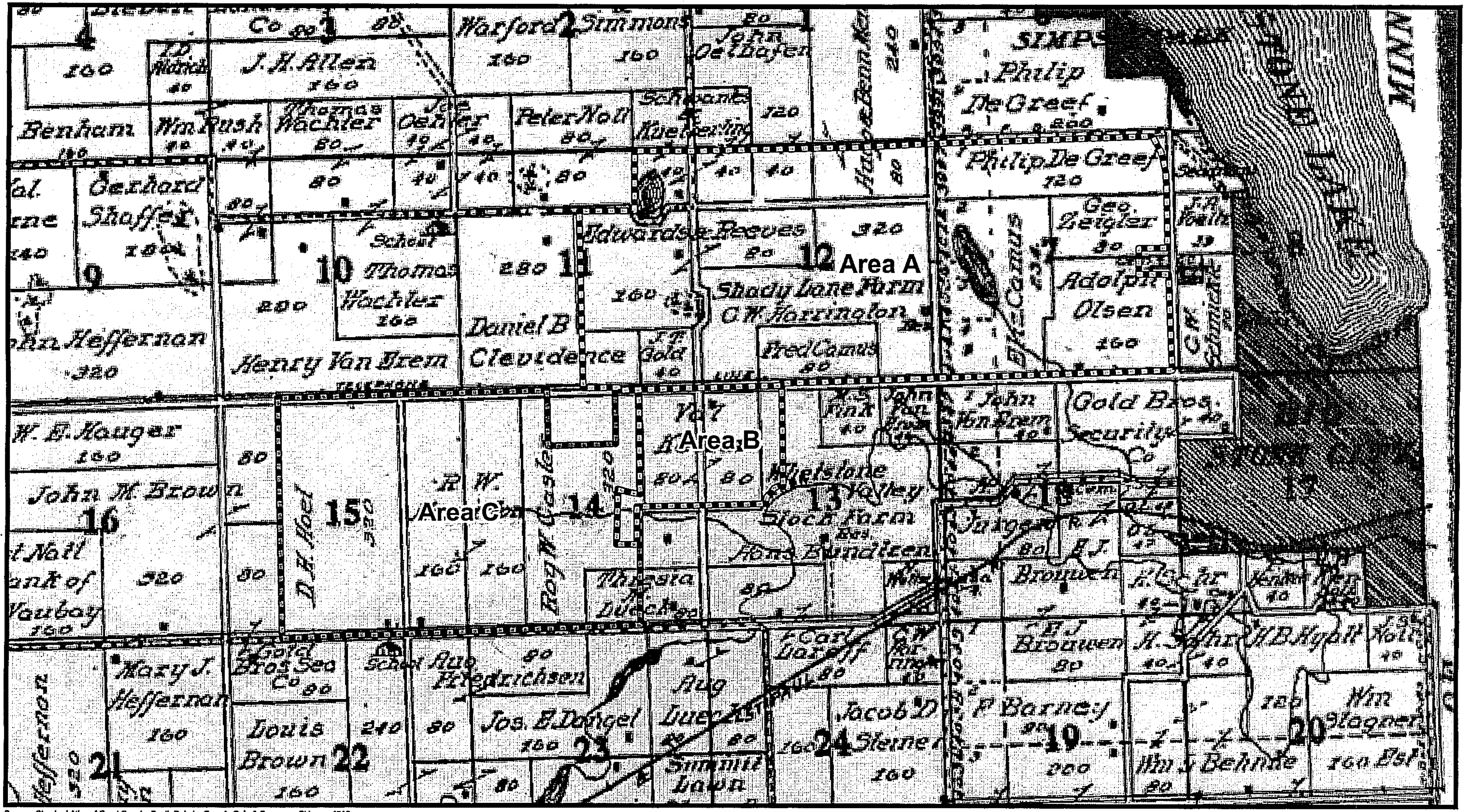
Staff from The 106 Group conducted an assessment (windshield survey) of the project area to identify areas with moderate or high archaeological potential on March 4, 2005. Anne Ketz, M.A., RPA, served as Principal Investigator. Holly Wright conducted the fieldwork assessment.

4.1.1 Precontact Archaeology

The majority of Area A has been disturbed by construction and cooling ponds associated with the Big Stone Power Plant and Northern Lights Ethanol Plant (see Figures 2 and 4). While small parts of Area A appear undisturbed, most are not situated within 500 ft. (150 m) of an existing or former water source of 40 acres (19 hectares) or greater in extent, within 500 ft. (150 m) of a former or existing perennial stream, or located on naturally occurring topographically prominent landscape features, and are therefore considered to have low potential for containing intact archaeological resources. The areas considered to have high potential include what appears to be undisturbed land on the north side of the pond in the northwestern portion of Area A, and a small part of the project area along the southern boundary of Area A (see Figure 4). The pond is found on historical plat maps from 1899 (Peterson 1899), 1910 (Geo. A. Ogle and Co. 1910), and 1929 (Brock and Co. 1929); the road that is now 143rd Street is shown consistently to run south of the pond (Figure 5). The small area to the south is in close proximity to the Whetstone River.

Area B consists of rolling hills and bluffs overlooking the Whetstone River. Land use is primarily agricultural, and most areas are either under cultivation or covered by grassland. The southern portion of Area B is recommended as having a high potential for intact archaeological resources due to its proximity to the Whetstone River, and lack of noticeable disturbance. A previous Level III survey was conducted in 1994, and revealed precontact artifacts just outside this high potential area (site 39GT24) (Donohue and Williams 1994) (see Figure 4). A portion of the previous survey area overlaps the high potential area and may therefore be eligible for exclusion from further survey. Consultation with the SHPO will be required to make this determination.

Area C consists of flat or gently rolling cultivated land, without topographically prominent landscape features or proximity to a significant former or existing water source, and the area is therefore considered to be of low potential for containing intact archaeological resources (See Figure 4).



Source: Standard Atlas of Grant County, South Dakota, Geo. A. Ogle & Company, Chicago, 1910

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1910 Plat Map of Big Stone Township

N W E S

0 0.25 0.5 0.75 1 Miles

1:24,000

Figure 5

4.1.2 Post-Contact Archaeology

No existing post-contact archaeological resources were observed during the assessment. Several farmsteads are indicated in the project area on the 1899 (Peterson 1899) and 1910 plat maps (Geo. A. Ogle and Co. 1910). Due to the level of disturbance in Area A, however, it is unlikely that anything remains intact (see Figure 5). The farmstead that was located in Area B is no longer extant; a pile of rubble is all that remains of the site. Two farmsteads shown in Area C correspond to the locations of present-day properties. The site of the non-extant farmstead identified by Ogle in Area B (northwest corner of Section 13, T121N, R47W) is considered to have high potential for intact post-contact archaeological resources. However, no information was found on any of the owners of the property in local history sources (Black 1939; Grant County Historical Society 1979). Consequently, the potential significance of any post-contact archaeological resources that might exist within the study area is considered to be low, because any intact archaeological remains that may exist are unlikely to answer important research questions.

4.2 ARCHITECTURAL HISTORY

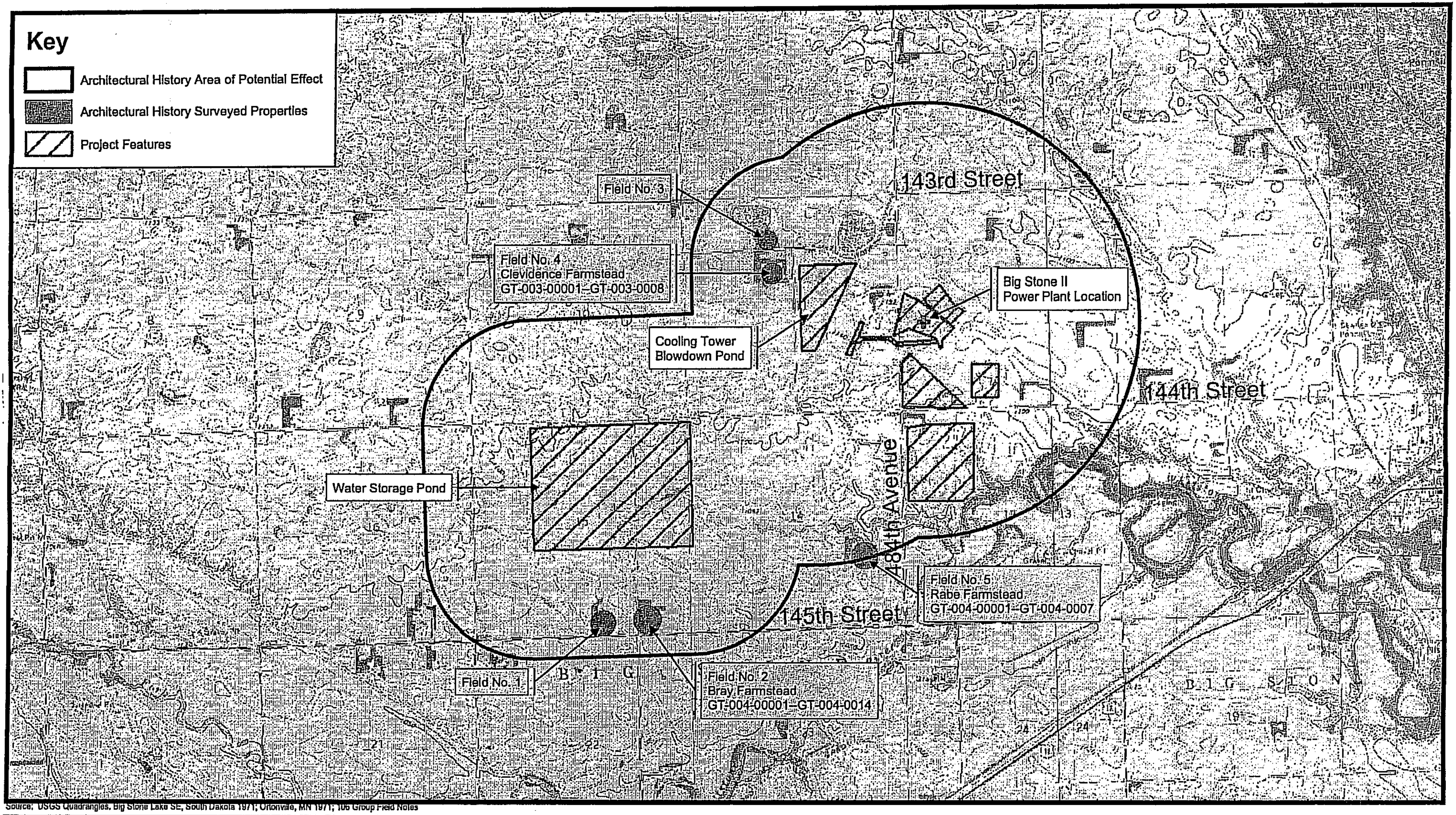
Staff from The 106 Group conducted an architectural history survey of the Big Stone II APE on April 4 and 5, 2005. Betsy H. Bradley, Ph.D., served as Principal Investigator and was assisted in the field by Holly Wright.

The 106 Group identified five properties in the architectural history APE, all of which are farmsteads and rural residences (Figure 6). Properties 1 and 3 are modern rural residences at the location of historic farmsteads though none of the historic farmstead buildings remain standing on these properties. Theses properties were not surveyed. Three properties are farmsteads on which buildings over 49 years of age stand; they are discussed below.

TABLE 2. PROPERTIES SURVEYED WITHIN THE ARCHITECTURAL HISTORY APE

Field No.	Address	Property Type	SHPO numbers
1	48254 145th Street	Modern rural residence	N/A
2	48280 145th Street	Bray farmstead	GT-002-00001—GT-002-00014
3	48333 143rd Street	Modern rural residence	N/A
4	Xxxx 484th Avenue	Clevidence farmstead	GT-003-00001—GT-003-00008
5	14461 484th Avenue	Rabe farmstead; round barn, livestock and hay barn	GT-004-00001—GT-004-00007

The surveyed farmsteads were evaluated in terms of the South Dakota statewide *Homesteading and Agricultural Development Context* (Brooks and Jacon 1994), which notes the importance of agriculture in the state. The potential for a historical agricultural landscape in this vicinity was assessed. There do not appear to be any distinctive characteristics about the farmsteads in the rural area west of Big Stone City that suggest that there is a cultural landscape that would be a strong candidate to be a NRHP-eligible historic district. If such an area were to be identified in the general vicinity, its boundaries would be unlikely to include any of the properties in the Big Stone II project APE.



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Architectural History Survey Results

Figure 6

4.2.1 Bray Farmstead, Field No. 2, GT-002-00001 through GT-002-00014

48280 145th Street, Big Stone Township, Grant County

Property Description
The Bray farmstead consists of a four-square house and gambrel-roofed barn erected circa 1915 (Figure 7). Earl Bray, father of the current owner, Donald Bray, purchased the farm in 1948 and then built the garage, drive-through granary, corn crib and two pole barn barns prior to 1971, according to Mrs. Donald Bray. Other buildings in the farmstead include two hog houses, a chicken house, a pump shed and grease shed (Figures 8 and 9). There is no longer any livestock on the farm and most of the buildings are not being used; some of the smaller outbuildings are in a state of partial collapse.

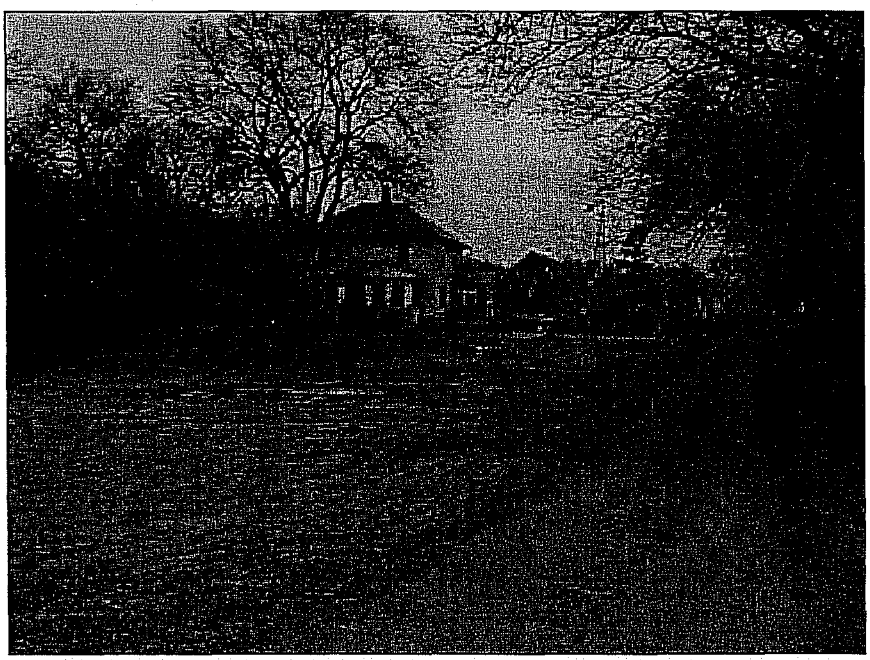


FIGURE 7. BRAY FARMSTEAD, FACING NORTH

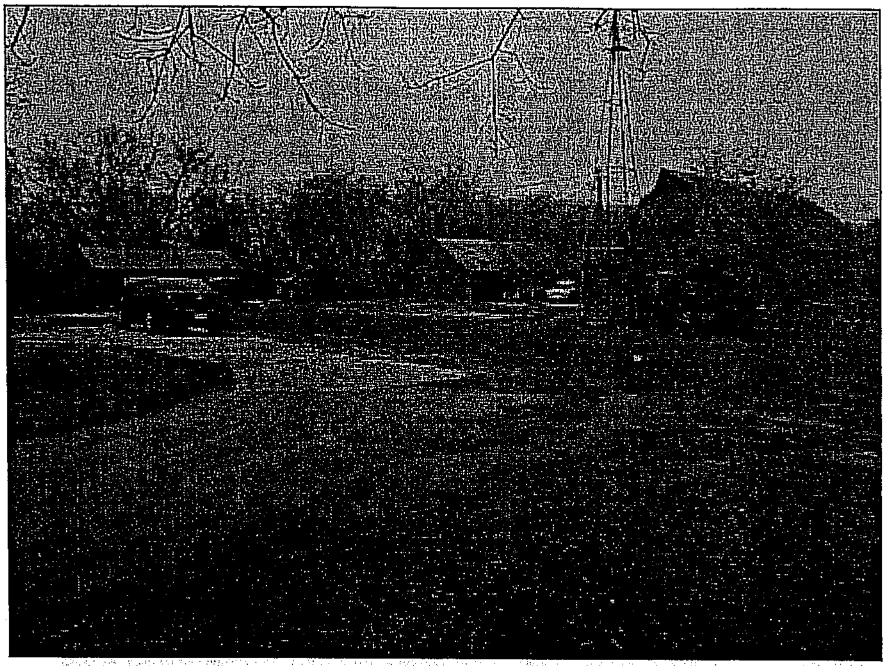


FIGURE 8. BRAY FARMSTEAD, FACING NORTHWEST

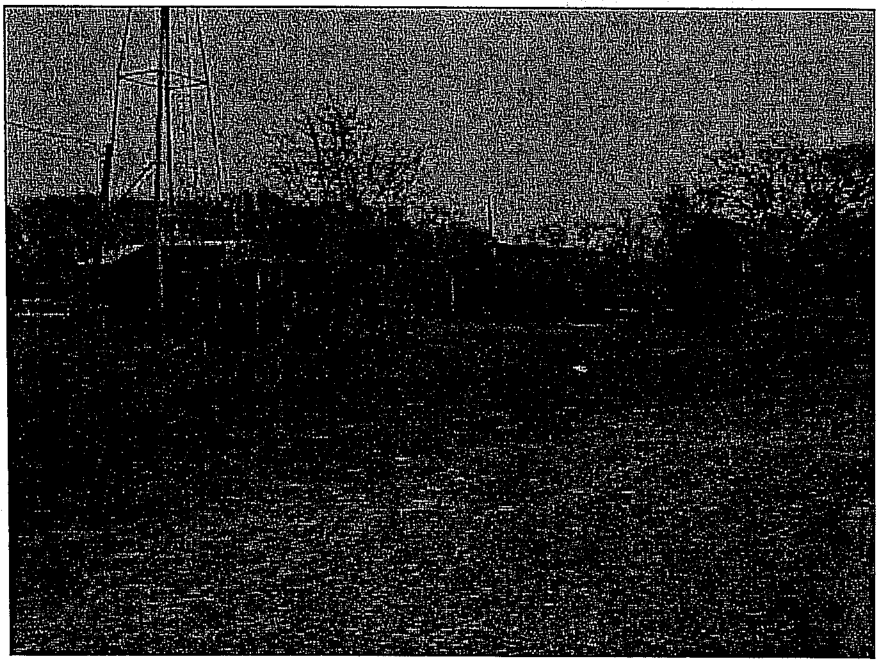


FIGURE 9. BRAY FARMSTEAD, FACING NORTHEAST

Property History
Sam C. Jones is recorded as the holder of the land patent for a 160-acre parcel in Sections 14 and 15 in Big Stone Township. A 320-acre farm that includes the Jones patent, appears to have been developed by Philip and Collete Roder, who were raising wheat and oats on the property in 1886. The Roders sold the property to Alfred C. Miller of Grant County in 1906. Miller sold the farm in 1911 to Ransom W. Hamilton, also a Grant County resident. Two years later Hamilton sold the farm to N. H. Reints of Aplington, Butler County, Iowa. Earl and Laura Bray acquired the farm from Minette K. Reints in 1948; the property is now owned by Mr. and Mrs. Donald Bray (Grant County Recorder's Office Deed Records; Bureau of Land Management General Land Office Patent Records).

Evaluation
This property was evaluated as an example of a mid twentieth-century farmstead since most of the buildings were erected after 1948. The presence of an earlier dwelling and barn on a property dominated by later buildings is not unusual. However, during this project it was observed that most of the farms in Grant County have one or more silos that were built during the 1950s and 1960s. The Bray farmstead, without a silo, appears to represent a somewhat different mix of diversified farming. This property may not represent a significant type of farming practice in Grant County, either the most common type or a significant specialty operation. The poor to fair condition of several of the farm buildings, including the barn and house, are another reason why the Bray farmstead does not appear to be an outstanding example of a mid twentieth-century farm property in South Dakota. The farmstead does not appear to have significance under Criterion A.

The farm is not known to be associated with any persons significant in local or state history and therefore the property does not have significance under Criterion B. The farm buildings on the property are representative of their types, but do not appear to be outstanding examples of a farm residence, gambrel-roofed barn, or secondary structures. None of the buildings appear to have significance individually under Criterion C. The Bray farmstead is not likely to yield information important in prehistory or history, and therefore is recommended as not significant under Criterion D. For these reasons, the Bray farmstead is recommended as not eligible for listing on the NRHP.

4.2.2 Clevidence Farmstead, Field No. 4, GT-003-00001 through GT-003-00008

Xxxx 484th Avenue, Big Stone Township, Grant County

Property Description
The Clevidence farmstead, currently unoccupied, has a mix of both early farm buildings and modern ones. The circa 1890 farmhouse is a gabled-ell dwelling clad with masonite siding (Figure 10). Remnants of the silo foundation suggest where the silo and, presumably, a barn once stood. Older outbuildings on the property include a granary clad with sheet-metal siding, a wood-framed loafing shed with a mow, and a small shed

(Figure 11). Modern buildings include a two-car garage, two pole barns with corrugated metal siding, and nine grain bins.

FIGURE 10. CLEVIDENCE FARMSTEAD DWELLING, FACING ORTHWEST

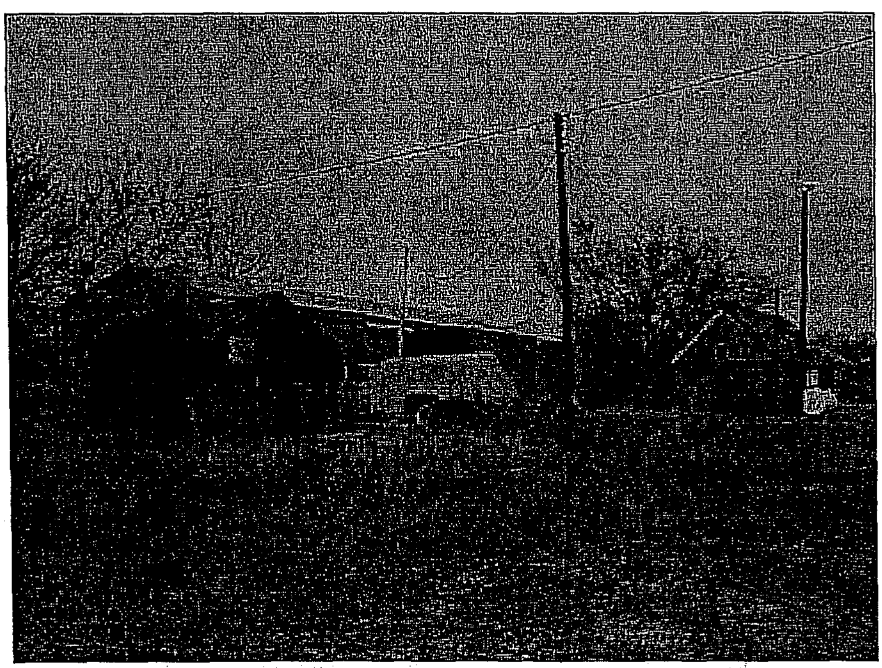


FIGURE 11. CLEVIDENCE FARMSTEAD, FACING NORTHEAST

Property History

Frank Farnum filed a land patent on much of this property in 1890. The 160-acre property was owned by both Frank and Sarah Farnum and John T. and Alice S. Gold during the 1890s. Ellen Doherty owned the property briefly, from May 1899 to November 1901. Daniel B. Clevidence of Humboldt County, Iowa owned the farm from 1901 through the mid-1930s (Grant County Recorder's Office Deed Records; Bureau of Land Management General Land Office Patent Records). Clevidence, who appears to have moved to South Dakota in 1904, expanded the farm to 280 acres by 1910 (Geo. A. Ogle and Company 1910). He is identified in a 1929 county atlas as a farmer and breeder of Black Polled cattle, Poland China hogs, Plymouth Rock chickens and Percheron horses (Brock & Company 1929:47). Daniel and Emma Clevidence appear to have lost their farm to the Mutual Benefit Life Insurance Company in the mid-1930s. Laura May and J. H. Blink owned the property from 1942 until 1952, when they sold it to Harry and Grace Russman (Grant County Recorder's Office Deed Records).

Evaluation

Without an early-twentieth-century barn, the farmstead does not convey the nature of the diversified farming operation that Daniel Clevidence and other owners of the property developed during the late nineteenth and early twentieth centuries. The property also does not convey well the nature of mid twentieth-century farming, when the later buildings were erected. The Clevidence farmstead does not appear to have significance under Criterion A. The property is not known to be associated with any persons significant in local or state history and therefore the property does not have significance under Criterion B. The older farm buildings on the property are representative of their types, but do not appear to be outstanding examples of a farm residence or outbuildings. None of the buildings appear to have significance under Criterion C. The Clevidence farmstead is not likely to yield information important in prehistory or history, and therefore is recommended as not significant under Criterion D. For these reasons, the Clevidence farmstead is recommended as not eligible for listing on the NRHP.

4.2.3 Rabe Farmstead, Field No. 5, GT-004-00001 through GT-004-00007

14461 484th Avenue, Big Stone Township, Grant County

Property Description

The former Rabe farmstead is now used as a rural residence. The farmhouse (Figure 12) is a gable-front dwelling erected circa 1900 and clad with stucco during the 1930s. A modern garage stands near the house. A 1915 wood-framed round barn with internal silo stands near the northwest corner of the farmstead (Figure 13). A circa 1917 gable-roofed livestock and hay barn stands west of the house (Figure 14). A group of more modern buildings, a Quonset building, a gothic-arched building, and three grain bins, are grouped on the south side of the farm lane leading to the barns. An additional bin stands near the round barn. The farmstead is enclosed by a shelterbelt of trees on its north and west sides. A lot for a modern rural residence, located south of the lane to 484th Avenue, was separated from the farm during the late twentieth century; this parcel is outside the APE and was not surveyed.

FIGURE 12. RABE FARM, FACING NORTHWEST

FIGURE 13. RABE ROUND BARN, FACING SOUTHWEST

FIGURE 14. RABE LIVESTOCK AND HAY BARN, FACING EAST

Property History

Christian Mahl, who filed a patent on a 160-acre farm in 1894, had already transferred title to the farm to his wife, Ottila Mahl, in 1886, according to Grant County deed records. The Mahls sold their 310-acre farm in 1902 to David E. Geier. David and Etta Geier resided in Ortonville, Minnesota in 1906 when sold the property to Roy W. Casler of Grant County and it appears that the Geiers did not reside on the property (Grant County Recorder's Office Deed Records; Bureau of Land Management General Land Office Patent Records).

The farm was acquired by the Rabe family in 1913. Frederick and Emma Rabe, parents of Lewis Rabe, of Altavista, Chicasaw County, Iowa, purchased the farm from Casler in 1913 and sold it to their 34-year-old son, Lewis Rabe, who relocated to Grant County, in March, 1914 (Grant County Recorder's Office Deed Records). Lewis G. Rabe (ca. 1880-1940) was identified in a Grant County atlas in 1929 as a farmer and breeder of Brown Swiss cattle, Duroc Jersey hogs, White Leghorn chickens and Percheron horses (Brock & Company 1929:48). The daily diaries that Rabe kept are in the possession of his daughter-in-law, Vi Rabe, who resides in Big Stone City. Mrs. Rabe states that the diaries indicate that the round barn was built in 1915 and the livestock and hay barn (the "new barn") was erected in 1917; she was not aware that the barn project was an expansion of an earlier building. Lewis Rabe married Hilda Bundtzen, who lived on a nearby farm, in 1921; Lewis and Hilda Rabe both died during the early 1940s. Their sons, Harold and Jim, continued the farm operation. Harold Rabe, and his wife, Vi, resided on the property until 1998 (Vi Rabe, personal communication, April 4, 2005).

Assessment

The Rabe farmstead includes a dwelling built circa 1900 and altered during the 1930s and a barn from the late nineteenth century that was expanded circa 1917. A round barn completes the group of pre-1940 buildings on the farmstead. The Quonset and gothic-arched building, as well as the grain bins, date from the post-World War II period. As a farmstead, it does not represent well the Mahl development of the farm, or the expansion of the farmstead by Lewis Rabe.

The Rabe farmstead does not appear to represent a Grant County farming operation of any particular period and therefore does not have significance under Criterion A. The farmstead is not known to be associated with any persons significant in local or state history and therefore the property does not have significance under Criterion B. The farm buildings other than the two barns are representative of their types, but do not appear to be outstanding examples of a farm residence, gambrel-roofed barn, or farm outbuildings. The buildings that appear to have significance under Criterion C, the two Rabe barns, are discussed below. The Rabe farmstead is not likely to yield information important in prehistory or history, and therefore is recommended as not significant under Criterion D. For these reasons, the Rabe farmstead is recommended as not eligible for listing on the NRHP.

4.2.3.1 The Rabe Round Barn, GT-004-00001

Historical Context

This property was evaluated in terms of the significant themes identified in the statewide South Dakota historical context, Homesteading and Agricultural Development, and the South Dakota's Round and Polygonal Barns and Pavilions National Register of Historic Places Multiple Property Documentation Form.

Description

The Rabe Round Barn has concrete foundations for the exterior wall and its center silo. The balloon-framed barn is clad with horizontal drop lapped siding (Figures 13 and 15). Four entrances, at the cardinal points, give access to the main area of the barn. A series of small square windows are set at eye-level in the barn wall; four-light wood sash remains in only a small number of the openings (Figure 16). A smaller number of similar openings are set just below the eaves. Larger square openings were positioned just above the north and south doors at the floor level of the hay mow. Two cattle chutes extend from the west door of the barn.

The barn has a conical roof from which the clerestory level of the silo rises. A small conical roof caps the silo (see Figure 15). The roof is self-supporting in that it is not supported by framing elements extending from the hay mow floor. Braces extend from the silo to support the roof rafters that are spanned by spaced boards to which the wood shingles are nailed (Figure 17). A hay door on the north side of the barn is sheltered by a projecting gable roof (Figures 15 and 18). The track for the hay hoist remains in place at the perimeter of the hay loft (Figure 18).

The silo that rises through the center of the barn consists of vertical redwood planks supported by cables (Figure 19). The silo was equipped with a Badger brand silo unloader. A laminated frame circular collar that surrounds the silo supports the center end of the framing for the hay loft level (see Figure 19). A fence-like barrier separates the main area from the feeding manger with a concrete floor that encircles the silo (Figure 20). A series of small openings give access to the top of the silo at its clerestory level above the main roof. This portion of the silo exterior is clad with narrow lapped siding (see Figure 15).

The overall condition of the barn is fair. The hay mow floor on the north side of the barn has collapsed. There are additional areas of material loss on the north side of the barn, at the roof level and near the door. Many of the wood shingles on the barn roof are no longer in place and since they were nailed to spaced boards, the mow area is exposed to precipitation. Some of the curved sheathing has become loose from the frame. The interior silo and lower level of the barn are in relatively good condition.

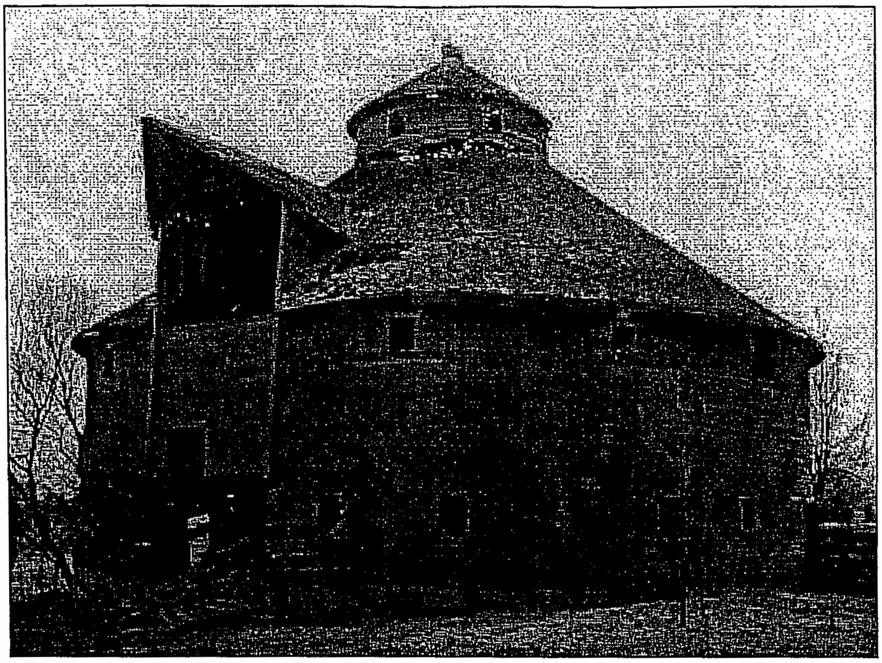


FIGURE 15. RABE ROUND BARN, FACING SOUTHEAST

FIGURE 16. RABE ROUND BARN SIDING AND WINDOW DETAIL

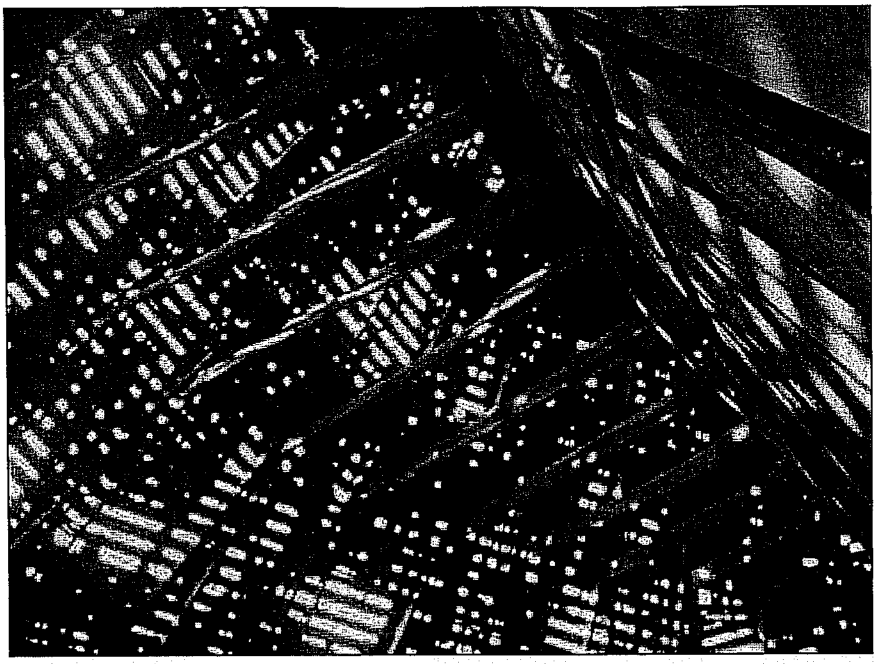


FIGURE 17. RABE ROUND BARN ROOF BRACES

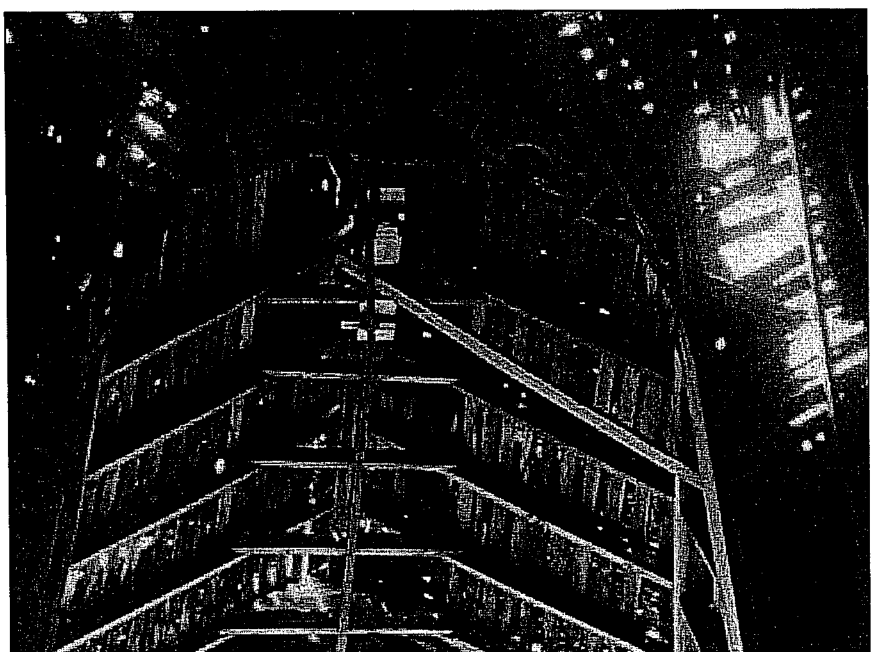


FIGURE 18. RABE ROUND BARN HAY HOOD WITH HOIST TRACK

FIGURE 19. RABE ROUND BARN REDWOOD SILO AT HAY MOW FLOOR LEVEL

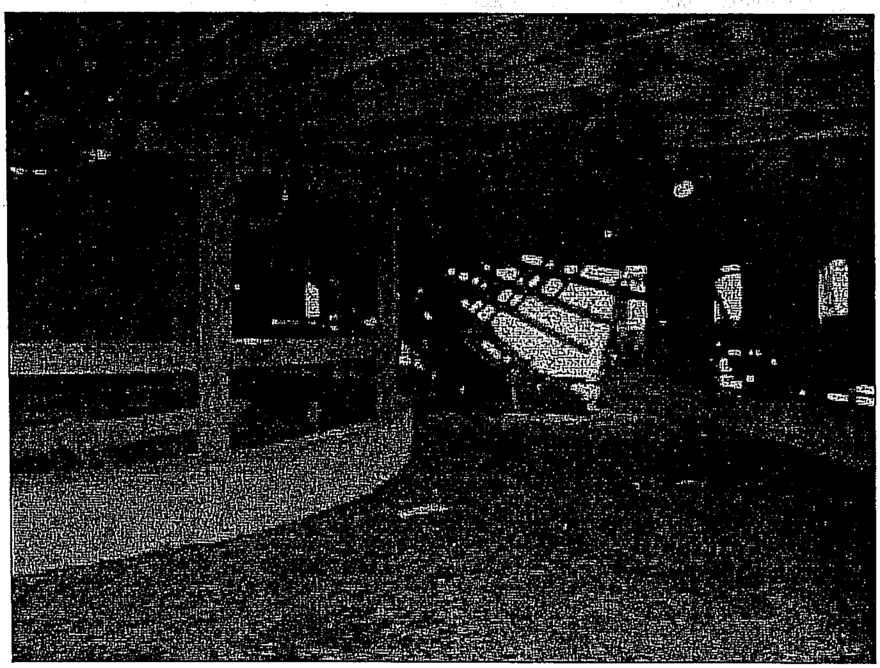


FIGURE 20. RABE ROUND BARN INTERIOR, FEEDING MANGER SURROUNDING SILO ON THE LEFT

Property History

As noted above, the daily diaries that Lewis Rabe kept after he took over the South Dakota farm property in March 1914, recorded the round barn construction project and its costs. The round barn, which Rabe used for feeder cattle, was built between July and October 1915. Rabe paid $1,674.25 for lumber for the barn and $772.55 for carpenters' labor. The silo was entered as a separate cost at $444.60. The total cost of the barn was $2891.40. Mrs. Vi Rabe, owner of the diaries, states that they do not indicate, nor is she aware of, the reason why Lewis Rabe erected a round barn (Vi Rabe, personal communication, April 4, 2005).

The *Big Stone Headlight* newspaper did not report on the barn construction project. The local paper reported that Rabe had a crop of sweet clover on his farm during the summer of 1915 (*Big Stone Headlight* August 5, 1915) and that in December of that year he traveled to St. Paul to "look up market conditions with a view of buying two or three carloads of feeders" (*Big Stone Headlight* December 23, 1915). The Rabe farm operation used the round barn through the early 1980s (Vi Rabe, personal communication, April 4, 2005).

The Rabe Round Barn as an Example of a South Dakota Round Barn

As in other states, round and octagonal barns are an unusual building type; however, a relatively large percentage of barns of this type built in South Dakota remain standing. Most of the round and octagonal barns in South Dakota were built east of the Missouri River and the earliest, as well as the largest number, of these barns are located in the northeast quadrant of the state near the rail lines constructed around 1880. Approximately 45 round barns were built in South Dakota between 1903 and 1946. As in other states, the majority of the barns were erected between 1910 and the early 1920s, a boom period for barn building related to an increase in livestock on South Dakota farms (Ahrendt 1995:E-2, E-7). The barns built during this time included wood-framed "Middle Period" barns, as well as "Final Period" barns, many of which were built from standard plans or are hollow clay tile buildings (Ahrendt 1995:F-2—F-6).

The wood-framed round barn erected by Lewis Rabe does not appear to be a particularly common form of the building type. Rabe may have become familiar with round barns that had been erected in Iowa. Soike's map of round barns in Iowa indicates that several were erected in northeastern Iowa, where Rabe's family resided near Altavista in Chicasaw County (Soike 1983:3). However, none of the barns depicted in Soike's study appear to be very similar to the one Rabe erected in Big Stone Township (Soike 1983:72-94).

The Rabe barn, a true round barn with interior silo, differs from many of the barns erected in the Midwestern and Great Plains states due to its horizontal wood siding and conical roof with a clerestory. The gambrel roofs that capped so many round barns were used because they enclosed a slightly larger loft area and were strong and "self-supporting" to the extent that they did not need supports from the floor of the mow that would obstruct hay storage (Soike 1983:38). The conical roof on the Rabe barn is self-supporting in a way similar to that of the gambrel roofs; its rafters are braced from the upper portion of the silo (see Figure 17) and there are no supports from the mow floor. Though conical barn roofs tended to sag (Soike 1983:38), the Rabe round barn roof appears to have performed well.

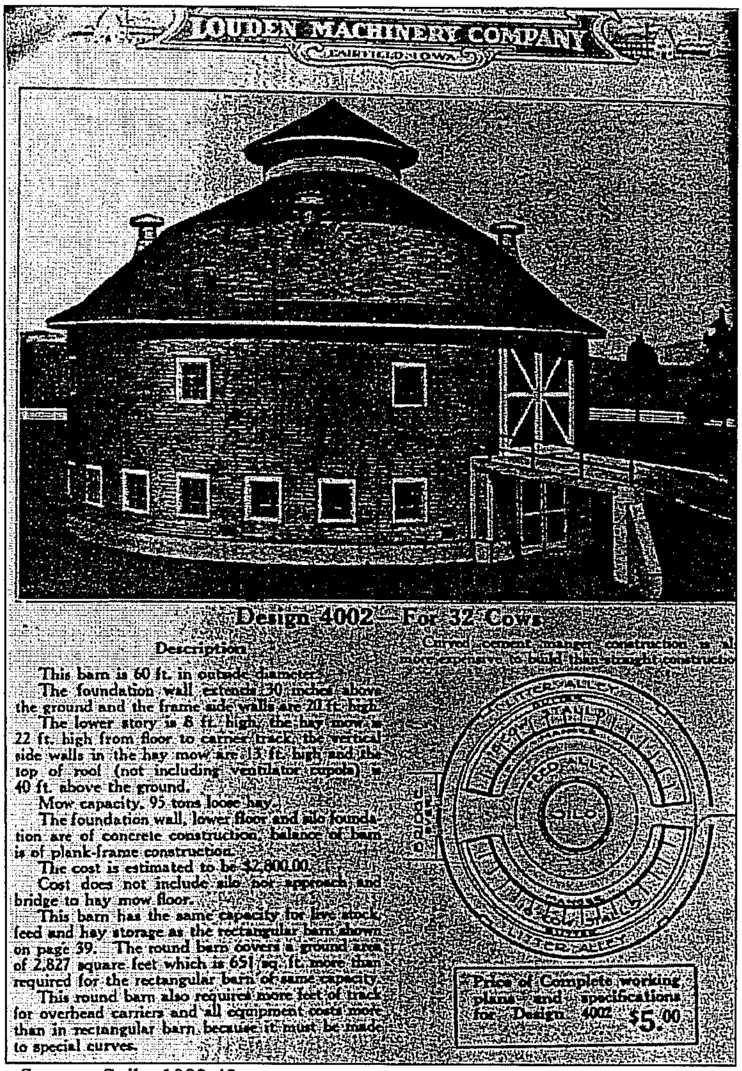
The Rabe Round Barn has similarities to a barn design presented in the Louden Machinery Company's catalog, *Louden Barn Plans* (1915) (Figure 21). The Louden barn has a lower story 8 feet in height, while the mow extends another 22 feet to the eaves of the roof. The barn is depicted with horizontal wood siding and with square windows in both levels of the barn, set closer together than those of the Rabe barn. The Louden barn plan has a gambrel roof with slightly projecting eaves; a conical roof caps the silo which rises slightly above the main roof. The plan for the barn shows a feed alley surrounding the silo separate from the manger that edges the ranges of stalls. The interior of the Rabe barn is simpler, with the manger surrounding the silo. Overall, the Rabe barn appears to have slightly different proportions than the Louden barn. The Rabe Round Barn could be a simplified version of the Louden barn, or be based on another design.

Benton Steele was a round barn designer known to have erected barns in South Dakota. Steele had worked at the Loudon Machinery Company in Fairfield, Iowa before he relocated to Kansas in 1909 (Sculle and Price 1995:198). The possibility that the Rabe Round Barn could be a Steele design could be further explored.

Significance

The design of the Rabe Round Barn represents an interesting variation on the round barn form. It exhibits many of the common features of barns of this type: a center silo, a hay mow above a main level, a self-supporting roof, a hay hood, and a hay track. Its conical roof and horizontal wood siding are less common features of round barns.

This barn is a previously unrecorded example of round barn construction in South Dakota, a property type considered to be significant. Excellent examples of this property type are considered to be eligible for listing on the NRHP in conjunction with the South Dakota's Round and Polygonal Barns and Pavilions multiple property listing. The 1915 barn meets the criteria for eligibility for "Middle Period Polygonal/Round Barns" by having been erected between 1910 and the early 1920s. The Rabe Round barn embodies the distinctive characteristics of the middle period of round barn construction in South Dakota. It was used as a general livestock barn, has a conical roof not requiring extra support except for the silo, has common interior features, and is located in a rural setting (Ahrendt 1995:F-3). The Rabe Round Barn, GT-004-00001, has statewide significance under Criterion C.



LOUDEN MACHINERY COMPANY

FAIRFIELD, IOWA

Design 4002—For 32 Cows

Description

This barn is 60 ft. in outside diameter.

The foundation wall extends 30 inches above the ground and the frame side walls are 20 ft. high.

The lower story is 8 ft. high, the hay mow is 22 ft. high from floor to carrier track, the vertical side walls in the hay mow are 13 ft. high and the top of roof (not including ventilator cupola) is 40 ft. above the ground.

Mow capacity, 95 tons loose hay.

The foundation wall, lower floor and silo foundation are of concrete construction, balance of barn is of plank-frame construction.

The cost is estimated to be $2,800.00.

Cost does not include silo nor approach and bridge to hay mow floor.

This barn has the same capacity for live stock, feed and hay storage as the rectangular barn shown on page 39. The round barn covers a ground area of 2,827 square feet which is 651 sq. ft. more than required for the rectangular barn of same capacity.

This round barn also requires more feet of track for overhead carriers and all equipment costs more than in rectangular barn because it must be made to special curves.

Curved cement manger construction is al more expensive to build than straight constructio

Price of Complete working plans and specifications for Design 4002 $5.00

Source: Soike 1983:43

FIGURE 21. LOUDEN MACHINERY COMPANY ROUND BARN DESIGN, 1915

The Rabe Round Barn does not appear to have significance under Criterion A in the area of agriculture. It is not part of a farmstead that is an excellent example of an early twentieth-century farming operation in eastern South Dakota. The round barn erected by Rabe is not known to have served as an example that influenced other farmers in the area to build similar structures.

The Rabe Round Barn does not appear to have significance under Criterion B since Lewis Rabe is not known to be individually significant in the history of South Dakota agriculture. The barn is not likely to yield information important in prehistory or history, and therefore is recommended as not significant under Criterion D.

Area of Significance: The area of significance is architecture.

Period of Significance: The period of significance is 1915, the year the barn was erected.

Historical Characteristics: The primary historical characteristics of the round barn are the true round form of the barn; concrete foundations; balloon-framed walls clad on the exterior with drop-lap siding; a conical roof supported by braces extending from the silo and extending below the clerestory level of the silo; the conical roof on the silo; two tiers of small, square window openings in the walls of the barn; the doors at the cardinal points of the barn; the center silo with concrete foundation and walls of vertical Redwood planks; the small openings in the clerestory level of the silo; the open interior space on the lower level and feeing manger surrounding the silo; the open hay mow level; and cattle chutes positioned on the exterior of the west door of the barn.

Property Boundary: The portion of the Rabe farmstead enclosed by the windbreak on the north and west sides, and by the fencing that edges the small pasture in which the barn stands on the south and east sides, is recommended as the boundary of this historic property.

Integrity

Despite the fair condition of the barn, it still conveys the design and layout and function of the barn. Its historic integrity is excellent with regards to location, setting, feeling, and association. The barn's integrity is very good with regards to design, materials and workmanship.

Recommendation

The Rabe Round Barn is recommended as eligible for listing on the NRHP under Criterion C in the area of architecture because it embodies the distinctive characteristics of the second stage of round barn building in South Dakota.

4.2.3.2 Rabe Livestock and Hay Barn, GT-004-00002

Historical Context

This property was evaluated in terms of the significant themes identified in the statewide South Dakota historical context, Homesteading and Agricultural Development.

Description

The Rabe Livestock and Hay Barn is a banked barn with an enclosed driveway on the west side that leads to the hay mow level (Figures 14 and 22). Roughly-coursed fieldstone forms the west wall of the lower level of the barn (Figure 23), as well as the central portion of the south wall (Figure 24); the central portion of the north wall foundation, covered with sheet metal, also appears to be stone. The same stonework forms the foundation for the driveway (Figure 25). The east and west thirds of the barn have concrete foundations. The exterior walls of the barn are clad with drop-lap siding. Some timber-framing posts remain in the lower level of the barn; the upper walls are balloon framed (see Figures 23 and 26). The gable roof of the barn, which extends over the entire structure, is supported by the framing of the walls that divide the interior of the barn into thirds, as well as angled Shawver-like trusses that extend from the floor to the rafters (Figure 26). An intersecting gable roof covers the driveway to the hay mow level. Two entrances to the lower level are located in the east wall (Figure 27). Square openings at two levels in the north and south walls of the hay mow are located near the east end of the building.

Property History

As noted above, the daily diaries that Lewis Rabe kept after he took over the farm property in March 1914, recorded the work undertaken on the farm. Mrs. Vi Rabe, owner of the diaries, states that this record notes the construction of a "new barn" in 1917; she referred to this barn both as the "white barn" and the "dairy barn." According to Mrs. Rabe, this barn building project was not as well documented as the round barn was.

It seems likely that in 1917 Lewis Rabe enlarged a bank barn that stood on the property when he acquired it. Christian and Otilla Mahl, who were some of the early settlers in the area and who lived on the property from the mid-1880s until 1906, would likely have built a barn on their farm. The barn presumed to have been built by the Mahls has stone walls on at least three sides (west, north, and south); its drive way into the hay mow level also has a stone foundation.

FIGURE 22. RABE LIVESTOCK AND HAY BARN, FACING SOUTHEAST

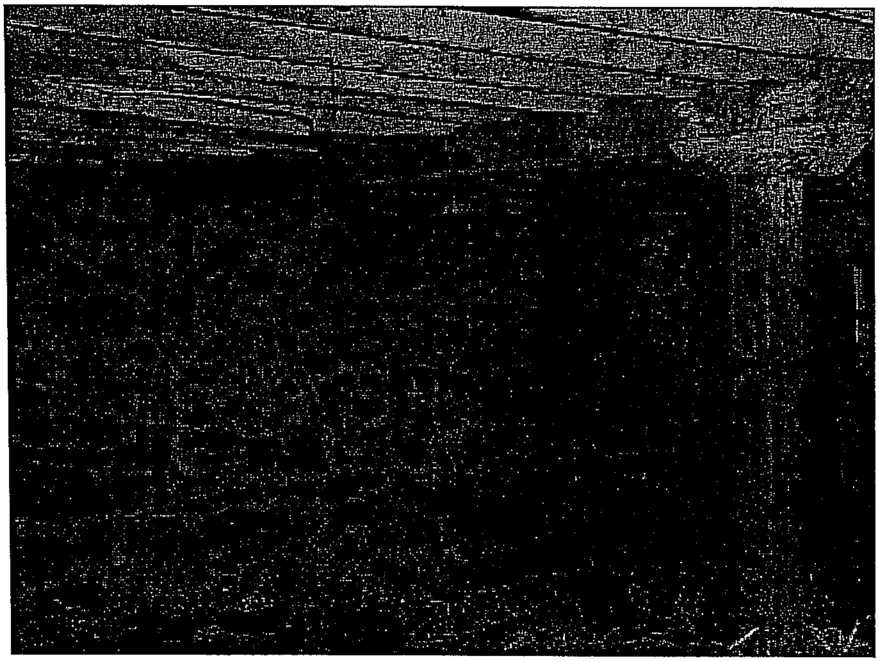


FIGURE 23. RABE LIVESTOCK AND HAY BARN, INTERIOR SIDE OF WEST WALL

FIGURE 24. RABE LIVESTOCK AND HAY BARN, FACING NORTHWEST

FIGURE 25. RABE LIVESTOCK AND HAY BARN, LOOKING THROUGH THE SOUTH EXTERIOR WALL TOWARDS THE COVERED DRIVEWAY, FACING NORTH

FIGURE 26. RABE LIVESTOCK AND HAY BARN, INTERIOR FRAMING OF HAY MOW LEVEL

FIGURE 27. RABE LIVESTOCK AND HAY BARN, FACING NORTHWEST

It appears that Lewis Rabe used the bank barn standing on his property as he planned to build a new round barn to house his feeder cattle. A few years after the round barn was completed, Rabe turned his attention to the older barn. He used concrete as the foundations for the additions to the barn (as he had on the round barn). On the west side, Rabe enclosed areas flanking the driveway that were separate from the mow area; on the east side he added a bay of similar width. The new upper level of the wall had balloon-framed construction. The gable roof that covered the entire barn was supported by interior walls and Shawver-type trusses and clad with wood shingles. An intersecting roof provided higher head-room above the enclosed driveway.

The initials of Harold Rabe and some other people, as well as the date 8/17/1940, are inscribed on a board in the driveway area of the barn; Mrs. Rabe is not aware that this information indicates any construction work done on the barn at that time (Vi Rabe, personal communication, April 4, 2005).

Mrs. Rabe recalls that the barn was used to house cows on the north end and horses on the south end. Harold and Jim Rabe installed an automatic feeder in the center of the lower level of the barn. They used the barn briefly to house their dairy herd before moving that operation to another property. The barn also was used briefly for potato storage before an underground storage facility was built on another property (Vi Rabe, personal communication, April 4, 2005).

Significance

This barn appears to represent two eras of barn building in South Dakota. If the barn is understood correctly, it originally had a form similar to that of the standard Pennsylvania barn, a building that supported both mixed grain and livestock agriculture. These barns had banked lower levels with upper levels approached by ramps or covered driveways (Wilhelm 1995:67). The lower levels of Pennsylvania barns usually had stone walls before concrete became a common farm building construction material. It seems likely that the barn erected by Christian and Ottila Mahl was a good-sized bank barn with long, narrow proportions. The lower portion sheltered their horses and cattle, while the upper level was used for hay and grain storage.

The expansion of the barn appears to be a cost-effective way for Rabe to increase his area for livestock sheltering and hay storage. The proportions of the enlarged barn are similar to the nearly square Midwest cattle feeder barns. The Rabe Livestock and Hay Barn represents the circa 1917 reworking of an earlier bank barn and a practical approach to farm building construction. The Rabe Livestock and Hay Barn is recommended as having significance under Criterion C as an example of barn construction and adaptation in South Dakota.

The Rabe Livestock and Hay Barn does not appear to have significance under Criterion A in the area of agriculture. It is not part of a farmstead that is an excellent example of an early-twentieth-century farming operation in eastern South Dakota. The Rabe Livestock and Hay Barn does not appear to have significance under Criterion B since Lewis Rabe is not known to be individually significant in the history of South Dakota agriculture. The barn is not likely to yield information important in prehistory or history, and therefore is recommended as not significant under Criterion D.

Area of Significance: The area of significance is architecture.

Period of Significance: The period of significance is from circa 1890, the time the bank barn might have been constructed, to circa 1917, the year the barn was enlarged.

Historical Characteristics: The primary historical characteristics of the livestock and hay barn is its roughly coursed rubble west wall, partial north and south walls, and foundation for the driveway to the mow area; the broad proportions of the barn that are similar to Midwest cattle feeder barns; a gable roof with intersecting gable over the driveway; the balloon-framed hay mow level and Shawver truss-like supports for the roof; exterior walls clad with drop-lap siding; a series of doors and windows in the lower level where livestock was housed; and openings in the how mow level near the east end of the building.

Property Boundary: The portion of the former Bray farmstead enclosed by the farmstead lane on the south, the driveway to the house on the east, the fenced pasture on the north, and a line extending north from the end of the farm lane on the west is recommended as the boundary of this historic property.

Integrity
The barn's historic integrity is excellent with regards to location, setting, feeling, and association. The stone foundation walls on the north and south side of the barn have failed or are covered with modern materials; the doors and windows in the lower level have been altered over time. The barn's integrity in terms of design, materials and workmanship is good.

Recommendation
The Rabe Livestock and Hay Barn is recommended as eligible for listing on the NRHP under Criterion C in the area of architecture because it represents two eras of barn building in South Dakota.

4.2.4 Summary of Architectural History Survey Results

Three properties with resources over 49 years of age were surveyed within the architectural history APE. Two barns on the Rabe Farmstead, the Rabe Round Barn and the Rabe Livestock and Hay Barn, are recommended as eligible for listing on the NRHP. The potential for a historical agricultural landscape as a NRHP-eligible historic district was assessed; no potential for a historic district was identified. The following table summarizes the results of the architectural history survey for the Big Stone II project.

TABLE 3. PROPERTIES RECOMMENDED ELIGIBLE FOR LISTING ON THE NRHP

Field No.	Inventory No.	Address	T	R	S	¼ Sec	Property Type	Date
5	GT-004-00001, GT-004-00002	14461 484th Avenue, Big Stone Township, Grant County	121N	47W	14	NE of the SE	Rabe Round Barn and Rabe Livestock and Hay Barn	1915, ca. 1890/1917

TABLE 4. PROPERTIES RECOMMENDED NOT ELIGIBLE FOR LISTING ON THE NRHP

Field No.	Inventory No.	Address	T	R	S	¼ Sec	Property Type	Date
2	GT-002-00001—GT-002-00014	48280 145th Street, Big Stone Township, Grant County	121N	47W	15	SE of the SE	Bray Farmstead Buildings	Ca 1915-1970
4	GT-003-00001—GT-003-00008	Xxxx 484th Avenue, Big Stone Township, Grant County	121N	47W	11	SE of the NW	Clevidence Farmstead Buildings	Ca. 1900-1990
5	GT-004-00003—GT-004-00007	14461 484th Avenue, Big Stone Township, Grant County	121N	47W1	14	NE of the SE	Rabe Farmstead Buildings	Ca. 1900-1980

5.0 ANALYSIS OF EFFECTS

The analysis of effects for this project was based on the project description included in the draft Big Stone II Siting Application Permit (Otter Tail Power Corporation 2005).

5.1 PROJECT EFFECTS

Land Acquisition. All project components will be located within the area shown on Figure 2. The existing Big Stone power generating plant and the Northern Lights Ethanol Plant are located near the center of this area. The water storage pond is the only permanent portion of the project that will be located beyond the existing extent of the Big Stone power generating plant.

Visual Effects. The visual effects of the Big Stone II project will be due to the construction of a power plant building and an additional smoke stack in the immediate vicinity of the existing plant, as well as from the construction of a cooling tower, two ponds, and coal storage and handling equipment. The existing plant is visible for some distance; to the southwest it can be seen from Milbank. The water storage pond will be enclosed by an earthen berm with a fence on top that may be as high as 20 feet above surrounding grade; the blowdown pond will be enclosed with dikes, the height of which is unknown at this time. As determined in consultation with SHPO, the possibility for significant visual effects is projected to be within one mile of the new plant and smoke stack and within one-half mile of the proposed cooling tower blowdown pond and large water storage pond.

Changes in Access to Properties, Alteration in Traffic Patterns, and Noticeable Traffic Volume Increase. The Big Stone II project will make use of existing road and rail spur infrastructure. It is not anticipated to pose any changes in access to properties outside of, though near to, the project area, or cause altered traffic patterns. 144th Street is a paved road that provides most of the vehicular access to the existing plants in the project area. The plant is also accessible from 484th Avenue. Anticipated changes in traffic include a temporary increase during the plant construction period and, in the long term, a general increase in transportation service needs. It is projected that an additional 30 operational workers will be traveling daily to the site.

Change in Land Use and a Property's Setting. The expansion of the Big Stone Plant property to accommodate a third industrial facility will not introduce a new land use to the project vicinity. The water storage pond will, however, extend the power plant facility further to the west and will enlarge the area of industrial land use. The water storage pond has the potential to alter the setting of properties in the area.

Perceptible Increase in Noise, Vibration, and Change in Air Quality. At this time, it is assumed that due to the presence of the Big Stone Power Plant and the Northern Lights

Ethanol Plant, the Big Stone II project will not introduce any significant change in noise and vibration. The noise and vibration associated with construction activities will be buffered by the extensive plant-owned project property adjacent to construction sites.

The approximately 500-foot height of the existing chimney, as well as the one proposed as part of the Big Stone II project, is intended to disperse plant emissions and minimize any local impacts. The water in the new pond will be at ambient temperature, like that of nearby Big Stone Lake. It is not projected to have a significant impact on air moisture content in the vicinity of the Big Stone II project area. The Big Stone II project is not anticipated to significantly alter the air quality of the project area.

The visual effects of the project on two properties, the Rabe Barns recommended eligible for listing in the NRHP, was analyzed.

5.2 THE RABE ROUND BARN EFFECTS (GT-004-00001)

The Rabe Round Barn stands on a farmstead located on the west side of 484th Avenue, approximately one mile from the proposed Big Stone II power plant (see Figure 6). The barn is positioned near the northwestern corner of the farmstead. A mature windbreak encloses the small field in which the barn stands on the north and west sides (Figure 28). Some trees that grow along a stream located between the farmstead and the power plant also visually separate the farm property from the power plant.

Due to the existence of the Big Stone power plant northeast of the barn, the effects of the expansion of the power plant is considered to be mainly visual. The existing power plant and chimney are visible in the distance from the Rabe Round Barn (Figure 29). The setting of the round barn in the former Rabe farmyard makes it only slightly visible from 484th Avenue. The cupola portion of the round barn rises above the trees in the windbreaks on the property and is visible from the intersection of 144th Street and 484th Avenue south of the power plant (Figure 30).

It is difficult to see the Rabe Round Barn and the power plant at the same time in any single view of the area. The two properties appear only in the background when seen from each other. Consequently, the proposed additions to the Big Stone plant property, which would be visible in the distance from the Rabe Round Barn, would be a minor visual effect. The presence of the new elements of the expanded Big Stone II project in the distance would not affect the immediate rural setting of the Rabe Round Barn or impact the characteristics that make this property eligible for listing on the NRHP. The visual effects of the project are not considered to comprise an adverse visual effect.

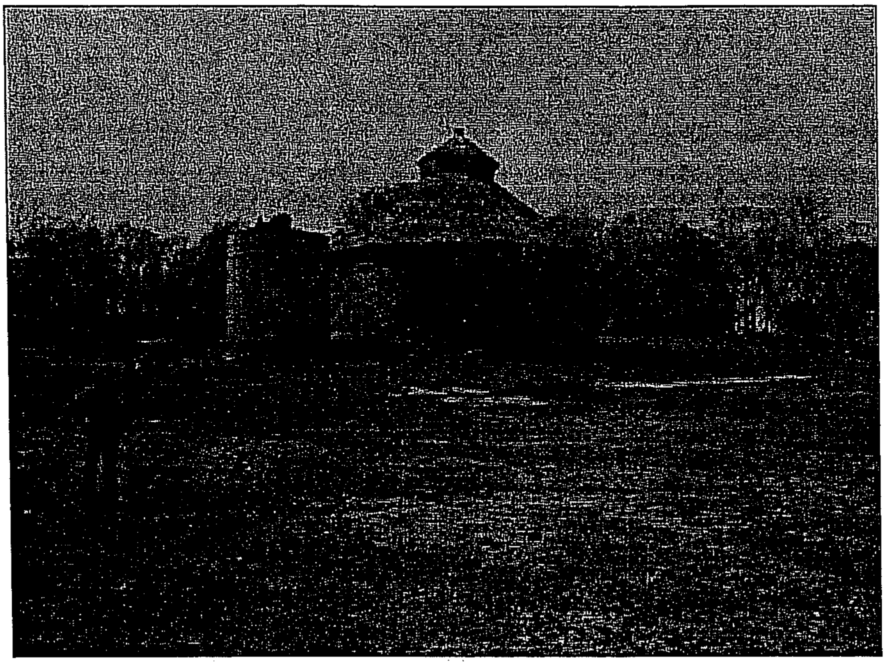


FIGURE 28. RABE ROUND BARN, FACING NORTHWEST

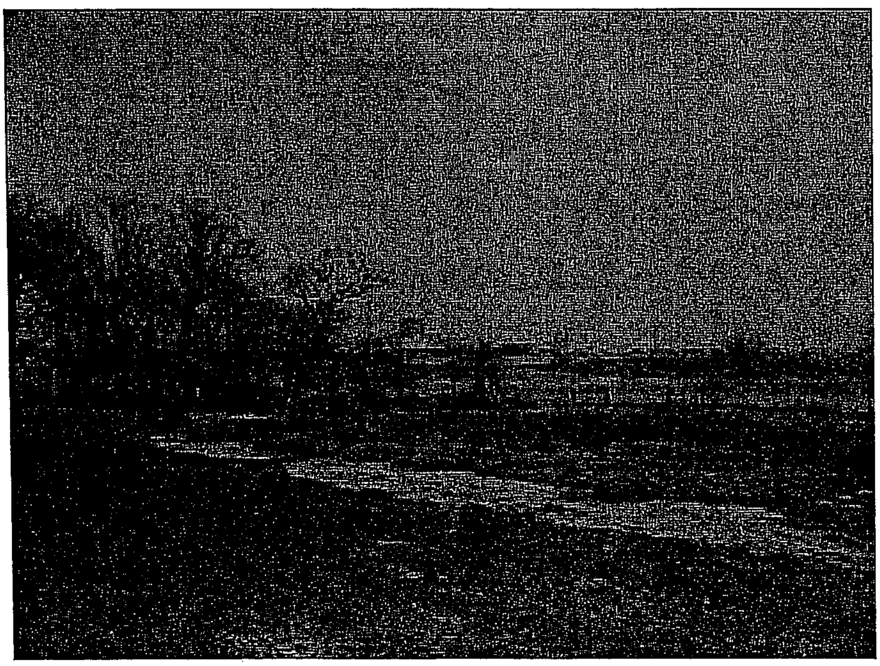


FIGURE 29. VIEW OF BIG STONE POWER PLANT FROM RABE ROUND BARN, FACING NORTHEAST

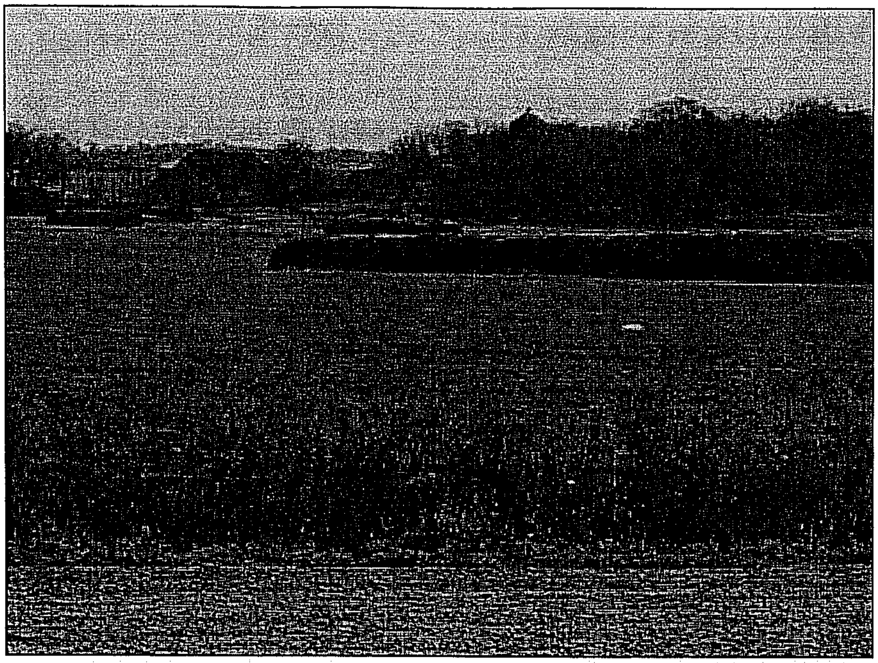


FIGURE 30. VIEW TOWARDS RABE ROUND BARN FROM INTERSECTION OF 144TH STREET AND 484TH AVENUE, FACING SOUTHWEST

The water storage pond proposed to be located west of the Rabe Round Barn would be three quarters of a mile from the barn. The view to the west of the farmstead is blocked by the mature windbreak that encloses the farmyard (see Figure 30). The water storage pond and Rabe Round Barn would not be visible from each other. As with the power plant, the Rabe Round Barn and the water storage pond could not be seen in any single view of the area. Consequently, the proposed water storage pond would have no visual effect on the Rabe Round Barn.

5.3 THE RABE LIVESTOCK AND HAY BARN EFFECTS (GT-004-00002)

The Rabe Livestock and Hay Barn is located in the same farmstead as the Rabe Round Barn. It is located approximately 100 feet southeast of the round barn. While this barn is more visible from 484th Avenue than the round barn (see Figure 30), the statements above about the visibility of the existing Big Stone power plant pertain to the Rabe Livestock and Hay Barn as well, as shown in Figure 31. As with the Rabe Round Barn, neither the additions to the Big Stone power plant property nor the water storage pond would have an adverse visual effect on the Rabe Livestock and Hay Barn. These new elements in the general vicinity would not affect the immediate rural setting of the barn or impact the characteristics that make this property eligible for listing on the NRHP.

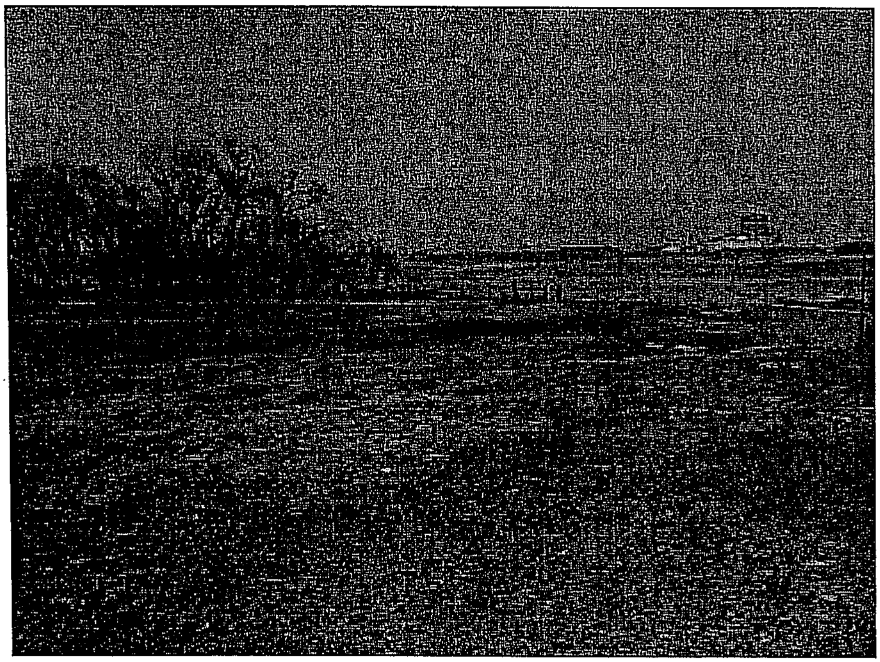


FIGURE 31. VIEW OF BIG STONE POWER PLANT FROM RABE LIVESTOCK AND HAY BARN, FACING NORTHEAST

5.4 RECOMMENDATION

The 106 Group recommends a finding of no adverse effect for the Big Stone II project on the Rabe Round Barn (GT-004-00001) and the Rabe Livestock and Hay Barn (GT-004-00002).

6.0 RECOMMENDATIONS

6.1 ARCHAEOLOGY

There are three areas within the project boundaries that appear to be undisturbed, have topographically prominent landscape features, and occur near existing natural water sources (Figure 4). It appears that current project plans for the Big Stone II project will only impact a small portion of one of these three areas. The plans indicate that a proposed construction laydown area (see Figure 2, Feature 6) will be located in Area B and may impact a portion of the area identified as having high potential (see Figure 4). The portion of the high potential area that may be impacted has been surveyed previously and, therefore, may be eligible for exclusion from further survey. Consultation with the SHPO will be required to make this determination.

If SHPO determines that the previously surveyed portion of Area B should not be excluded, or changes are made to the current project plans that may impact other areas within the project area identified as having high potential for containing intact precontact archaeological resources, a Level III survey should be undertaken in those areas. The survey should include surface reconnaissance and subsurface testing, as appropriate.

In addition, one area within the project area has been identified through historical plat maps as having a high potential for containing intact post-contact archaeological resources (see Figure 5, Area B). The proposed construction laydown area may impact this high potential area; however, if a post-contact archaeological site survives intact, it is unlikely to be able to answer important research questions. Therefore no further work is recommended in that portion of the project area.

6.2 ARCHITECTURAL HISTORY

The 106 Group identified three architectural history properties of 49 years in age or older within the APE. Two of these properties, the Bray Farmstead and the Clevidence Farmstead, are not recommended as eligible for listing on the NRHP as a whole, or as individual buildings. Two buildings on the third property, the Rabe Farmstead, are recommended as eligible for listing on the NRHP. Both the Rabe Round Barn and the Rabe Livestock and Hay Barn are recommended as eligible under Criterion C as significant examples of barns in South Dakota.

6.3 PROJECT EFFECTS

The effects of the Big Stone II project on two properties recommended as eligible for listing on the NRHP was analyzed. The 106 Group recommends a finding of *no adverse effect* for the Big Stone II project on the Rabe Round Barn (GT-004-00001) and the Rabe Livestock and Hay Barn (GT-004-00002).

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APPENDIX A: PROJECT PERSONNEL

LIST OF PERSONNEL

Project Manager	Anne Ketz, M.A., RPA
Principal Investigators	Anne Ketz, M.A., RPA Betsy H. Bradley, Ph.D.
Field Archaeologist	Holly Wright, M.S.
Report Authors	Betsy H. Bradley, Ph.D. Holly Wright, M.S.
Graphics and GIS	Matthew Schillerberg

Exhibit E

Resolution of Support-City of Big Stone City, South Dakota

The City of Big Stone City

RESOLUTION NO. 2004-12

Resolution of Support

Introduced by Councilmember Hanson, who moved its adoption:

WHEREAS, the development of a second generating unit at the Big Stone Plant site ("Big Stone II Project") would positively impact the region both economically and in terms of electric reliability; and

WHEREAS, the demand for electricity and the need for base load power continues to grow each year; and

WHEREAS, job creation, both temporary and permanent, and other benefits that would result from the Big Stone II Project, the largest investment of private and public dollars ever made in South Dakota, will stimulate our region's economy;

NOW, THEREFORE, BE IT RESOLVED, that the City Council of the City of Big Stone City supports the development and construction of a second generating unit at the Big Stone Power Plant and encourages the South Dakota Legislature to enact Tax Incentives that will make economically feasible the development of major infrastructure projects such as the Big Stone II Project.

Dated this 6th day of December, 2004.

James L. McFarlane, Mayor

ATTEST:

Janet M. Smith, Finance Officer

Councilmember Wiik seconded motion for adoption.

Ayes – 5 Nays – 0 Absent – 1

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(605) 862-8121 •

Exhibit F

Resolution of Support-County of Grant, South Dakota

County of Grant, South Dakota

2005-03

Resolution of Support

Introduced by Commission member Clayton Tuchalke*, who moved its adoption:*

Date: February 7, 2005

Be it Resolved by the Grant County Commission of, to-wit:

Whereas, the development of a second generating unit at the Big Stone Plant site ("Big Stone II Project") would positively impact the region both economically and in terms of electric reliability; and

Whereas, the demand for electricity and the need for base load power continues to grow each year; and

Whereas, job creation, both temporary and permanent, and other benefits that would result from the Big Stone II Project, the largest investment of private and public dollars ever made in South Dakota, will stimulate our region's economy;

NOW THEREFORE, BE IT RESOLVED, that the Grant County Commission supports the development and construction of a second generating unit at the Big Stone Power Plant and encourages the South Dakota Legislature to enact Tax Incentives that will make economically feasible the development of major infrastructure projects such as the Big Stone II Project.

ATTEST:

Karen M Layher

Grant County Auditor

APPROVED:

Richard Resovo

Chairman, Grant County Commission

Commission member Guy E. Mann seconded motion for adoption.

Roll Call Vote:

Ayes 3 Nays 0 Absent 2

Exhibit G

Resolution of Support-City of Milbank, South Dakota

City of Milbank, South Dakota

2-7-05

Resolution of Support

Introduced by Foster*, who moved its adoption:*

Date: 2/7/05

Be it Resolved by the City Council of Milbank*, to-wit:*

Whereas, the development of a second generating unit at the Big Stone Plant site ("Big Stone II Project") would positively impact the region both economically and in terms of electric reliability; and

Whereas, the demand for electricity and the need for base load power continues to grow each year; and

Whereas, job creation, both temporary and permanent, and other benefits that would result from the Big Stone II Project, the largest investment of private and public dollars ever made in South Dakota, will stimulate our region's economy;

NOW THEREFORE, BE IT RESOLVED, that the City Council of the City of Milbank supports the development and construction of a second generating unit at the Big Stone Power Plant and encourages the South Dakota Legislature to enact Tax Incentives that will make economically feasible the development of major infrastructure projects such as the Big Stone II Project.

ATTEST:

[signature]

Finance Officer

APPROVED:

[signature]

Mayor

Exhibit H

Resolution of Support-School Board of Milbank School District, South Dakota

School Board of Milbank School District, South Dakota

Resolution of Support

Introduced by Board member Kathy Tyler *, who moved its adoption:*

Date: 2-7-05

Be it Resolved by the School Board of Milbank School District*of, to-wit:*

Whereas, the development of a second generating unit at the Big Stone Plant site ("Big Stone II Project") would positively impact the region both economically and in terms of electric reliability; and

Whereas, the demand for electricity and the need for base load power continues to grow each year; and

Whereas, job creation, both temporary and permanent, and other benefits that would result from the Big Stone II Project, the largest investment of private and public dollars ever made in South Dakota, will stimulate our region's economy;

NOW THEREFORE, BE IT RESOLVED, that the School Board of Milbank School District supports the development and construction of a second generating unit at the Big Stone Power Plant and encourages the South Dakota Legislature to enact Tax Incentives that will make economically feasible the development of major infrastructure projects such as the Big Stone II Project.

ATTEST:

[signature]
Superintendent

APPROVED:

President, Malcolm Dickson
School Board

Board member Milt Stengel *seconded motion for adoption.*