

Considered: _____

WATER PERMIT NO. 5597-3

Phone: 612-639-1234

Name of Applicant: Northern States Power Company

Post Office Address: 414 Nicollet Mall, Minneapolis MN 55401

Amount of Water Claimed: 0.22 cfs Total Acres: NA

Source of Water Supply: groundwater

Water to be used for: industrial County: Minnehaha

About _____ miles East of Sioux Falls

PROOF OF PUBLICATION: Received _____ Not Received _____

APPLICATION: Approved _____ Subject to _____

F.F.& C/.L. Adopted _____ Not Approved _____ Deferred _____

PRIORITY _____ Date Received: 10-2-91 Fee: \$225 Remarks See Permit

No. 742-3

Corrected Application Received 11-27-91 Period of Annual Use Jan 1 - Dec 31

WATER QUALITY APPROVAL RECEIVED NA APPROVED/CONDITIONAL (Circle one)

WI-1 Description same as Application YES _____ NO _____ REMARKS _____

Diversion Point: NE 1/4 NE 1/4 Sec 32-T102N-R48W

Land to be Irrigated: _____

				⊗	
		3/			

Well Log: Driller: Layne-Minnesota Co. Licensed YES _____ NO _____

Depth of Well: 170' REMARKS _____

Type of Map: plat PREPARED BY: E. W. Benson Reviewed and the Number

Assigned on 12-3-91 By Karen Schlaak

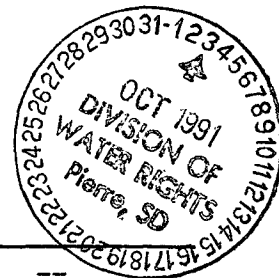
No. 5597-3 Hydrologic Unit Split Rock Creek
 Map No. Basin Big Sioux
 Newspaper Argus Leader, PO Box 5034

Sioux Falls 57117-5034

Application For Permit To Appropriate Water Within The State Of South Dakota

Check use of water: Industrial ☒ Commercial ☐ Municipal ☐ Other Common Distribution System ☐
 Rural Water System ☐ Suburban Housing ☐ Geothermal Heat ☐ Institutional ☐ Recreational ☐
 Domestic ☐ (above 18gpm) Other ☐

Type of Application: Check one or more of the following

New ☐ Vested Right ☐ Future Use ☐ Change Use ☒☒ Amend Permit No. 742-3 with old priority date retainedChange diversion point(s) ☐ Add diversion point(s) ☐ Other ☐ --☐ Application to: Change diversion point(s) ☐ Add diversion point(s) ☐ on Permit No. --☐ Construction to use water reserved by Future Use Permit No. --1. Name of Applicant Northern States Power Company Phone No. 612/639-1234Post Office Address 414 Nicollet Mall Minneapolis State MN Zip Code 55401
(Street, RR or Box) (City)2. Amount of water claimed (c.f.s.) ~~0.33 c.f.s. or 150 gpm~~ 100 gpm 0.22 cfs3. Source of water supply Split Rock Creek aquifer4. Location of point of diversion 42 feet west and 1270 feet south of the northeast corner of
Section 31, T102N, R48W (NE 1/4 NE 1/4)County Minnehaha5. Counties where water will be used Minnehaha6. Annual period during which water is to be used Throughout year January 1 - December 31

7. Give a brief description of proposed project. When available include any preliminary engineering report or other reports or information that will help explain the project. (Attach sheet if more space is needed)
 Northern States Power Company (NSP) proposes to construct a Combustion Turbine Generator (CTG) facility at NSP's existing Pathfinder Power Plant near Sioux Falls. The proposed facility will consist of up to four CTG units and required equipment to support the units. The new CTG facility is anticipated to operate during periods of high electrical demand. It is expected that the proposed units will operate for and between 100 and 800 hours per year each with an annual full load average of 300 hours. The average full load operation of the existing Pathfinder facility is 100 hours per year.

Attachments: Attach Form 2A if diversion from a well or dugout, or if storage of water, is proposed. Attach map (see instruction) A map has already been filed with the previous Application

STATE OF SOUTH DAKOTA) depicting this well location (under Permit 742-3).

County of _____)

I, James Alders, the applicant, certify that I have read this application, have examined the attached map and that the matters stated are true and that I intend, and am able to complete the necessary construction.



SYLVIA M. C. WILMO
 NOTARY PUBLIC—MINNESOTA
 HENNEPIN COUNTY

My Commission Expires Dec. 20, 1993

Signed James Alders1st day of October 19 91Sylvia M C Wilmo

Notary Public

**SOUTH DAKOTA
WATER PERMIT No. 5597-3**

Date of first receipt of application October 3, 1991.

Date of return to applicant for corrections, amendments or changes
October 8, 1991.

Date of receipt of corrected application November 25, 1991.

The Chief Engineer, on behalf of the Water Management Board, issues Water Permit No. 5597-3 to Northern States Power Company, 414 Nicollete Mall, Minneapolis MN 55401 authorizing the construction of the water use system and the placing of water to beneficial use subject to the following limitations, conditions and qualifications:

1. Water Permit No. 5597-3 appropriates an additional 0.22 cubic feet of water per second (cfs) from one well authorized by Water Right No. 742-3. Water Right No. 742-3 diverts 0.11 cfs from one well (Split Rock Creek Aquifer) 170 feet deep located in the NE 1/4 NE 1/4 Section 31-T102N-R48W.
2. The water appropriated shall be used for the purpose of supplying water at the power plant and may not exceed the amount of water needed for beneficial use for industrial purposes.
3. The water is to be used during the following described annual period: January 1 - December 31.
4. The date of approval of Permit No. 5597-3 is March 4, 1992.
5. The date from which applicant may claim right is October 3, 1991.
6. One-fifth of the construction is to be completed on or before September 4, 1994.
7. All construction is to be completed on or before March 4, 1997.
8. Water is to be put to beneficial use on or before March 4, 2001.
9. Water rights obtained in compliance with the laws of the State of South Dakota may not be unlawfully impaired by this appropriation.

QUALIFICATION

The well approved under this Permit will be located near domestic wells and other wells which may obtain water from the same aquifer. The well owner under this Permit shall control his withdrawals so there is not a reduction of needed water supplies in adequate domestic wells or in adequate wells having prior water rights.

WATER MANAGEMENT BOARD

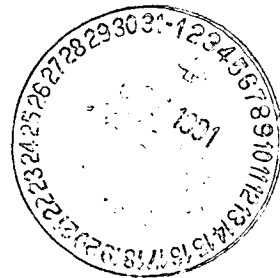
By: 
Chief Engineer, Water Rights Division
Department of Environment and Natural Resources

MAY 1 1992

date

Supplemental Information

(type or print in ink)



1. Well Information - Proposed construction

- a) Drill Hole Diameter 17 inches Depth 170 feet
 Double cased Carbon 12" (outer)
 b) Casing Type Steel Diameter 8" (liner) Thickness 3/8" (outer) 5/16" (liner)
 Stainless Steel Shutter
 c) Screen Type _____ Diameter 8" Thickness 5/16" (assumed)
 d) Gravel Pack Thickness 26-inch Length of Gravel Pack 50 feet
 e) Depth to Top of Water Bearing Material unknown
 f) Depth to Water (ground surface to water level) 57 feet
 g) Distance to nearest existing domestic well:
 no other domestic wells
 On applicants property on plant property On property owned by others 4,000' ESE

2. Dugout Information Estimates Not Applicable

- a) Surface Dimensions _____ Depth _____
 b) Depth to water (ground surface to water level) _____

3. Water Storage Dams Not Applicable

If the proposed water use system contains one or more storage dams, please furnish the information requested below. The locations of each dam should be shown on the map submitted with the application.

- a) If a private engineering firm or government agency was involved in the design of this dam please give their name and address

b) Freeboard _____

c) Crest Width _____

Crest Length _____

d) Height _____

e) Primary Outlet Capacity _____
 If Pipe, diameter _____

f) Secondary Spillway Capacity _____
 Spillway width _____

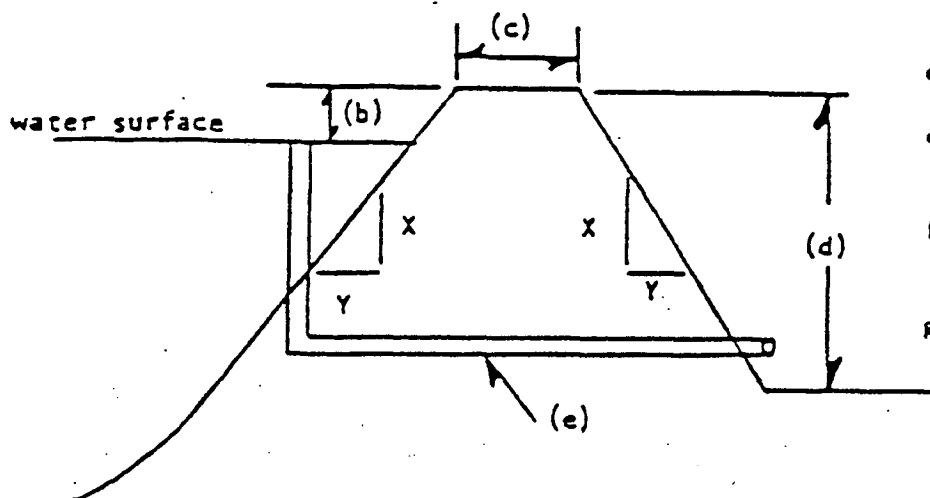
g) X & Y Slope
 Upstream _____

Downstream _____

Surface Area of Impoundment _____

Storage _____ acre feet

Drainage area above dam _____



Signature of Applicant _____

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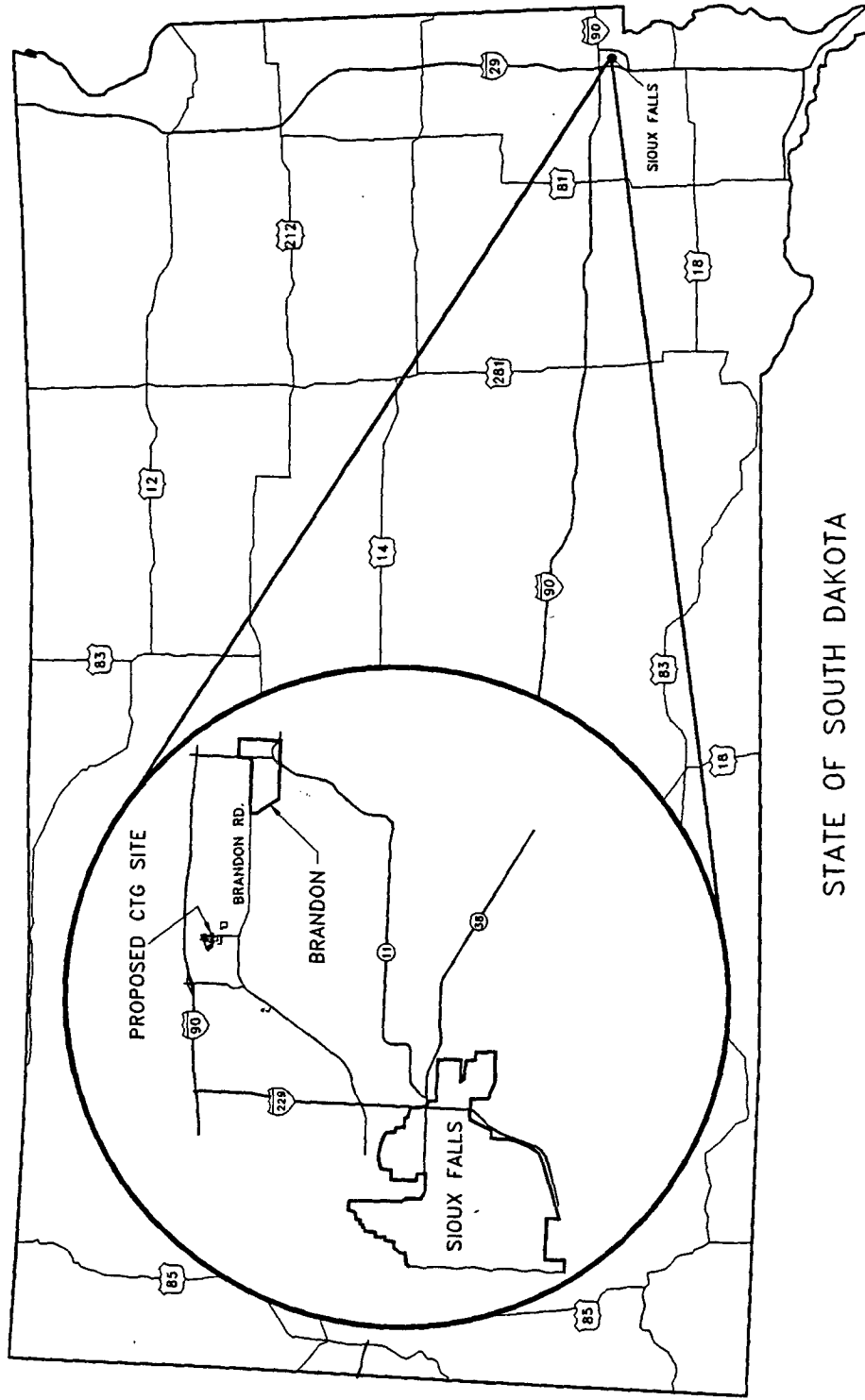
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1.0 INTRODUCTION

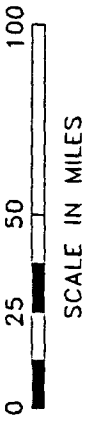
Northern States Power Company (NSP) proposes to construct a combustion turbine generator (CTG) facility consisting of up to four 105-megawatt (MW) combustion turbine generators at the NSP Pathfinder Generating Plant located approximately 0.75 miles northeast of the Sioux Falls city limits and 6.5 miles northeast of the Sioux Falls city center, in Minnehaha County, South Dakota. The CTG facility is proposed for commercial operation in June, 1994. The site location is presented in Figure 1-1, Site Location Map.

The primary purpose of this Environmental Impact Report (EIR) is to review available environmental information relevant to the proposed project and assess the potential impact of the project on the physical, biological and socioeconomic environment so that an Environmental Impact Statement (EIS) can be prepared by the state of South Dakota.

NORTH



STATE OF SOUTH DAKOTA



NORTHERN STATES POWER COMPANY
MINNEHAHA COUNTY, SOUTH DAKOTA

FIGURE 1-1
SITE LOCATION MAP

2.0 PROJECT DESCRIPTION

2.1 NEED FOR THE PROPOSED CTG ADDITION

2.1.1 Demand for Energy Conversion Facility

Demand for the proposed CTG facility is based upon NSP's forecast of demand for electricity in future years and the resources currently available to meet that demand. NSP's existing generating plants, committed additions, and contracted capacity purchases together constitute the resources NSP currently has available to meet customer's future demand for electricity. The NSP forecast demand, adjusted for conservation and load management programs (past and future), is referred to as the net forecast. The net forecast of native energy requirements for NSP's service territory has a median average annual growth rate of 2.3 percent over the forecast horizon for the years' 1991-2005. This represents a substantial decline from the 3.4 percent growth NSP experienced from 1985-1990.

To measure uncertainty and the attendant need for flexibility, NSP supplements the median scenario with four other scenarios: a semi-low and semi-high scenario to reflect a narrow range of alternative paths for the economy, and a low and high scenario to reflect broader based risk. The median native energy requirement growth rates for the semi-low and semi-high scenarios are 1.8 and 3.0 percent per year while the growth rates for the low and high scenarios are 1.2 percent and 3.5 percent per year. These rates are also generally lower than the 3.4 percent growth NSP experienced from 1985-1990.

The net forecast of median average annual peak growth between 1991 and 2005 is 1.7 percent per year while the semi-low, semi-high and low, high ranges are 1.4 to 2.4 and 0.4 to 3.0 percent per year, respectively. Due to aggressive conservation and load management, the net forecast of all scenarios is well below the 3.9 percent peak growth NSP experienced from 1984 to 1990.

The "bandwidth" bounded by the "semi-high" and "semi-low" scenarios is used most frequently in NSP's long-range forecasting to capture a "business as usual" context, (i.e., with a relatively narrow range of U.S. economic growth and no basic change in the

relationship between regional and national economies). This scenario also assumes "normal" weather, (i.e., the average seasonal weather over the past 20 or more years). NSP estimates this narrow bandwidth to capture the middle 30 percent of probability for NSP's future requirements. As depicted in Figure 2-1, NSP Demand Forecast, NSP estimates there is a 65 percent chance NSP's customer needs will remain on a path staying below the "semi-high" scenario, and similarly a 35 percent chance of remaining below the "semi-low" scenario.

NSP's future requirements include:

- Forecast summer peak demand, after adjustment for the expected impact of Demand Side Management (DSM) programs;
- 15 percent Mid Continent Area Power Pool (MAPP) reserve requirement;
- Contracted obligations to sell to other utilities.

Figure 2-2, NSP Obligations and Committed Resources, shows how NSP's future requirements, based on the semi-low to semi-high forecast, compare to existing and committed supply capability. This figure shows that the demand for electricity of peaking capacity is forecasted to exceed NSP's available resources by as much as 200 MW in 1994 and up to 700 MW by 1997.

Thus, based on a review of its projected forecasts and resource needs, NSP has concluded that the resource need in the 1990s will be primarily peaking capacity. NSP plans to meet this peaking capacity need through the installation of simple cycle CTGs.

2.2 APPLICABLE LAWS AND REGULATIONS

South Dakota Statutes Chapter 20:10:22, Energy Facility Site Rules requires that an Application for Construction Permit for an Energy Conversion Facility be submitted for the proposed project. NSP is submitting a final application with this EIR.

Figure 2-1
NSP Demand Forecast

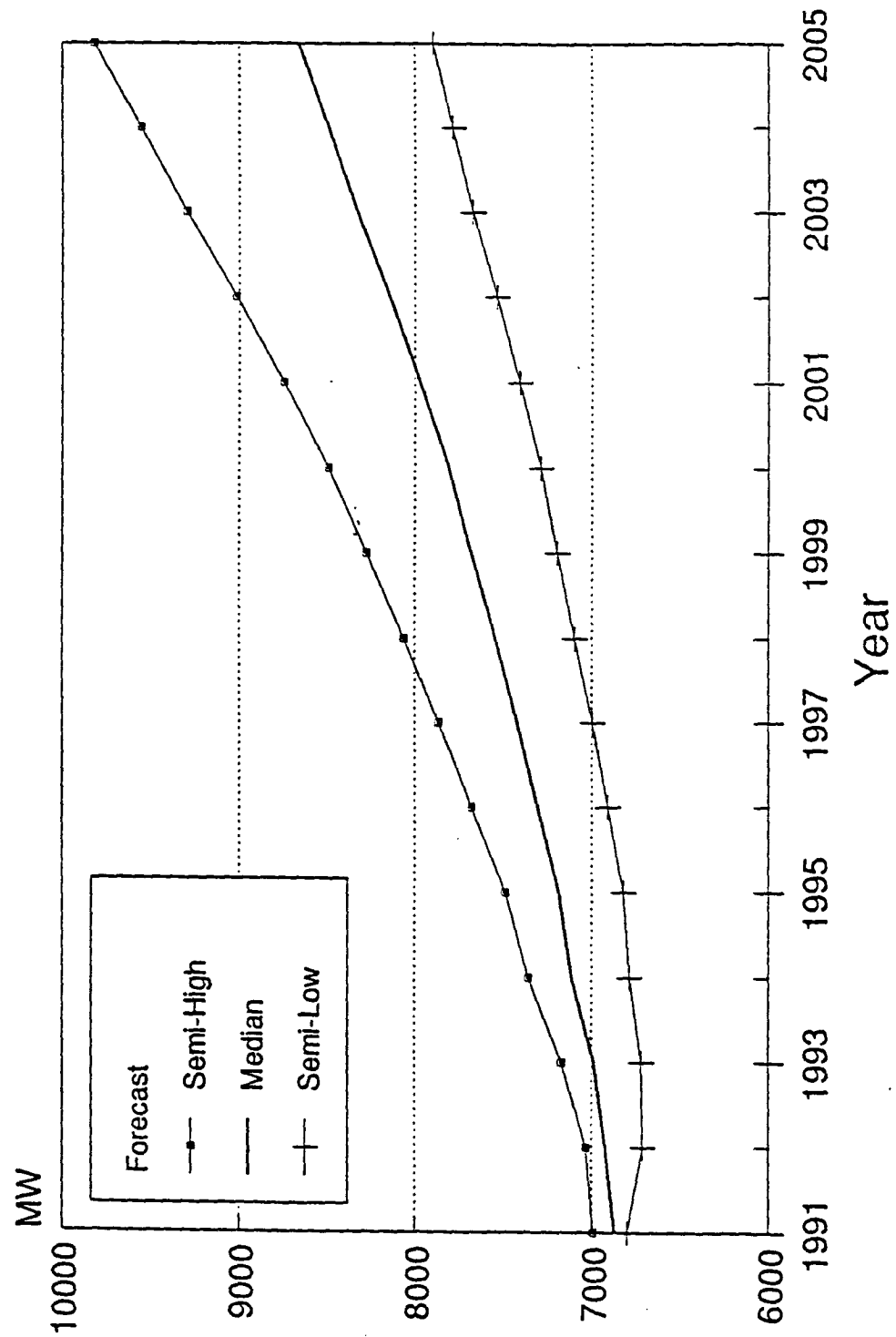
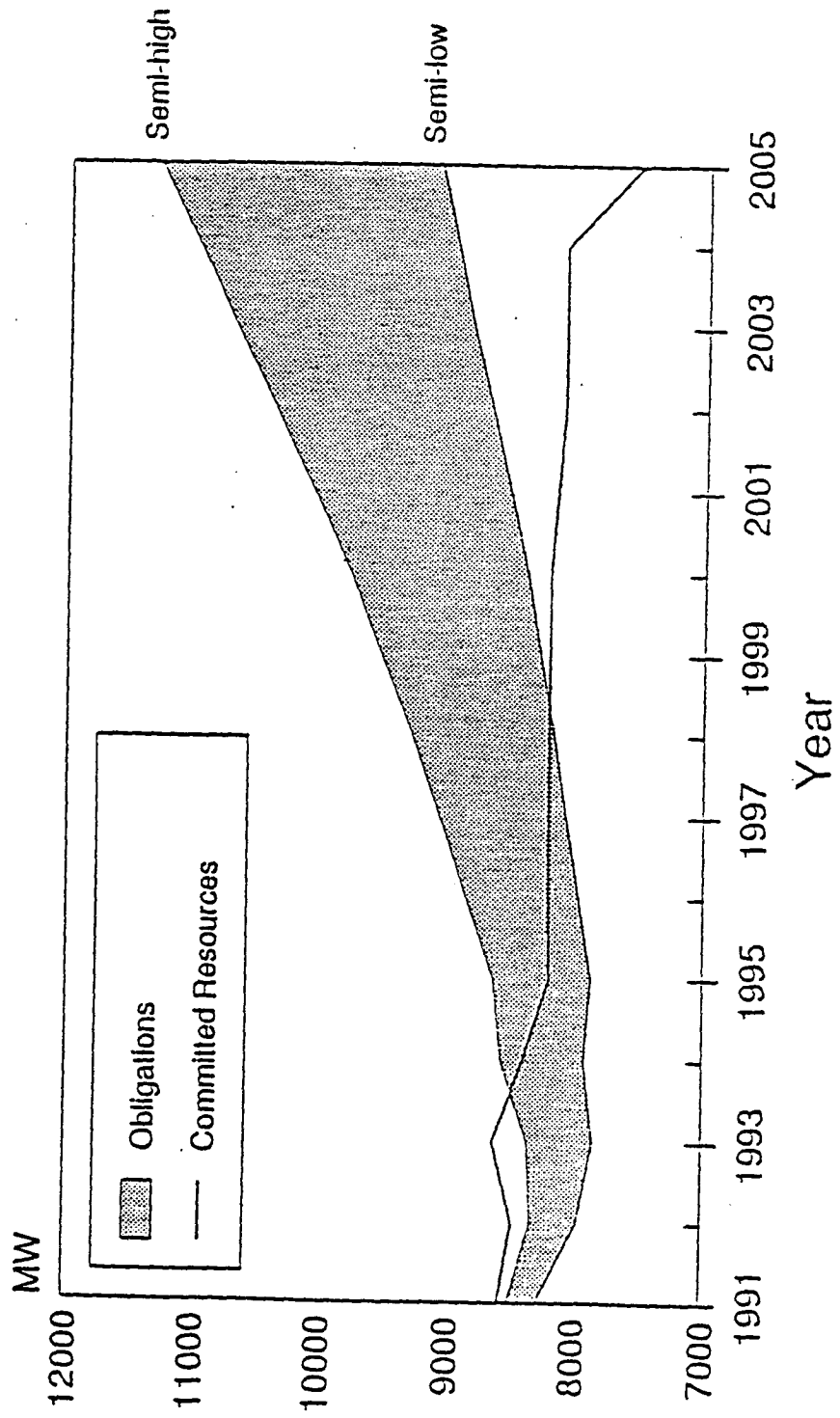


Figure 2-2 NSP Obligations and Committed Resources



Other potential federal, state, and local permit requirements that could apply to this project are summarized in Table 2-1, Anticipated Permits and Approvals from Federal and State Agencies.

2.3 PROPOSED CTG FACILITY DESCRIPTION

2.3.1 Site Location

The Pathfinder Power Plant site is located on property owned by NSP in the southwest quarter of Section 30, Township 102 north, Range 48 west in Minnehaha County, South Dakota. The site is approximately 0.75 miles northeast of the Sioux Falls city limits, 6.5 miles northeast of Sioux Falls city center, and approximately 2.8 miles west of the city of Brandon. The site location is presented in Figure 1-1, Site Location Map.

2.3.2 Site Layout

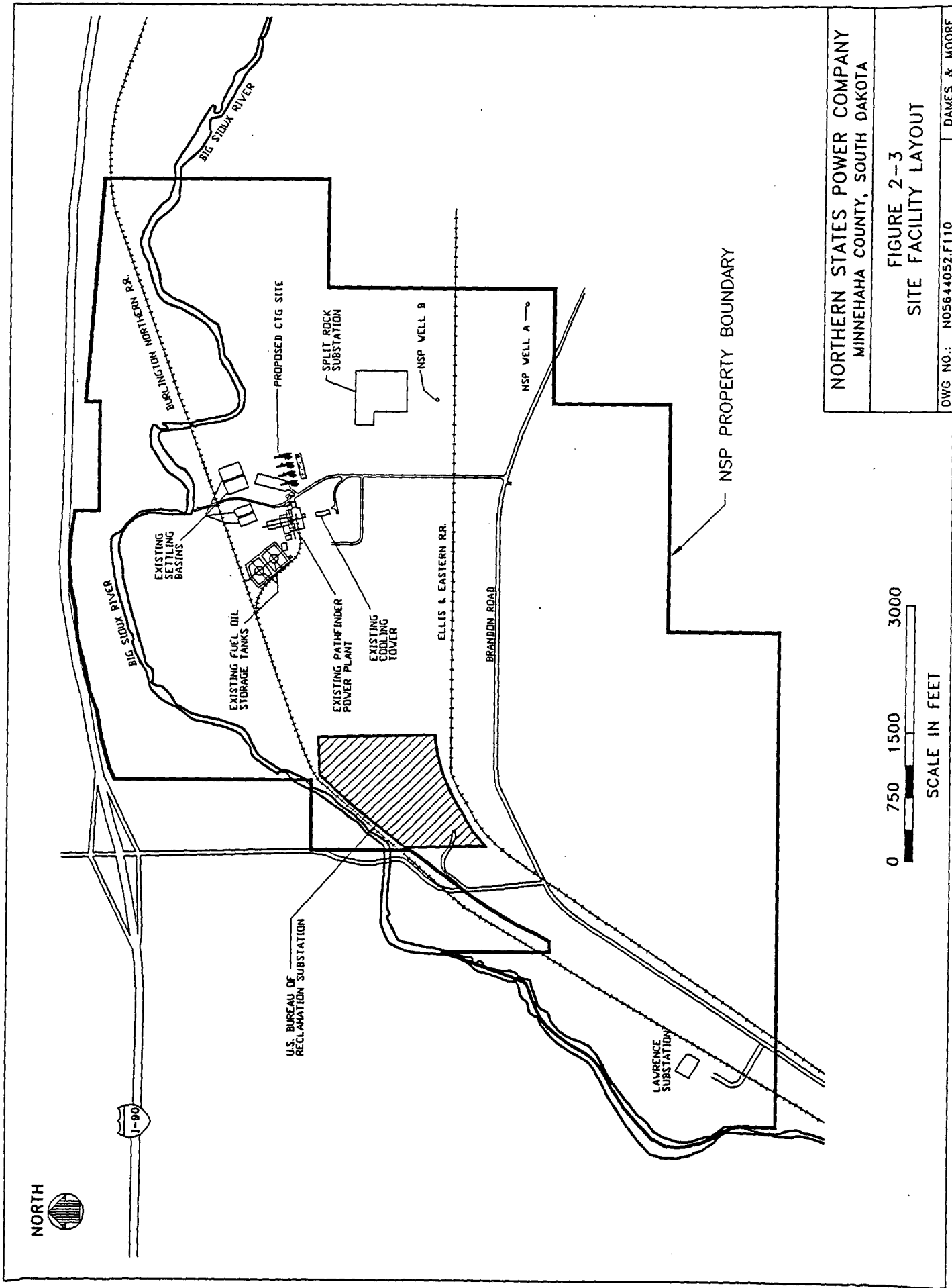
The plant site property is bordered by Interstate 90 to the north. The southern boundary is located approximately 3,400 feet south of Brandon Road. The Big Sioux River flows west to east across the site, forming the western boundary at the southwestern corner of the property and running through the property in the northern portion of the site. The existing Pathfinder Power Plant is located south of the Big Sioux River. There are three substations in the vicinity of the proposed CTG site. NSP's Lawrence Substation is located in the southwestern property corner, NSP's Split Rock Substation is located southeast of the proposed plant site and the U.S. Bureau of Reclamation's Substation is located southwest of the proposed CTG site. Two railroad lines are located within NSP's property boundary, one operated by Burlington Northern and the other operated by Ellis & Eastern, (see Figure 2-3, Site Facility Layout).

Existing facilities at the Pathfinder site include a 60 MW natural gas-fired steam generating plant, two 2-million gallon fuel oil storage tanks, a cooling tower, four settling basins, a river intake structure, two water supply wells, a substation and associated electric transmission facilities, and miscellaneous equipment required to support the operation of the steam plant (see Figure 2-3, Site Facility Layout). The

TABLE 2-1

ANTICIPATED PERMITS AND APPROVALS
FROM FEDERAL AND STATE AGENCIES

AGENCY	ACTIVITY	TYPE OF APPROVAL
FEDERAL		
U.S. Environmental Protection Agency	Air pollutant emissions	Permit to construct and operate air emissions source
U.S. Environmental Protection Agency	Wastewater discharge to surface water	NPDES permit modification
Federal Aviation Administration	Construction of stack	Stack permit
U.S. Department of Energy	Fuel Use Exemption Act	Exemption to burn natural gas and No. 2 fuel oil
STATE		
South Dakota Public Utilities Commission	Construction and operation of energy conversion facility	Permit to construct Energy Conversion Facility
South Dakota Department of Environment and Natural Resources	Water supply	Water Appropriations Permit
	Ground water discharge	Ground Water Discharge Permit
	Oil storage tanks	Certification of Compliance
State Historical Society of South Dakota	Site preparation and grading	Approval of archaeological surveys



NORTHERN STATES POWER COMPANY
MINNEHAHA COUNTY, SOUTH DAKOTA

FIGURE 2-3
SITE FACILITY LAYOUT

DWG NO.: N05644052.F110 | DAMES & MOORE

existing Pathfinder power plant will continue to operate in addition to the proposed CTG facility.

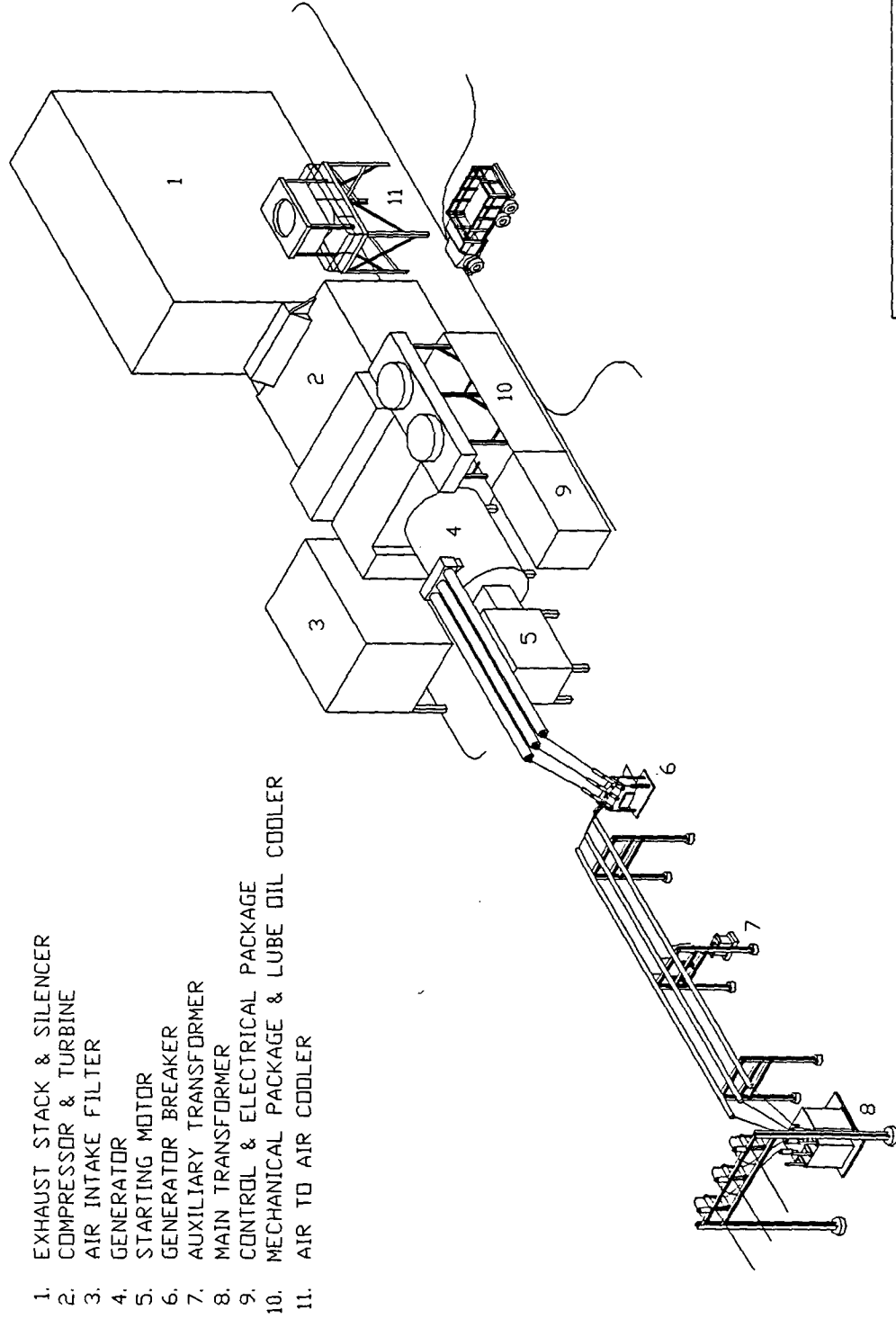
The Pathfinder site was the location of a 1962 vintage demonstration nuclear power plant. The nuclear steam supply equipment was decommissioned. The reactor vessel has been removed from the site and removal of other equipment is in progress. The removal of all necessary equipment is scheduled for completion before the start of the proposed CTG facility construction.

The proposed facility will consist of up to four Westinghouse 501D5 CTG units. The primary fuel supply for the proposed CTG facility will be natural gas, which will be supplied by Minnegasco. The existing plant fuel oil tanks and equipment will be used to supply No. 2 distillate fuel oil, the back-up fuel supply. The existing settling basins will be used for the CTG facility's water treatment system waste water discharge. The existing Pathfinder Plant wells will be used to supply water to the CTG facility and for domestic purposes.

2.3.3 Combustion Turbine Generator Units

The 105 MW CTGs selected for the Pathfinder site will be manufactured by Westinghouse. CTGs are compact, modular power plants that can be installed quickly and at a lower capital cost than other types of generating facilities such as coal, nuclear, or hydroelectric generating plants. The major components of each CTG are combustors, air intake filter, compressor, turbine, generator, 50-foot emission stack, starting motor, generator breaker, auxiliary and main transformers, and related controls and support equipment. Figure 2-4, Combustion Turbine Generator Diagram, depicts the major components of a typical CTG. Each combustion turbine unit is approximately 150 feet by 70 feet in dimension. Four units situated side-by-side will require approximately 2 acres of land which does not include buffer zones around the unit.

High pressure air (typically 10 to 15 atmospheres) is generated by the compressor and supplied to the combustor, where it is mixed with fuel. The air-fuel mixture is burned in the combustor, and the resultant gases are directed to the turbine. The expanding hot gas spins the turbine, which, in turn, drives the compressor and a generator to produce electric power. The combustion gas is exhausted to the atmosphere



1. EXHAUST STACK & SILENCER
2. COMPRESSOR & TURBINE
3. AIR INTAKE FILTER
4. GENERATOR
5. STARTING MOTOR
6. GENERATOR BREAKER
7. AUXILIARY TRANSFORMER
8. MAIN TRANSFORMER
9. CONTROL & ELECTRICAL PACKAGE
10. MECHANICAL PACKAGE & LUBE OIL COOLER
11. AIR TO AIR COOLER

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PATHFINDER SITE, SOUTH DAKOTA

FIGURE 2-4
COMBUSTION TURBINE GENERATOR
DIAGRAM

DWG NO.: N05644052.F109 DAMES & MOORE

through a 50-foot high stack. Silencers will be installed in both the air intake and exhaust plenums to minimize noise emissions. The turbines will be equipped with a water injection system to control nitrogen oxide (NO_x) emissions.

2.3.4 Operation

Under normal conditions, the proposed CTG facility at the Pathfinder site will be operated remotely from the NSP system operations center in Minneapolis, Minnesota. An operator and security personnel at the existing Pathfinder Plant will be responsible for the operation, maintenance, and site security coverage of the proposed CTG facility.

Combustion turbine start-up is accomplished by spinning the turbine with a motor. Once the speed of the turbine is sufficient to establish a proper flow of air through the combustors, fuel can be injected and ignited. The power generated from the combustion process is then used to bring the turbine speed up to 3600 revolutions per minute. After the unit is synchronized to the NSP transmission system, the load is increased, as required. The typical start-up time is 20 minutes from initial start to full load operation.

2.4 POLLUTION CONTROLS

2.4.1 Air Emissions

The proposed CTG facility will emit nitrogen oxides (NO_x), sulfur dioxide (SO₂), carbon monoxide (CO), particulates, volatile organic compounds (VOCs) and unburned hydrocarbons when natural gas is burned. When fuel oil is burned, beryllium (Be) will be emitted as well.

Emissions control for the proposed CTG facility based on BACT analyses are as follows:

- NO_x control will be by water injection when combusting either natural gas or No. 2 distillate fuel oil;
- CO emissions, which are a byproduct of the combustion process, are controlled by maintaining proper combustion techniques;

- SO₂ emissions will be minimized by using natural gas as the primary fuel. When the use of the back-up fuel is required, No. 2 distillate fuel oil, a low sulfur fuel oil (anticipated sulfur content of 0.37 percent by weight) will be used to minimize SO₂ emissions;
- VOC emissions will be minimized by maintaining proper combustion techniques.
- TSP/PM₁₀ emissions will be minimized by using natural gas as the primary fuel and by maintaining proper combustion techniques; and
- Emissions of Be will be minimized by using natural gas as the primary fuel.

To minimize adverse ground-level air quality impacts, 50-foot tall stacks will be constructed to exhaust spent gas from the proposed CTG units. Air quality modeling was performed to ensure that adverse air quality impacts will be minimized. A more detailed discussion of anticipated impacts to air quality from operation of the proposed CTG facility is contained in Chapter 5.2.1, Air Pollution.

2.4.2 Wastewater

Wastewater from the proposed CTG facility and existing Pathfinder Power Plant will be discharged to four existing settling basins. It is anticipated that the capacity of the basins may be exceeded, resulting in a discharge to the Big Sioux River. This discharge is expected to meet all applicable water quality discharge standards for the Big Sioux River with the exception of Total Dissolved Solids (TDS). Anticipated impacts as a result of this discharge are discussed in Chapter 5.2.2, Impacts on Water Resources.

NSP is working with the South Dakota Department of Environment and Natural Resources (SDDENR) to develop an acceptable permit for the discharge from the settling basins to the Big Sioux River which will be included as Exhibit C, NPDES Permit Application, to the Facility Permit Application.

2.4.3 Sound Control

Sound emitted from the proposed CTGs will be reduced by the use of a silencer in the air intake and the flue gas exhaust ducts. Sound will also be reduced by an insulated enclosure over the compressor, turbine and generator.

2.5 WATER USAGE

NSP proposes to supply the proposed CTG facility with water from two existing on-site wells screened in the Split Rock Creek Aquifer which currently supply the Pathfinder Power Plant. Figure 2-3, Site Facility Layout, depicts the location of these wells, labeled as NSP Well A and NSP Well B. These wells may supply water at a combined rate of up to 650 gallons per minute (gpm). Well A, which has a maximum output of 500 gpm, serves the existing plant and will also serve the proposed CTG facility. Well B, which has a maximum output of 150 gpm serves the domestic needs of the existing plant and will also serve the proposed CTG facility. Based on available information, it appears that the Split Rock Creek Aquifer will be capable of adequately supplying the water needs for operation of the proposed CTG facility and Pathfinder Plant. Additional information about the Split Rock Creek Aquifer is presented in Chapters 4.1.9.2, Split Rock Creek Aquifer and Chapter 5.2.2, Impacts on Water Resources.

NSP has submitted Water Appropriations Permit Applications to the SDDENR for both wells. The Water Appropriations Permit Applications are included as Exhibit F to the Facility Permit Application.

2.6 TRANSMISSION FACILITIES

Approximately 2,500 feet of new 115 kv transmission line will be constructed to connect the proposed CTG facility with the existing Split Rock Substation located on the Pathfinder site. The new transmission facilities will be wholly contained on existing NSP property and will not require any clearing activities.

2.6.1 Configuration of Towers and Poles

The poles for the transmission facility are expected to consist of eight single wooden structures with heights of 80, 85, 90, and 95 feet (two poles at each height). The poles are expected to be spaced at approximately 350 feet. Each pole will contain three arms and three conductors, two on one side and one on the other. In the worst case scenario, each pole would contain six arms and six conductors, three on each side.

The exact transmission line layout, configuration, number of poles, heights, and spans will not be known until detailed engineering has been performed.

2.6.2 Conductor Configuration

The new transmission facility is expected to be a single-pole, three-arm, three-conductor, single-circuit configuration with one shield wire on top. In the worst case scenario, the transmission facility would be a single-pole, six-arm, three conductor, double-circuit configuration with one shield wire on top. The exact conductor configuration will not be known until detailed engineering has been performed.

2.6.3 Proposed Transmission Site and Major Alternatives

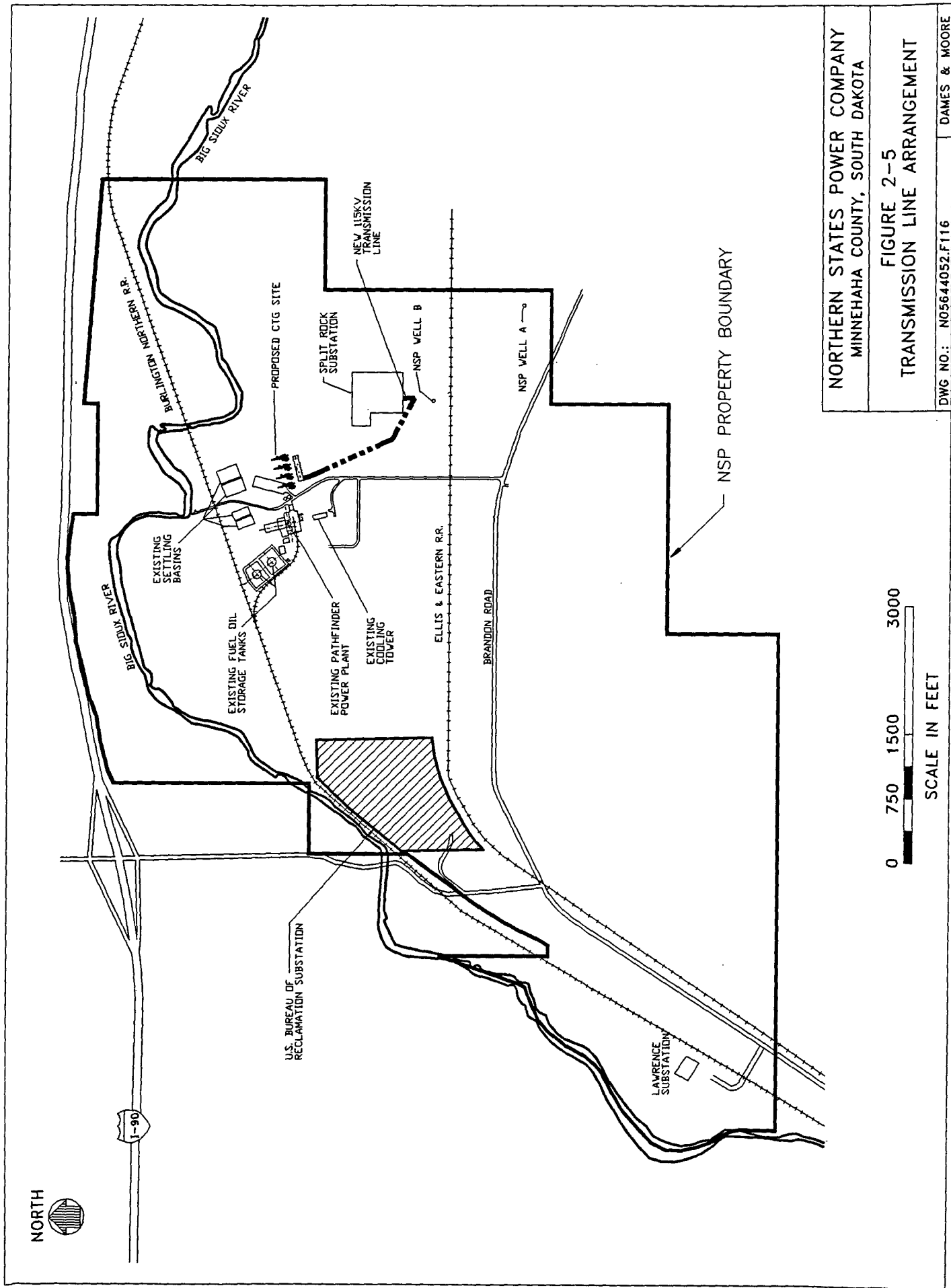
The expected transmission line route is shown on Figure 2-5, Transmission Line Arrangement.

2.6.4 Reliability and Safety

The new transmission facility will be built to NSP standards and comply with all applicable Federal, State and local codes and regulations.

2.6.5 Right-of-way or Condemnation Requirements

The new transmission facility will be wholly contained on NSP property. There will be no right-of-way condemnation requirements.



NORTHERN STATES POWER COMPANY
MINNEHAHA COUNTY, SOUTH DAKOTA

FIGURE 2-5
TRANSMISSION LINE ARRANGEMENT

DWG NO.: N05644052.F116

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2.6.6 Necessary Clearing Activities

The new transmission facility will not require any clearing activities.

2.7 FUELS

2.7.1 Proposed Fuel Types

The primary fuel utilized by the proposed CTG facility will be natural gas of pipeline quality. The BTU content of the pipeline quality gas can be expected to range from 990 to 1020 Btu/ft³, with specific gravities ranging from 0.58 to 0.62, and a maximum water content of 7 pounds per million cubic feet of gas.

Backup fuel for the proposed CTG facility will be No. 2 distillate fuel oil, which will be used during times when natural gas is unavailable. It is anticipated that a one week supply of fuel oil will be stored on-site in the two existing fuel oil storage tanks, based on the assumption that the proposed CTG facility would operate 50 hours per week at full capacity at winter design conditions.

2.7.2 Anticipated Yield and Range

Natural gas BTU content is approximately 1,000,000 Btu per 1000 cubic feet plus or minus 10 percent. No. 2 distillate fuel oil BTU content is expected to be about 19,000 Btu per pound plus or minus 10 percent.

2.7.3 Chemical Analysis of the Proposed Design Fuel

Table 2-2, General Composition of Natural Gas Fuel, and Table 2-3, General Composition of No. 2 Distillate Fuel Oil, present the anticipated approximate chemical analysis of the natural gas and No. 2 distillate fuel oil.

TABLE 2-2

GENERAL COMPOSITION OF NATURAL GAS FUEL

Element	Pipeline Laboratory Standard (%)	Actual Recorded Composition ¹ (%)
N ₂ - Nitrogen	4.0	1.07
CO ₂ - Carbon Dioxide	1.0	0.42
C ₁ - Methane	86.0	95.05
C ₂ - Ethane	3.0	2.5
C ₃ - Propane	0.5	0.09
IC ₄ - Iso-Butane	0.5	0.0
NC ₄ - Normal Butane	0.5	0.01
IC ₅ - Iso-Pentane	0.5	0.0
NC ₅ - Normal Pentane	0.5	0.0
C ₆ - Hexanes	0.5	0.0
H ₆ - Helium	1.0	0.03
H ₂ - Hydrogen	2.0	0.03

Proximate Analysis % by volume.

¹ Taken from St. Paul area gas chromatograph

TABLE 2-3

GENERAL COMPOSITION OF NO. 2 DISTILLATE FUEL OIL

COMPOUND	WEIGHT PERCENT
Aliphatic Hydrocarbons	64%
Aromatic Hydrocarbons	35%
Xylene	1%
Olefinic Hydrocarbons	1-2%
Naphthalene	1%
Sulfur	0 - 0.57 ppm
Arsenic	0.012 - 0.13 ppm
Cadmium	0.089 - 0.89 ppm
Chromium	0.055 - 2.8 ppm
Iron	3.8 - 71.0 ppm
Lead	<0.49 - 2.0 ppm
Manganese	0.29 - 6.2 ppm
Molybdenum	0.018 - 0.27 ppm
Nickel	<6.1 - 23.0 ppm
Vanadium	<0.06 - 0.16 ppm
Zinc	1.3 - 4.8 ppm

Sources: The Installation Restoration Program Toxicology Guide, Volume 4, Oak Ridge National Laboratory, 1989; MSDS for No.2 Distillate Fuel Oil

2.7.4 Proposed Primary and Secondary Fuel Sources and Transportation

The primary fuel, natural gas, will be delivered to the proposed CTG facility by Minnegasco. The secondary fuel, No. 2 distillate fuel oil, will be delivered to the site by rail or truck depending on market conditions.

2.8 TIME SCHEDULE

The proposed CTG facility is scheduled for a June, 1994 in-service date. Table 2-4 lists the major milestones and target dates to achieve this schedule:

TABLE 2-4
PROPOSED CTG FACILITY TIME SCHEDULE

Milestone	Target Date
Facility Permit Application Filed	9/91
Release CTG for engineering and manufacturing	9/91
Receive Facility Permit, PSD Permit, and other permits	9/92
Start CTG Construction	6/93
Commercial operation	6/94

2.9 PROJECT COSTS

The estimated capital cost of the facility is dependent on the number of CTG units installed at the site. Table 2-5 presents the estimated cost to install up to four CTG units in 1994 dollars.

TABLE 2-5
ESTIMATED COST OF CTG FACILITY

Number of Units	Estimated Capital Cost ¹
1	\$ 48,000.000
2	\$ 78,000,000
3	\$ 112,000,000
4	\$ 145,000,000

¹ Capital costs based on a 1994 in-service date

3.0 ALTERNATIVES

3.1 ALTERNATIVE SITES FOR THE PROPOSED CTG FACILITY

NSP conducted a detailed site identification and screening study to establish the preferred site for the proposed CTG facility. Twenty-one (21) locations throughout a four-state area were identified for initial consideration. These 21 sites were selected based on their proximity to an existing NSP generating plant or substation.

As a basis for screening and comparing potential sites, a conceptual "Greenfield" two-unit CTG installation was established and a capital cost estimate developed for this facility. Site-specific capital additions or deletions from the base "Greenfield" site were used to develop the site-specific capital costs for each of the potential sites. Operational and maintenance costs (total or differential) were developed for each potential site. A net present value cost was determined for each site. Potential sites were then compared and rated based on net present value cost.

Environmental and licensing aspects such as air quality, land use, and permitting time were also considered and incorporated into the screening process.

The following items were investigated for each site:

Capital Costs:

- Base Capital Cost - The Greenfield facility estimate was used as a base capital cost for each site.
- Transmission Line Adjustments - The need for new transmission line construction to increase transmission line capacity, as well as upgrading and increasing substation capabilities and wheeling charges, was evaluated for each site, as appropriate.
- Fuel Source Adjustments - Natural Gas Pipeline access was evaluated for each site. The cost for construction of the gas line and regulating station, as needed, was also evaluated.

- Site Equipment Adjustments - Fuel oil storage capacity, waste pond capacity, railroad access, security fence coverage, well capacity, fire protection equipment, and roads/parking were evaluated and appropriately credited for each site.
- Environmental/Site Conditions Adjustments - Credit was given to sites at lower elevations (CTG capacity decreases with an increase in elevation), sites with an adequate buffer zone, sites with adequately cleared areas, and sites which required less time to permit (those in South Dakota and North Dakota). Sites were penalized which contained poor soil conditions for foundations, as well as sites in close proximity to residential areas or other sensitive receptors, and sites classified as non-attainment with regard to air quality regulations.

Annual Operating and Maintenance Expenses:

- Staffing Differentials - Estimates were made for each site regarding the number of personnel required, distance to travel, and cost.
- Natural Gas - Total gas consumption per year was estimated, and costs were calculated and added to all sites.
- Fuel Oil - Estimated annual fuel consumption was estimated, and costs were calculated and added to all sites.
- Property Tax - Property taxes were estimated and added to each site.
- Transmission Wheeling Charge - Credits and additions were added based on current or estimated wheeling charges for each site.

Net Present Value (NPV) of capital costs in 1994 dollars (including depreciation) and annual operating and maintenance expenses were then calculated. This value was used to compare the economics of siting the CTGs at the individual sites. As a result, the 21 potential sites were classified into three groups -- five low cost sites, nine middle cost sites, and seven high cost sites, based on the calculated NPV of each site.

The five low cost or preferred sites were then further evaluated. These preferred sites were:

- Ashland (Wisconsin);
- Wheaton (Wisconsin);
- French Island (Wisconsin);
- Hurley (Wisconsin); and
- Pathfinder (South Dakota).

The French Island site was eliminated due to insufficient space availability. From a transmission standpoint, Ashland and Hurley were viewed as the same site. That is, the transmission capacity would be based on the total number of units at both sites. The existing transmission system in the area may support up to 200 MW of CTGs. Significant transmission improvements would be needed more for than 200 MW of CTGs, making it uneconomical to add more than two units to the area. Since the Ashland site was deemed more cost effective than the Hurley site, the Hurley site was eliminated from further consideration.

Three sites remained as most appropriate for combustion turbine development. These sites are the Pathfinder Power Plant site near Sioux Falls, South Dakota; a site near Ashland, Wisconsin; and the Wheaton Combustion Turbine site near Eau Claire, Wisconsin. NSP is pursuing licensing approval at all three sites.

Further discussion of the site selection process is contained in the Site Screening Study, attached as Exhibit B to the Facility Permit Application.

3.2 NO ACTION ALTERNATIVE

Figure 2-2, NSP Obligations and Committed Resources, illustrates NSP's forecast of demand for electricity in future years and the resources currently available to meet that demand. The figure displays a range of growth in electricity demand to reflect the uncertainty inherent in forecasting future energy requirements. The range bounded by the forecast bandwidth captures the middle 30 percent of probability for future peak demand and energy requirements. There is a 35 percent chance that actual

demand will exceed the range portrayed and a 35 percent chance that actual demand for electricity will fall below the range.

In the early 1990s, any demand in excess of available resources will be met through short-term purchases from other utilities. The demand for electricity could exceed NSP's available resources by as much as 200 MW in 1994 and by as much as 700 MW by 1997. Based on a review of its projected forecasts and on a study of resource needs, NSP has concluded that the resource need in the 1990s will be primarily peaking capacity. NSP plans to meet this peaking capacity need through the installation of simple cycle CTGs.

If this project does not proceed, there would be a significantly higher risk that forecasted electrical energy needs in the NSP service area could not be met.

3.3 ALTERNATE ENERGY RESOURCES

3.3.1 Combined Cycle Design

One alternative to the simple cycle design of the proposed CTGs would be a combined cycle unit. A combined cycle unit consists of a combustion turbine, a heat recovery steam generator (HRSG), and a steam turbine generator. The hot gases exhausted from the combustion turbine are used to produce steam that, in turn, spins a steam turbine. A combined cycle unit typically obtains two-thirds of its electricity output from the combustion turbine and one-third from the steam turbine. Adding a steam turbine to combustion turbine improves the overall energy conversion efficiency by about 30 percent, making the efficiency of combined cycle gas-fired generation comparable or greater than coal-fired steam generation.

A combined cycle facility has lower fuel costs than a simple cycle combustion turbine due to the higher efficiency, but higher installation, operating (non-fuel), and maintenance costs.

If a simple cycle combustion turbine plant is operated for short periods of time when peaking energy requirements are needed, the fuel cost savings of operating a

combined cycle facility will not compensate for the higher installation, operating (non-fuel), and maintenance costs.

The anticipated annual capacity factor for the proposed simple cycle combustion turbine is less than 10 percent, which is typical for a peak load duty cycle. The higher installation costs of a combined cycle unit will require a larger annual capacity factor in order to be offset by its lower fuel costs.

For these reasons, the combined cycle design option is not being considered for short-term peak load duty.

3.3.2 Conservation and Load Management

NSP has initiated an aggressive program of demand-side management options (DSM) in recent years to displace a significant portion of base forecast growth, lower peak demand growth rate and also to improve the economic and environmental development of NSP service territories. Key DSM components include:

- Cost-Effective Conservation - Helps customers control total energy costs through improved conservation.
- Load Shifting - Helps customers save money and improve NSP generation resource use by promoting thermal or other potential energy storage methods, or rescheduling end-use loads to off-peak periods.
- Peak Reduction - Provides opportunities for customers to save money and reduce NSP peak operating costs through selective interruption of end use loads.
- Valley Filling - Meets customer productivity or lifestyle needs with low cost electricity, and improves the use of NSP resources by offering off-peak discounts and ways to make appropriate use of off-peak electricity.

The objective of these strategies is to significantly improve NSP's annual load factor while meeting customer energy requirements at the lowest possible cost. Doing so improves the use of existing resources, helps mitigate the need for added generation, and maintains low rates over the long term.

NSP's long range DSM goal is to achieve 1,000 MW of impact system-wide by 1995. The 1,000 MW are equivalent to 91 percent of NSP's current peaking capacity. Additional impacts are projected beyond 1995. To accomplish this goal, NSP has assumed favorable customer acceptance and favorable regulatory treatment. In a survey of DSM activity conducted by an independent consultant for Ontario Hydro, NSP was ranked third most aggressive promoter of conservation and load management strategies, by projected goals, among 29 other utilities in North America.

Through year-end 1990, DSM has accounted for 544 MW of system-wide peak coincident reduction, 415 MW of which were achieved with NSP's load shifting and peak reduction (load management) programs. The remaining 129 MW of peak reduction were achieved through NSP's conservation programs. Figure 2-2, NSP Obligations and Committed Resources, assumes that the above-mentioned goal will be met.

3.3.3 Purchased Power Alternative

NSP purchases power from the non-utility market and other utilities to help meet the capacity and energy needs of its customers.

The non-utility market is a recently emerging market created by the Public Utilities Regulatory Policy Act (PURPA) of 1978, whereby utilities must buy all the capacity and energy offered by developers of facilities that qualify under the Act. NSP has contracted with or actively negotiated with a number of cogeneration, hydro, or municipal solid waste (MSW) developers, resulting in about 116 MW of potential capacity. All but 60 MW of this capacity are currently operating.

Over the last several years, NSP has worked with other utilities to purchase significant amounts of generating capacity. Long-term power purchases currently under contract began as early as 1963 and continue until the year 2015.

NSP's ability to purchase additional generating capability from other utilities depends upon two main factors: the future capacity needs of other utilities and the price and quality of available capacity. As the availability of utility generating capacity in the Mid Continent Area Power Pool (MAPP) region declines through the 1990s, NSP's opportunities for additional purchases will also diminish. Additionally, if prices other utilities are willing to accept are not economical compared to other available capacity options, purchases may not be made.

NSP will continue to examine the purchase options for the future, and will purchase to defer construction of new facilities if economically feasible.

4.0 AFFECTED ENVIRONMENT

This Chapter describes the existing physical, biological, and socioeconomic environment at the Pathfinder site.

4.1 PHYSICAL ENVIRONMENT

4.1.1 Climate and Air Quality

Sioux Falls, South Dakota can best be described as having a mid-continental, sub-humid climate. Over half of the yearly precipitation occurs during the warmer months, with annual total precipitation being of moderate amounts. There are frequent weather changes from day to day or week to week as the Sioux Falls area is subjected to air masses originating in the Arctic/Canada (cold), the northern Pacific (cool, dry), the Gulf of Mexico (warm, moist), or the southwest U.S. (hot, dry).

The area experiences a relatively severe temperature range from winter to summer, with seasonal temperatures varying year to year. The winter months of December through February can experience cold spells with average temperatures under 8°F and more than 60 consecutive days below 32°F. Temperatures of 100°F and above generally occur about once every 3 years, usually in July.

Thirty-year monthly normal temperatures and precipitation amounts are presented in Table 4-1. The highest monthly average temperature is 74.4 °F occurring in July, and the lowest monthly average temperature is 14.9 °F, occurring in January. The annual average temperature is 46.2 °F.

Nearly 64 percent of the normal yearly precipitation occurs during the growing season of April through August. Thirty-year normals show precipitation ranging from a high of 4.09 inches in June, to a low of 0.61 inches in January, with an annual average of 25.02 inches. Summertime precipitation is generally in the form of showers and thunderstorms caused by cyclonic activities as the result of convective heating. These storms generally are sudden downpours and are of short duration. Winter-time precipitation generally is caused by slow moving low pressure disturbances that can bring extensive cloudiness. This precipitation can be in the form of rainfall, snow, or ice.

TABLE 4-1

30-YEAR NORMAL TEMPERATURES AND PRECIPITATION
FOR SIOUX FALLS, SOUTH DAKOTA

Month	Normal Temperature (°F)	Normal Precipitation (inches)
January	14.9	0.61
February	20.4	0.76
March	32.2	1.44
April	47.2	2.50
May	59.0	3.46
June	68.5	4.09
July	74.4	2.95
August	71.8	3.09
September	61.7	2.76
October	49.9	1.57
November	33.3	1.06
December	20.2	0.72
ANNUAL AVERAGE	46.2	25.02

Note: Normals are average value of the meteorological element over a 30-year period: 1960 - 1989.

Source: National Oceanic and Atmospheric Administration, 1989 Local Climatological Data - Annual Summary for Sioux Falls, South Dakota

One or two very heavy snowstorms usually occur each winter. Severe winter storms have occurred with 15 to 30 inches of recorded snowfall.

Wind speed data was obtained from the National Oceanic and Atmospheric Administration's "1989 Local Climatological Data, Annual Summary with Comparative Data, Sioux Falls, South Dakota." The average annual wind speed in Sioux Falls is 11.2 miles per hour. Wind speeds are generally highest during winter and early spring months.

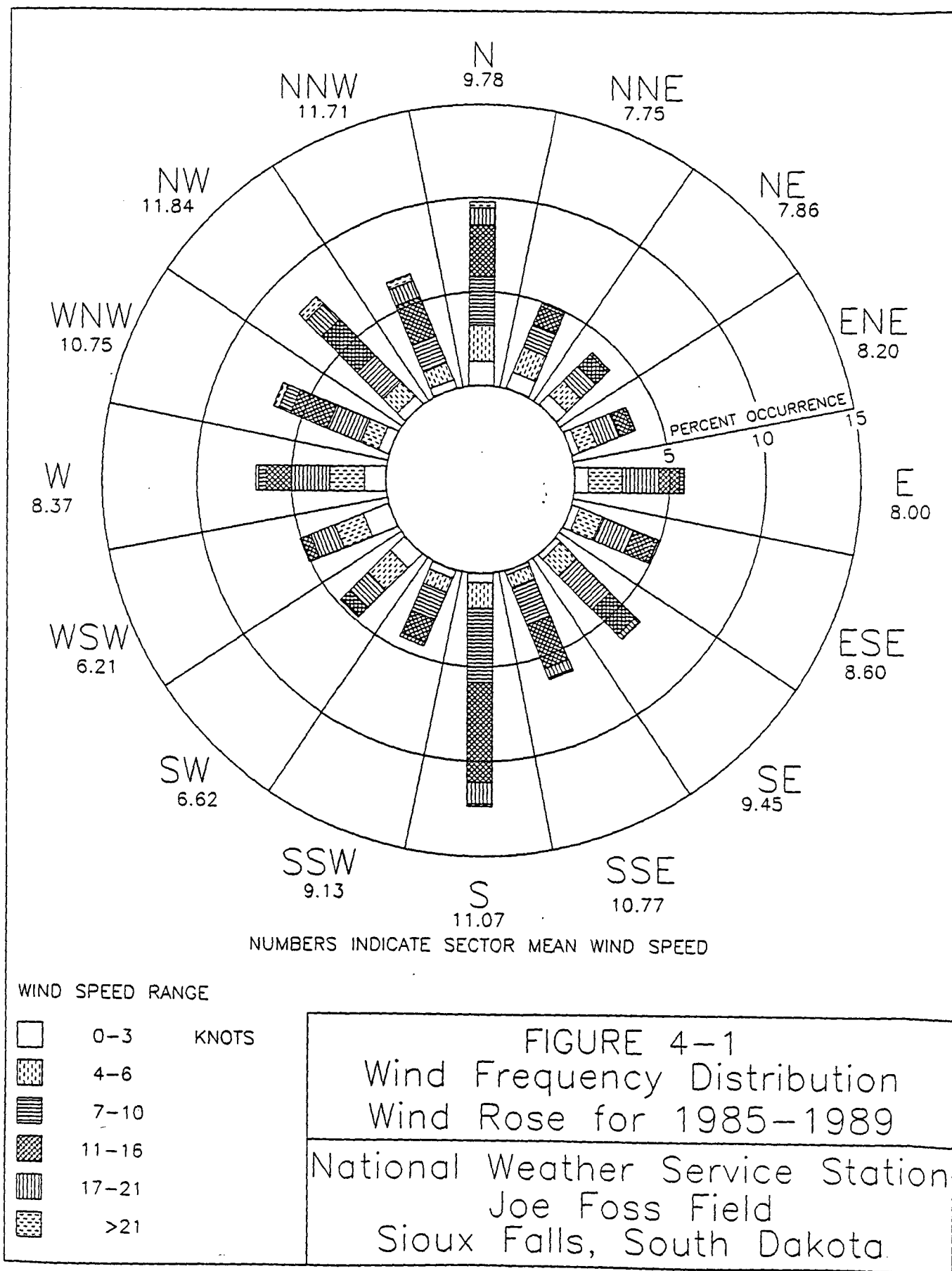
Monthly prevailing wind directions obtained from the National Weather Service station at Sioux Falls Municipal Airport (Joe Foss Field) indicate that prevailing wind direction is generally from the northeast during March and April, from the southeast from May through September, and from the northwest from October through February. The prevailing wind direction is from the south, occurring approximately 13 percent of the time. Figure 4-1, Wind Frequency Distribution, Wind Rose for 1985-1989 shows a 5-year cumulative wind frequency distribution for the period 1985-1989 for Sioux Falls.

The Sioux Falls area and Minnehaha County are classified by the U.S. Environmental Protection Agency as attainment for all criteria air pollutants, including ozone, total suspended particulates, sulfur dioxide, nitrogen oxides, and carbon monoxide.

4.1.2 Regional Land Forms

The proposed CTG site lies on the southern flank of the Coteau des Prairies section of the Central Lowlands physiographic province. This flat to gently rolling topography is the result of past glacial activity. The general topography of this area is a reflection of the most recent Wisconsin-age glacial event. The Wisconsin-age land surface is smooth and gently undulating with poorly developed drainage features.

In contrast, the uplands immediately north and south of the Pathfinder site are bluffs of the older Kansan-age glacial event. This region is characterized by a well-defined network of small streams which have carved channels into the boulder-rich clay. The plateau-like uplands are rough to rolling in this hill country.



The uplands of the area are drained by the Missouri River and its tributaries. The Pathfinder site is located on glacial outwash deposits within the Big Sioux River valley. The Big Sioux River is a major tributary that flows west to east within the Pathfinder site. Most of NSP's property lies on the south side of the river valley between the river channel and the bluffs.

The upland bluffs rise to an elevation greater than 1450 feet (NGVD) in the area. The base of the bluffs at the southern edge of the Pathfinder site is approximately 1370 feet in elevation, as contrasted to the elevation of the river channel which is approximately 1290 feet.

A sand-rich "upper" terrace is located between elevations 1350 feet and 1370 feet. This stream deposit is approximately 2000 to 3000 feet wide on the southern portion of the Pathfinder site. A portion of the upper terrace is also located on the north side of the river channel within the boundary of the Pathfinder site. A "lower" terrace is located on both sides of the river between elevations 1305 feet and the edge of the river channel at approximately 1295 feet. The width of this area at the base of the river valley is approximately 2000 feet. The current channel of the Big Sioux River meanders through the lower terrace.

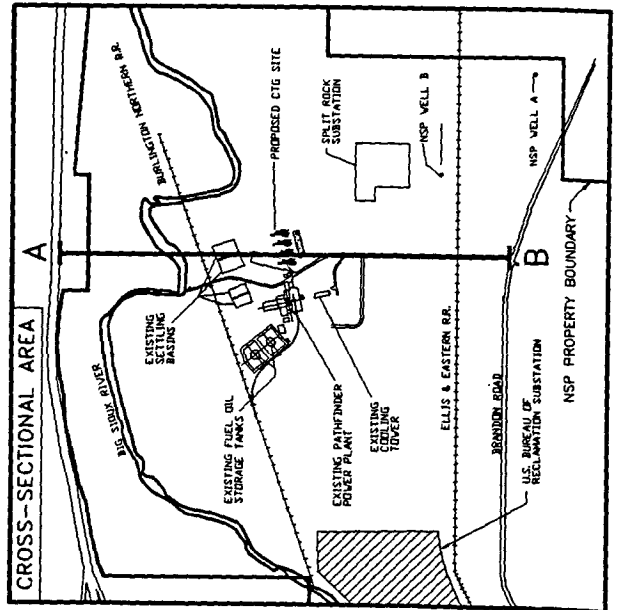
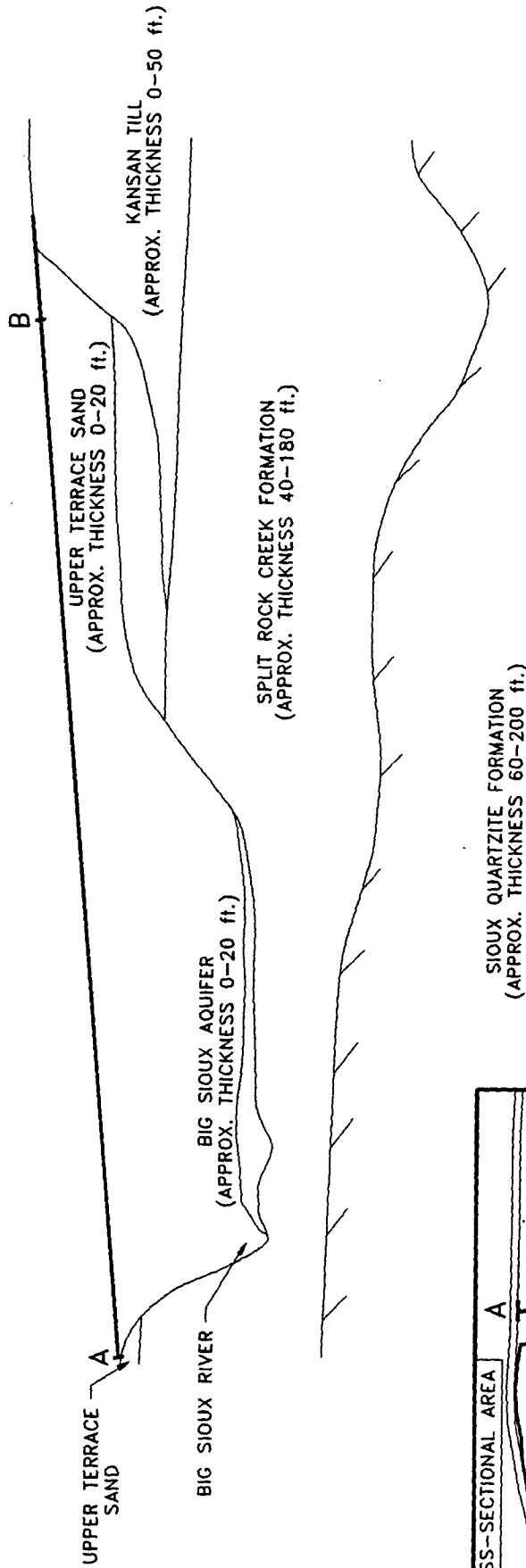
4.1.3 Geology

The proposed CTG site is underlain by a series of alluvial, glacial, and marine sediments, some of which are approximately 570 million years old. The most important geological units are the water-bearing portions of the Split Rock Creek formation and the surface sediments upon which the proposed CTG facility will be constructed.

This section describes the sequence of geologic formations, as referenced in Figure 4-2, Generalized Geological Cross-Section, beginning with the oldest formations.

Sioux Quartzite Formation: The Sioux Quartzite formation is the basement rock which underlies most of southeastern South Dakota. This Precambrian rock is a massive orthoquartzite interbedded with thin shale and a few units of poorly cemented quartz sand. The material is composed primarily of clean and well sorted beach sands that have

NORTH



SIoux QUARTZITE FORMATION
(APPROX. THICKNESS 60-200 ft.)

0 400 800 1600

APPROX. HORIZONTAL SCALE IN FEET

NORTHERN STATES POWER COMPANY
PATHFINDER SITE, SOUTH DAKOTA

FIGURE 4-2
GENERALIZED GEOLOGICAL
CROSS-SECTION

DWG NO.: N05644052.F101 DAMES & MOORE

been firmly cemented with silica. The formation may be 3000 to 5000 feet thick and is one of the oldest rock units that has been identified in South Dakota.

The quartzite is chiefly pink, with red to purple interbedded shales and mudstones. The formation exhibits primary depositional features such as ripple marks, cross-bedding, and mud cracks. It is jointed vertically and horizontally and is reported to have a southward dip in the vicinity of the Pathfinder site, as generally shown in Figure 4-2, Generalized Geological Cross-Section.

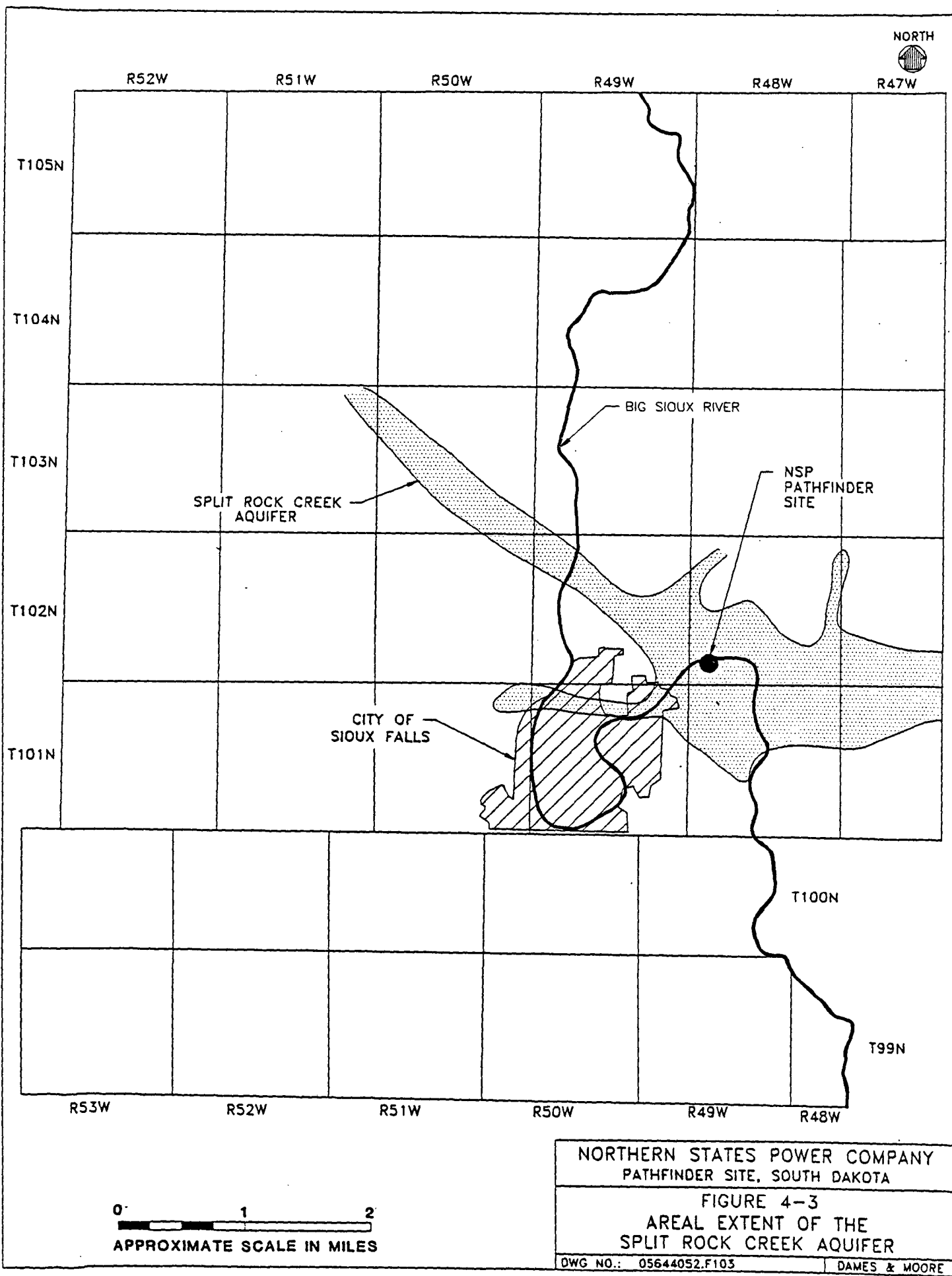
A limited amount of water is locally available from fractures and porous zones in the Sioux Quartzite. A small quantity of water may also be found in the weathered zone near the top of the rock surface.

The Sioux Quartzite is buried beneath the Pathfinder site at depths ranging from 60 to more than 200 feet. However, the formation is exposed in several outcrops in the area. The closest outcrop location is in the northeast part of the City of Sioux Falls.

Split Rock Creek Formation: The Cretaceous Split Rock Creek formation is described by Rothrock (1958) as having been deposited in a marine embayment or a drowned valley. The horizontal extent covers about 100 square miles in Minnehaha County (Barari, 1989), as shown in Figure 4-3, Areal Extent of Split Rock Creek Aquifer. Further definition of the formation is in process (Pence, 1991). The Split Rock Creek formation at the Pathfinder site is approximately 180 feet thick beneath the upper terrace. The formation is eroded to approximately 40 feet thick and exposed in the Big Sioux River channel.

A full sequence of the Split Rock Creek formation typically contains five identifiable units, as shown in Figure 4-4, Generalized Stratigraphic Column, Split Rock Creek Formation. Although the units are referred to in some drilling logs as being "clay", they are actually poorly indurated shales and mudstones. Early drilling records referred to the units as "Black Rock" because of the extensive black shales and siltstones present.

The thin basal clay is a cream to pink sandy shale and siltstone unit. The water-bearing sand is a pink, partially-cemented quartz which may contain gray to black shale



R52W

R51W

R50W

R49W

R48W

R47W

T105N

T104N

T103N

T102N

T101N

SPLIT ROCK CREEK
AQUIFER

BIG SIOUX RIVER

NSP
PATHFINDER
SITE

CITY OF
SIOUX FALLS

T100N

T99N

R53W

R52W

R51W

R50W

R49W

R48W

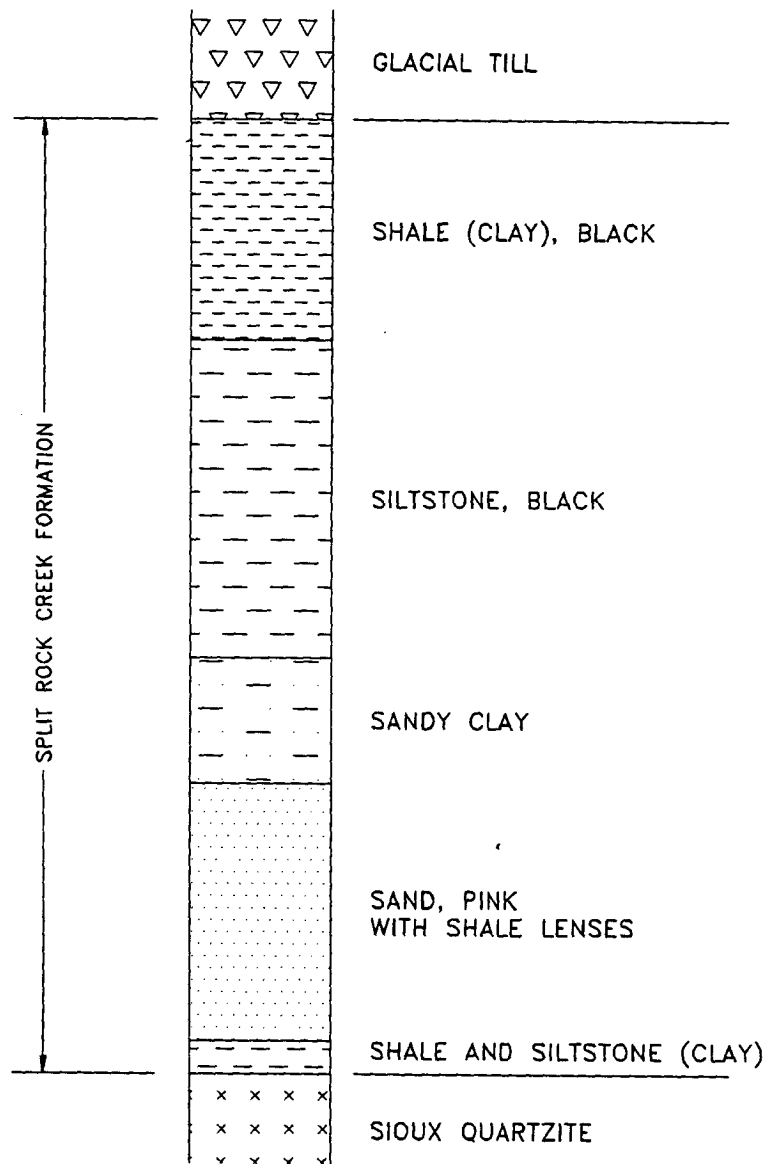
0 1 2
APPROXIMATE SCALE IN MILES

NORTHERN STATES POWER COMPANY
PATHFINDER SITE, SOUTH DAKOTA

FIGURE 4-3
AREAL EXTENT OF THE
SPLIT ROCK CREEK AQUIFER

DWG NO.: 05644052.F103

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0 20 40 80
 APPROXIMATE SCALE IN FEET

NORTHERN STATES POWER COMPANY
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FIGURE 4-4
 GENERALIZED STRATIGRAPHIC COLUMN
 SPLIT ROCK CREEK FORMATION

DWG NO.: 05644052.F102 DAMES & MOORE

lenses. The sandy clay is a more prominent black shale unit above the water-bearing sand. The black siltstone is hard and well cemented. The upper clay unit is a silty, black shale.

Kansan Till: The Pleistocene Kansan Till is composed of a boulder-rich clay till which may contain some outwash deposits. It is approximately 0 to 50 feet in thickness. The material was deposited on top of the Cretaceous sediments and forms the uplands in the vicinity of the site. The till is believed to have been deposited from glacial ice which moved southwesterly across the Precambrian rocks of Minnesota.

Upper Terrace Sand: The Upper Terrace Sand is approximately 20 feet thick. This unit is a fluvial deposit that may or may not be of glacial origin. This former flood plain has been abandoned by the Big Sioux River which has cut a deeper channel and developed a new flood plain at a lower level. This permeable material does not contain a permanent source of significant water because it is above the current local water table.

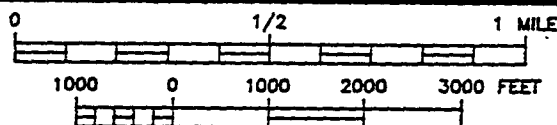
4.1.4 Floodplains

Figure 4-5, 100-year, Flood Plain Map, depicts areas of special flood hazard as indicated by the Flood Insurance Rate Maps developed by the Federal Emergency Management Agency (FEMA, 1979, 1982). The northern portion of the Pathfinder site bordering the Big Sioux River is within the 100-year flood plain as classified by FEMA. The site of the proposed CTG is not within the 100-year flood plain, however.

4.1.5 Seismic Activity

Major faulting has been recognized and studied in the Black Hills area of western South Dakota. Although minor synclines, anticlines, and faults are expected to be scattered elsewhere in the state, their presence is masked by glacial sediments.

The Pathfinder site is located in an area that is relatively free of damaging seismic activity associated with faults. Two earthquakes have been recorded in the Sioux Falls area since 1872. The first was recorded in 1921 with a measured intensity of 3 on the Modified Mercalli Scale, which would indicate an earthquake which is noticeable indoors and on upper floors of buildings but is not generally recognized by most people as an



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earthquake. The second earthquake was recorded in 1938 with a measured intensity of 5 on the Modified Mercalli Scale. An earthquake of this intensity is typically noticed by everyone in the vicinity and usually results in minor damage such as broken dishes, windows, and cracked plaster (Burchett, 1979).

4.1.6 Mineral Resources

Other than small sand and gravel deposits found along the present-day Big Sioux River Valley, the only other potential source of significant mineral resources in the siting area is the Sioux Quartzite formation (Jarret, 1991).

The Precambrian Sioux Quartzite is a metamorphosed pink sandstone underlying most of Minnehaha County, with outcrops in stream valleys and areas where glacial drift has been eroded. Major present-day uses for the stone include concrete aggregate, railroad ballast, road construction, rip-rap for dams and riverbank stabilization, and production of ferro-silica for the steel industry (Jarrett, 1990). Similar deposits to the Sioux Quartzite resting on and derived from complex terrains of older metamorphic and igneous rocks have been found to contain very significant deposits of gold and uranium (Southwick et. al., 1986). To date, however, there have been no documented occurrences of economic or subeconomic mineralization in conjunction with the Sioux Quartzite (Jarrett, 1990).

4.1.7 Soil Resources

4.1.7.1 Soil Associations

The major soil associations surrounding the project area were obtained from a soil survey published by the U.S. Department of Agriculture Soil Conservation Service. The Minnehaha County, South Dakota soil survey was published in 1964 (Netrud, et.al., 1964). Four soil associations are found in the immediate project area, as follows:

1. Luton-Dimmick;
2. Fordville-Estelline;
3. Buse-Sioux;
4. Nora-Moody;

The distribution of these soils is shown in Figure 4-6, Soils Associations Map. A description of the four soil associations occurring in the project area, excerpted from Soil Conservation Service publications, is presented below.

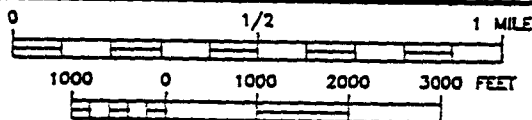
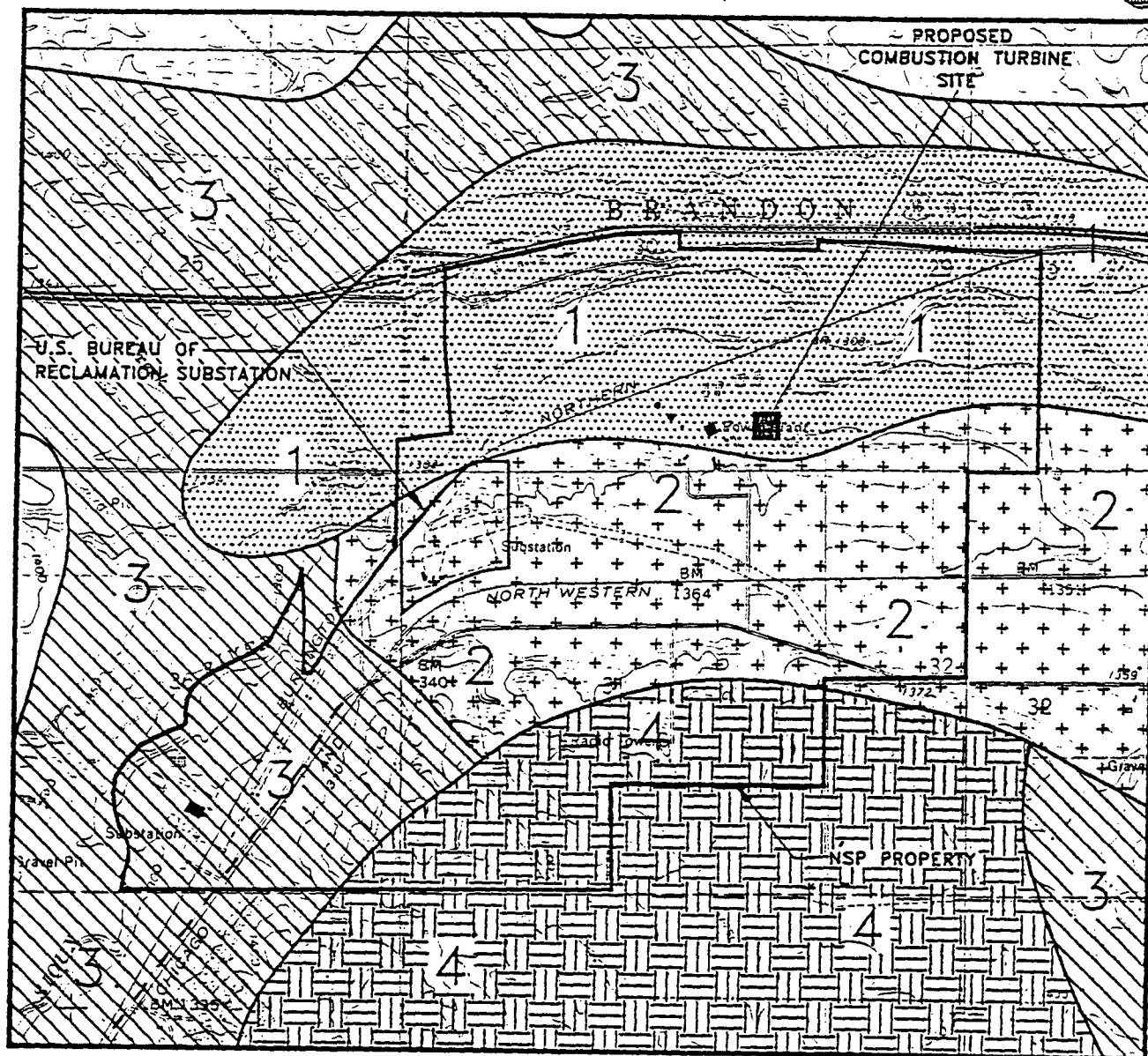
Luton-Dimmick Association: The Luton-Dimmick Association occurs on level or nearly level bottoms along the Big Sioux River and its tributaries. It contains fine-textured to moderately fine-textured soils on flood plains that are moderately well-drained to very poorly-drained. The soils in this association that can be cultivated are fertile, but are difficult to till. They dry out slowly in the spring, and planting is usually delayed. Flooding is also a problem, especially during the spring thaws and after heavy rains. Corn, soybeans, small grains, and alfalfa are grown and produce good to high yields if precipitation is normal or less than normal. Some of the wetter areas can be used for hay or pasture.

Fordville-Estelline Association: The Fordville-Estelline Association consists of nearly level to gently-sloping soils on stream terraces along the Big Sioux river. It contains medium-textured moderately well-drained to well-drained soils over sand and gravel. The soils in this association are generally cultivated and produce fair to good yields. Corn, small grains, and alfalfa are grown. The water-holding capacity is fair. Because of underlying sand and gravel, these soils are somewhat droughty. Wind erosion is a problem in areas where the surface is not protected. Sheet erosion is likely where runoff on the gentle slopes is uncontrolled.

Buse-Sioux Association: The Buse-Sioux association consists of thin, excessively drained coarse-textured, and medium-textured soils that formed in glacial drift on hilly uplands, gravelly knobs and ridges, and stream terraces. This soil association is mostly associated with pasture land. The soils are droughty, and runoff is excessive. Some areas are too strong or steep for safe operation of farm machinery. Commercial gravel is obtained from this association in the Cactus Hills area between the Pathfinder Plant site and the city of Sioux Falls.

Nora-Moody Association: This association consists of medium-textured and moderately-fine-textured, well-drained soils formed in loess on uplands. These soils are deep, (10 to 30 inches or more) and exist on slopes ranging from 3 to 9 percent. The majority of this association is cultivated. Corn, small grains, soybeans, and alfalfa are

NORTH



LEGEND:

- 1. Lutes-Dickmick: Fine-textured to moderately fine-textured soils on flood plains
- 2. Forville-Erlewine: Medium-textured soils over sand and gravel on stream terraces
- 3. Bose-Snow: Coarse-textured and medium-textured soils in glacial drift
- 4. Ware-Woody: Medium-textured and moderately fine-textured soils in loess on uplands

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FIGURE 4-6
SOILS ASSOCIATIONS MAP

DWG NO.: NQ5644052.F115

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grown and generally produce good to fair yields. Because these soils are silty and have rapid runoff, they erode easily, resulting in the deposit of substantial amounts of sediment.

4.1.7.2 Pathfinder Plant Site Soils

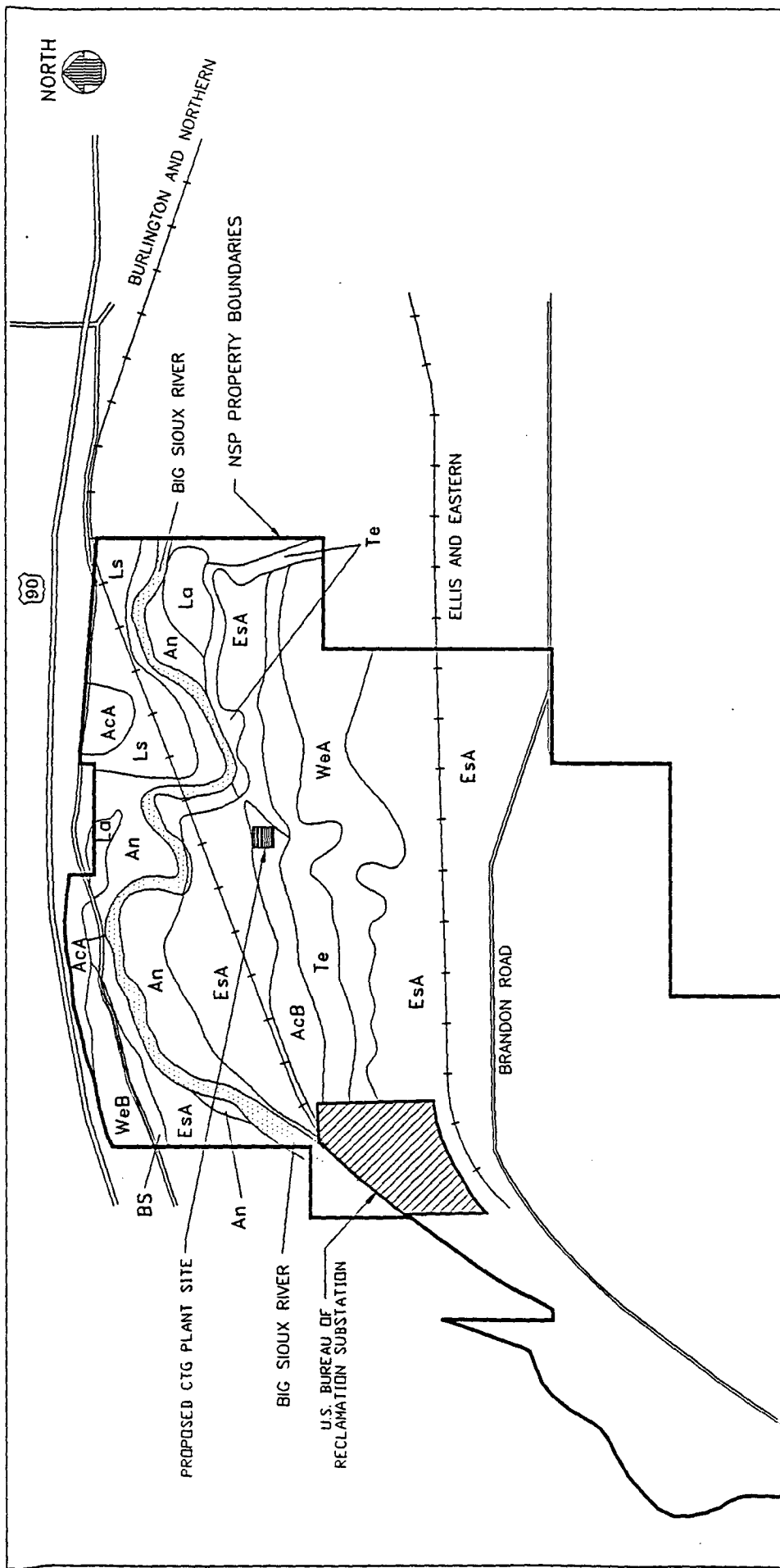
The specific soil mapping units at the Pathfinder plant site property are shown in Figure 4-7, Plant Site Soil Mapping Units. A mapping unit is made up of soils with similar profiles and characteristics that affect their behavior in undisturbed landscape and their use by man.

The proposed CTG facility will be located on Alcester Silt Loam (3 to 5 percent slopes) soils. This soil occurs on nearly level, narrow strips on the foot slopes and in the narrow valleys of the loessal uplands. The surface layer is a dark grayish brown silty loam, about 8 inches thick. The subsoil is a dark grayish brown silty loam, about 26 inches thick. In most places lime occurs in the lower part of the subsoil. These deep, moderately well-drained soils have fair to moderate natural fertility, and a low to fair water-holding capacity (Netud, et. al., 1964).

4.1.8 Surface Water Resources

4.1.8.1 General Description

The Big Sioux River, which lies north of the proposed CTG site, drains a large portion of eastern South Dakota and portions of southwest Minnesota and northwest Iowa. The head waters are located about 30 miles north of Watertown in the Coteau des Prairies of northeastern South Dakota. The river flows southeast from the source to the town of Flandreau. The flow is then predominantly southerly to the confluence with the Missouri River near Sioux City, Iowa although the flow at the proposed CTG site is from west to east. The drainage area of the Big Sioux River basin consists mainly of glacial till ranging from 50 to 400 feet thick. The river bed itself lies in alluvial soils deposited by the retreat of the last ice sheet. The river bed is composed of loose sand and small gravel. Silty areas occur in backwaters while large rocks are rare except those outcrops that form Dell Rapids and Sioux Falls (Sinning, 1968).



LEGEND

AcA Alceator Silt Loam (1 to 3 percent slopes)
Cumulic Haplustolls, fine-silty, mixed, mesic.

AcB Alceator Silt Loam (3 to 5 percent slopes)
Cumulic Haplustolls, fine-silty, mixed, mesic.

An Alluvial Land
Water deposited sediments (varied texture and profile of soil material—cannot be taxonomically classified)

BS Buge-Sioux Complex (5 to 17 percent slopes)
Udorthentic Haplustolls, sandy-skeletal, mixed, mesic.

EsA Estelling Silt Loam (0 to 2 percent slopes)
Pachic Haplustolls, fine-silty, mixed, mesic.

La Lamoure Silty Clay Loam (0 to 2 percent slopes)
Cumulic Haploquolls, fine-silty, mixed (calcareous), mesic.

Ls La Prairie Silt Loam (0 to 3 percent slopes)
Cumulic Udic Haploborolls, fine-loamy, mixed, mesic

Te Terrace Escarpments (7 to 20 percent slopes)
Udorthentic Haplustolls, sandy-skeletal, mixed, mesic.

WeA Fordville Loam (1 to 3 percent slopes)
Pachic Haplustolls, fine-loamy over sandy or sandy-skeletal, mixed, mesic.

WeB Fordville Loam (3 to 5 percent Slopes)
Pachic Haplustolls, fine-loamy over sandy-skeletal, mixed, mesic.

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FIGURE 4-7
PLANT SITE
SOIL MAPPING UNITS

DWG NO.: N05644052.F100

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Sinning (1968) described river flow as highly variable in the upper reaches with only scattered pools, from subsurface springs, remaining during low flow periods. The width of the river varies from about 20 feet at Watertown to about 200 feet near the mouth. The average depth ranges from 1 to 5 feet, except in the last 10 miles above the confluence with the Missouri River which is deeper. The only major tributary to the Big Sioux River is the Rock River which drains extreme southwest Minnesota and northwest Iowa before entering the Big Sioux River from the Iowa side. There are numerous intermittent creeks and streams that enter the Big Sioux River in South Dakota. The river, except at a few impounded areas, consists of long riffles and pools with a noticeable current.

The entire drainage area of the Big Sioux River Basin was original prairie country which is now extensively farmed. The effects of agricultural activities are evident, such as heavy silt loads due to erosion from grazing and plowing up to the river banks. Rogers (1968) found historical accounts that described the rivers and creeks of the Big Sioux River Basin as clear with stable banks, uniform flow throughout the year, and with good populations of desirable fish species. However, due to poor erosion control management practices in recent years, the river carries more silt, causing greater variability in flows such as higher than normal flooding with a resulting rapid drop in river flow rate. In addition, heavy water usage has resulted in a drop in the alluvial water table causing reduced flow from springs which feed the river.

4.1.8.2 Big Sioux River Flow

The U.S. Geological Survey (USGS) maintains a gauging station on the Big Sioux River at North Cliff Avenue in Sioux Falls. The gauging station is approximately 6.5 river miles upstream of the proposed CTG facility. The two major discharge sources upstream of the proposed CTG site are the John Morrell Meat Packaging Company (Morrell), which is located 6.9 river miles upstream of the proposed CTG site, and the Sioux Falls Wastewater Treatment Plant (SFWWTP), which is approximately 2.2 river miles upstream of the proposed CTG site. Complete monthly flow data, based on daily averages, is available for 19 water years (1972 through 1990) from the North Cliff Avenue Station. The monthly mean flows along with the daily maximum and minimum for the month are tabulated over the 19-year period in Table 4-2. For the 19-year period, river flow in the Big Sioux River has ranged from a minimum daily average of

TABLE 4-2

MONTHLY MEAN AND RANGE OF FLOW IN THE BIG SIOUX RIVER AT SIOUX FALLS
1972-1990. (in cubic feet per second)

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
Maximum	3100	2070	1260	350	3790	8440	9880	7310	20700	4330	1300	9660
Minimum	12	13	7.1	1.4	0.8	9.7	24	31	14	14	11	9.0
Mean	254.0	221.2	132.3	72.0	133.66	1098.8	1465.9	834.5	872.4	427.4	221.1	319.6

0.8 cubic feet per second (cfs) in February 1992 to a maximum daily average of 20,700 cfs in June 1984. Monthly mean flow over the 19-year period has varied from 72 cfs in January (lowest monthly flow) to 1465.9 cfs in April (highest monthly flow).

Table 4-3 lists the monthly flow exceedance values for the Big Sioux River at the North Cliff Avenue station in Sioux Falls (South Dakota Department of Environment and Natural Resources (SDDENR), 1991), based on nine years of data. The one-in-ten year monthly low flow is 6.26 cfs and occurs in January. The lowest summer one-in-ten year monthly low flow is 19.77 cfs, occurring in July. The five-year seven-day low flow (7Q5) for the Big Sioux River at Sioux Falls is 12.5 cfs and the 100-year flood flow is 26,500 cfs (SDDENR, 1991).

4.1.8.3 Water Quality

South Dakota has classified the waters of the State by beneficial use classes and has based water quality standards on those intended uses. The eleven use classes are listed on Table 4-4. The Big Sioux River in the vicinity of the proposed CTG facility has been assigned beneficial use classes 5, 7, 8, 9 & 10. The applicable water quality criteria for these classes are listed in Table 4-5. When more than one use class is listed the most stringent standards apply.

Data on water quality is collected by the SDDENR at monitoring stations located in Sioux Falls and Brandon. The station at Sioux Falls, (WQM B529) is 1.9 river miles downstream of Morrell, 2.8 miles upstream of SFWWTP, and 5 miles upstream of the proposed CTG site. The station at Brandon (WQM 31) is 0.75 miles downstream of the Brandon wastewater treatment facility, and 3.3, 5.5, and 10.2 river miles downstream of the proposed CTG facility, the SFWWTP, and Morrell, respectively. Data is available for the period 1974 through 1990. Morrell was discharging wastewater prior to 1974; operations at the SFWWTP began in 1982 although the final phase of construction was not completed until 1986; the Brandon wastewater facility has been in operation since 1981.

Table 4-6 compares the minimum, maximum, and mean values for the parameters at the two SDDENR monitoring stations for the 17-year period.

TABLE 4-3

FLOW EXCEEDENCE VALUES FOR THE BIG SIOUX RIVER
AT NORTH CLIFF AVENUE, SIOUX FALLS, SD
(NINE YEARS OF RECORD)

Month	10%	30%	50%	70%	90%
October	1580.32	781.83	168.32	90.80	30.83
November	1008.90	601.43	317.66	105.33	41.26
December	476.38	302.64	185.80	98.25	36.32
January	289.25	172.42	118.54	32.25	6.26
February	798.17	199.78	179.60	75.67	32.25
March	3478.61	2295.48	1025.08	562.45	77.06
April	6543.00	2884.68	1524.10	477.03	106.73
May	4518.12	1600.03	499.51	223.42	55.00
June	6880.16	778.23	617.10	185.70	53.60
July	1729.96	888.12	470.45	236.38	19.77
August	912.22	217.61	141.74	114.38	33.03
September	3467.66	354.00	124.46	62.00	28.00

Source: South Dakota Department of Water and Natural Resources.

TABLE 4-4

BENEFICIAL USE CLASSES OF PUBLIC WATERS
ESTABLISHED BY THE STATE OF SOUTH DAKOTA

1.	Domestic water supply users;
2.	Coldwater permanent fish life propagation waters;
3.	Coldwater marginal fish life propagation waters;
4.	Warmwater permanent fish life propagation waters;
5.	Warmwater semipermanent fish life propagation waters;
6.	Warmwater marginal fish life propagation waters;
7.	Immersion recreation waters;
8.	Limited contact recreation waters;
9.	Wildlife propagation waters;
10.	Irrigation waters;
11.	Commerce and industry waters.

TABLE 4-5

**WATER QUALITY STANDARDS FOR THE BIG SIOUX RIVER
NEAR THE PROPOSED CTG FACILITY**

Parameter	Concentration (mg/l unless noted)
Total residual	<0.2
Unionized ammonia	<0.04
Total cyanide	<0.02
Free cyanide	<0.005
Dissolved oxygen	>5.0
Undissociated hydrogen sulfide	<0.0002
pH (pH units)	6.3-8.3
Total suspended solids	<90
Temperature (Degrees F)	<90
PCBs	<0.000001
Fecal coliforms (# org./100 ml)	
mean of 5 samples	<200
daily maximum applicable 5/1 through 9/30	<400
Acids	cannot alter pH of receiving water >0.5 pH
Oil and grease	concentration < 10 mg/l and no visible sheen
Ammonia-N	<0.04
Total Residual Chlorine	<0.02
Total Dissolved Solids	<2500
Total Alkalinity	<750
Nitrate - N	<50
Sodium Absorption Ratio	<10.0

Source: South Dakota Surface Water Quality Standards, SDCL 34A-2,
Chapter 74:03:02.

TABLE 4-6

BIG SIOUX RIVER WATER QUALITY DATA VALUES 1974 TO 1990.
ALL UNITS IN MG/L UNLESS NOTED.

	SIOUX FALLS			BRANDON			Percent Difference (mean)
	Max	Min	Mean	Max	Min	Mean	
Temperature C	34.4	0.0	12.7	33.9	0.6	11.6	4.5
Cond. @25 C umho	3350.0	280.0	1187.0	2700.0	290.0	1224.0	1.5
Dissolved oxygen	19.0	4.0	10.5	15.6	1.8	9.5	5
BOD	13.0	4.0	8.0	11.0	3.4	8.2	1.2
pH field pH units	9.2	4.5	8.0	10.1	5.9	7.9	6.3
Ph lab pH units	8.8	7.0	8.1	8.7	7.0	8.0	6.2
Alkalinity, total	560.0	0.4	218.5	352.0	0.0	209.6	2.1
HCO ₃	318.0	223.0	271.7	346.0	129.0	266.3	1.0
Total residue	2355.0	441.0	954.8	1773.0	383.0	955.4	0.03
Dis. residue @105 C	1419.0	274.0	818.3	1747.0	261.0	889.5	4.2
Dis. residue @180 C	2295.0	169.0	913.9	1325.0	357.0	842.6	4.1
Nonfilter residue	420.0	1.0	65.7	710.0	1.0	63.4	1.8
NH ₃ +NH ₄ -N Dis.	18.2	0.6	5.4	25.9	0.2	7.9	18.8
NH ₃ +NH ₄ -N Tot.	19.0	0.0	1.4	19.2	0.0	1.3	3.7
No 2- N Dis.	0.9	0.0	0.1	1.6	0.0	0.2	33
Kjeldl N Tot.	7.6	7.4	7.5	21.0	0.8	8.7	7.4
NO ₂ &NO ₃ N Tot.	22.0	0.1	2.6	19.8	0.1	2.6	0
Hardness Total	630.0	180.0	426.0	490.0	190.0	398.8	3.2
Calcium Total	134.0	41.9	89.3	118.0	45.6	90.6	.72
Magnesium Tot.	59.0	16.5	43.0	94.9	17.3	42.0	1.2
Sodium Tot.	326.0	7.1	81.1	403.0	5.6	127.5	22.2
Potassium Tot.	20.1	8.6	14.8	23.3	6.6	14.2	2.1

TABLE 4-6 (continued)

	SIOUX FALLS			BRANDON			Percent Difference (mean)
	Max	Min	Mean	Max	Min	Mean	
Chloride Tot.	814.0	7.9	237.2	590.0	7.5	232.5	1.0
Manganese µg/L	550.0	230.0	418.9	980.0	230.0	550.4	13.6
Fec. Coli. FCBR	220000.0	3.0	3615.4	220000.0	3.0	4253.6	8.1
Fec. Strep KFAGAR	290.0	5.0	77.8	.7E+7	4.0	1.64E+5	2107.97
Phos. Total	4.0	0.1	0.7	3.8	0.1	1.1	22.2
PO4 Tot. P-col	11.5	0.1	1.8	12.1	0.2	2.6	18.2
PO4 Sol. T P- col	2.8	0.4	1.3	2.6	0.2	1.8	16.1
PO4 Ortho Tot.	10.4	0.0	1.7	11.8	0.0	2.5	19.0
Phos. Dis. Ortho	475.0	0.0	7.2	4.5	0.0	1.0	75.6

Data from SD Department of Water and Natural Resources Storet database

Although the minimum and maximum values for the two stations vary widely, the mean values are within 10 percent for most parameters (see Table 4-6). One parameter which exhibits a wide difference in mean values is fecal streptococcus counts. The mean values for this parameter obtained at the Brandon site are substantially higher than at the Sioux Falls station. This parameter is often an indication of contamination from animal feed lots and processing facilities. Mean fecal coliform counts at Brandon are also slightly higher than Sioux Falls but the overall ranges are similar. These fecal coliform values indicate that the water quality standards for that reach of the Big Sioux River are likely exceeded at times.

Many other parameters reflect the silt burden and agricultural influence on the Big Sioux River. Such parameters as conductivity, residue, hardness and chloride are relatively high compared to other surface waters. Dissolved oxygen mean values are adequate although the minimum values listed for the station in Brandon are below state standards and would likely be detrimental to most aquatic life.

Minimum field pH values recorded at both monitoring stations are below standards for the designated use classes of the river. However, lab pH values are within the specified ranges. Mean nonfilterable residue values are within the water quality standards but the maximum concentrations are in excess of the water quality standards. Recent improvements to the Sioux Falls Wastewater Treatment Plant and the animal processing plants have likely reduced the frequency of the water quality standard excessions.

4.1.9 Ground Water Resources

There are two principal aquifers which underlie the Pathfinder site, the shallow Big Sioux Aquifer and the deeper Split Rock Creek Aquifer. This section describes both aquifers.

4.1.9.1 Big Sioux Aquifer

The alluvial material of the Big Sioux Aquifer is in the current flood plain of the Big Sioux River. The semi-stratified deposits of sand, gravel, and silt may reach a thickness of 20 feet along the river. This aquifer is reported to have an excellent hydraulic connection with the river and is a significant source of water.

4.1.9.2 Split Rock Creek Aquifer

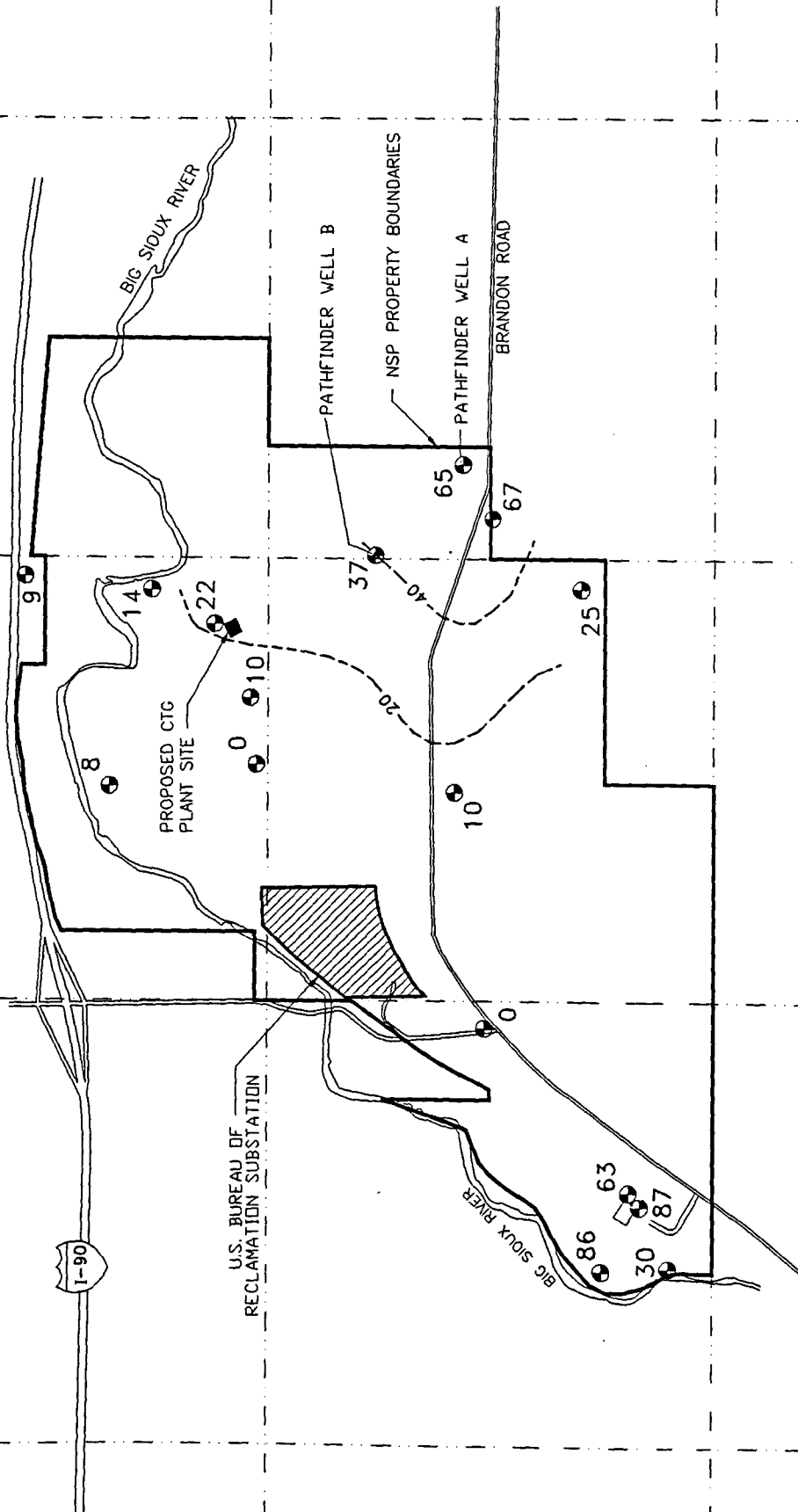
The water-bearing unit of the Split Rock Creek formation is primarily a quartz sandstone formation which is believed to be derived from weathering of the Sioux Quartzite formation. The porous sandstone includes layers of carbonaceous shales, mudstones, and limey zones.

As shown in Figure 4-8, Isopach Map, Sand Aquifer within the Split Rock Creek Formation, the thickness of the sand unit varies from 0 to more than 60 feet at the Pathfinder site and to more than 80 feet at the NSP Lawrence site, located approximately 1.5 miles west of the Pathfinder site. The areas of thick sand are localized and often contain shale and siltstone lenses.

A pumping test was conducted at the Pathfinder site in 1958 at the Pathfinder Well A. The test was run for 8 days at 626 gallons per minute (gpm). The projected annual need for the proposed CTG facility is 300 gpm, with a short-term peak demand of 650 gpm. The results of the 1958 test are summarized in Rothrock, 1958, but the physical data are not available. The text states that "The testing of this well reached what seemed to be a stable flow at 626 gpm ...".

Two pumping tests were conducted at the former wells at the NSP Lawrence site in 1988 to evaluate the Split Rock Creek Aquifer. The two 24-hour tests were pumped at 197 gpm and 397 gpm. These short term tests provided data to determine aquifer characteristics, but were not long enough to estimate a sustained yield from the formation. Wells at the Pathfinder site were not monitored during these tests.

Pumping in the Split Rock Creek Aquifer is currently being monitored on a long-term basis west of the Pathfinder site. The City of Sioux Falls is conducting a pump test



LEGEND:

10 - THICKNESS
(in feet)

--- AQUIFER CONTOURS NEAR THE
PATHFINDER WELLS.

0 1000 2000 4000
SCALE IN FEET

NORTHERN STATES POWER COMPANY
PATHFINDER SITE, SOUTH DAKOTA

FIGURE 4-8

ISOPACH MAP, SAND AQUIFER
WITHIN THE SPLIT ROCK CREEK FORMATION
DWG NO.: ND5644052.F104 DAMES & MOORE

from a well at the Lawrence site and from a well at the Sioux Falls Wastewater Treatment Plant. These wells are approximately 3,000 feet apart and are pumping at a rate of approximately 300-325 gpm each. The pump tests began in September 1990 and are expected to continue through September, 1991. The State of South Dakota is monitoring a network of wells in the area during the pumping program, including an observation well near the Pathfinder production well A.

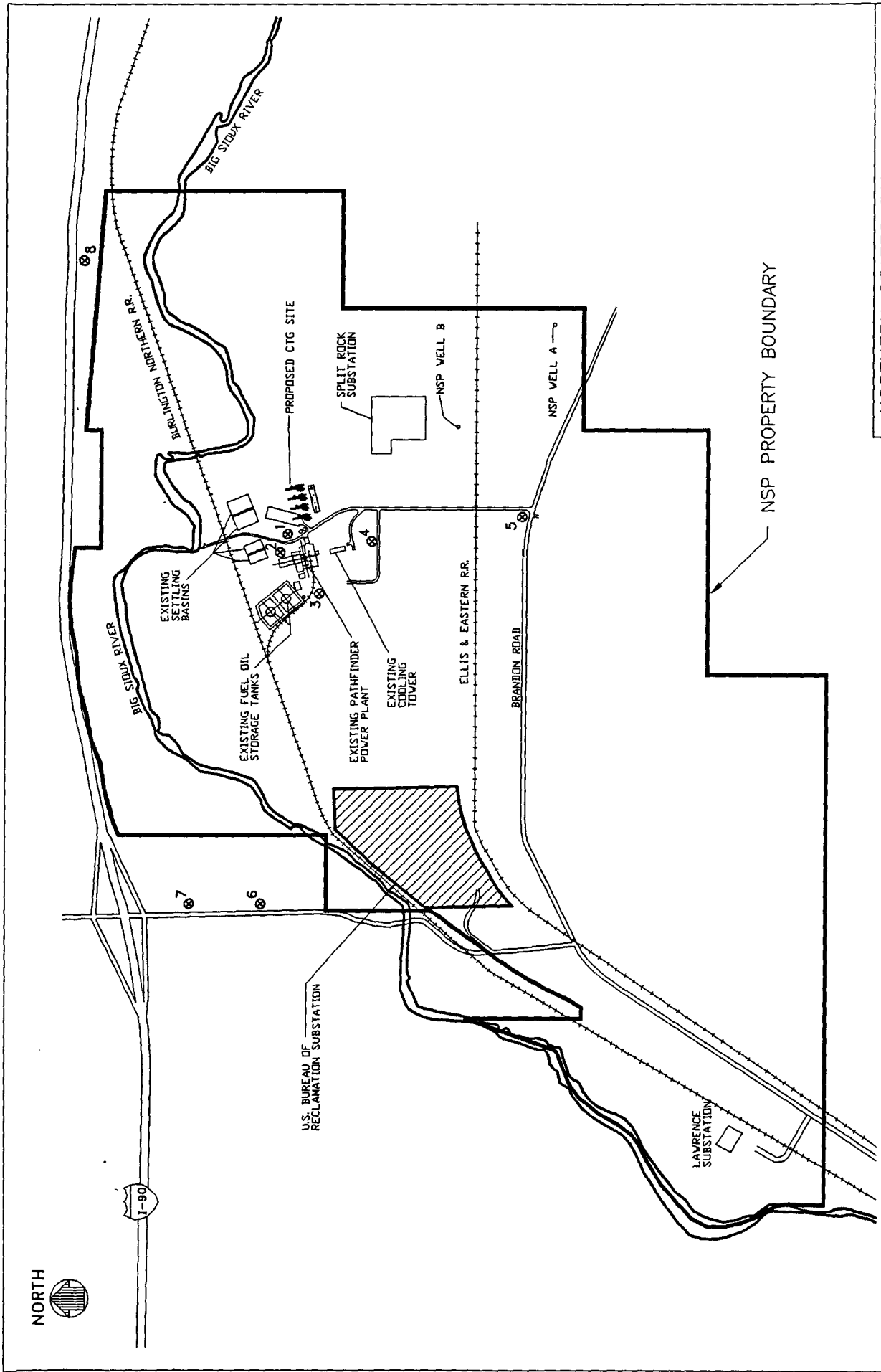
4.1.10 Existing Sound Levels

A field survey was conducted to establish existing sound levels in the immediate vicinity of the Pathfinder site. Sound monitoring stations were selected on the basis of the sensitivity, proximity and typicality of the sound receptors in the area.

The land surrounding the Pathfinder site is generally an undeveloped rural agricultural area. It is bordered to the north by the Big Sioux River and Interstate 90 (I-90). Two residences are located approximately 4,240 feet west and 4,280 feet northwest of the proposed CTG facility. In addition, a campground is located approximately 5,200 feet northwest of the proposed CTG facility on the north side of I-90. There are no residences directly south or east of the proposed CTG facility. A farmstead is located approximately 5,400 feet northeast of the proposed CTG facility. There is also a large substation operated by the U.S. Bureau of Reclamation approximately 3,000 feet west of the proposed CTG facility (see Figure 4-9, Pathfinder Site Sound Monitoring Stations).

Existing sound level measurements were recorded at eight locations surrounding the proposed CTG facility including four sites (stations 1-4) located on the Pathfinder property surrounding the existing plant; one site (station 5) at the intersection of the Pathfinder site entrance road and Brandon Road; two sites (stations 6 and 7) located at the nearest residences to the proposed CTG facility; and one site (station 8) located on a gravel road parallel to I-90 northeast of the plant.

The monitoring station locations are shown in Figure 4-9, Pathfinder Site Sound Monitoring Stations, and described in Table 4-7, Sound Level Monitoring Stations, Pathfinder Site.



KEY:
 Ⓢ¹ = SOUND MONITORING STATION NUMBER

NORTHERN STATES POWER COMPANY MINNEHAHA COUNTY, SOUTH DAKOTA	
FIGURE 4-9 PATHFINDER SITE SOUND MONITORING STATIONS	
DWG NO.:	N05644052.F121
DAMES & MOORE	

TABLE 4-7

SOUND LEVEL MONITORING STATIONS - PATHFINDER SITE

STATION	DESCRIPTION
1	Pathfinder site, approximately 250 feet northwest of the proposed CTG facility
2	Pathfinder site, approximately 500 feet northwest of proposed CTG facility
3	Pathfinder site, approximately 800 feet west of proposed CTG facility
4	Pathfinder site, approximately 800 feet southwest of proposed CTG facility
5	Pathfinder site, at entrance from Brandon road, approximately 2,400 feet south of proposed CTG facility
6	Residence, approximately 4,240 feet west of proposed CTG facility
7	Residence, approximately 4,280 feet northwest of proposed CTG facility
8	Gravel road parallel to I-90, approximately 3,500 feet northeast of proposed CTG facility

Background sound level measurements were recorded at the existing Pathfinder plant on July 18, 1991. To account for the intermittent operation of the existing plant, sound level monitoring was performed between the hours of midnight and 0330 (while the plant was not running) and from noon to 1430 the same day (while the plant was running at full load). Prevalent sources contributing to the existing sound level were noted during each sampling event.

A Larson-Davis Real Time Analyzer (S/N 3100D-1287), a Bruel & Kjaer 2230 sound level meter (S/N 1082186) with a Bruel & Kjaer octave filter set (S/N 1092032), and a Metrosonics db-604 (SN 1208) were used to perform the sound level monitoring. All equipment had been recently calibrated by the factory. The Larson Davis and Bruel & Kjaer microphones were field calibrated with a Bruel & Kjaer type 4230 calibrator (S/N 1059980). A GenRad type 1562A calibrator (S/N 16982) was used to field calibrate the Metrosonics db-604.

Weather conditions during the midnight to 0330 survey were: clear skies; temperature 88°F; wind southeast at 8 to 10 miles per hour; relative humidity 59 percent and; no precipitation. During the noon to 1430 survey, weather conditions were: clear but hazy skies; temperature 95°F to 100°F; wind southwest at 8 miles per hour gusting to 15 miles per hour towards the end of survey; relative humidity 57 percent and; no precipitation.

The results of the sound level monitoring survey are presented in Table 4-8. Sound pressure levels are expressed in decibels using an A-weighted frequency scale (dBA). The A-weighted frequency scale uses the specific weighting of a sound pressure level for the purpose of determining the human response to sound. The specific weighting characteristics and tolerances are specified in American National Standards Institute 51.4-1983, Section 5.1. The data obtained in the field survey were used to calculate day/night noise levels (L_{dn}), which represent a single number measure of community noise exposure over a 24-hour period. The L_{dn} is used to assess the quality of the habitable, 24-hour noise environment. Calculated L_{dn} levels for the existing sound level environment are based on an assumed worst-case scenario of the existing plant running 24 hours per day. These L_{dn} values are presented in Table 4-9.

TABLE 4-8

PATHFINDER AMBIENT SOUND LEVEL MONITORING DATA
RECORDED JULY 18, 1991
SOUND PRESSURE LEVELS (dBA)

Monitoring Location	Time	Plant On/Off	L_{max}	L_{min}	L_{10}	L_{50}	L_{eq}	Prevalent Sources*
1	0029	Off	67	56	52	48	54	Crickets, Frogs
	1232	On	70	59	63	62	54	Plant
2	0054	Off	69	59	62	58	52	Crickets, Frogs
	1248	On	68	65	67	67	58	Plant
3	0112	Off	66	53	57	53	56	Crickets
	1313	On	70	59	65	62	54	Plant, Cooling Tower
4	0133	Off	68	54	51	46	58	Crickets
	1330	On	69	62	66	65	52	Cooling Tower
5	0152	Off	65	56	50	45	53	Substation, Crickets
	1422	On	75	48	68	63	47	Substation
6	0210	Off	60	47	42	39	49	Crickets, Substation
	1441	On	75	44	62	51	47	Substation, Birds
7	0252	Off	74	23	54	51	46	Crickets
	1502	On	70	50	63	57	49	Crickets, Birds
8	0228	Off	78	49	48	42	57	Freeway
	1523	On	79	56	71	65	56	Freeway

*Listed in generally decreasing order of observed prevalence.

Note: dBA is a logarithmic unit for measuring the relative level of various acoustical quantities. 0 dBA represents the faintest sound; 130 dBA represents the threshold of pain.

L_{max} = Maximum noise level measured

L_{min} = Minimum noise level measured

L_{10} = Sound level exceeded 10 percent of the time

L_{50} = Sound level exceeded 50 percent of the time

L_{eq} = Equivalent or energy averaged mean sound level

TABLE 4-9

CALCULATED DAY-NIGHT SOUND LEVELS (L_{dn})
BASED ON BACKGROUND SOUND MEASUREMENTS

MONITORING STATION	BACKGROUND SOUND LEVEL (L_{dn})
1	53
2	54
3	54
4	52
5	42
6*	42
7*	53
8	52

* Station represents an existing residence

At the proposed CTG site, the highest L_{dn} calculated for a residence was 53 dBA. Major sound sources included crickets and birds chirping.

Table 4-10 is a land use/sound compatibility matrix that is used by the U.S. Department of Housing and Urban Development (HUD). The matrix utilizes the day/night noise description to determine the relative acceptability of the sound environment for various land uses. According to the matrix L_{dn} sound levels below 65 dBA are "clearly" or "normally" acceptable for all land uses. Ambient sound, levels measured at the nearest residences to the proposed CTG facility resulted in L_{dn} sound levels that are well below the 65 dBA threshold.

4.2 BIOLOGICAL ENVIRONMENT

4.2.1 Wetlands

Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. To be classified as a wetland, one or more of the following attributes must exist: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year, (Cowardin et. al., 1979).

As depicted in Figure 4-10, Wetlands Map, there are no identified wetlands at the site of the proposed CTG facility, although it should be noted that the National Wetlands Inventory Map (Sioux Falls East) identified the existing wastewater settling basins at the Pathfinder site as wetlands. There are several small potholes or closed depressions and intermittent streams identified on the National Wetlands Inventory Map in the vicinity of the Pathfinder site. The majority of these wetlands are of the Palustrine System which includes all nontidal wetlands dominated by trees, shrubs, persistent emergents, emergent mosses or lichens.

TABLE 4-10

LAND USE/SOUND COMPATIBILITY MATRIX

Land Use	Decibel Levels (L_{dn})		
	Over 75	65 - 75	Under 65
Residential			
Mobile homes	C.U.	N.A.	C.A.
Single family (a/c)	C.U.	N.A.	C.A.
Single family (w/o a/c)	C.U.	N.U.	N.A.
Multi-family	C.U.	N.A.	C.A.
Commercial			
Retail	N.U.	N.A.	C.A.
Wholesale	N.A.	C.A.	C.A.
Office	N.U.	N.A.	C.A.
Schools	C.U.	N.U.	N.A.
Institutional (a/c)	N.U.	N.A.	C.A.
Industrial			
Light	N.A.	N.A.	C.A.
Heavy	N.A.	C.A.	C.A.
Transportation/Utilities	N.A.	C.A.	C.A.
Recreational			
Golf courses	N.A.	C.A.	C.A.
Parks	N.U.	N.A.	C.A.
Open Land/Wildlife Habitat	N.A.	C.A.	C.A.
Agricultural	N.A.	C.A.	C.A.

Note: a/c = Air Conditioning

C.A. = Clearly Acceptable

C.U. = Clearly Unacceptable

N.A. = Normally Acceptable

N.U. = Normally Unacceptable

Source: U.S. Department of Housing and Urban Development

4.2.2 Plant Communities

The Pathfinder Site is approximately 6.5 miles northeast of Sioux Falls city center, in Minnehaha county which is in the southeastern corner of South Dakota. As depicted in Figure 4-11, Original Native Vegetation of South Dakota, the eastern edge of South Dakota is on land which was originally tallgrass prairie, a climax vegetation, principally composed of big bluestem, Indian grass and switch grass. Some of the dryer prairie areas were dominated by little bluestem, side-oats gramma and blue gramma grass while scattered potholes and depressions contained hydrophytic vegetation. However, by the mid-1800's the majority of the prairie had disappeared due to settlement and farming of the land. In addition, most of the potholes have been ditched and drained.

Today, the vast majority of the land in Minnehaha county outside the Sioux Falls city limit is cultivated. Scattered small areas are still in native grasses and are used for pasture. However, most of the pastures used for grazing consist of tame grasses seeded either as permanent pasture or as rotation hay and pasture in a conservation cropping system, (Rogers, 1974; Whitney et. al., 1978; Minnehaha Soil Conservation Survey, 1958).

The land within the Pathfinder property boundary contains riparian forest (along the Big Sioux River), cultivated fields, and brome grass.

The proposed CTG facility construction site is on unused land, vegetated with brome grass. There are no native vegetation species within the proposed CTG facility site.

The majority of the trees along the Big Sioux river are silver maple (*Acer saccharinum*). Other species present include box elder (*Acer negundo*), green ash (*Fraxinus pennsylvanica*), willow (*Salix* sp), cottonwood (*Populus deltoides*), and woody shrubs including wild rose (*Rosa* sp), honeysuckle (*Lonicara* sp), and buckbrush or wolfberry (*Symphoricarpos occidentalis*).

The rest of the Pathfinder site property consists of scattered aspen (*Populus tremuloides*), cottonwood, plum (*Prunus americana*), siberian elm (*Ulmus pumila*),

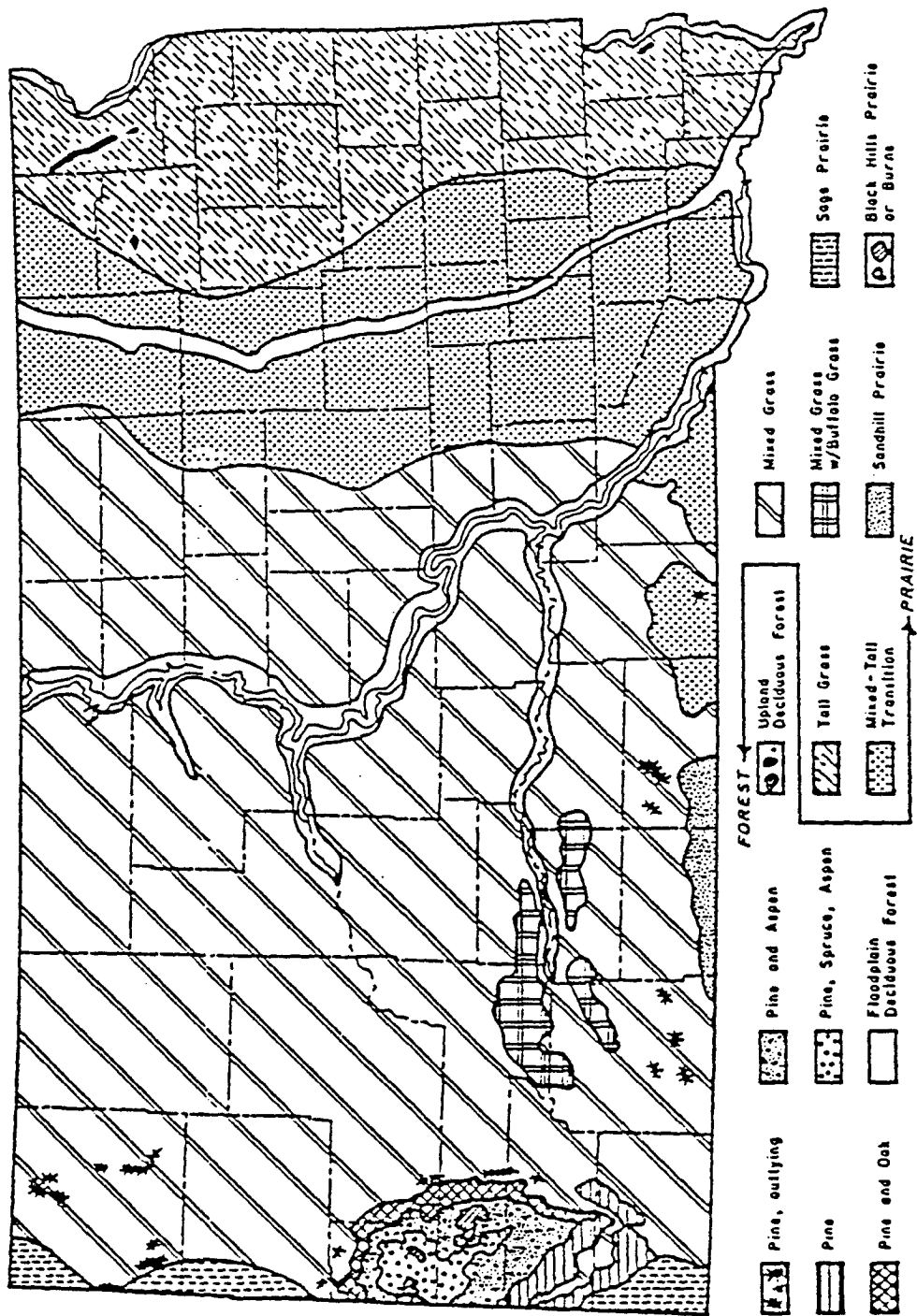


Figure 2. Natural Vegetation of South Dakota (prepared by Byron E. Harrell, based on: Küchler 1964; J.R. Johnson and Nichols 1970; USDA Soil Conservation Service Map 5, P-35, 738, 1970; Svotos 1976; USDA aerial photographs).
(from Whitney, et. al., 1978)

NORTHERN STATES POWER COMPANY
PATHFINDER SITE, SOUTH DAKOTA

FIGURE 4-11
ORIGINAL NATIVE VEGETATION
OF SOUTH DAKOTA

Dames & Moore

cultivated fields, and grassy fields consisting mainly of brome grass (*Bromus* sp) and alfalfa (*Medicago sativa*) mixed.

Although no native prairie plant species were observed within the boundaries of the plant site, a small tract of native prairie was located adjacent to the plant, along the east boundary of the Big Sioux River. Native tall-grass prairie plants observed include: side-oats gramma grass (*Bouteloua curtipendula*), big bluestem (*Andropogon gerardi*), little bluestem (*Andropogon scoparius*), pasque flower (*Anemone patens*), prairie violet (*Viola pedatifida*), ground cherry (*Physalis virginiana*), and puccoon (*Lithospermum* sp).

Plant species (categorized as Prairie Herbs or Emergent Vegetation) that have been found in the Sioux Falls area in the past are listed in Tables 4-11 and 4-12.

4.2.3 Native Animals

The original dominant animals in the southeastern region of South Dakota included bison, pronghorn antelope, wolf, and prairie chicken. All of these have been extirpated for over 100 years, however.

An animal survey was conducted at the Pathfinder site on May 20, 1991 focusing on bird, mammal, reptilian, and amphibian species observed. Tables 4-13 and 4-14 list the bird and mammal species observed during that survey. The predominant birds observed were those which inhabit grasslands, most commonly the western meadowlark, which breeds in every county of South Dakota. Mammals observed on the plant site included white-tailed deer (*Odocoileus virginianus*), eastern cottontail rabbit (*Sylvilagus floridanus*), fox squirrel (*Sciurus niger*), gray squirrel (*Sciurus carolinensis*), weasel (*Mustela* sp.), beaver (*Castor canadensis*), and raccoon (*Procyon lotor*). No reptiles or amphibians were observed during the site visit.

Tables 4-15, 4-16, and 4-17 list birds, mammals, and amphibians and reptiles, respectively that could occur within the Sioux Falls area.

TABLE 4-11

LIST OF PRAIRIE HERBS AROUND SIOUX FALLS

<u>Scientific Name</u>	<u>Common Name</u>
Allium canadense	Wild onion
Andropogon gerardi	Big bluestem
A. scoparius	Little bluestem
Bouteloua curtipendula	Side-oats grama
B. gracilis	Blue grama
B. hirsuta	Hairy grama
Buchloe dactiloides	Buffalo grass
Calamagrostis canadensis	Blue joint
Koeleria cristata	June grass
Lilium philadelphicum	Wood-lily
Muhlenbergia cuspidata	Muhly
Panicum virgatum	Switch grass
Sisyrinchium campestre	White-eyed grass
Sorghastrum nutans	Indian grass
Sporobolus cryptandrus	Sand dropseed
Stipa spp.	Porcupine grass
Trasdescantia bracteata	Spiderwort
Zygadenus elegans	Death camas
Anemone canadensis	Canada anemone
A. cylindrica	Thimble weed
A. patens	Pasque-flower
Antennaria neglecta	Pussy toes
Artemisia spp.	Wormwood
Asclepias verticillata	Whorled milkweed
Aster spp.	Aster
Astragalus spp.	Milk-vetch
Cassia fasciculata	Partridge-pea
Comandra pallida	Bastard toad-flax
Delphinium verescens	Larkspur
Desmodium canadense	Tickclover
Echinacea pallida	Purple coneflower
Erigeron strigosus	Daisy fleabane
Euphorbia heterophylla	Fire-on-the-mountain
E. marginata	Snow-on-the-mountain
Gentiana puberula	Downy gentian
Geum triflorum	Purple avens, Prairie smoke
Glycyrrhiza lepidota	Licorice
Grindelia squarrosa	Gum plant, Rosin-weed
Helianthus spp.	Sunflower
Heliopsis helianthoides	Ox-eye
Kuhnia eupatorioides	False boneset
Lactuca pulchella	Blue lettuce
Liatris aspera	Rough blazing-star
L. punctata	Dotted blazing-star
Linum sulcatum	Flax
Lithospermum spp.	Puccoon
Lobelia spicata	Pale-spike lobelia
Lygodesmia juncea	Rush-pink

TABLE 4-11
PRAIRIE HERBS - (Continued)

<u>Scientific Name</u>	<u>Common Name</u>
Monarda fistulosa	Wild bergamot
Oenothera serrulata	Evening primrose
Onosmodium occidentale	False gromwell
Oxytropis lambertii	Loco-weed
Pedicularis canadensis	Wood-betony, Lousewort
Petalostemum candidum	White prairie clover
P. purpureum	Purple prairie clover
Penstemon gracilis	Small beard-tongue
Penstemon grandiflorus	Large-flowered beard-tongue
Phlox pilosa	Downy phlox
Physalis heterophylla	Clammy ground-cherry
P. lanceolata	Ground-cherry
P. virginiana	Virginia ground-cherry
Plantago purshii	Wooly plantain
Psoralea agorophylla	Silverleaf scurf-pea
P. esculenta	Prairie-turnip
Ratibida columnifera	Coneflower
R. pinnata	Gray-headed coneflower
Rudbeckia hirta	Black-eyed Susan
Senecio plattensis	Prairie ragwort
Silphium laciniatum	Compass-plant
Solidago canadensis	Canada goldenrod
S. missouriensis	Missouri goldenrod
S. nemoralis	Gray goldenrod
S. rigida	Hard-leaved goldenrod
Tragopogon dubius	Goat's beard
Veronicastrum virginicum	Culver's root
Viola nuttallii	Prairie yellow violet
V. pedatifida	Prairie violet

TABLE 4-12
LIST OF EMERGENT VEGETATION AROUND SIOUX FALLS

<u>Scientific Name</u>	<u>Common Name</u>
Anacharis canadensis	Water-weed
Carex spp.	Sedge
Cyperus spp.	Chufa nut grass
Eleocharis spp.	Rush
Equisetum spp.	Horsetail, Scouring rush
Hypoxis hirsuta	Star-grass
Juncus spp.	Spike rush
Lemna minor	Lesser duckweed
Phragmites communis	Cane
Potamogeton spp.	Pondweed
Sagittaria latifolia	Arrowhead
Scirpus spp.	Bulrush
Sparganium eurycarpum	Giant burreed
Spartina pertinata	Cord grass
Typha latifolia	Common cattail
Apocynum sibiricum	Indian hemp
Asclepias incarnata	Swamp-milkweed
Bidens vulgata	Beggar-ticks
Cicuta maculata	Water-hemlock
Gentiana andrewsii	Closed gentian
Heracleum lanatum	Cow-parsnip
Impatiens pallida	Touch-me-not, Jewel-weed
Lobelia siphilitica	Lobelia
Lactuca biennis	Lettuce
Lathyrus palustris	Vetchling, Wild pea
Liatris pycnostachya	Blazing star
Lycopus americanus	Bugle-weed, Water-horehound
Mentha arvensis	Mint
Nasturtium officinale	Water-cress
Polygonum spp.	Smartweed
Potentilla anserina	Silver-weed
P. rivalis	Cinquefoil
Rorippa islandica	Marsh-cress, yellow cress
Rudbeckia laciniata	Goldenglow
Scutellaria lateriflora	Skullcap
Silphium perfoliatum	Compass-plant
Sium suave	Water-parsnip
Solidago ginatea	Goldenrod
Stachys palustris	Hedge nettle
Vernonia fasciculata	Ironweed

TABLE 4-13
LIST OF BIRDS OBSERVED ON THE PATHFINDER PLANT SITE

<u>Common Name</u>	<u>Scientific Name</u>
Gray partridge	Perdix perdix
Western meadowlark	Sturnella neglecta
Common grackle	Quiscalus quiscula
House sparrow	Passer domesticus
Ring-necked pheasant	Phasianus colchicus
Black-capped chickadee	Parus atricapillus
Yellow warbler	Dendroica petechia
Common yellowthroat	Geothlypis trichas
Northern oriole	Icterus galbula
Orchard oriole	Icterus spurius
House wren	Troglodytes aedon
Field sparrow	Spizella pusilla
Brown-headed cowbird	Molothrus ater
Red-winged blackbird	Agelaius phoeniceus
Bobolink	Dolichonyx oryzivorus
Spotted sandpiper	Actitis macularia
Canada goose	Branta canadensis
Blue jay	Cyanocitta stelleri
Robin	Turdus migratorius
Hairy woodpecker	Dendrocopos villosus
Mourning dove	Zenaida macroura
Red-eyed vireo	Vireo olivaceus
American redstart	Setophaga ruticilla
Eastern kingbird	Tyrannus tyrannus
Killdeer	Charadrius vociferus
Catbird	Dumetella carolinensis
Eastern phoebe	Sayornis phoebe
Rose-breasted grosbeak	Pheucticus ludovicianus
Eastern wood pewee	Contopus virens
American goldfinch	Spinus tristis
White-breasted nuthatch	Sitta carolinensis
Clay-colored sparrow	Spizella pallida
Song sparrow	Melospiza melodia
Swainsons thrush	Catharus ustulata
Brown thrasher	Toxostoma rufum
Least flycatcher	Empidonax minimus
Flycatcher sp.	Empidonax sp.
Tennessee warbler	Vermivora peregrina
Red-tailed hawk	Buteo jamaicensis
Bank swallow	Riparia riparia
N Rough-winged swallow	Stelgidopteryx ruficollis
Cliff swallow	Petrochelidon pyrrhonota
Black-billed cuckoo	Coccyzus erythrophthalmus
American crow	Corvus brachyrhynchos

NOTE: Field study conducted on May 20, 1991

TABLE 4-14

MAMMALS OBSERVED ON THE PATHFINDER SITE

<u>Common Name</u>	<u>Scientific Name</u>
White-tailed deer	Odocoileus virginianus
Eastern cottontail	Sylvilagus floridanus
Fox squirrel	Sciurus niger
Gray squirrel	S. carolinensis
Weasel	Mustela sp.
Beaver	Castor canadensis
Raccoon	Procyon lotor

NOTE: Field study conducted on May 20, 1991

TABLE 4-15

LIST OF BIRDS SPECIES OCCURRING IN THE SIOUX FALLS AREA

KEY:

Check list of birds of the Sioux Falls area

A - Abundant; C - Common; U - Uncommon; R - Rare

P - Permanent resident (nesting); S - Summer resident (nesting);

M - Migrant; W - Winter resident

OrderGaviiformes

Common loon

UM

Red-breasted merganser

UM

Podicipediformes

Red-necked grebe

RM

Horned grebe

UM

Eared grebe

UM

Western grebe

US

Pied-billed grebe

CS

Pelecaniformes

White pelican

UM

Double-crested cormorant

UM

Ciconiiformes

Great blue heron

CM

Green heron

CS

Great egret

UM

Snowy egret

RM

Black-crowned night heron

US, CM

Yellow-crowned night heron

RM

American bittern

CS

Least bittern

US

White-faced ibis

RM

Anseriformes

Whistling swan

RM

Canada goose

CM

White-fronted goose

UM

Snow (and blue) goose

AM

Mallard

AM

Black duck

RM

Gadwall

CM, US

Pintail

AM, US

Green-winged teal

CM, RS

Blue-winged teal

AS

American wigeon

CM

Northern shoveler

AM

Wood duck

CS

Redhead

CM, US

Ring-necked duck

CM

Canvasback

CM, US

Lesser scaup

AM

American goldeneye

UM

Bufflehead

UM

Ruddy duck

CM, US

Hooded merganser

RM

Common merganser

CM

Falconiformes

Turkey vulture

RS

Sharp-shinned hawk

RM

Cooper's hawk

UM

Red-tailed hawk

CS, UM

Red-shouldered hawk

RS

Broad-winged hawk

UM

Swainson's hawk

US

Rough-legged hawk

UM

Golden eagle

RM

Bald eagle

UM

Marsh hawk

US

Osprey

RM

Prairie falcon

RM

Peregrine falcon

RM

Merlin

RM

American kestrel

CM, US

Galliformes

Bob-white

UM

Ring-necked pheasant

UM

Gray partridge

UM

Turkey

RM

Gruiformes

Sandhill crane

RM

King rail

RS

Virginia rail

CS

Sora

CS

American coot

AS

Common gallinule

RM

Charadriiformes

Piping plover

RS

Semi-palmated plover

UM

Killdeer

AM, CS

American golden plover

UM

Black-bellied plover

UM

American woodcock

RS

Common snipe

UM

Ruddy turnstone

RM

Upland sandpiper

CS

Spotted sandpiper

US

Solitary sandpiper

UM

Willet

UM

TABLE 4-15 (Continued)
LIST OF BIRD SPECIES

Greater yellowlegs	UM	Piciformes	
Lesser yellowlegs	CM	Common flicker	AS, UW
Pectoral sandpiper	CM	Red-bellied woodpecker	UP
White-rumped sandpiper	CM	Red-headed woodpecker	CS
Baird's sandpiper	CM	Yellow-bellied sapsucker	CM
Least sandpiper	CM	Hairy woodpecker	CP
Dunlin	UM	Downy woodpecker	AP
Long-billed dowitcher	UM		
Short-billed dowitcher	RM	Passeriformes	
Stilt sandpiper	UM	Eastern kingbird	AS
Semi-palmated sandpiper	CM	Western kingbird	CS
Western sandpiper	UM	Great crested flycatcher	CS
Buff-breasted sandpiper	UM	Eastern phoebe	CS
Marbled godwit	RM	Say's phoebe	RS
Hudsonian godwit	UM	Yellow-bellied flycatcher	UM
Sanderling	UM	Willow flycatcher	CS
American avocet	RM	Least flycatcher	CS
Wilson's phalarope	CM	Alder flycatcher	RS
Northern phalarope	UM	Eastern wood pewee	CS
Herring gull	UM	Olive-sided flycatcher	UM
Ring-billed gull	CM	Horned lark	CS, CM
Franklin's gull	AM	Tree swallow	CM, US
Forster's tern	UM	Bank swallow	CS
Common tern	UM	Rough-winged swallow	CS
Caspian tern	RM	Barn swallow	AS
Black tern	CS	Cliff swallow	CS
		Purple martin	CS
Columbiformes		Blue jay	AS, CM
Rock dove (pigeon)	AP	Black-billed magpie	RM
Mourning dove	AS, RW	Common crow	CP
		Black-capped chickadee	AP
Cuculiformes		White-breasted nuthatch	CP
Yellow-billed cuckoo	CS	Red-breasted nuthatch	UM
Black-billed cuckoo	CS	Brown creeper	CM, UW
		House wren	AS
Strigiformes		Winter wren	RM
Barn owl	RP	Long-billed marsh wren	CS
Screech owl	CP	Short-billed marsh wren	CS
Great-horned owl	CP	Mockingbird	RS
Snowy owl	RW	Gray catbird	CS
Barred owl	UP	Brown thrasher	AS
Long-eared owl	UW	American robin	AS, RW
Short-eared owl	RS, UW	Wood thrush	US
Burrowing owl	RM, RS	Hermit thrush	UM
		Swainson's thrush	CM
Caprimulgiformes		Gray-cheeked thrush	CM
Whippoorwill	RS	Veery	UM, RS
Common nighthawk	CS	Eastern bluebird	US, RW
		Mountain bluebird	RS
Apodiformes		Golden-crowned kinglet	CM, UW
Chimney swift	AS	Ruby-crowned kinglet	AM, RW
Ruby-throated hummingbird	US	Water pipit	UM
		Bohemian waxwing	RM
Coraciiformes		Cedar waxwing	UM
Belted kingfisher	CS	Loggerhead shrike	RM

TABLE 4-15 (Continued)
LIST OF BIRD SPECIES

Northern shrike	US	Indigo bunting	CS
Starling	AP	Dickcissel	AS
Bell's vireo	US	Evening grosbeak	UW
Yellow-throated vireo	UM	Purple finch	CM, UW
Solitary vireo	CM	Pine grosbeak	RW
Red-eyed vireo	CS	Common redpoll	UW
Philadelphia vireo	RM	Hoary redpoll	RW
Warbling vireo	AS	American goldfinch	CS, UW
Black-and-white warbler	CM	Pine siskin	CM, US
Prothonotary warbler	RS	Red crossbill	UW
Tennessee warbler	AM	White-winged crossbill	RW
Orange-crowned warbler	CM	Rufous-sided towhee	CS, RW
Nashville warbler	CM	Lark bunting	RS
Parula warbler	RM	Savannah sparrow	US
Yellow warbler	CS	Grasshopper sparrow	AS
Magnolia warbler	UM	LeConte's sparrow	UW
Cape May warbler	RM	Henslow's sparrow	RW
Yellow-rumped warbler	AM	Vesper sparrow	AS
Black-throated blue warbler	RM	Lark sparrow	US
Black-throated green warbler	RM	Gray junco	CM, CM
Cerulean warbler	RS	Tree sparrow	AW
Blackburnian warbler	UM	Chipping sparrow	AS
Yellow-throated warbler	RS	Clay-colored sparrow	CM, US
Chestnut-sided warbler	UM	Field sparrow	US
Bay-breasted warbler	RM	Harris' sparrow	CM, RW
Blackpoll warbler	CM	White-crowned sparrow	CM
Pine warbler	RM	White-throated sparrow	CM
Palm warbler	RM	Fox sparrow	UW
Ovenbird	RS	Lincoln's sparrow	CM
Northern waterthrush	CM	Swamp sparrow	CS
Mourning warbler	UM	Song sparrow	AS, UW
Yellowthroat	AS	Lapland longspur	UW
Yellow-breasted chat	US	Smith's longspur	RW
Hooded warbler	RM	Chestnut-collared longspur	RW
Wilson's warbler	UM	Snow bunting	UW
Canada warbler	UM		
American redstart	CM, CS		
House sparrow	AP		
Bobolink	CS		
Eastern meadowlark	RS		
Western meadowlark	AS		
Yellow-headed blackbird	AS		
Red-winged blackbird	AS, UW		
Orchard oriole	CS		
Northern oriole	CS		
Rusty blackbird	CM, RW		
Brewer's blackbird	UM		
Common grackle	AS, RW		
Brown-headed cowbird	CS		
Scarlet tanager	US		
Cardinal	CP		
Rose-breasted grosbeak	CS		
Blue grosbeak	US		

TABLE 4-16

LIST OF MAMMALS OCCURRING IN THE SIOUX FALLS AREA

Check list of mammals of possible occurrence in the Sioux Falls area
KEY: (*no longer present in the wild state)

Order Marsupialia

Family Didelphidae

Didelphis marsupialis-Opossum

Order Insectivora

Family Talpidae

Scalopus aquaticus-Eastern mole

Family Soricidae

Blarina brevicauda-Short-tailed shrew

Microsorex hoyi-Pygmy shrew

Sorex cinereus-Masked shrew

Order Chiroptera

Family Vespertilionidae

Lasionycteris noctivagans-Silver-haired

Lasiurus borealis-Red bat bat

L. cinereus-Hoary bat

Pipistrellus subflavus-Eastern pipistrel

Eptesicus fuscus-Big brown bat

Myotis keenii-Keen's myotis

M. lucifugus-Little brown myotis

Order Lagomorpha

Family Leporidae

Lepus townsendii-White-tailed jackrabbit

Sylvilagus floridanus-Eastern cottontail

Order Rodentia

Family Sciuridae

Sciurus carolinensis-E. gray squirrel

S. niger-Fox squirrel

**Tamiasciurus hudsonicus*-Red squirrel

Spermophilus franklinii-

Franklin's ground squirrel

S. richardsonii-

Richardson's ground squirrel

S. tridecemlineatus-

Thirteen-lined ground squirrel

Family Geomyidae

Geomys bursarius-Plains pocket gopher

Family Heteromyidae

Perognathus flavescens-

Plains pocket mouse

P. hispidus-Hispid pocket mouse

Family Castoridae

Castor canadensis-American beaver

Family Cricetidae

Reithrodontomys megalotis-

Western harvest mouse

Peromyscus leucopus-Wood mouse,

white-footed mouse

P. maniculatus-Deer mouse

Onychomys leucogaster-

Northern grasshopper mouse

Clethrionomys gapperi-

Red-backed vole

Microtus ochrogaster-

Prairie vole

M. pennsylvanicus-Meadow vole

Ondatra zibethicus-Muskrat

Family Muridae

Mus musculus-European or

house mouse

Rattus norvegicus-Norway rat

Family Zapodidae

Zapus hudsonius-Jumping mouse

Family Erethizontidae

Erethizon dorsatum-Porcupine

Order Carnivora

Family Canidae

Canis latrans-Coyote

**C. lupus*-Gray wolf

Urocyon cinereoargenteus-

Gray fox

Vulpes fulva-Red fox

V. velox-Swift fox

Family Felidae

**Felis concolor*-Mountain lion

**Lynx canadensis*-Lynx

L. rufus-Bobcat

Family Procyonidae

Procyon lotor-Raccoon

Family Mustelidae

**Lutra canadensis*-River otter

Taxidea taxus-Badger

Mephitis mephitis-Striped skunk

Spilogale putorius-Spotted skunk

Mustela frenata-Long-tailed

weasel

M. rixosa-Least weasel

M. vison-Mink

Family Ursidae

**Ursus americanus*-Black bear

Order Artiodactyla

Family Cervidae

**Cervus canadensis*-Elk

Odocoileus hemionus-Mule deer

O. virginianus-White-tailed deer

Family Antilocapridae

**Antilocapra americana*-Pronghorn

Family Bovidae

**Bison bison*-Bison

TABLE 4-17

LIST OF AMPHIBIANS AND REPTILES OCCURRING IN THE SIOUX FALLS AREA

Check list of amphibians and reptiles of possible occurrence in the
Sioux Falls area

CLASS AMPHIBIA

Order Urodela - Salamanders

Family Ambystomidae

Ambystoma tigrinum - Tiger salamander

Order Anura - Toads and Frogs

Family Pelobatidae

Scaphiopus bombifrons - Plains spadefoot toad

Family Bufonidae

Bufo americanus - American toad

B. cognatus - Great Plains toad

B. woodhousei - Rocky Mountain toad

Family Hylidae

Acris crepitans - Cricket frog

Pseudacris triseriata - Chorus frog

Family Ranidae

Rana pipiens - Leopard frog

CLASS REPTILIA

Order Chelonia - Turtles

Family Chelydridae

Chelydra serpentina - Snapping turtle

Family Testudinae

Chrysemys picta - Painted turtle

Terrapene ornata - Ornate box turtle

Family Trionychidae

Trionyx muticus - Smooth softshell

T. spinifer - Spiny softshell

Order Squamata - Lizards and Snakes

Family Scincidae

Eumeces septentrionalis - Northern prairie skink

Family Colubridae

Storeria occipitomaculata - Red-bellied snake

Thamnophis radix - Plains garter snake

T. sirtalis - Red-sided garter snake

Tropidoclonion lineatum - Northern lined snake

Heterodon nasicus - Western hognose snake

Diadophis punctatus - Prairie ringneck

Coluber constrictor - Yellow-bellied racer

Opheodrys vernalis - Smooth green snake

Elaphe vulpina - Fox snake

Pituophis melanoleucus - Bullsnake

Lampropeltis dolia - Red milk snake

Family Viperidae

Crotalus viridis - Prairie rattlesnake

4.2.4 Aquatic Biota

4.2.4.1 Invertebrate Species

A literature search and review was conducted of invertebrate species studies documented on the Big Sioux River. The only documented invertebrate study encountered involved a surficial invertebrate sampling along approximately 40 kilometers (km) of the Big Sioux River in Brookings and Moody counties north of the proposed CTG site area (Smith and Flake, 1985). The purpose of the Smith and Flake study was to better define the movements and habitats of brood-rearing wood ducks on a prairie river.

Invertebrates were collected on the river and adjacent oxbows (palustrine aquatic bed and palustrine emergent wetlands) from July 2 to July 8, 1981. Sampling was conducted beneath the water surface for a distance of 5 meters at five locations on the river and three locations in the oxbows.

Sampling results indicated that Amphipoda, Annelida, Cladocera, Copepoda, Diptera, Gastropoda, and Ostracopa were extremely abundant in the oxbows but absent in samples from the river. Hemiptera and Odonata were not abundant in any of the samples but were more common in oxbows than in the river. However, it should be noted that since the Smith and Flake study did not include sampling of benthic aquatic invertebrates (those living at the river bottom) it does not represent a complete survey of invertebrate species colonizing the Big Sioux River.

Other more extensive aquatic invertebrate surveys have been documented on prairie streams in the midwestern United States (Kennedy and Miller, 1990; and Smith, 1985).

For instance, in a survey of benthic macroinvertebrates of the Big Spring Basin, in northeastern Iowa, (Kennedy and Miller III, 1990) a total of 167 taxa including seven species of leeches, five genera of snails, three genera of clams, one crayfish genus and over 150 taxa of aquatic insects were identified.

However, the streams in the Big Spring Basin are somewhat unique when compared to most midwestern prairie streams due to the fact that this region was bypassed by the last continental glacier. As a result, the Big Spring Basin contains a greater than normal topographic relief, extensive bedrock exposure, and cool, spring fed, deeply dissected springs. Although the majority of the organisms identified are widely distributed, several invertebrate species limited to the area were also collected.

Invertebrate species identified in the Big Spring Basin research which are considered commonly and widely distributed throughout the midwest (and thus likely to occur in the Big Sioux River) included:

- Three species of leeches (Hirudinea) including *Helobdella triserialis*, *Placobdella ornata*, and *Mooreobdella fertida*.
- Two species of clams (Pelecypoda), *Pisidium* and *Sphaerium* and one snail species of the Gastropoda phylum, Basommatophora order.
- Two amphipods (*Gammarus pseudolimnaeus* and *Hyaella azteca*). However, these species prefer unpolluted clear waters (Pennak, 1978, cited by Kennedy and Miller, 1990) and thus may not be present in the somewhat silty waters of the Big Sioux River.
- One decapod, of the crayfish family Astacidae, species *Orconectes*.

Of the aquatic insects class, common species identified in the Big Spring Basin study which may be present in the Big Sioux River include:

- The genus *Helichus*, in the beetle family Dryopidae (the long-toed water beetles).
- Six genera of the family Dytiscidae or predaceous diving beetles (*Agabus* sp., *Dytiscus* sp., *Hyadaticus* sp., *Hydroporus* sp., *Laccophilus* sp., and *Uvarus* sp.).

- Two genera (*Dubiraphia* and *Stenelmiss*) of riffle beetles (family Elmidae). Although considered common and widespread, both of these organisms require habitats containing high concentrations of dissolved oxygen (Merritt and Cummins, 1984, cited by Kennedy and Miller, 1990) and thus may not be present in the Big Sioux River since dissolved oxygen levels have been reported as being below the State of South Dakota standards near Brandon, (Chapter 4.1.8.3, Water Quality).
- One genus (*Peltodytes*) of the family Haliplidae (crawling water beetles).
- Six genera (*Berosus*, *Enochrus*, *Helophorus*, *Hydrophilus*, *Tropisternus*, and *Enochrus*) of the insect family Hydrophilidae (water scavenger beetles), the second most commonly encountered aquatic beetles in the midwest (State Biological Survey of Kansas, 1981).
- Thirteen families of dipterans (true flies) representing 48 taxa. The family Chironomidae was represented by 27 genera, almost all of which are considered widespread in distribution.
- Three species of mayflies (Ephemeroptera), *Baetis brunneicolor*, *Callibaetis*, and *Stenacron interpunctatum*.
- Four species of aquatic or semi-aquatic Hemiptera ("true bugs") including the giant waterbug (*Belostomatidae*), the water boatmen (*Hesperocorisa*), the water striders (*Gerris* and *Trepobates*) and the back swimmer (*Notonecta*).
- Two genera of the insect order Megaloptera, *Sialis* (alder flies) and *Corydalus* (dobsonflies).
- Four genera of dragonflies, (Odonata, Anisoptera) including *Aeshna*, *Boyeria*, *Libellula*, and *Plathemis*.
- Four genera of damselflies (Odonata, Zygoptera) including *Calopteryx*, *Hetaerina*, *Argia*, and *Enallagma*.

Another invertebrate study involving leaf litter processing and associated invertebrate fauna in a tall grass prairie stream of northeastern Kansas was conducted from November, 1980 through April, 1981, (Smith, 1986). Invertebrates were collected in artificial and natural leaf packs. Twenty-two species of aquatic insects were collected from six different orders (Plecoptera, Diptera, Trichoptera, Ephemeroptera, Coleoptera, and Megaloptera). In addition, two species of mollusks (gastropods) in the Basormmatophora order were collected. Species from all of these orders were also collected in the Big Spring Basin study mentioned previously.

In summary, no documented invertebrate species studies were identified for the Big Sioux River near the proposed CTG facility site. However, based on a surficial invertebrate study conducted on the Big Sioux River north of the proposed CTG site, and two other more detailed studies conducted in midwestern prairie streams, it is anticipated that the invertebrate composition in the Big Sioux River near the proposed CTG facility site likely consists of species in the Annelida, Mollusca and Arthropoda phylum, the majority of which are most likely in the Arthropoda phylum, Insecta class.

4.2.4.2 Fish Species

Recent fishery studies on the Big Sioux River have been conducted by Sinning (1968) and by the South Dakota Department of Game, Fish, and Parks (SDDGFP, unpublished).

In 1967 and 1968, Sinning conducted sampling at 14 stations over the length of the Big Sioux River by a number of methods including trap, hoop, and gill nets, seines, electrofishing, explosives, and poisoning. Sampling stations numbered 6 through 10 were in the vicinity of Sioux Falls. Common and scientific names of all fish collected in the river are listed on Table 4-18. Relative abundance of the fish in the reaches near Sioux Falls is shown on Table 4-19.

The results of Sinning's survey indicate that there are some differences in the fish populations above and below Sioux Falls. He attributed this finding to differences in habitat availability, water quality, and the falls being a barrier to fish passage. Species common above Sioux Falls but absent below included yellow perch, common shiners, and trout perch. Quillback, freshwater drum, white bass, gizzard shad, and goldeye were

TABLE 4-18

**COMMON AND SCIENTIFIC NAMES OF FISH SPECIES
COLLECTED IN THE BIG SIOUX RIVER**

Common Name	Scientific Name
Shortnose gar	<i>Lepisosteus platostomus</i>
Gizzard shad	<i>Dorosoma cepedianum</i>
Goldeye	<i>Hiodon alosoides</i>
Central mudminnow	<i>Umbra limi</i>
Northern pike	<i>Esox lucius</i>
Stoneroller	<i>Campostoma anomalum</i>
Creek chub	<i>Semotilus atromaculatus</i>
Bluntnose minnow	<i>Pimephales notatus</i>
Fathead minnow	<i>Pimephales promelas</i>
Western silvery minnow	<i>Hybognathus argyritis</i>
Brassy minnow	<i>Hybognathus hankinsoni</i>
Sand shiner	<i>Notropis stramineus</i>
Bigmouth shiner	<i>Notropis dorsalis</i>
Red shiner	<i>Notropis lutensis</i>
Rosyface shiner	<i>Notropis rubellus</i>
Topeka shiner	<i>Notropis tristis</i>
Common shiner	<i>Notropis cornutus</i>
Emerald shiner	<i>Notropis atherinoides</i>
Carp	<i>Cyprinus carpio</i>
Dace spp.	<i>Rhinichthys</i> spp.
Blacknose dace	<i>Rhinichthys atratulus</i>
Northern redbelly dace	<i>Phoxinus eos</i>
River carpsucker	<i>Carpoides carpio</i>
Quillback	<i>Carpoides cyprinus</i>

TABLE 4-18 (continued)

Common Name	Scientific Name
White sucker	<i>Catostomus commersoni</i>
Shorthead redhorse	<i>Moxostoma macrolepidotum</i>
Redhorse spp.	<i>Moxostoma</i> spp.
Bigmouth buffalo	<i>Ictiobus cyprinellus</i>
Smallmouth buffalo	<i>Ictiobus bubalus</i>
Black buffalo	<i>Ictiobus niger</i>
Channel catfish	<i>Ictalurus punctatus</i>
Flathead catfish	<i>Pylodictus olivaris</i>
Black bullhead	<i>Ictalurus melas</i>
Stonecat	<i>Noturus flavus</i>
Trout-perch	<i>Percopsis omiscomayous</i>
White bass	<i>Morone chrysops</i>
White crappie	<i>Pomoxis annularis</i>
Black crappie	<i>Pomoxis nigromaculatus</i>
Green sunfish	<i>Lepomis cyanellus</i>
Orangespotted sunfish	<i>Lepomis humilus</i>
Yellow perch	<i>Perca flavescens</i>
Walleye	<i>Stizostedion vitreum</i>
Sauger	<i>Stizostedion canadense</i>
Johnny darter	<i>Etheostoma nigrum</i>
Iowa darter	<i>Etheostoma exile</i>
Freshwater drum	<i>Aplodinotus grunniens</i>

TABLE 4-19

RELATIVE ABUNDANCE OF FISH SPECIES
NEAR SIOUX FALLS ON THE BIG SIOUX RIVER

Species	Station ¹				
	6	7	8	9	10
Bigmouth buffalo ²	A+	S			
Black bullhead	A+	S	A	C	S
Black bullhead (YY) ³	S	S	C		
Carp	A	A	A+	A	C
Carp (YY)	C		A	C	C
Quillback				C	S
Quillback (YY)				S	A
Channel catfish					S
Channel catfish (YY)	A			C	A
Black crappie	C		C		
White crappie	S			S	
Northern pike	S				
Northern redhorse	A			C	A
White sucker	S		S	A	A
White sucker (YY)	A	C	A	C	C
Green sunfish	C	S	A	C	
Orangespotted sunfish		S	S		S
Pumpkinseed			S		
Walleye (YY)		S		S	
Silvery minnow		S			
Emerald shiner	S	S			A
Red shiner	A+	A	A	C	A+
Sand shiner	A+	A	A	C	A+

TABLE 4-19 (continued)

Species	Station ¹				
	6	7	8	9	10
Bluntnose minnow	S	S			
Fathead minnow	A	C	A+	A+	A+
Creek chub	S			C	A
Trout-perch	A	C			
Johnny darter		C		C	C
Stonecat	C		S		

¹#6 and #7 are above Sioux Falls, #8, #9, and #10 are downstream

²A+ = very abundant, A = abundant, C = common, S = scarce

³YY = young-of-the-year

Source: Sinning, J.A. 1968, Fishes of the Big Sioux River. M.S. Thesis, South Dakota State University, Brookings, South Dakota, 72 pp.

relatively common below Sioux Falls but were absent upstream. Six species were collected at all five sites near Sioux Falls including black bullhead, carp, sucker, red shiner, sand shiner, and fathead minnow.

The SDDGFP conducted fish population sampling on the Big Sioux River in 1980 and 1983. In 1980 seining was the only method used. However, in 1983, seining, baited hoop nets, and electrofishing were all employed. Tables 4-20 and 4-21 list the species collected at the stations closest upstream and downstream of the proposed CTG site using various trapping methods. Seining data revealed similar densities of fish at both locations. However, species diversity was slightly higher at the downstream site. Sampling with hoop nets and electrofishing showed similar species diversity at the two locations but greater density at the upstream station. Site specific habitat differences likely contributed to the difference in effectiveness of the various sampling methods. Table 4-22 compares species diversity over a longer reach of the river and shows the lowest diversity at the two sites near Sioux Falls, T101 and T102.

Comparing the results of the Sinning and SDDGFP studies in the vicinity of Sioux Falls, (Tables 4-19, 4-20 and 4-21) reveals minor differences. Of the species collected by SDDGFP, five species were not observed by Sinning. Sinning, however, observed eleven additional species that were not found in the SDDGFP survey. The difference may be due to the variety of sampling methods Sinning used. Table 4-23 compares the species observed by the two studies over the length of the river.

4.2.5 Threatened and Endangered Species

Table 4-24 depicts the federally-listed endangered and threatened species for South Dakota (USFWS, 1989) while Table 4-25 provides a list of the state-listed endangered and threatened species which are not on the federal list (SDCL, 1989).

From the federal list, the bald eagle (*Haliaeetus leucocephalus*), piping plover (*Charadrius melodus*), and Peregrine falcon (*Falco peregrinus anatum*) are known to occur within the Sioux Falls area. The bald eagle and the Peregrine falcon are listed as being endangered and the piping plover is listed as a threatened species. Bald eagles migrate through and winter in South Dakota with sightings reported for every county in the state. Eagles use mature riparian timber areas near rivers, streams, and lakes.

TABLE 4-20

FISH SPECIES COLLECTED BY SEINING
IN THE BIG SIOUX RIVER

	T101 R48 Downstream CTG Site			T102 R49 Upstream CTG Site		
	8/80	7/83	8/83	8/80	7/83	8/83
Northern pike		5	4			
Creek chub	10	2	2			
Bluntnose minnow		1	1			3
Fathead minnow		27	12		35	32
Minnow	29					
Sand shiner		14	3		29	2
Red shiner	4	21	68		3	27
Common shiner	99					
Dace spp.	7					
White sucker	21		1	13	23	6
Redhorse spp.	1			1		
River carpsucker	5	2	1		1	
Carp		1		1	1	1
Channel catfish	4	1	3	5	1	3
Black bullhead		3	4	22	1	10
Green sunfish		3	2	1		
Orangespotted sunfish		19	3			
White crappie		1		4		
Johnny darter		1	4		6	12
Total individuals	180	101	108	47	100	96
# species	9	14	13	7	9	9

Source: South Dakota Department of Game, Fish and Parks. Unpublished fishery data from the Sioux Falls Area Fishery Manager, Sioux Falls, South Dakota.

TABLE 4-21

**FISH SPECIES COLLECTED BY BAITED HOOP NET AND ELECTROFISHING
IN THE BIG SIOUX RIVER (1983)**

T101 R48 DOWNSTREAM CTG SITE			T102 R49 UPSTREAM CTG SITE	
	Baited Hoop Net	Electrofishing	Baited Hoop Net	Electrofishing Net
Northern pike	-	3	-	-
White sucker	3	3	2	1
River carpsucker	-	-	-	1
Redhorse spp.	-	-	4	1
Carp	1	1	3	10
Channel catfish	6	5	1	-
Black bullhead	4	7	58	16
Green sunfish	-	5	-	-
White crappie	-	-	-	2
Total Individuals	14	24	68	31
# species	4	6	5	6

Source: South Dakota Department of Game, Fish and Parks.

Unpublished Fishery data from the Sioux Falls area Fishery Manager, Sioux Falls, South Dakota.

TABLE 4-22

FISH SPECIES COLLECTED IN THE BIG SIOUX RIVER
DURING 1980 AND 1983 BY SDDGFP

Species	Upstream of T102	T102	T101	T95	T93
Shortnose gar				x	x
Gizzard shad				x	x
Goldeye				x	x
Northern pike	x		x		
Stoneroller	x				
Creek chub	x		x		
Bluntnose minnow		x	x		
Fathead minnow		x	x	x	x
Western silvery minnow				x	x
Sand shiner		x	x	x	x
Bigmouth shiner				x	x
Red shiner	x	x	x	x	x
Rosyface shiner				x	x
Common shiner			x	x	x
Emerald shiner				x	x
Flathead catfish				x	x
Carp	x	x	x	x	x
Dace spp.	x	x			
River carpsucker		x	x		x
Quillback				x	x
White sucker	x	x	x		
Shorthead redhorse		x		x	x
Redhorse spp.	x	x		x	x

TABLE 4-22 (continued)

Species	Upstream of T102	T102	T101	T95	T93
Bigmouth buffalo	x	x			x
Channel catfish	x	x	x	x	x
Black bullhead	x	x	x	x	
Stonecat	x	x			
Trout-perch	x			x	
White crappie	x	x	x		
Green sunfish	x		x		
Orangespotted sunfish	x		x		
Yellow perch	x				
Walleye	x				x
Sauger				x	x
Johnny darter	x	x	x	x	x
Freshwater drum					x
Total Species	19	16	16	21	23

TABLE 4-23

COMPARISON OF FISH SPECIES FROM 1965 & 1967 (SINNING, 1968)
AND 1980 & 1983 (SDDGFP, unpub.)

	Sinning	SDDGFP
Shortnose gar		
Gizzard shad	x	x
Goldeye	x	x
Northern pike	x	x
Stoneroller	x	x
Creek chub	x	x
Bluntnose minnow	x	x
Fathead minnow	x	x
Western slivery minnow	x	x
Brassy minnow	x	
Sand shiner	x	x
Bigmouth shiner		x
Red shiner	x	x
Rosyface shiner		x
Common shiner	x	x
Emerald shiner	x	x
Dace spp.		x
Blacknose dace	x	
Carp	x	x
River carpsucker		x
Quillback	x	x
White sucker	x	x
Shorthead redhorse	x	x
Redhorse spp.		x

TABLE 4-23 (continued)

	Sinning	SDDGFP
Bigmouth buffalo	x	x
Smallmouth buffalo	x	
Channel catfish	x	x
Flathead catfish		x
Black bullhead	x	x
Stonecat	x	x
Trout-perch	x	x
White bass	x	x
White crappie	x	x
Black crappie	x	
Green sunfish	x	x
Orangespotted sunfish	x	x
Yellow perch	x	x
Walleye	x	x
Sauger		x
Johnny darter	x	x
Iowa darter	x	
Freshwater drum	x	x
Total species	34	36

TABLE 4-24

**SOUTH DAKOTA'S FEDERALLY LISTED THREATENED AND
ENDANGERED SPECIES (OCTOBER 1989)**

LISTED SPECIES	STATUS	EXPECTED OCCURRENCE
Bald Eagle, (<i>Haliaeetus leucocephalus</i>)	E	Migration, winter resident
Whooping Crane, (<i>Grus americana</i>)	E	Migration
Eskimo Curlew, (<i>Numenius borealis</i>)	E	Rare migrant
Peregrine Falcon, (<i>Falco peregrinus</i>)	E	Migration
Piping Plover, (<i>Charadrius melodus</i>)	T	Migration, summer breeding
Interior Least Tern (<i>Sterna antillarum</i>)	E	Migration, summer breeding
Black-footed ferret, (<i>Mustela nigripes</i>)	E	Possible inhabitant of prairie dog towns
American Burying Beetle, (<i>Nicrophorus americanus</i>)	E	Anywhere in South Dakota with significant humus and topsoil suitable for the burying of carrion
Western Prairie Fringed Orchid, (<i>Platanthera praeclara</i>)	T	Tallgrass calcareous silt loam prairie or sub-irrigated sand prairies
PROPOSED SPECIES		
Pallid Sturgeon, (<i>Scaphirhynchus albus</i>)	E	Missouri River

Status Code:

(E) - Endangered species

(T) - Threatened species

Reference: USFWS 1989

TABLE 4-25

**SOUTH DAKOTA'S STATE LISTED THREATENED AND
ENDANGERED SPECIES (JULY 1989)**

LISTED SPECIES	STATUS	EXPECTED OCCURRENCE
Osprey, (<i>Pandion haliaetus</i>)	T	Rare/Migrant
Buff-breasted Sandpiper (<i>Tryngites subruficollis</i>)	T	Uncommon/ Migrant
Northern Swift Fox, (<i>Vulpes velox hebes</i>)	T	Found on short to midgrass prairie. Are closely associated with black-tailed prairie dog colonies.
River Otter, (<i>Lutra canadensis interior</i>)	T	
Mountain Lion, (<i>Felix concolor</i>)	T	
Black Bear, (<i>Ursus americanus</i>)	T	
Central Mudminnow, (<i>Umbra limi</i>)	E	Found in clear water with slow or no current. Prefers bottoms of organic debris and muck. Historically collected only from Roberts, Deuel, and Brookings Counties.
Pearl Dace, (<i>Semotilus margarita</i>)	E	Prefers cool bog ponds, creeks and lakes. Historically found only in Todd County.
Banded Killifish, (<i>Fundulus diaphanus</i>)	E	Found in habitat types ranging from muddy streams with no vegetation to clear lakes with abundant vegetation. Has been collected from the eastern edge of the state at a few locations.
Sturgeon chub, (<i>Hybopsis gelida</i>)	T	Inhabits channels of large, silty rivers and occurs in swift current preferably over gravel bottoms. In South Dakota it has been found in the Missouri, White, Cheyenne, Grand and Little Missouri Rivers.
Sicklefin Chub, (<i>Hybopsis meeki</i>)	T	Found in channels of large, turbid rivers with strong current and sand or gravel bottoms (Historically collected only in the Missouri River).
Northern Redbelly Dace, (<i>Phoxinus eos</i>)	T	Prefers stream-fed streams. Has been collected at a few locations in the Big Sioux, Minnesota, Niobrara and Crow Creek drainages.

TABLE 4 - 25 (continued)

Finscale Dace, (<i>Phoxinus neogaeus</i>)	T	Found in cool spring waters. Has been historically found in a few lakes and streams near Spearfish. May be present in the Sand Hills area of South Dakota.
Longnose Sucker, (<i>Catostomus catostomus</i>)	T	Found in cool, spring-fed creeks in the Belle Fourche River drainage north of the Black Hills.
Trout-Perch, (<i>Percopsis omiscomaycus</i>)	T	Occurs over clean sand or gravel bottoms in both lakes and streams. Has been reported only from the Big Sioux and Minnesota River drainages in South Dakota.
Plains Topminnow, (<i>Fundulus sciadicus</i>)	T	Found in clear streams which have aquatic vegetation. Has been collected from isolated areas in Vermillion, James, Cheyenne, and Missouri drainages.
Blandings Turtle, (<i>Emydoidea blandingii</i>)	T	
False Map Turtle, (<i>Graptemys pseudogeographica</i>)	T	
Spiny Softshell Turtle, (<i>Trionyx spiniferus</i>)	T	
Eastern Hognose Snake, (<i>Heterodon platyrhinos</i>)	T	
The Lined Snake, (<i>Tropidoclonion lineatum</i>)	T	
Northern Red-Bellied Snake, (<i>Storeria occipitomaculata</i>)	T	

Status Code:

(E) - Endangered species

(T) - Threatened species

Eagles are usually found in South Dakota from October through April, but juveniles have been sighted in the State during the summer months. Piping plovers are late spring and summer residents that nest on sparsely vegetated islands, sandbars, and shoreline of the Missouri River and in alkali wetlands. Their breeding season is from late April to August. Peregrine falcons migrate through South Dakota and are generally associated with wetlands and open areas, such as cropland and grassland. It is possible to sight them any month of the year in South Dakota.

Historically, the western prairie fringed orchid (*Platanthra praeclara*), which is a federally listed endangered plant species, has been found to occur in wet meadows in the Big Sioux River Valley. Specifically, a historical collection was made near Brandon, Minnehaha County, South Dakota (approximately 2.8 miles east of the proposed CTG site). Although there are presently no known occurrences of the orchid in South Dakota, potential habitat does exist; and, therefore, the orchid may occur in South Dakota. The plant communities supporting this orchid include tallgrass calcareous, silt loam prairie or sub-irrigate sand prairies.

No other plant or animal species occurring in the Sioux Falls area is on the Federal endangered or threatened species list.

From the State list, the following species are known to occur in the Sioux Falls area: the osprey (*Pandion haliaetus*), buff-breasted sandpiper (*Tryngites subruficollis*), northern swift fox (*Vulpes velox hebes*), spiny softshell turtle (*Trionyx spiniferus*), the lined snake (*Tropidoclonion lineatum*), northern red-bellied snake (*Storeria Occipitomaculata*), northern redbelly dace (*Phoxinus eos*), and the trout-perch (*Percopsis omiscomaycus*). All of these species are listed as threatened. Historically, one endangered species, the central mudminnow (*Umbra limi*) was observed about 50 miles north of the proposed CTG site.

The two species of fish listed as threatened are the northern redbelly dace and the trout-perch. Northern redbelly dace were last observed in 1952 at two sites near Brookings about 50 miles north of Sioux Falls. Neither Sinning nor the SDDGFP recorded this species during their studies of the Big Sioux River. Phillips et. al. (1982) list the preferred habitat of this species as boggy lakes, ponds and creeks, generally in quiet water. Thus, it is unlikely that the Big Sioux River would provide much suitable

habitat for the northern redbelly dace. The other listed species, the trout-perch, is a fish of larger rivers and clear lakes. Trout-perch prefer deeper water with sandy to gravelly bottoms and have been found to be sensitive to elevated water temperatures (Phillips et. al., 1982). No trout-perch were collected at the stations near Sioux Falls during the SDDGFP sampling effort. Sinning, however (1968) found them to be abundant to common at the two sites upstream of the City, but absent at the closest sites to the proposed CTG facility (Table 4-19).

One endangered species, the central mudminnow, was last observed in 1956 about 50 miles north of the proposed CTG site. However, neither the Sinning nor the SDDGFP studies referenced earlier found this species during their fairly intensive sampling of the Big Sioux River. The preferred habitat of this species includes ponds, pools and ditches with mucky bottoms and choked with vegetation. The central mudminnow is quite tolerant of low dissolved oxygen levels and warm water temperatures but will not tolerate sedimentation (Phillips et. al., 1982).

A database search was conducted for the area within 15 miles of the Pathfinder plant site by the Department of Game, Fish and Parks Natural Heritage Survey to locate observed occurrences of endangered and threatened species, as well as species not officially listed as threatened or endangered, but of special concern due to population levels or threat of habitat loss. Table 4-26 lists the results of the database search including the species observed, Heritage Status, date last observed, and legal location of the observation. The only additional endangered or threatened species that was found to occur in that area was the blanding's turtle (*Emydoidea blandingii*) which is on the State's threatened list.

Blandings turtle was last observed in 1963 about four miles south of the Pathfinder site. This turtle prefers calm shallow water with rich aquatic vegetation surrounded by sandy uplands, typical river backwaters, and prairie marshes (Coffin and Pfannmueller, 1988). Blandings turtle is threatened over most of its range due to the drainage of wetlands. Coffin and Pfannmueller (1990) also reported the presence of blandings turtle in Pipestone County, Minnesota in recent years (no date given) confirming their existence in the Missouri River drainage. Southwest Minnesota and southeast South Dakota are on the extreme western edge of the range for this turtle.

TABLE 4-26

**CRITICAL SPECIES OBSERVED WITHIN 15 MILES
OF THE PROPOSED CTG SITE**

COMMON NAME	SCIENTIFIC NAME	STATUS	LAST OBSERVED	TOWNSHIP-RAN & SECTION
Smooth Softshell	<i>Apalone mutica</i>	C	1983-Summer	102N048W03
Ringneck Snake	<i>Diadophis punctatus</i>	C(p)	1964-04-25	102N048W23
American Spikenard	<i>Aralia racemosa</i>	B(p)	1959-07-13	103N047W30
Finger Coreopsis	<i>Coreopsis palmata</i>	B(p)	1959-07-12	103N047W30
Meadowsweet	<i>Spiraea alba</i>	B(p)	1959-07-13	103N047W17
Meadowsweet	<i>Spiraea alba</i>	B(p)	1952-07-04	103N047W30
Culver's Root	<i>Veronicastrum virginicum</i>	B(p)	1959-07-13	103N047W17
Culver's Root	<i>Veronicastrum virginicum</i>	B(p)	1923-07-07	
Small White Lady's-Slipper 3C	<i>Cypripedium candidum</i>	A(p)	1920-05-29	
Rock Polypody	<i>Polypodium virginianum</i>	B(p)	1970-05-25	103N047W31
Topeka Shiner	<i>Notropis tristis</i>	A(e)	1939-09-19	101N050W10
Blanding's Turtle	<i>Emydoidea blandingii</i>	ST, U	1963-Fall	101N04918
Compass Plant	<i>Silphium laciniatum</i>	B	1988-07-01	101N049W18

STATUS CODES

FE FEDERAL ENDANGERED
 FT FEDERAL THREATENED
 PE PROPOSED FEDERAL ENDANGERED
 FT PROPOSED FEDERAL THREATENED
 CL CANDIDATE FOR FEDERAL LISTING
 SE STATE ENDANGERED
 ST STATE THREATENED

A CRITICALLY RARE
 B RARE
 C UNCOMMON

U STATUS UNDETERMINED
 H HISTORICAL RECORD ONLY
 X PRESUMED EXTIRPATED

(p) PERIPHERAL

(d) DISJUNCT

(e) ENDEMIC

TABLE 4-26 (continued)

COMMON NAME	SCIENTIFIC NAME	STATUS	LAST OBSERVED	TOWNSHIP-RAN & SECTION
Compass Plant	<i>Silphium laciniatum</i>	B	1988-07-01	101N050W10
Bush Clover	<i>Lespedeza capitata</i>	B(p)	1962-08	
Woodland Blue Phlox	<i>Phlox divaricata</i>	X	1952-05-11	101N050W19
Meadowsweet	<i>Spiraea alba</i>	B(p)	1892-08	101N050W
Wild Rice	<i>Zizania aquatica</i>	C(p)	1919-08-23	101N050W10
Wild Rice	<i>Zizania aquatica</i>	C(p)	1919	101N050W06
American Woodcock	<i>Scolopax minor</i>	B	1959-07-22	101N050W
Trout-Perch	<i>Percopsis omiscomaycus</i>	ST, B	1967	102N049W32
Smooth Softshell	<i>Apalone mutica</i>	C	-	101N050W
Northern Redbelly Snake	<i>Storeria occipitomacula</i>	ST, B(p)	1916-08	101N050W
Lined Snake	<i>Tropidoclonion lineatum</i>	ST, A(p)	1964-05-16	101N049W01
Tallgrass Prairie, Glacia		A	-	102N049W36
Tallgrass Prairie, Glacia		A	-	102N049W36
Tallgrass Prairie, Glacia		A	-	102N049W33

STATUS CODES

FE FEDERAL ENDANGERED
 FT FEDERAL THREATENED
 PE PROPOSED FEDERAL ENDANGERED
 FT PROPOSED FEDERAL THREATENED
 CL CANDIDATE FOR FEDERAL LISTING
 SE STATE ENDANGERED
 ST STATE THREATENED

A

B CRITICALLY RARE

C RARE

U UNCOMMON

H STATUS UNDETERMINED

X HISTORICAL RECORD ONLY

X PRESUMED EXTIRPATED

(p) PERIPHERAL

(d) DISJUNCT

(e) ENDEMIC

TABLE 4-26 (continued)

COMMON NAME	SCIENTIFIC NAME	STATUS	LAST OBSERVED	TOWNSHIP-RAN & SECTION
Champion Boxelder Tree	<i>Acer negundo</i>	-	1982-05-07	101N049W01
Finger Coreopsis	<i>Coreopsis palmata</i>	B(p)	1950-07-30	
Finger Coreopsis	<i>Coreopsis palmata</i>	B(p)	1983-09-22	102N049W36
Finger Coreopsis	<i>Coreopsis palmata</i>	B(p)	1985-01-05	101N049W01
Compass Plant	<i>Silphium laciniatum</i>	B	1966-10-10	101N049W01
Compass Plant	<i>Silphium laciniatum</i>	B	1892-08-24	101N050W
Compass Plant	<i>Silphium laciniatum</i>	B	1988-07-01	101N049W01
Compass Plant	<i>Silphium laciniatum</i>	B	1988-07-01	101N049W10
Bush Clover	<i>Lespedeza capitata</i>	B(p)	1962-08	
Bush Clover	<i>Lespedeza capitata</i>	B(p)	1985-01-05	101N049W01
Downy Gentian	<i>Gentiana puberulenta</i>	C	1985-01-05	101N049W01
Downy Gentian	<i>Gentiana puberulenta</i>	C	1966-10-18	101N050W34
Downy Gentian	<i>Gentiana puberulenta</i>	C	1983-09-22	101N049W36
Meadowsweet	<i>Spiraea alba</i>	B(p)	1892-08	101N050W

STATUS CODES

FE FEDERAL ENDANGERED
 FT FEDERAL THREATENED
 PE PROPOSED FEDERAL ENDANGERED
 FT PROPOSED FEDERAL THREATENED
 CL CANDIDATE FOR FEDERAL LISTING
 SE STATE ENDANGERED
 ST STATE THREATENED

A

B

C

U

H

X

CRITICALLY RARE

RARE

UNCOMMON

STATUS UNDETERMINED

HISTORICAL RECORD ONLY

PRESUMED EXTIRPATED

(p) PERIPHERAL

(d) DISJUNCT

(e) ENDEMIC

TABLE 4-26 (continued)

COMMON NAME	SCIENTIFIC NAME	STATUS	LAST OBSERVED	TOWNSHIP-RAN & SECTION
Prairie Willow	<i>Salix humilis</i>	H	1923-09-07	101N049W
Wild Rice	<i>Zizania aquatica</i>	C(p)	1919-08-23	101N050W17
Ringneck Snake	<i>Diadophis punctatus</i>	C(p)	1963-09	101N049W
Tallgrass Prairie, Glacia		A	-	101N048W13
Champion Hackberry Tree	<i>Celtis occidentalis</i>	-	1982-06-21	101N048W10
Champion Green Ash Tree	<i>Fraxinus pennsylvanica</i>	-	1981-06-03	101N048W09
Champion Eastern Cottonwood Tree	<i>Populus deltoides</i>	-	1981-06-03	101N048W09
Champion Eastern Cottonwood Tree	<i>Populus deltoides</i>	-	1981-06-17	101N049W04
Champion Bur Oak Tree	<i>Quercus macrocarpa</i>	-	1981-06-17	101N048W04
Finger Coreopsis	<i>Coreopsis palmata</i>	B(p)	1951-08-04	
Finger Coreopsis	<i>Coreopsis palmata</i>	B(p)	1984-07-06	102N048W34
Finger Coreopsis	<i>Coreopsis palmata</i>	B(p)	1988-07-01	101N047W05
Compass Plant	<i>Silphium laciniatum</i>	B	1951-09-02	101N049W
Compass Plant	<i>Silphium laciniatum</i>	B	1971-07-15	101N048W13

STATUS CODES

FE FEDERAL ENDANGERED
 FT FEDERAL THREATENED
 PE PROPOSED FEDERAL ENDANGERED
 FT PROPOSED FEDERAL THREATENED
 CL CANDIDATE FOR FEDERAL LISTING
 SE STATE ENDANGERED
 ST STATE THREATENED

A CRITICALLY RARE
 B RARE
 C UNCOMMON
 U STATUS UNDETERMINED
 H HISTORICAL RECORD ONLY
 X PRESUMED EXTIRPATED

(p) PERIPHERAL

(d) DISJUNCT

(e) ENDEMIC

TABLE 4-26 (continued)

COMMON NAME	SCIENTIFIC NAME	STATUS	LAST OBSERVED	TOWNSHIP-RAN & SECTION
Compass Plant	<i>Silphium laciniatum</i>	B	1988-07-01	101N047W05
Black Walnut	<i>Juglans nigra</i>	C(p)	1977	101N048W13
White Water-Lily	<i>Nymphaea odorata</i>	H	-	101N049W28
Western Prairie Fringed Orchid	<i>Platanthera praeclara</i>	H	1916-07-14	
Rock Polypody	<i>Polypodium virginianum</i>	B(p)	1968-05-27	
Finger Coreopsis	<i>Coreopsis palmata</i>	B(p)	1988-07-01	101N047W05
Compass Plant	<i>Silphium laciniatum</i>	B	1988-07-01	101N047W05
Compass Plant	<i>Silphium laciniatum</i>	B	1988-07-01	101N047W04
Whip-Poor-Will	<i>Caprimulgus vociferus</i>	B	1981-SUM	101N049W11
Black Buffalo	<i>Ictiobus niger</i>	B(p)		100N049W

STATUS CODES

FE FEDERAL ENDANGERED
 FT FEDERAL THREATENED
 PE PROPOSED FEDERAL ENDANGERED
 FT PROPOSED FEDERAL THREATENED
 CL CANDIDATE FOR FEDERAL LISTING
 SE STATE ENDANGERED
 ST STATE THREATENED

A
B
C
U
H
X

CRITICALLY RARE
 RARE
 UNCOMMON
 STATUS UNDETERMINED
 HISTORICAL RECORD ONLY
 PRESUMED EXTIRPATED

(p) PERIPHERAL

(d) DISJUNCT

(e) ENDEMIC

4.3 SOCIAL AND ECONOMIC ENVIRONMENT

4.3.1 Land Use

The proposed site for the CTG facility is located on NSP-owned property adjacent to the existing Pathfinder Power Plant site, approximately 0.75 mile northeast of the Sioux Falls city limits and approximately 2.8 miles west of the City of Brandon.

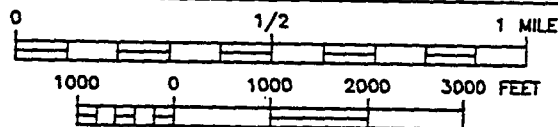
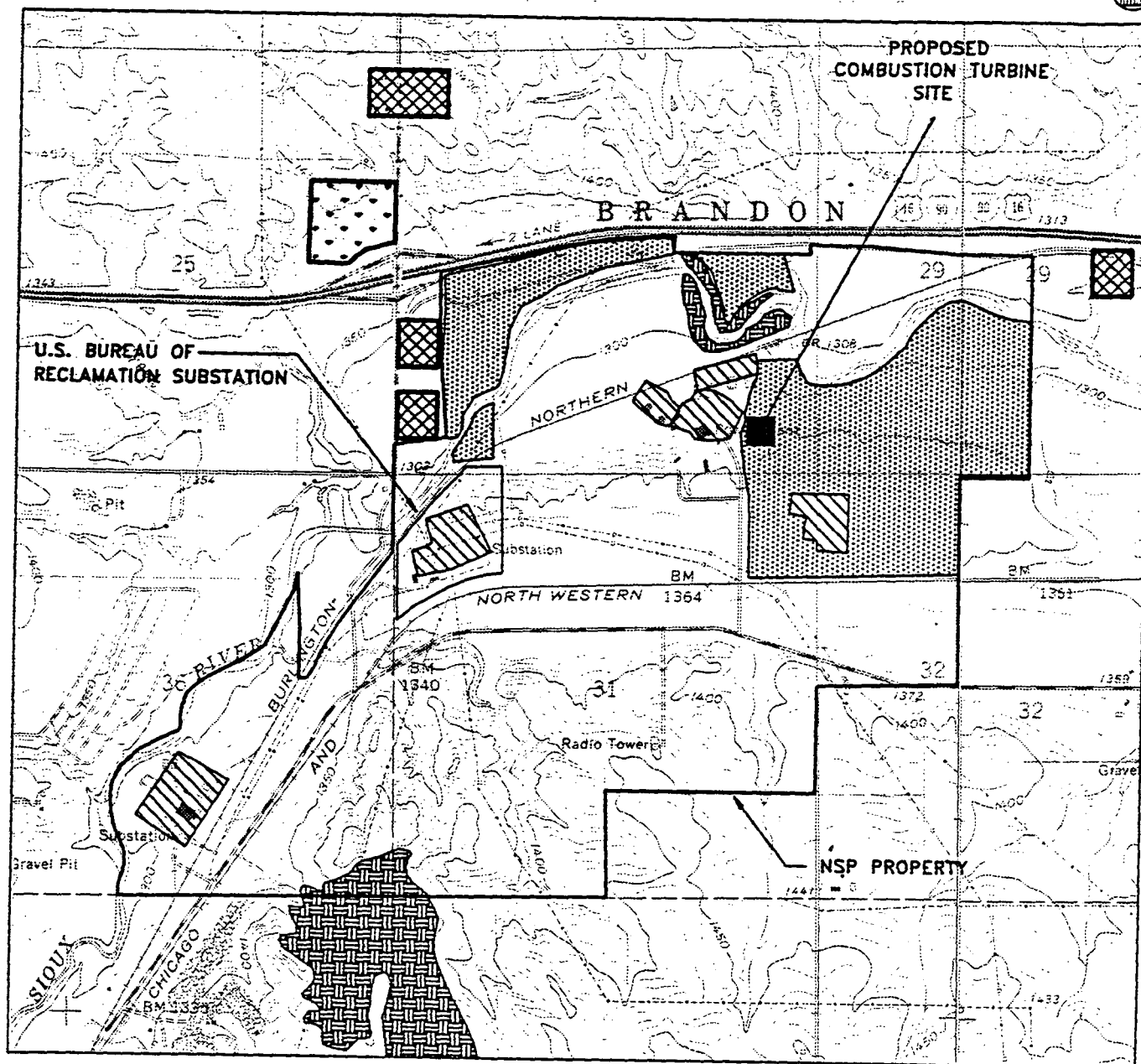
A 60 MW natural gas-fired power plant, Pathfinder, currently operates at the site. The existing facility will continue to operate in addition to the proposed CTG facility. NSP owns approximately 1,020 acres of land surrounding the Pathfinder Plant. Approximately 60 acres of the site is occupied by existing plant facilities and associated electrical equipment such as substations and transmission lines. Approximately 550 acres are cultivated, and roughly 410 acres are unused grass land. It is anticipated that the proposed CTG facility will require approximately 2 acres.

The U.S. Bureau of Reclamation Substation lies approximately 3,000 feet west of the proposed CTG site, encircled by NSP's property. In addition, a campground lies approximately 5,200 feet northwest of the proposed CTG site on the north side of Interstate 90. The Sioux Falls Wastewater Treatment Plant lies on the Big Sioux River, across from the Lawrence Substation along the southwestern edge of NSP's property line. The remaining land surrounding NSP's property is predominantly agricultural in use.

As shown in Figure 4-12, Land Use Map, land use in the vicinity of the Pathfinder site is predominantly agricultural with scattered rural residences and farmsteads.

4.3.2 Zoning

Zoning designations for the proposed CTG facility are depicted in Figure 4-13, Zoning Map. The site of the proposed CTG facility is located on land zoned I-2, General Industrial District, and WS, Water Source Protection Overlay District. In an area zoned I-2, a public utility installation is listed as a permissive use. Therefore, there are no special zoning permits required for the proposed CTG facility.



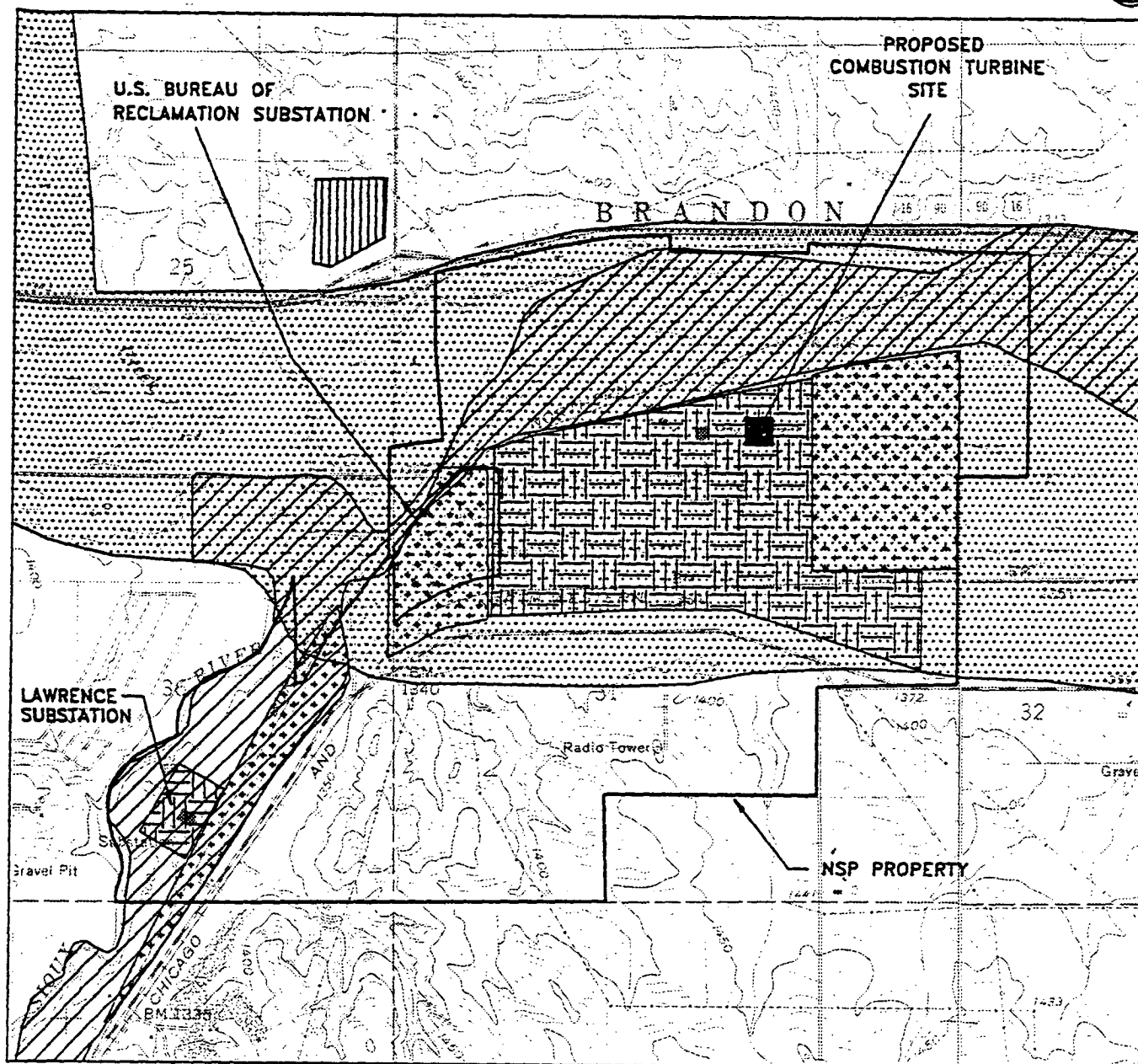
LEGEND

-  AGRICULTURAL LAND
-  RURAL RESIDENCES AND FARMSTEADS, FAMILY FARMS AND RANCHES
-  INDUSTRIAL
-  PUBLIC, COMMERCIAL, AND INSTITUTIONAL USE
-  FORESTED LAND
-  NOISE SENSITIVE LAND USE (OVERLAY)
-  GRASS LAND

NORTHERN STATES POWER COMPANY
PATHFINDER SITE, SOUTH DAKOTA

FIGURE 4-12
LAND USE MAP

NORTH



LEGEND:



WATER SOURCE PROTECTION OVERLAY DISTRICT



RECREATION CONSERVATION DISTRICT



AGRICULTURAL DISTRICT



LIGHT INDUSTRIAL DISTRICT



GENERAL INDUSTRIAL DISTRICT



COMMERCIAL DISTRICT

NORTHERN STATES POWER COMPANY
PATHFINDER SITE, SOUTH DAKOTA

FIGURE 4-13
ZONING MAP

DWG NO.: N05644052.F112

DAMES & MOORE

TABLE 4-27

POPULATION CHANGE, SELECTED AREAS, 1970-1990

	1970	1980	1990 ¹	PERCENT CHANGE	
				1970-1980	1980-1990
Township of Brandon	1,960 ²	624	612	-68.4	-1.9
City of Sioux Falls	72,488	81,343	99,405	12.2	22.2
Minnehaha County	95,209	109,435	123,809	14.9	13.1
South Dakota	666,257	690,768	696,004	3.7	0.8

Source: U.S. Bureau of the Census, years cited.

¹The population counts are subject to possible correction for undercount or overcount. The U.S. Department of Commerce will publish corrected counts, if any, by July 15, 1991.

²Prior to the 1980 census, the population of the City of Brandon was included in the census of Brandon Township.

in the City of Sioux Falls and Minnehaha County, in the past decade, has continued to increase at a rate of 16 to 28 times faster than the state's population growth, while the Township of Brandon has experienced a gradual out-migration of twelve persons during that same decade.

Baseline population projections prepared by the State Data Center at the University of South Dakota in 1987, project that Minnehaha County will continue to dominate the state's overall population through the year 2007. The projections were based on the 1980 census of population and an optimistic growth rate. The actual population growth experienced from 1980 to 1990 was 5.6 percent less than projected for the county and 2.4 percent less than projected for the state (see Table 4-28). Based on the 1987 projections, the 20-year forecast for population growth indicates a 1.3 percent per year increase for Minnehaha County.

4.3.4 Income Characterization

One demographic measure of the population is income. It establishes the standard of living in terms of the community's demand for certain types of goods, services, and facilities. Historically, per capita personal income in Minnehaha County is higher than the average per capita personal income for the State of South Dakota. This is not unusual for a state which is primarily rural with few urban centers and which tends to lack the overall income opportunities present in a more industrialized economy.

As indicated in Table 4-29, per capita personal income for Minnehaha County grew at a constant rate of 5 percent per year during the period 1984 to 1988. The state's per capita personal income grew at a 10.8 percent rate from 1984 to 1986 and an 8.2 percent rate from 1986 to 1988.

4.3.5 Economic Conditions

Minnehaha County is more industrialized and more affluent than South Dakota as a whole. Not only is the per capita personal income higher than the state's average income, but the county has also experienced a lower annual unemployment rate during the past six years, as indicated in Table 4-30.

TABLE 4-28

**POPULATION PROJECTIONS FOR
MINNEHAHA COUNTY AND SOUTH DAKOTA**

	ACTUAL	PROJECTIONS			PERCENT CHANGE 1990-2010
	1980	1990	2000	2010	
Minnehaha County	109,435	130,752	148,754	165,271	26.4
South Dakota	690,768	712,839	736,177	763,291	7.1

Source: State Data Center, University of South Dakota, Population Projections, South Dakota Counties, 1985-2010.

TABLE 4-29

PER CAPITA PERSONAL INCOME

	1984	1986	1988
Minnehaha County	\$12,615	\$13,807	\$15,285
South Dakota	\$10,612	\$11,758	\$12,727

Source: U.S. Department of Commerce, Bureau of Economic Analysis.

TABLE 4-30

AVERAGE UNEMPLOYMENT TRENDS, 1984-1990

	1984	1985	1986	1987	1988	1989	1990
Minnehaha County	3.6	4.6	4.3	3.7	3.9	3.6	2.7
South Dakota	4.3	5.1	4.7	4.2	3.9	4.2	3.7

Source: South Dakota Department of Labor, Labor Market Information Center, years cited.

Table 4-31 presents the number of employees and average weekly earnings per selected industry group in the county and state, for workers covered by unemployment insurance. Average weekly earnings for Minnehaha County exceeded South Dakota's average earnings in every disclosed industry group by as much as 30 percent during 1989. The services and retail trade industries represent the greatest number of employees at both the county and state levels. However, employees in these industries receive the lowest weekly salaries. The employment and earning extremes often reflect the large degree of part-time employees in these types of businesses. Overall, the relatively low unemployment rate in the county and the strong diversified manufacturing base in Sioux Falls point to a healthy economic outlook for the area.

In the past 10 years, the City of Sioux Falls has experienced a 26 percent increase in the number of year-round housing units (see Table 4-32). This increase is attributed to the rise in population, the increase in employment opportunities and the decline in household size. Between 1980 and 1990 the average household size decreased by 4 to 10 percent in the Sioux Falls area. This tendency toward smaller households is a national trend which reflects the shift toward fewer children and more single person households.

4.3.6 Aesthetics

Existing Pathfinder facilities consist of a 60 MW natural gas-fired generating facility, an adjacent electric substation and associated electric transmission towers, an intake structure, fuel supply system including two 2-million gallon fuel oil storage tanks, a cooling tower, warehouses, and four wastewater settling basins. The facility is surrounded by a chain link fence.

The Big Sioux River flows across the northern portion of the site. Two railroad lines cross the site, one north of the existing generating facility and one south of the existing generating facility. The electric substation and transmission towers are easily visible from Brandon road to the south as well as from Interstate 90, located approximately 0.5 miles north of the proposed CTG site.

The Split Rock Substation and the Lawrence Substation are located adjacent to and 1.5 miles southwest of the Pathfinder site, respectively. The U.S. Bureau of

TABLE 4-31

1989 AVERAGE COVERED EMPLOYMENT AND EARNINGS
MINNEHAHA COUNTY AND SOUTH DAKOTA

INDUSTRY	MINNEHAHA COUNTY		SOUTH DAKOTA	
	Covered Employment	Average Weekly Earnings	Covered Employment	Average Weekly Earnings
Agriculture, Forestry, Fisheries	*	*	1,758	\$291.87
Mining and Quarrying	*	*	2,613	607.41
Contract Construction	3,053	\$401.80	10,253	354.26
Manufacturing	8,498	394.30	32,143	353.84
Transportation, Communication, and Public Utilities	4,988	427.14	13,116	406.95
Wholesale Trade	5,732	435.56	18,516	363.91
Retail Trade	14,340	203.81	54,186	178.45
Finance, Insurance, and Real Estate	7,486	395.23	15,521	366.72
Services and Miscellaneous	17,875	352.33	59,723	272.11
Total Private Ownership	62,279	\$344.97	207,829	\$292.52
Federal Government	1,920	571.88	11,200	475.60
State Government	852	373.47	13,175	372.86
Local Government	4,102	365.91	28,980	289.59
Total Government	6,874	\$424.38	53,355	\$349.20

* Data was suppressed to prevent disclosure of confidential information.

Note: Individual column data may not sum to totals due to suppression of data.

Source: South Dakota Employment and Earnings Covered by Unemployment Insurance, 1989. South Dakota Department of Labor, Labor Market Information Center.

TABLE 4-32

SELECTED HOUSING CHARACTERISTICS

	TOTAL HOUSING UNITS			PERSONS PER OCCUPIED HOUSING UNIT		
	1980	1990	% Change	1980	1990	% Change
Township of Brandon	200	217	8.5	3.1	2.8	-9.7
City of Sioux Falls	32,961	41,568	26.1	2.5	2.4	-4.0
Minnehaha County	42,636	49,780	16.8	2.6	2.5	-3.8
South Dakota	269,644	292,436	8.5	2.6	2.4	-7.7

Source: U.S. Bureau of the Census, years cited

Reclamation's Substation and Western Area Power Association (WAPA) transmission lines are located approximately 3,000 feet southwest of the proposed CTG site.

The nearest residences to the proposed facility are farmsteads which are approximately 4,240 feet west and 4,280 feet northwest of the proposed CTG facility. A farmstead is located approximately 5,400 feet northeast of the site. In addition, a campground is located approximately 5,200 feet northwest of the proposed CTG facility on the north side of I-90 (see Figure 4-12).

4.3.7 Infrastructure

4.3.7.1 General

The proposed CTG facility site is located in a rural area in Minnehaha county approximately 0.75 miles east of the Sioux Falls city limits, and approximately 2.8 miles west of the nearest developed area (the town of Brandon). The area surrounding the proposed site is undeveloped. The following is a brief discussion of the infrastructure known to be in place near the proposed CTG facility site.

4.3.7.2 Electrical Utilities

The proposed CTGs will be constructed adjacent to the existing Pathfinder Plant. The Pathfinder Plant is owned and operated by NSP. Existing electrical transmission lines leading to and from the Split Rock Substation are part of the NSP transmission network which serves southeastern South Dakota and southwestern Minnesota. The WAPA/US Bureau transmission lines and substation which serve east-central South Dakota and northwestern Iowa are located approximately 3,000 feet southwest of the proposed CTG site.

4.3.7.3 Telephone

The phone lines which serve the Pathfinder site are underground lines routed along the entrance road which serves the plant from Brandon Road.

4.3.7.4 Water Supply Facilities

The Pathfinder site is not served by a city water supply system. The Sioux Falls water supply system is located approximately 5 miles west of the site. Sanitary and process water is provided by two existing on-site wells which operate as needed. Cooling water for the existing gas-fired generating facility is provided by a river water intake in the Big Sioux River. Local residences are served by individual private wells.

4.3.7.5 Sanitary Sewers

There are no municipal sewers in the vicinity of the CTG facility site. The City of Sioux Falls Municipal Wastewater Treatment Plant is located approximately 1.9 miles to the southwest. Residences in the vicinity of the site are served by septic systems. Sanitary facilities for the existing Pathfinder Plant are provided by a septic system.

4.3.7.6 Stormwater Facilities

There are no underground stormwater sewers in the area of the proposed CTG facility site. Roof and parking lot drains at the existing Pathfinder Plant are directed to normal surface drainage.

4.3.7.7 Natural Gas Distribution

The existing Pathfinder Plant is currently supplied by a 10-inch natural gas line from Sioux Falls which traverses the northwestern section of the site.

4.3.7.8 Roadways

Major highways providing access to the site are Interstate 90 and State Route 229. Local access to the site is provided by Brandon Road which bisects the southern portion of the site.

4.3.7.9 Rail Lines

The Pathfinder site is served by a rail spur extension of an existing Burlington Northern rail line. The rail line crosses the site immediately north of the existing generating plant. An Ellis and Eastern rail line also crosses the Pathfinder site, south of the existing generating plant. The proposed CTG facility will be located approximately 800 feet south of the existing Burlington Northern rail line.

4.3.8 Cultural Resources

The South Dakota Historical Preservation Office has requested that an archaeological survey be completed for the area surrounding the proposed CTG facility site. It is NSP's understanding that the State of South Dakota will be conducting this survey as part of the Environmental Impact Statement process.

5.0 ENVIRONMENTAL IMPACTS

This Chapter describes anticipated environmental impacts from the construction and operation of the proposed CTG facility.

5.1 CONSTRUCTION IMPACTS

5.1.1 Sound Impacts Construction

The most prevalent sound source during construction is anticipated to be from the internal combustion engines used to provide mobility and operating power to construction equipment. The sound level impacts at sensitive sites from construction operations will depend on the type of equipment used, the equipment's mode of operation, the length of time the equipment is in use, the amount of equipment used simultaneously and the distance between the sound source and sensitive site. All of these factors will be constantly changing throughout the construction period, making the calculation of an L_{dn} or L_{eq} and, hence, the quantification of impacts difficult.

Table 5-1 gives a sound level range for equipment commonly used in construction. For the noisier pieces of equipment listed in Table 5-1, a distance of approximately 1000 feet to 1200 feet between the sound sensitive site (residence) and sound source (construction equipment) would result in a sound level of 65 dBA or less. A 65 dBA sound level during daytime hours would not be considered a substantial sound impact. The nearest residences to the Pathfinder Site are located approximately 4,240 feet and 4,280 feet from the proposed CTG construction site.

The intermittent, short term nature of construction sound and the distance between the sound sensitive sites and the proposed construction area suggests that impacts from construction sound will be minimal.

5.1.2 Construction Workforce

The estimated construction workforce required for the proposed CTG facility is summarized in Table 5-2. It is anticipated that the majority of these workers will be drawn from the local or area workforce.

TABLE 5-1

TYPICAL CONSTRUCTION EQUIPMENT NOISE RANGES

EQUIPMENT	NOISE LEVEL RANGE AT 50 FEET (dBA)	AVERAGE (dBA)
Front Loaders	72 - 84	81
Backhoes	72 - 93	90
Tractors	77 - 96	93
Graders	80 - 93	90
Pavers	86 - 88	87
Trucks	82 - 94	91
Concrete Mixers	75 - 88	85
Cranes	75 - 87	84
Pumps	69 - 71	70
Generators	71 - 82	79
Compressors	74 - 87	84

Source: EPA, 1971

TABLE 5-2

ESTIMATED SITE MANPOWER LOADINGS

1993		1994	
MONTH	MANPOWER	MONTH	MANPOWER
JUNE	10	JANUARY	60
JULY	20	FEBRUARY	55
AUGUST	30	MARCH	40
SEPTEMBER	40	APRIL	20
OCTOBER	40	MAY	20
NOVEMBER	50	JUNE	10
DECEMBER	55		

5.1.3 Traffic

Construction-related activities will increase local traffic levels due to the influx of construction crews, increased numbers of trucks and movement of heavy equipment. These impacts will be temporary as construction activities progress.

Most of the heavy equipment associated with the CTG facility will be transported to the site by rail. This would include the main CTG components and large transformers. For a two unit installation, this would require about 24 rail cars. The remaining equipment would be delivered by truck. Approximately 100 truck deliveries would be required for the installation of two CTG units.

It is estimated that approximately 4,000 cubic yards of concrete would be required for two CTG units. This would require approximately 500 truck deliveries. Delivery would be spread over a two- to three-month period averaging 10 to 12 trucks per day. However, since detailed design has not been completed, nor soil borings taken, these are only rough estimates.

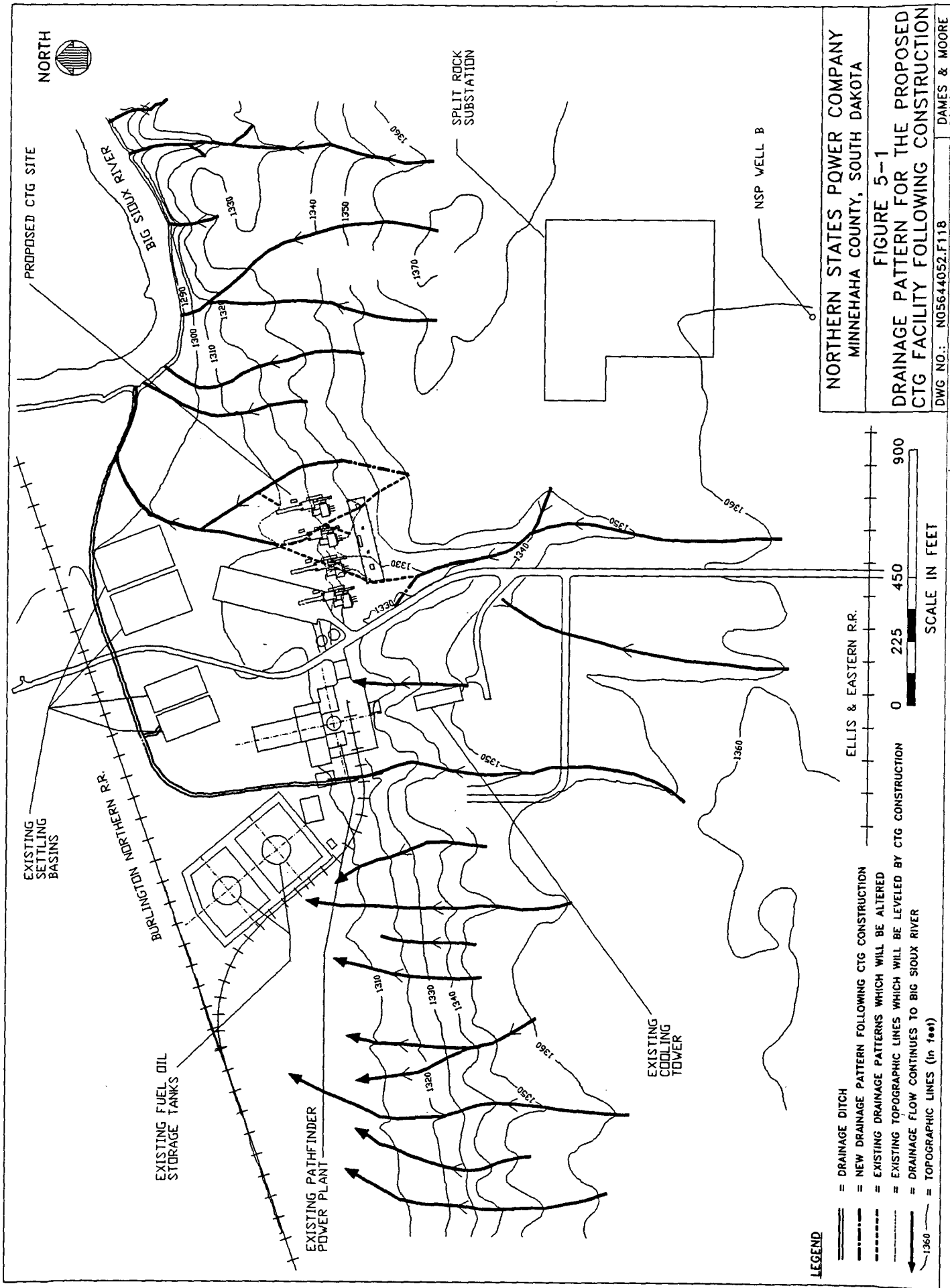
Initial filling of fuel oil storage tanks will be by rail, truck, or a combination of both depending on market conditions. If all the fuel oil for two CTG units is delivered by rail, approximately 90 rail cars will be required at 20,000 gallon capacity each. If all the fuel oil for two CTG units is delivered by truck, approximately 230 tankers will be required at a capacity of 7,500 gallons each.

5.1.4 Drainage Patterns

Figure 5-1 depicts the anticipated drainage patterns for the proposed CTG facility area following construction. Based on current information and facility layout, no significant change in drainage patterns is expected as a result of the construction of the proposed CTG facility.

5.1.5 Soil Erosion

A soil is classified as highly erodible if it has the inherent potential to erode eight times the rate at which soil can naturally replenish itself to maintain continued



productivity. Lists of highly erodible soils were obtained from the Minnehaha County Soil Conservation Service office.

None of the soils in the area of the proposed CTG facility are considered highly erodible. However, soils exposed during construction activities will be vulnerable to erosion until stabilized. All Federal, State, and local regulations governing site erosion will be followed. It is anticipated that erosion control will be achieved by a number of methods. Hay bales and/or silt fences will be utilized to control erosion and reduce runoff velocity during construction in areas susceptible to erosion. Disturbed areas that are not covered by gravel/rock or pavement will be reseeded following the completion of construction activities.

5.1.6 Impacts on Terrestrial and Aquatic Resources

The proposed construction site is on unused land vegetated with brome grass. Any animal species inhabiting the proposed 2-acre CTG facility site would be permanently displaced. However, similar habitat exists in adjacent areas that would not be disturbed. It is not anticipated that the overall carrying capacity of the area would be impacted.

It is unlikely that activities required during construction of the CTGs would have significant impact on the aquatic resources near the site. No work will be necessary in the river bed so physical disturbance and siltation will not occur. A potential conflict is not expected to occur with nesting activities of Blandings turtles, since the Blandings turtle has not been observed in this area for nearly thirty years. In addition, as discussed in Chapter 4.2.5, Threatened and Endangered Species, the Blanding's turtle prefers a wetlands-type habitat for nesting. No wetlands are present on the CTG facility site. Thus, it is unlikely that construction activities would impact Blandings turtle populations in the event any are present in the area.

5.1.7 Geologic Hazards and Constraints

Based on current information, no geologic hazards or constraints have been identified which may affect the construction or operation of the proposed CTG facility.

5.1.8 Fugitive Dust

Temporary increases in fugitive dust resulting from site clearance and construction activities will occur during the construction of the proposed CTG facility. This could cause some localized nuisance conditions within the plant property, but should not affect homeowners around the site nor the air quality in the area. Contractors will be required to utilize water wagons to periodically spray any unpaved access roads and haul roads to reduce fugitive dust emissions in the event that the emissions affect area residences. Potential impacts are expected to be localized and quickly dissipated.

5.1.9 Solid Waste

Refuse and construction debris generated during construction of the proposed facility will be recycled or disposed in a licensed sanitary landfill. The amount of construction debris is anticipated to be minimal.

5.1.10 Health and Safety

It is not anticipated that construction of the CTG facility will impose any unusual or unique health or safety hazards to construction workers, NSP employees or the general public. The proposed project will be undertaken with the health and safety of all construction workers and the general public in mind. Contract safety requirements will require all contractors to comply with applicable federal, state and local safety statutes, orders, rules and regulations pertaining to the protection of workers, frequenters and the public from injury or damages.

5.1.11 Archaeological/Historical

The South Dakota Historic Preservation Office has requested an archaeological survey of the proposed CTG facility site. It is NSP's understanding that the State of South Dakota will be conducting this survey as part of the Environmental Impact Statement process.

NSP is not aware of any state or federal listed archaeological or historical resources which exist within the project area.

5.2 OPERATIONAL IMPACTS

5.2.1 Air Pollution

One of the impacts of operating the proposed CTG facility will be the emissions of air pollutants from the combustion of natural gas and distillate fuel oil. The major air pollutants that will be emitted from the proposed CTG facility include nitrogen oxides (NO_x), sulfur dioxide (SO₂), carbon monoxide (CO), Volatile Organic Compounds (VOCs), total suspended particulate matter (TSP), particulate matter less than 10 microns (PM₁₀), and Beryllium (Be).

5.2.1.1 Effects of Air Pollutants

The USEPA has developed National Ambient Air Quality Standards (NAAQS). The primary NAAQS were promulgated to protect public health. The secondary NAAQS were promulgated to protect public welfare, including vegetation, soil and animals. The NAAQS development process incorporated years of toxicological studies on potentially effected species.

Nitrogen Oxides

Oxides of nitrogen (NO_x) are gaseous compounds formed at high temperatures. Nitric oxide (NO) and nitrogen dioxide (NO₂) are the two most commonly emitted to the atmosphere. Exposure to NO₂ above threshold levels can cause respiratory tract damage to humans as well as animals. The primary and secondary NAAQS for NO₂ is

100 $\mu\text{g}/\text{m}^3$. NO_2 may affect vegetation either by direct contact with the leaf surface or by solution in water drops. Acute and chronic threshold injury levels for NO_2 are at concentrations of approximately 2,000 $\mu\text{g}/\text{m}^3$ (USEPA, 1971).

Dispersion modeling results have shown that the maximum predicted NO_2 concentrations from the proposed CTG facility are well below the primary and secondary NAAQS of 100 $\mu\text{g}/\text{m}^3$ and threshold injury levels.

Sulfur Dioxide

Sulfur dioxide (SO_2) is a heavy colorless gas having the same odor as a struck match. This gas can combine with water vapor to form aerosols of sulfurous acid (H_2SO_3), a colorless, mildly corrosive liquid which in turn can combine with oxygen in the air and be transformed into the more corrosive, irritating sulfuric acid (H_2SO_4). Exposure to high concentrations of SO_2 for short periods of time can cause bronchial constriction and increased mucous flow. Exposure to lower concentrations for longer periods can also impair the respiratory system's defenses against foreign particles and bacteria. Children, asthmatics and mouth breathers, (e.g., people with head colds, or who are exercising) are most susceptible to these effects. SO_2 appears to enhance the harmful effects of another pollutant, ozone (O_3). Combinations of the two gases at concentrations occasionally found in the ambient air appear to increase airway resistance to breathing.

Certain plant species and varieties, both native and cultivated, are injured by prolonged exposure to SO_2 . Some of the most sensitive plants include various commercially valuable pines, legumes, red and black oaks, white ash, alfalfa and blackberry (most of which are not found in this predominantly agricultural region). A positive response to low levels of SO_2 has been observed in a few species, growing on sulfur deficient soils, (Wisconsin Department of Natural Resources (WDNR), 1989).

Dispersion modeling results have shown that maximum SO_2 concentrations from the proposed CTG facility are significantly lower than the primary NAAQS of 80 $\mu\text{g}/\text{m}^3$ (annual average) and 365 $\mu\text{g}/\text{m}^3$ (24-hour average); the secondary NAAQS of 1,300 $\mu\text{g}/\text{m}^3$ (3-hour average); and the acute and chronic injury level to vegetation of 80 $\mu\text{g}/\text{m}^3$ (annual average).

Carbon Monoxide

Carbon monoxide (CO) is a colorless, odorless, tasteless gas. It enters the blood stream by combining with hemoglobin, the substance that carries oxygen to the cells. This combination occurs 200 times more readily with CO than with oxygen, so the amount of oxygen being distributed throughout the body by the blood stream is reduced in the presence of CO. Blood laden with CO can weaken heart contractions, lowering the volume of blood distributed to various parts of the body. People with heart disease, lung disease, anemia, or cerebral-vascular disease, and the human fetus are most sensitive. CO does not appear to have adverse effects on plants or wildlife at concentrations commonly monitored in the ambient air, (WDNR, 1989).

Maximum predicted CO concentrations from the proposed CTG facility are significantly less than the primary and secondary NAAQS of 10,000 $\mu\text{g}/\text{m}^3$ (8-hour average) and 40,000 $\mu\text{g}/\text{m}^3$ (1-hour average).

Volatile Organic Compounds/Ozone

Volatile organic compounds (VOCs) are reactive organic gases whose bulk component has a vapor pressure greater than 1.1 millimeters (mm) Mercury. Short-term effects of acute VOC exposure include irritation of eyes, respiratory tract, and skin, sometimes causing dermatitis. VOC exposure can also cause dizziness, nausea, and vomiting. Long-term effects of chronic exposure include central nervous system depression and liver damage. The USEPA and the State of South Dakota do not require an assessment of the effects of VOCs through dispersion modeling.

Chemical reactions between VOCs and NO_x in the presence of oxygen and sunlight produce ozone. Ozone is the major photochemical oxidant and represents about 90 percent of all oxidants found in the air. High levels of ozone can irritate the mucous membranes of the nose and throat. Significant ozone levels impair normal functioning of the lungs and reduces the ability to perform physical exercise. Individuals with lung disease, asthma, or diseases of the heart and circulatory system are most sensitive.

USEPA-developed conservative screening tables were used to demonstrate that maximum potential VOC and NO_x emissions from the proposed CTG facility will result

in the formation of an additional 0.026 ppm of ozone. Summation of this value with a representative background concentration of 0.08 ppm yields an assumed worst-case ozone concentration of 0.106 ppm, which is below the primary and secondary NAAQS of 0.120 ppm designed to protect public health and human welfare.

Total Suspended Particulate Matter (including PM₁₀)

Total Suspended Particulate Matter (TSP) includes airborne particles or aerosols ranging in size from less than 1 micrometer to more than 100 micrometers. If deposited in the lung's capillaries and alveoli, TSP will slow down the exchange of oxygen for CO₂ in the blood, causing shortness of breath. Particulates may also accumulate in the lungs after repeated, long-term exposure causing respiratory distress and other health problems. People with respiratory diseases such as emphysema, bronchitis or asthma, or heart problems and the elderly and children are most sensitive, (WDNR, 1989).

TSP on the leaf surfaces of crops, trees and shrubs may injure or inhibit the growth of plants through a reduction in photosynthesis. In addition, visibility and solar radiation is often impaired by fine particulates in the air. Very small particles remain suspended in the air and scatter light. The haze caused by these particles may affect crop productivity by reducing solar radiation; it may also adversely affect property values, aesthetics in urban, country-side and wilderness areas, transportation safety, and potentially, the weather (WDNR, 1989).

Particulate matter less than 10 microns (PM₁₀) is a relatively new indicator for the short and long-term health related particulate standards. The 10 micrometer "cut point" was chosen to ensure that the full range of particles capable of penetrating to the sensitive lung areas is emphasized. PM₁₀ are particles or aerosols which are formed in the atmosphere from other vaporous or gaseous pollutants.

Maximum predicted concentrations of PM₁₀ from the proposed CTG facility are less than the primary and secondary NAAQS of 50 µg/m³ (annual average) and 150 µg/m³ (24-hour average).

Beryllium

Beryllium (Be) in the form of particulate dust has been labeled as a suspected human carcinogen. An exposure limit of $0.0002 \mu\text{g}/\text{m}^3$ has been established by the American Conference of Governmental Industrial Hygienists. Dispersion modeling has shown that maximum expected concentrations of Be from the CTG facility will be less than the exposure limit.

5.2.1.2 Applicable Regulations

5.2.1.2.1 Determination of Project Emissions

Guaranteed levels of emissions for three ambient air temperature values (-40°F , 59°F , and 100°F) and for both potential fuels (natural gas and distillate oil) were obtained from Westinghouse, the CTG manufacturer. The emission rates (shown in Table 5-3) classify the project as a major new source, thus requiring Prevention of Significant Deterioration (PSD) review. Table 5-4 lists PSD threshold emission rates, PSD increments (the maximum allowable increase in concentration that is allowed to occur above a baseline concentration for a pollutant), and the primary and secondary NAAQS.

5.2.1.2.2 Prevention of Significant Deterioration Regulations

The PSD regulations, amended by the U.S. Environmental Protection Agency (USEPA) on August 7, 1980 (45 FR 52675), specify that any major new stationary source or major modification to an existing source within an air quality attainment area must undergo a PSD review prior to commencement of construction. For new sources, the regulations apply to:

- Any source type in any of 28 designated industrial source categories having potential emissions of 100 tons per year or more; and
- Any other source having potential emissions of 250 tons per year or more of any pollutant regulated under the Clean Air Act.

TABLE 5-3

ESTIMATED POLLUTANT EMISSION RATES
FOR PROPOSED CTGs AT THE PATHFINDER SITE

POLLUTANT	NATURAL GAS (1 TURBINE)		DISTILLATE OIL (1 TURBINE)		WORST-CASE FUEL - 4 CTGs ⁵ (TPY ²)
	STACK CONCENTRATION (ppmdv @ 15% O ₂)	TPY ²	STACK CONCENTRATION (ppmdv @ 15% O ₂)	TPY ²	
TSP/PM ₁₀ ¹	-	52.6	-	394.2	1576.8
SO ₂ ¹	12	311.0	76	1839.6	7358.4
NO _x ¹	24	521.2	41	862.9	3451.6
CO ¹	50	556.3	50	569.4	2277.6
VOCs ¹	20	127.0	35	227.8	911.2
Be ³	-	-	-	0.013	0.051
Hg ³	-	-	-	0.015	0.061
Pb ³	-	-	-	0.045	0.182
Fluorides (F) ⁴	-	-	-	0.149	0.595

¹ Based on Westinghouse emission guarantee at 59 °F, base load operation, base elevation of 1000 feet above mean sea level, water injection.

² Tons per year, assuming 365 days per year, 24-hour per day operation.

³ Emission factor from: USEPA, Toxic Air Pollutant Emission Factors - A Compilation for Selected Air Toxic Compounds and Sources, 1988. Specifically, Be = 2.5 lbs/10¹² Btu, Hg = 3 lbs/10¹² Btu Pb = 8.9 lbs/10¹² Btu. Assuming a maximum heat input rate of 1163.8 MMBtu/hr.

⁴ Emission factor from: Radian Corp., Estimated Toxic Air Emissions from Coal and Oil Sources, 1989. Specifically, 29.2 lbs/10¹² Btu. Assuming a maximum heat input rate of 1163.8 MMBtu/hr.

⁵ CTGs are identical.

TABLE 5-4

**NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS), PSD INCREMENTS,
SIGNIFICANT EMISSION RATES, SIGNIFICANT IMPACT INCREMENTS,
AND MONITORING DE MINIMIS CONCENTRATIONS**

POLLUTANT	AVERAGING PERIOD	NAAQS ($\mu\text{g}/\text{m}^3$)		PSD INCREMENTS ($\mu\text{g}/\text{m}^3$)			SIGNIFICANT EMISSION RATES (tons/year)	SIGNIFICANT IMPACT INCREMENTS ($\mu\text{g}/\text{m}^3$)	MONITORING DE MINIMIS CONCENTRATIONS ($\mu\text{g}/\text{m}^3$)
		PRIMARY	SECONDARY	CLASS I	CLASS II	CLASS III			
Total Suspended Particulate Matter (TSP)	Annual	—	—	5 ^a	19 ^a	37 ^a	25	1	—
	24-Hour	—	—	10 ^{a,b}	37 ^{a,b}	75 ^{a,b}		5	10
Particulate Matter Less than 10 μm (PM ₁₀)	Annual	50	c	—	—	—	15	1	—
	24-Hour	150 ^b	c	—	—	—		5	10
Sulfur Dioxide	Annual	80	—	2	20	40	40	1	—
	24-Hour	365 ^b	—	5 ^b	91 ^b	182 ^b		5	13
	3-Hour	—	1300 ^b	25 ^b	512 ^b	700 ^b		25	—
Nitrogen Dioxide	Annual	100	e	2.5	25	50	40	1	14
Ozone	1-Hour	235 ^d	e	—	—	—	40 ^e	—	f
Carbon Monoxide	8-Hour	10,000 ^b	e	—	—	—	100	500	575
	1-Hour	40,000 ^b	e	—	—	—		2000	—
Lead	Calendar Quarter	1.5 ^b	e	—	—	—	0.6	—	0.1
Total Reduced Sulfur (TRS) Reduced Sulfur Compounds	1-Hour	—	—	—	—	—	10	—	10
Asbestos	—	—	—	—	—	—	0.007	—	—
Mercury	24-Hour	—	—	—	—	—	0.1	—	0.25
Beryllium	24-Hour	—	—	—	—	—	0.0004	—	0.001
Fluorides	24-Hour	—	—	—	—	—	3	—	0.25
Vinyl Chloride	24-Hour	—	—	—	—	—	1	—	15
Sulfuric Acid Mist	—	—	—	—	—	—	7	—	—
Hydrogen Sulfide	1-Hour	—	—	—	—	—	10	—	0.2

^aTSP increment to be replaced by PM₁₀ increment.

^bConcentration not to be exceeded more than once per year.

^cSame as primary NAAQS.

^dExpected number of days in which one or more hourly ozone concentrations exceed this value must be greater than 1.

^eEmissions of volatile organic compounds.

^fIncrease in volatile organic compounds of more than 100 tons/year.

"Potential emissions" are defined as the emissions of any pollutant at maximum design capacity (or less than maximum design capacity if specified as a permit condition), including the control efficiency of air pollution control equipment. For modifications of existing sources, the regulations apply if the existing source is major (as defined above) for any criteria pollutant and the modification results in increased emissions of any criteria pollutant exceeding the significant emission rates presented in Table 5-4.

PSD review generally consists of:

- A case-by-case Best Available Control Technology (BACT) demonstration, taking into account energy, environmental, and economic impacts as well as technical feasibility;
- An ambient air quality impact analysis to determine whether the allowable emissions from the proposed CTGs, in conjunction with all other applicable emission increases or reductions, would cause or contribute to a violation of the applicable PSD increments and NAAQS;
- An assessment of the direct and indirect effects of the proposed CTGs on general growth, soil, vegetation, and visibility; and
- Preconstruction ambient air quality monitoring for up to a 1-year period may be required for each pollutant subject to PSD review. An applicant may be exempt from this requirement, however, if there are existing air quality monitoring data representative of the station site, or if the impact from the proposed facility is less than the de minimis concentrations listed in Table 5.4.

The proposed CTGs are considered a major modification to an existing major source. As such, the project is subject to PSD review.

BACT Analyses

The BACT analyses conducted considered various control technologies applicable to stationary simple-cycle CTGs. Based on these BACT analyses the following control technologies will be used to control emissions from the proposed CTGs:

- NO_x control will be by water injection when combusting either natural gas or No. 2 distillate fuel oil;
- CO emissions, which are a byproduct of the combustion process, are controlled by maintaining proper combustion techniques;
- SO₂ emissions will be minimized by using natural gas as the primary fuel. When the use of the back-up fuel, No. 2 distillate fuel oil, is required, a low sulfur fuel oil (anticipated sulfur content of 0.37 percent by weight) will be used to minimize SO₂ emissions;
- VOC emissions will be minimized by maintaining proper combustion techniques.
- TSP/PM₁₀ emissions will be minimized by using natural gas as the primary fuel and by maintaining proper combustion techniques; and
- Emissions of Be will be minimized by using natural gas as the primary fuel.

The BACT analyses are found in Section 2.3 of the PSD Permit Application which is included as Exhibit E to the Facility Permit Application.

Air Quality Impact Analyses

Air quality impact analyses were conducted to determine whether each pollutant would have a significant impact under assumed worst-case conditions. Table 5-5 presents the results of the analysis. From this table it can be seen that only emissions of SO₂ and TSP/PM₁₀ would result in a significant impact. As such, the PSD regulations require

TABLE 5-5

**COMPARISON OF ISCST AND COMPLEX I MAXIMUM PREDICTED CONCENTRATIONS
DUE TO THE PROPOSED MODIFICATION WITH
SIGNIFICANT IMPACT INCREMENTS AND DE MINIMIS CONCENTRATIONS**

POLLUTANT	AVERAGING PERIOD	DATA PERIOD			UTM RECEPTOR LOCATION (meters)		MAXIMUM PREDICTED CONCENTRATION ($\mu\text{g}/\text{m}^3$)	SII* ($\mu\text{g}/\text{m}^3$)	DMC** ($\mu\text{g}/\text{m}^3$)
		DATA YEAR	JULIAN DAY	PERIOD ENDING	NORTHING	EASTING			
SO ₂	Annual	1985			4836350.0	702654.0	1.1	1	a
		1986			4840350.0	704654.0	1.4		
		1987			4840350.0	704654.0	1.3		
		1988			4840350.0	704654.0	1.4		
		1989			4840350.0	704654.0	1.4		
	3-Hour Highest	1985	140	8	4827346.0	689154.0	54.4	25	a
		1986	6	2	4827346.0	689154.0	55.8		
		1987	44	7	4827346.0	689154.0	52.2		
		1988	160	1	4827346.0	689154.0	52.1		
		1989	190	8	4827346.0	689154.0	50.7		
	24-Hour Highest	1985	69	1	4827346.0	689154.0	22.2	5	13
		1986	6	1	4826346.0	689154.0	21.5		
		1987	284	1	4840350.0	704654.0	18.2		
		1988	34	1	4822346.0	687654.0	16.7		
		1989	293	1	4840350.0	704654.0	22.2		
NO ₂	Annual	1985			4836350.0	702654.0	0.5	1	14
		1986			4840350.0	704654.0	0.6		
		1987			4840350.0	704654.0	0.5		
		1988			4840350.0	704654.0	0.6		
		1989			4840350.0	704654.0	0.6		

TABLE 5-5 - Continued

POLLUTANT	AVERAGING PERIOD	DATA PERIOD			UTM RECEPTOR LOCATION (meters)		MAXIMUM PREDICTED CONCENTRATION ($\mu\text{g}/\text{m}^3$)	SII* ($\mu\text{g}/\text{m}^3$)	DMC** ($\mu\text{g}/\text{m}^3$)
		DATA YEAR	JULIAN DAY	PERIOD ENDING	NORTHING	EASTING			
CO	1-Hour Highest	1985	184	18	4830446.0	690954.0	105.1	2000	a
		1986	187	13	4829346.0	691154.0	73.5		
		1987	215	13	4831346.0	692654.0	92.3		
		1988	229	15	4830446.0	690954.0	367.8		
		1989	112	12	4830646.0	690554.0	111.6		
	8-Hour Highest	1985	69	1	4827346.0	689154.0	53.4	500	575
		1986	360	1	4827346.0	689154.0	56.1		
		1987	250	1	4826346.0	689154.0	36.8		
		1988	229	2	4830446.0	690954.0	52.9		
		1989	292	1	4827346.0	690154.0	44.3		
TSP/PM ₁₀	Annual	1985			4836350.0	702654.0	0.3	1	a
		1986			4840350.0	704654.0	0.4		
		1987			4840350.0	704654.0	0.4		
		1988			4840350.0	704654.0	0.4		
		1989			4840350.0	704654.0	0.4		
	24-Hour Highest	1985	69	1	4827346.0	689154.0	7.6	5	10
		1986	6	1	4827346.0	689154.0	7.2		
		1987	284	1	4840350.0	704654.0	5.9		
		1988	332	1	4828846.0	692654.0	5.9		
		1989	293	1	4840350.0	704654.0	7.3		
Be	24-Hour Highest	1985	69		4827346.0	689154.0	0.00014	a	0.001
		1986	6		4826346.0	689154.0	0.00014		
		1987	284		4840350.0	704654.0	0.00012		
		1988	34		4822346.0	687654.0	0.00011		
		1989	293		4840350.0	704654.0	0.00014		

* Significant Impact Increment

** De Minimis Concentration

a Not Defined

further analyses to demonstrate that the maximum potential impact of the CTGs will not jeopardize PSD increments and NAAQS.

The PSD increments were designed by USEPA to keep "clean" areas clean. Specifically, the impact of the proposed sources is required to be below allowable increments. The primary NAAQS were designed to protect public health from exposure to various pollutants, while the secondary NAAQS were designed to protect human welfare, including soil, vegetation, and animal exposure to pollutants.

The results of dispersion modeling analyses conducted with USEPA-recommended dispersion models demonstrate that PSD increments will not be exceeded, nor will the primary or secondary NAAQS be threatened (see Tables 5-6 and 5-7). It should be noted that, in conducting the dispersion modeling analyses, an assumed worst-case methodology was employed. Specifically, four operating load scenarios were considered (peak, base, 75 percent, and 35 percent). Peak load (or 110 percent) represents operation of the CTGs at maximum output capacity; base load (or 100 percent) represents operation of the CTGs at design output capacity; 75 percent and 35 percent loads represent operation of the CTGs at 75 percent and 35 percent of design output capacity, respectively.

For each load, the lowest volumetric gas flow rate, lowest exhaust temperature, and highest pollutant emission rate from the two potential fuels and three ambient temperature values were modeled. Next, the load which produced the maximum impact for each pollutant was used for comparisons to PSD increments and NAAQS.

It should be noted that the dispersion modeling analyses incorporated assumed worst-case emission scenarios. In most cases, actual emissions, and consequently, pollutant impacts, are anticipated to be much lower than those used in the modeling analyses.

Effects on Soil and Vegetation

The effects of the pollutants emitted from the proposed CTGs on soil and vegetation were assessed in terms of demonstrating compliance with the secondary NAAQS. Since the maximum potential impact of the proposed CTGs is below the

TABLE 5-6

**COMPARISON OF ISCST AND COMPLEX I MAXIMUM PREDICTED CONCENTRATIONS
DUE TO THE PROPOSED MODIFICATION WITH PSD INCREMENTS**

POLLUTANT	AVERAGING PERIOD	DATA PERIOD			UTM RECEPTOR LOCATION (meters)		MAXIMUM PREDICTED CONCENTRATION ($\mu\text{g}/\text{m}^3$)	PSD INCREMENT ($\mu\text{g}/\text{m}^3$)
		DATA YEAR	JULIAN DAY	PERIOD ENDING	NORTHING	EASTING		
SO ₂	Annual	1985			4836350.0	702654.0	1.1	20
		1986			4840350.0	704654.0	1.4	
		1987			4840350.0	704654.0	1.3	
		1988			4840350.0	704654.0	1.4	
		1989			4840350.0	704654.0	1.4	
	3-Hour Highest Second Highest	1985	127	2	4827346.0	689154.0	52.6	512
		1986	22	8	4827346.0	689154.0	53.3	
		1987	95	2	4827346.0	689154.0	48.4	
		1988	286	1	4827346.0	689154.0	51.2	
		1989	296	8	4827346.0	689154.0	50.4	
	24-Hour Highest Second Highest	1985	68	1	4836350.0	702654.0	18.2	91
		1986	138	1	4826346.0	689154.0	17.9	
		1987	284	1	4840350.0	708654.0	13.6	
		1988	132	1	4827346.0	689654.0	13.6	
		1989	351	1	4840350.0	704654.0	19.0	
TSP	Annual	1985			4836350.0	702654.0	0.3	19
		1986			4836350.0	702654.0	0.4	
		1987			4836350.0	702654.0	0.4	
		1988			4836350.0	702654.0	0.4	
		1989			4836350.0	702654.0	0.4	
	24-Hour Highest Second Highest	1985	12	1	4836350.0	702654.0	5.3	37
		1986	138	1	4826346.0	689154.0	6.9	
		1987	96	1	4827346.0	689154.0	4.8	
		1988	132	1	4822346.0	687654.0	4.7	
		1989	351	1	4840350.0	704654.0	5.3	

TABLE 5-7

**COMPARISON OF ISCST AND COMPLEX I MAXIMUM PREDICTED CONCENTRATIONS
DUE TO THE PROPOSED MODIFICATION WITH NAAQS**

POLLUTANT	AVERAGING PERIOD	DATA PERIOD			UTM RECEPTOR LOCATION (meters)		MAXIMUM PREDICTED CONCENTRATION ($\mu\text{g}/\text{m}^3$)	Background Concentration ($\mu\text{g}/\text{m}^3$)	Total Concentration ($\mu\text{g}/\text{m}^3$)	NAAQS ($\mu\text{g}/\text{m}^3$)
		DATA YEAR	JULIAN DAY	PERIOD ENDING	NORTHING	EASTING				
SO ₂	Annual	1985			4824346.0	685654.0	14.9	5.0	19.9	80
		1986			4824346.0	684654.0	12.8	5.0	17.8	
		1987			4824346.0	684654.0	13.2	5.0	18.2	
		1988			4824346.0	685654.0	13.2	5.0	18.2	
		1989			4824346.0	685654.0	13.1	5.0	18.1	
	3-Hour Highest Second Highest	1985	136	1	4825346.0	684654.0	426.0	11.2	437.2	1,300
		1986	285	3	4824346.0	684654.0	361.1	11.2	372.3	
		1987	279	5	4824346.0	684654.0	364.4	11.2	375.6	
		1988	297	6	4825346.0	684654.0	375.3	11.2	386.5	
		1989	282	6	4825346.0	684654.0	392.4	11.2	403.6	
	24-Hour Highest Second Highest	1985	41	1	4824346.0	684654.0	117.6	7.4	125.0	365
		1986	162	1	4824346.0	684654.0	146.8	7.4	154.2	
		1987	334	1	4824346.0	684654.0	150.6	7.4	158.0	
		1988	332	1	4825346.0	684654.0	188.7	7.4	196.1	
		1989	303	1	4824346.0	684654.0	114.6	7.4	122.0	
PM ₁₀	Annual	1985			4824346.0	685654.0	2.1	23.4	25.5	50
		1986			4824346.0	684654.0	1.8	23.4	25.2	
		1987			4824346.0	684654.0	1.9	23.4	25.3	
		1988			4824346.0	685654.0	1.9	23.4	25.3	
		1989			4824346.0	685654.0	1.9	23.4	25.3	
	24-Hour Highest Second Highest	1985	41	1	4824346.0	684654.0	16.2	54.3	70.5	150
		1986	162	1	4824346.0	684654.0	20.3	54.3	74.6	
		1987	334	1	4824346.0	684654.0	20.7	54.3	75.0	
		1988	332	1	4825346.0	684654.0	26.0	54.3	80.3	
		1989	303	1	4824346.0	684654.0	15.8	54.3	70.1	

secondary NAAQS, it is anticipated that there will be no significant adverse effects on either soil or vegetation.

Effects on Nonattainment Areas and Visibility

The PSD regulations require that an assessment on the effects on nonattainment areas and visibility be conducted. Since the area within 100 kilometers (km) of the proposed CTG facility does not contain a nonattainment area for any pollutant, significant nonattainment area impacts are not expected and have not been calculated. Further, the nearest PSD Class I area (e.g. wilderness areas and national parks) is greater than 400 km from the proposed CTG facility site. Thus, the impact of emissions from the proposed CTGs on Class I areas is anticipated to be negligible.

A more thorough description of the effects on nonattainment areas, PSD Class I areas, and visibility can be found in the PSD Permit Application, which is attached as Exhibit E to the Facility Permit Application.

Preconstruction Monitoring

The PSD regulations require preconstruction ambient air quality monitoring for each pollutant subject to PSD review. An applicant may be exempt from this requirement, however, if there are existing air quality monitoring data representative of the station site, or if the impact of the proposed modification is below the de minimis concentrations. Because the existing Pathfinder site is located in an area which lacks representative NO₂, TSP/PM₁₀, CO, and Be ambient air quality monitors, it was necessary to demonstrate the exemption through dispersion modeling. The maximum impacts of NO₂, TSP/PM₁₀, CO, and beryllium determined through dispersion modeling are below respective de minimis concentrations, exempting NSP from monitoring requirements for these pollutants. Dispersion modeling analyses predicted a maximum

SO₂ concentration slightly higher than the SO₂ de minimis concentration. However, background SO₂ concentrations measured in Sioux Falls have all been below the de minimis concentration. Thus, USEPA - Region VIII has granted NSP a waiver for SO₂ ambient air quality monitoring. A copy of the SO₂ ambient air quality monitoring waiver is contained in the PSD Permit Application, which is attached as Exhibit E to the Facility Permit Application.

Because annual potential emissions of VOCs are in excess of 100 tons per year, USEPA-Region VIII has requested an assessment of the additional ozone formation due to VOC emissions from the proposed CTGs. The Reactive Plume Model lookup tables were used to determine the worst-case ozone formation increment due to the proposed CTGs. This value, 0.026 ppm, was added to a representative worst-case ozone background concentration of 0.08 ppm. The resultant worst-case ozone concentration of 0.106 ppm is below the ozone primary and secondary NAAQS of 0.12 ppm. As such, USEPA-Region VIII has waived the ozone preconstruction monitoring requirement of PSD. A copy of the ozone preconstruction monitoring waiver is contained in the PSD Permit Application, which is attached as Exhibit E to the Facility Permit Application.

5.2.1.2.3 New Source Performance Standards

The USEPA has promulgated New Source Performance Standards (NSPS) for gas turbines which were designed to control emissions of NO_x and SO₂. The proposed CTGs will incorporate water injection to control NO_x emissions. SO₂ emissions will be controlled by using natural gas as a primary fuel and 0.37 percent sulfur (low sulfur) distillate fuel oil as the back-up fuel. The control levels of NO_x and SO₂ will meet gas turbine NSPS.

5.2.2 Impacts on Water Resources

5.2.2.1 Water Use

Big Sioux River water will not be appropriated for use by the proposed CTG facility. This eliminates the possibility of impingement or entrainment impacts on river biota as a result of CTG facility operation.

It is anticipated that ground water taken from two existing on-site wells (wells A and B) screened in the Split Rock Creek Aquifer will be used as a source of process and sanitary water for the proposed CTG facility. NSP has submitted Appropriation Permit Applications for these wells which are attached as Exhibit F to the Facility Permit Application.

In order to assess the possible impacts of this appropriation on other ground water users in the area, the South Dakota Division of Water Rights (SDDWR) was contacted to obtain a listing of wells on record at the state which are completed into the Split Rock Creek Aquifer and located within 3 miles of the proposed CTG facility. In addition, a door-to-door field inventory was conducted to locate any additional undocumented wells within the above-mentioned area. The results of this survey are listed on Table 5-8 and illustrated on Figure 5-2, Water Supply Wells Near the Proposed CTG Facility. Aside from the NSP-owned wells (Pathfinder wells A and B) there are only three wells within one mile of the proposed CTG facility.

As stated in Chapter 4.1.9, Ground Water Resources, pumping tests have been conducted at the Pathfinder site in the past. The City of Sioux Falls and State of South Dakota are also currently monitoring pumping in the Split Rock Creek Aquifer on a long-term basis near the Pathfinder site. In addition, the sustainable capacity of the aquifer will be further defined by the SDGS following interpretation of the current long-term pumping program.

Based on the well survey results and pumping test data currently available, it appears that sufficient water is likely to be available from the Split Rock Creek Aquifer for the proposed CTG facility without causing significant effects on groundwater users in the area.

TABLE 5-8

WATER SUPPLY WELLS
NEAR THE PROPOSED CTG SITE

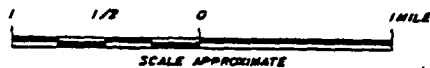
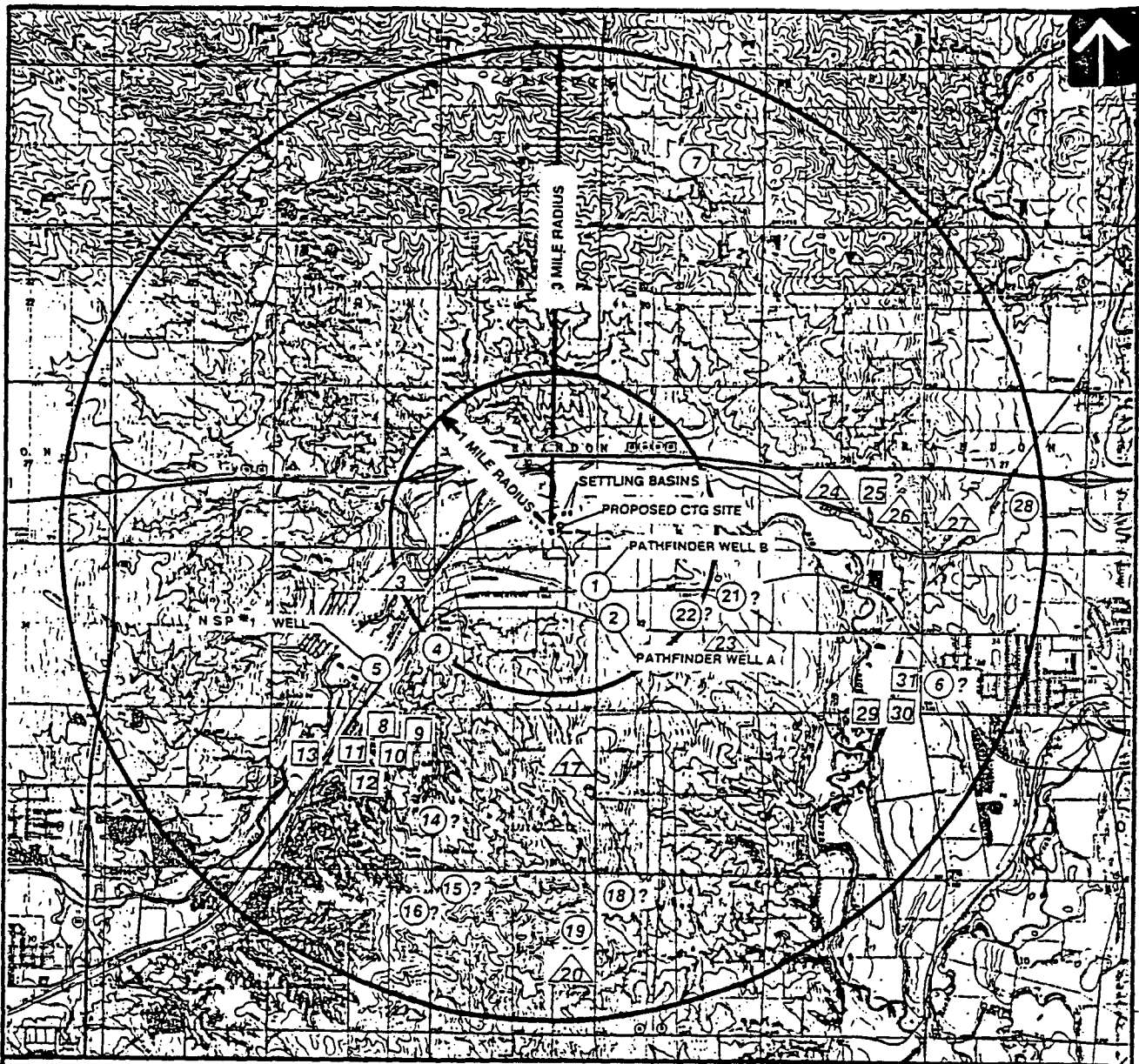
NAME	WATER USEAGE	APPROXIMATE YIELD (gpm)	WELL DEPTH	AQUIFER (not verified)	Bottom of well screen elevation
1. NSP-Well B	C	150	170	SRC	1190
2. NSP-Well A	C	800	255	SRC	1145
3. Norwin Bittner	D	60	?	?	1240
4. Garrels Myron	D	15	162	SRC	-
5. SDIENR/Lawrence #1	M	500	128	SRC	-
6. ?? SDDWNR ??	M?	-	44	BS?	1274
7. Gerrit Brands	D	*	238?	SRC	1192
8. City of Sioux Falls	M?	-	31	BS	1348
9. City of Sioux Falls	M?	-	24	BS	1411
10. City of Sioux Falls	M?	-	25	BS	1354
11. City of Sioux Falls	M?	-	42	BS	1338
12. City of Sioux Falls	M?	-	31	BS	1349
13. Discount Golf	C	*	20 ^{int}	BS	1290
14. Gordon Ode	Ag	*	360 ^{int}	BS?	1150
15. Roger Knochenmus	D	*	250 ^{int}	SRC?	1250
16. Roger Knochenmus	Ag	*	125 ^{int}	SRC?	1385
17. Clay Forrette	D	*	?	SRC?	-
18. Chuck Bakker	D	*	167 ^{int}	SRC	1283
19. Chuck Bakker	Ag	*	197	SRC	1240
20. John Grode	D	*	?	?	-
21. Tom Ode	Ag	*	85 ^{int}	SRC?	1265
22. Tom Ode	D/Ag	*	100 ^{int}	SRC?	1250
23. Tom Ode	D/Ag	*	25 ^{int}	?	1325
24. Jeff & Pam Eitein	D	*	?	?	-
25. Jan Shatter	D	*	20 ^{int}	BS?	1310
26. H. Hubbell	D	*	?	?	-
27. Charles McIntyre	D	*	10 ^{int}	?	1380
28. Brandon Woods Preserves	C		140	SRC	1210
29. ?? SDDWNR ??	M?	-	54	BS	1236
30. Brandon Cemetery	C	-	49	BS	1286
31. Brandon Cemetery	C	40	49	BS	1281

* Based upon interview, pumping rate is less than 20 gpm.

^{int} Denotes well depths obtained by personal interview.

C = commercial, D = domestic, Ag = agricultural, M = monitoring, Pub = municipal.

SRC = Split Rock Creek, BS = Big Sioux, ? = unknown/unverified.



KEY:

- ① Wells Screened in Split Rock Aquifer
- △ Wells Screened At An Unknown Depth / Aquifer
- Wells Screened in Big Sioux Aquifer
- ? Unverified (Based On Personal Interview Only)

U.S.G.S QUADRANGLE MAPS
 7.5 MINUTE SERIES (TOPOGRAPHIC)
 BRANDON, SOUTH DAKOTA
 RENNER, SOUTH DAKOTA
 GARRETSON WEST, SOUTH DAKOTA
 SIOUX FALLS EAST, SOUTH DAKOTA
 PHOTOREVISED 1976

FIGURE 5-2
 WATER SUPPLY WELLS
 NEAR THE PROPOSED CTG FACILITY

5.2.2.2 Ground Water Quality

Two potential ground water impact sources from the proposed CTG facility exist: (1) the two existing 2-million-gallon fuel oil tanks and (2) seepage occurring from the four settling basins.

The existing fuel oil tanks are provided with separate containment dikes designed to contain over 110 percent of the volume of the tank to protect against catastrophic spills or tank ruptures. Normally, precipitation will evaporate from the containment dike. If the containment areas become full due to large amounts of rain or spring snow melt, the precipitation will be tested for the presence of No. 2 distillate fuel oil. If fuel oil is found to be present above the NPDES permit limits, then steps will be taken to treat the precipitation to remove the fuel oil. The treated water will then be discharged to the existing wastewater settling basins. If the testing of the precipitation indicates that no fuel oil is present or is present at levels below the NPDES permit limits, then the precipitation will be discharged to the settling basins.

There is no sump pump, oil skimmer, or oil water separator associated with the fuel oil basins. Minor oil spills and drips will be cleaned up by NSP maintenance personnel.

Seepage losses from the settling basins would enter the alluvial (Big Sioux) Aquifer which is in the current flood plain of the Big Sioux River. The settling basins are located within 1,000 feet of the Big Sioux River. Figure 5-2, Water Supply Wells Near the Proposed CTG Facility, depicts any wells screened in the Big Sioux Aquifer which are within three miles of the proposed CTG facility. There are no ground water users between the settling basins and the river.

Table 5-9 lists the estimated annual average discharge concentrations for chemical parameters of concern into the settling basins and compares these concentrations to the applicable South Dakota Ground Water Discharge Standards (SDGWDS). As indicated in Table 5-9, it appears that the estimated wastewater composition will exceed the SDGWDS for nitrate-N, chloride, sulfate, and total dissolved solids (TDS). However, the estimated concentrations of these parameters are dependent upon highly conservative assumptions, which are:

TABLE 5-9

ESTIMATED GROUND WATER DISCHARGE CONCENTRATION
AS COMPARED TO
SOUTH DAKOTA GROUND WATER QUALITY STANDARDS

Parameter	Concentration (mg/l)			
	Influent River Water Concentration	Influent Ground Water Concentration	Estimated Concentration of Discharge to Big Sioux Aquifer ¹	South Dakota Ground Water Quality Standards
Fluoride	0.4	0.51	1.0	2.4
Nitrate-N	16.6	4.3	20.0	10.0
Chloride	348.7	60.0	342.0	250.0
Sulfate	243.1	382.0	1754.0	500.0
TDS	37.0	1038.0	3091.0	1000.0
pH	8.0 units	7.4 units	6.5-8.5 units	6.5-8.5 units

¹The values listed are estimated annual average concentrations for these parameters in the discharge to the settling basins. These values do not take into account potential attenuation resulting from seepage into the Big Sioux aquifer.

Note: Section 74:03:15, Groundwater Quality Standards, of the South Dakota State Code of Regulations lists several additional parameters for which standards exist. However, since none of these constituents are expected to be present in the combined discharge from the Pathfinder facility, they have not been listed in this table.

- Two CTG demineralizer systems operating 280 days per year, which is equivalent to four CTG units operating 2,000 hours per year each;
- The existing steam plant operating 100 days per year;
- No evaporation losses from the settling basins, and no direct discharge from the settling basins to the Big Sioux River;
- A seepage rate equivalent to the rate at which wastewater enters the settling basins;
- No attenuation of chemical constituents from seepage to the alluvial aquifer;
- No dilution of wastewater in the settling basins from other sources (i.e., stormwater).

It should be noted that the nitrate-N and chloride concentrations in the influent river water samples and the TDS concentration in the influent well water samples used for this analysis also exceed the SDGWDS.

Of the parameters anticipated to exceed the SDGWDS, nitrate-N is the only parameter which is listed as a criteria for human health. The primary reasons this parameter is estimated to exceed the SDGWDS in the effluent wastewater is (1) the high concentration of nitrate-N in the influent river water at 16.6 mg/l and (2) the concentrating effect of facility processes on inlet water concentration of nitrate-N. No additions of nitrate-N or any chemical parameter of concern are anticipated as a result of facility operations.

The assumed worst case incremental additional flow into the Big Sioux Aquifer (268,653 gallons per day) from the Pathfinder facility represents less than 5 percent of the total flow of the Big Sioux River Basin ground water and surface water flow system, which is estimated to be more than 5.8 million gallons per day.

NSP is working with the SDDENR to develop an acceptable permit for the seepage of wastewater from the settling basins to the Big Sioux Aquifer. A copy of the South Dakota Ground Water Discharge Permit Application will be included as Exhibit D to the Facility Permit Application.

5.2.2.3 Surface Water Quality

In the event of extended operating periods in which settling basin capacities are exceeded, water from the settling basins may overflow to the Big Sioux River. Under the assumed worst case scenario, flow to the river is estimated to be in excess of 33,000,000 gallons per year. The assumed worst case scenario assumes full settling basins, no seepage from the settling basins, no evaporation loss from the settling basins, operation of two CTG demineralizer systems for 280 days per year (which is equivalent to four CTG units operating 2,000 hours per year each), and operation of 100 days/year for the existing Pathfinder Plant.

Discharge water chemistry was estimated based on the composition of inlet water supply and chemicals added in the water treatment process. Actual analysis of wastewater discharge is not available because water has never been discharged to the river from the settling basins. Estimated discharge water composition is compared to applicable Waste Load Allocation and Surface Water Quality Standards in Table 5-10.

Based on the above-mentioned conservative assumptions, it appears that the estimated wastewater discharge from the Pathfinder and proposed CTG facilities may exceed the SDSWQS limit for total dissolved solids (TDS). The SDSWQS for TDS discharges in stream segments classified as "wildlife propagation and stock watering" beneficial use class is 2,500 mg/l, while the estimated worst-case TDS discharge concentration for the proposed CTG facility and existing plant is 3,083 mg/l (see Table 5-10). The estimated TDS discharge concentration is made up of a mixture of fluorides, chlorides, sulfates, nitrates, bicarbonates, and phosphates of sodium, potassium, calcium, magnesium, iron, and manganese.

The "wildlife propagation and stock watering" beneficial use class is assigned to streams and lakes which are satisfactory as habitat for aquatic and semi-aquatic wild animals and fowl and are of suitable quality for watering domestic and wild animals.

TABLE 5-10

**COMPARISON OF WASTE LOAD ALLOCATION LIMITS
AND SURFACE WATER QUALITY STANDARDS
TO ESTIMATED WASTEWATER DISCHARGE CONCENTRATION**

PARAMETER	CONCENTRATION (mg/l)		
	WLA LIMIT	SDSWQS LIMIT	ESTIMATED DISCHARGE INTO BIG SIOUX RIVER (Maximum Daily)*
Ammonia - N	1.0 - 8.8**	0.04	<0.04
Dissolved Oxygen	5.0 - 7.0**	>5.0	>5.0
Total Residual Chlorine	0.03	0.02	<0.02
Oil and Grease	10	-	<10
Total Suspended Solids	30	90	<30
Total Dissolved Solids	-	2500	3083
Total Alkalinity	-	750	96
Nitrate-N	-	50	21.2
Temperature	-	<90°F	<90°F
pH	-	6.5 - 9 units	6.5 - 9 units
Sodium Absorption Ratio	-	10.0	3.68

* Based on combined waste streams

** Dependent of season of year

Thus, an evaluation of the potential effects of the proposed discharge (focusing specifically on effects of TDS) on aquatic and semi-aquatic organisms inhabiting the Big Sioux River is presented below.

Fish Species

All species of fish and other aquatic life must tolerate a range of dissolved solids concentrations in order to survive under natural conditions. However, the presence of the major ions at relatively high concentrations or in combinations not usually encountered by fishes may cause direct toxemia or subtle changes resulting in reduction of fish populations, (USEPA, 1976).

Specifically, TDS fish toxicity is dependent upon the TDS concentration in the water and the combination of ions which make up TDS. Carbonate (or bicarbonate) salts of calcium, magnesium, and sodium are more toxic to fishes if they occur singly than if the water also contains chloride or sulfate salts of these cations. Sulfate salts are less toxic to freshwater fishes than carbonate (or bicarbonate) salts, and chloride salts are the least toxic. However, tolerance to higher concentrations of either sulfates or chlorides by freshwater fishes appears to be enhanced if there is a well balanced mixture of all major cations and anions, (Post, 1983).

In addition, fish can become acclimated slowly to higher salinities than those to which they are accustomed, but fish in waters of low salinity cannot survive sudden exposure to high salinities, (Post, 1983).

A study of TDS effects on fish species was conducted in over 60 lakes in Saskatchewan, which ranged in dissolved solids concentration from 300 to 118,000 mg/l. Twenty-six species of fish inhabit the series of lakes with the common sucker, northern pike, yellow perch, and pickerel as dominant species. Only one fish, the nine-spined stickleback, inhabited a lake with a TDS concentration as high as 20,000 mg/l. The study concluded that lakes with TDS in excess of 15,000 mg/l were unsuitable for most freshwater fishes, and that TDS concentrations between 5,000 and 10,000 mg/l may be limiting to freshwater fishes, depending on ionic complement in the water, fish species, and previous acclimation of the fishes to higher concentrations. (Rawson and Moore, 1944).

A study of the limnological characteristics of prairie lakes and their influence on wetland biota and use by waterfowl in south-central North Dakota found that lakes that supported game fish within the study area had specific conductances ranging from 770 to 4,150 microsiemens per centimeter ($\mu\text{S}/\text{cm}$), [conductivity measured in $\mu\text{S}/\text{cm}$ is roughly equivalent to TDS in mg/l], (Swanson, no date).

A study of fathead minnows in the alkaline lakes of Nebraska's Sandhill region and some South Dakota lakes, found that fathead minnows were found in lakes with an average TDS concentration greater than 7,000 mg/l . Moreover, adult minnows could overwinter in a lake where TDS levels approached 12,000 mg/L and spawn successfully in spring where TDS levels ranged from 6,000-7,000 mg/l , (Held and Peterka, 1974).

A study was conducted in an Illinois river to determine the acute toxicity of chlorides, sulfates, and TDS on certain fish species. Test specimens were exposed to a given concentration of TDS principally made up of chloride (TDS-Cl water) in one case, and sulfate (TDS- SO_4 water) in the other, for 14 days. Test specimens used were largemouth bass fingerlings, bluegill fry, and channel catfish fingerlings.

A median tolerance limit (TL_{50}) (i.e., the concentration at which 50 percent of the test specimens survive), was used to determine acute toxicity. In the TDS-Cl water, the TL_{50} concentrations for the species used ranged from 13,000 to 15,000 mg/l TDS. In the TDS- SO_4 water, the TL_{50} concentrations ranged from 14,000 to 17,500 mg/l . In both cases catfish were the most sensitive, (Reed and Evans, 1981).

Juveniles of three endangered Colorado River fishes were subjected to a gradient of TDS to determine the concentrations they preferred or avoided. The results of the study indicated that Colorado squawfish, *Ptychocheilus lucius*, preferred TDS concentrations of 560 to 1,150 mg/l and avoided TDS concentrations at 4,400 mg/l . Humback chub, *Gila cypha*, preferred TDS concentrations of 1,000 to 2,500 mg/l and avoided TDS concentrations above 5,100 mg/l . Bonytail, *Gila elegans*, preferred TDS concentrations between 4,100 and 4,700 mg/l and avoided TDS concentrations less than 560 mg/l or greater than 6,600 mg/l , (Pimental and Buckley, 1985).

In summary, based on the results of the fish studies presented herein, limiting concentrations of dissolved solids for fresh-water fish appear to range from 5,000 to

10,000 mg/l, according to dissolved ion make-up, fish species, and prior acclimation of the fish.

The potential impact of the wastewater discharge from the proposed CTG facility on fish species in the Big Sioux River is expected to be minimal for the following reasons:

- The estimated worst-case TDS concentration in the discharge is 3,083 mg/l, and is comprised of a mixture of all the major cations and anions, reportedly the least toxic form of TDS to fish.
- The estimated worst-case TDS discharge when mixed with the Big Sioux River, even at low flow periods, will have a minimal impact on the TDS concentration of the river.
- Dominant fish species in the Big Sioux River near the proposed CTG facility are hardy, disturbance tolerant species such as carp, white sucker, black bullhead, and fathead minnow which were all shown to be more TDS tolerant in the studies presented above.
- The only threatened species that may be present would be the trout-perch which is a temperature sensitive species. The temperature of the discharge from the settling basins is anticipated to be similar to ambient river temperature due to the residence time in the settling basins.

Wildlife and Livestock Species

According to the Livestock Water Quality Handbook, developed by the Great Plains States Cooperative Extension Service, waters containing up to 3,000 mg/l TDS are satisfactory for all classes of livestock including poultry, and waters containing 3,000 to 5,000 mg/l TDS are satisfactory for livestock but poor to unsatisfactory for poultry. Adverse health effects to poultry resulting from ingestion of water with TDS concentration in the range of 3,000 to 5,000 mg/l include watery feces, and possible immortality and decreased growth, especially near the upper limit, and especially to turkeys (Olson and Fox, 1973).

Waterfowl contain salt glands that increase their tolerance of elevated salt levels (Ellis et. al., 1963; Cooch 1964; Riggert 1969, 1977; Swanson et. al, 1984). Salt glands become functional with age and length of exposure to elevated salt levels. Birds with flight capability can feed on saline lakes and fly to fresh water in spring seeps or adjacent fresh lakes (Swanson et. al. 1984). However, recently hatched ducklings require fresh water for survival (Riggert 1969; Swanson et al 1984) because their salt glands are not fully functional until about 6 days posthatch (Ellis et al 1963; Riggert 1969).

Some recently hatched mallard and blue-winged teal ducklings exposed to lake water under controlled conditions (Swanson et. al. 1984) experienced mortality in water that had a conductivity of 16,000 $\mu\text{S}/\text{cm}$, and none could tolerate water exceeding 23,000 $\mu\text{S}/\text{cm}$. All water with a specific conductivity equal to or greater than 17,000 $\mu\text{S}/\text{cm}$ significantly reduced duckling growth rates when compared with control groups. Conductivity levels below 17,000 $\mu\text{S}/\text{cm}$ were not tested. Thus, a maximum limit of salinity that allows normal growth was not established.

About 150 waterfowl died and another 250 became weak and lethargic from suspected salt poisoning after using White Lake, a highly saline lake in Mountrail County, North Dakota. Frigid temperatures made fresh water unavailable, forcing the birds to ingest the saline waters with resultant toxic effects. Average sodium concentrations were greater than 17,000 mg/l when measured in July, 1986. Sixty percent of the affected waterfowl were Canadian geese, 30 percent were snow geese. Also affected were the common merganser, the lesser scaup, and the Ross goose, (Windingstad, 1987).

Other than waterfowl, no information was available regarding the effects of water elevated in TDS on wildlife. However, it is assumed that the effects of drinking water elevated in TDS on other types of wildlife in the area (i.e., beavers, white-tailed deer, etc.) would be similar to the effects on livestock mentioned previously.

In summary, based on the limited information available, it appears that the estimated TDS concentration of 3,083 mg/l in the discharge from the existing and proposed CTG facility would not significantly affect livestock or wildlife in the area for the following reasons:

- The estimated worst-case TDS discharge when mixed with the Big Sioux River, even at low flow periods, will have a minimal impact on the TDS concentration of the river;
- In general, the dissolved solids concentration which may have a detrimental effect on livestock and wildlife appears to be significantly higher than the estimated worst-case TDS discharge from the proposed CTG facility.

Invertebrate Species

Limited data is available which addresses the potential effects of TDS on invertebrates. However, the data which is available suggests that invertebrate species present in a water body may change in composition with changes in dissolved solids concentration (Swanson, et. al. 1974). The data also suggests that the changes are most pronounced when the dissolved solids levels exceed 5,000 $\mu\text{S}/\text{cm}$. Gastropods, (i.e., pond snails) such as *Lymnaea stagnalis* prefer water bodies low in dissolved solids (less than 5,000 $\mu\text{S}/\text{cm}$). As dissolved solids concentrations increase (up to 10,000 $\mu\text{S}/\text{cm}$), Stagnicola species tend to dominate over the *Lymnaea stagnalis*. Crustaceans (i.e., crayfish, crabs, and shrimp) such as amphipods are replaced by Anostraca as salt concentrations increase and eventually brine shrimp dominate the crustaceans at dissolved solids concentrations greater than 35,000 $\mu\text{S}/\text{cm}$. Insecta (i.e., insect species) decrease in numbers as dissolved solids concentration increases. Eventually brine flies, (*Ephydra* spp.) and water boatmen (*Corixidae*) predominate, (Swanson, no date).

Since the estimated TDS concentration in the discharge from the proposed CTG facility is less than 5,000 mg/l, changes in the existing invertebrate species composition in the Big Sioux River near the Pathfinder site are anticipated to be minimal.

Summary

In summary, even under the assumed worst case discharge rate of 268,653 gallons per day, the anticipated impact to aquatic and semi-aquatic organisms in the Big Sioux River is expected to be minimal due to the fact that:

- the discharge water quality is not significantly different than ambient river water quality, and;
- the discharge water will likely become rapidly diluted to near ambient concentrations, even under summer low flow conditions.

NSP is working with the SDDENR to develop an acceptable permit for the discharge from the settling basins to the Big Sioux River. A copy of the NPDES Permit Application will be included as Exhibit C to the Facility Permit Application.

5.2.3 Impacts on Terrestrial Resources

Since the proposed CTG facility site is adjacent to an existing power plant, and operation of the CTG facility is expected to be intermittent (during high energy demand periods), anticipated operational impacts on plant and animal resources in the vicinity of the proposed CTG facility will be minimal. No rare, threatened or endangered species are known to inhabit the area on which the proposed CTG facility will be located.

5.2.4 Sound - Operation

The degree of disturbance from unwanted sound depends upon three factors: the nature of the sound, the amount of background sound, and the nature of the activity being carried out. The nature of the sound is determined by the frequency distribution, the time pattern, and the intensity of the sound. This study of sound level impacts considered the frequency of the sound by utilizing the A-weighted frequency scale (which is discussed in Chapter 4.1.10, Existing Sound Levels). The time pattern of sound relates to the time characteristics of the sound and the time of day at which the sound is heard. A smooth continuous sound is considered to be more comfortable or acceptable than impulsive or intermittent sound. CTGs emit a sound that would generally be

described as smooth and continuous. This study considered the time of day factor by utilizing L_{dn} values in assessing potential sound impacts. The intensity of the sound (sound level) was determined and is discussed later in this section.

The second factor affecting the degree of disturbance is the amount of background sound present before the intruding sound. The background sound levels are listed in Table 4-8 (see Chapter 4.1.10, Existing Sound Levels).

Finally, the degree of disturbance depends on the nature of the activity being carried out by persons at the receptor site. The ambient sound level survey included a review of surrounding land uses to identify potential sound-sensitive sites.

A review of sound emission data provided by the CTG manufacturer indicates that the proposed CTGs at base load conditions will emit a sound level of 60 dBA at a reference distance of 400 feet at roughly 5 feet from the ground surface. Using 60 dBA as an assumed worst case, Table 5-11 shows the expected sound level from the operation of one to four combustion turbines at various distances. This data was used to calculate anticipated L_{dn} values at the sound monitoring stations which is presented in Table 5-12.

Studies have shown that a 2 or 3 dB change in a sound level is barely noticeable by the human ear while a 5 dB change is readily perceived. According to U.S. Department of Housing and Urban Development (HUD) guidelines, common building construction will provide an acceptable indoor environment and the outdoor environment will be reasonably pleasant for recreation and play if the L_{dn} is less than 65 dBA. Table 5-13 lists typical outdoor L_{dn} values.

At the sound level monitoring stations located on the Pathfinder site, an increase in the L_{dn} value ranging from 0 to 23 dBA is anticipated. At the off-site monitoring station 6, there is an expected increase in the L_{dn} value of 3 dBA. There is no expected increase in L_{dn} values at monitoring stations 7 or 8. The expected sound levels at the three off-site monitoring stations are less than the sound level considered acceptable by HUD. The anticipated sound levels at all off-site stations [6 (45 dBA), 7 (53 dBA), and 8 (52 dBA)] will be in the range typical of a quiet to normal suburban residential area (see Table 5-13).

TABLE 5-11

EXPECTED SOUND LEVELS (dBA)
OPERATION OF 1 TO 4 COMBUSTION TURBINES
PATHFINDER SITE

Distance in Feet	Number of Turbines in Operation			
	One	Two	Three	Four
100	73	76	78	79
500	58	62	63	65
1000	51	54	56	57
2000	44	47	49	50
5000	30	33	35	36

TABLE 5-12

PROJECTED SOUND LEVEL (L_{dn}) FROM THE SIMULTANEOUS OPERATION
OF FOUR COMBUSTION TURBINES AT PATHFINDER

Monitoring Station	Background Sound Level (L_{dn})	Calculated Sound Level (L_{dn})		Sound Level Increase Attributed to Turbines (dBA)
		Proposed Turbines Without Background	Proposed Turbines With Background	
1	53	76	76	23
2	54	69	69	15
3	54	64	64	10
4	52	64	64	12
5	42	51	52	10
6*	42	42	45	3
7*	53	42	53	0
8	52	42	52	0

*Station represents an existing residence.

TABLE 5-13

TYPICAL OUTDOOR L_{dn} VALUES MEASURED
AT VARIOUS LOCATIONS

LOCATION DESCRIPTION	TYPICAL L_{dn} RANGE (dBA)
Quiet Suburban Residential	48 - 52
Normal Suburban Residential	53 - 57
Urban Residential	58 - 62
Noisy Urban Residential	63 - 67
Very Noisy Urban Residential	68 - 72

Source: EPA, 1974

The results indicate that the addition of the proposed CTG facility at the Pathfinder site would not result in any substantial community sound impacts. Although the CTG may be audible off-site, particularly when background sound levels are below normal, predicted sound levels would be in a range that is acceptable for respective land uses in the vicinity of the proposed CTG facility.

5.2.5 Fuel Use

It is anticipated that the proposed CTG facility will burn natural gas approximately 75 percent of the time. The proposed CTG facility is expected to operate between 100 and 800 hours per year per unit.

At base load, the proposed CTG facility will burn approximately 5400 million cubic feet (MCF) per hour of natural gas with a total annual usage of approximately 0.54 to 4.3 million MCF for 100 to 800 hours of base load operation, respectively.

It is expected that enough fuel will be stored in the fuel oil storage tanks to operate the CTG units for one week each at base load winter conditions. This is equivalent to approximately 430,000 gallons of fuel oil per unit or 1.7 million gallons of fuel oil total.

Annual filling of the fuel oil storage tanks to maintain the one week capacity will require approximately 4.3 million gallons based on 400 hours of CTG facility operation per year. This amount of fuel oil will be delivered by 215 rail cars with a capacity of 20,000 gallons each, 574 tank trucks with a capacity of 7,500 gallons each, or a combination of the two depending on market conditions.

The availability of future natural gas and fuel oil supplies is expected to be sufficient to support the CTG facility for the life of the units.

5.2.6 Traffic Impacts

Once the CTG units are in operation, the only regular deliveries required will be for No. 2 distillate fuel oil. Fuel oil will be delivered by rail car or truck depending on market conditions.

Fuel oil is only anticipated to be burned during periods of natural gas interruption, cold days. Thus, fuel oil deliveries will be made to support the burning of fuel oil. Deliveries are expected to be made between October and November to fill the storage tanks for the upcoming winter season. Deliveries are expected to be made between December and March to maintain the fuel oil storage capacity at the one week supply quantity based on the amount of fuel oil burned.

5.2.7 Aesthetics

The Pathfinder site and general area is visually dominated by the existing generating facility, substations, and associated support facilities, as well as numerous electrical transmission towers. The proposed CTG facility will be similar in appearance to the existing facilities. There are few close neighbors to the site, and the primary visual impact will be to vehicle traffic along Brandon Road or Interstate 90. Therefore, while the new facilities will add to the horizontal dimensions presented to the viewer, the visual intrusion on the general area will be minor.

5.2.8 Tax Payments

The economic book life of the proposed combustion turbine is 25 years. However, the facility will continue to operate as long as it is economically viable to do so. The impact on sales taxes and property taxes will be dependent on the number of CTG's installed at the Pathfinder site, as indicated in Table 5-14.

TABLE 5-14
ANTICIPATED SALES AND PROPERTY TAX PAYMENTS

No. Units	Estimated Project Cost (\$1000)	Sales Tax*		Property Tax	
		Rate	Amount (\$1000)	Rate	Amount per year (\$1000)
1	\$ 48,000	1.33%	\$ 640	2.15%	\$1,030
2	78,000	0	0	2.15%	1,680
3	112,000	0	0	2.15%	2,410
4	145,000	0	0	2.15%	3,120

* The sales tax rate and amount include the refund for large projects.

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RECEIPT

Division of Water Rights

South Dakota Department of Water and Natural Resources

412938

Pierre, November 27, 19 91

RECEIVED OF Northern States Power Co., 414 Nicollet Mall, Minneapolis, MN 55401

the following amount in fees for services rendered as provided for by law:

Fee for Application for Permit No. <u>5597-3</u> to Appropriate Water, to construct works and to put water to beneficial use _____	225	00
Fee for Application for Permit No. _____ to Appropriate Water for Future Use _____		
Fee to retain Future Use Permit No. _____ after period of seven years.		
Fee for Inspecting Constructed Works, confirming beneficial use and issuing Water License No. _____		
Fee for Filing Transfer Form _____		
Fee for Filing Extension Request _____		
Fee for Certified Copy of _____		
Fee for Print Copy of Map _____		
Fee for Certifying _____		
Fee for _____		
(Any Other Work Provided by Law)	Total	225 00

By

John Hatch (Signature)
Chief Engineer



Northern States Power Company

414 Nicollet Mall
Minneapolis, Minnesota 55401-1927
Telephone (612) 330-5500

October 1, 1991



Water Rights Division
South Dakota Department of
Environment & Natural Resources
Joe Foss Building
Pierre, South Dakota 57501

RE: PATHFINDER COMBUSTION TURBINES
WATER RIGHT APPLICATION

Northern States Power hereby applies for a permit to appropriate water within the State of South Dakota. Enclosed are completed application forms and a check made out to the Water Rights Division DENR for \$675.00.

Currently NSP owns and operates a 60mw gas fired power plant at the Pathfinder site near Sioux Falls. Water is supplied from two existing wells. On September 24, 1991 NSP made application to the South Dakota Public Utilities Commission for a facility permit for up to four 100mw combustion turbines at the Pathfinder site. The turbines are designed to be air cooled, however, water is injected into the combustion chamber during operation to minimize the emission of oxides of nitrogen into the air. NSP proposes to supply water to the combustion turbines from the existing wells at the site.

A copy of the Facility Permit Application and the Environmental Impact Report are enclosed. These reports provide additional information and, hopefully, will assist you in evaluating this appropriation request.

Please feel free to call me if you have any questions or need additional information.

Thank you,

A handwritten signature in cursive script that reads "Jim Alders".

James R. Alders
Manager
New Facility Permitting
(612) 330-6732

Enclosures

cc: Martin Bettmann, South Dakota PUC
Angus Anson, NSP South Dakota

Water Rights Division - DENR
Conversation File Documentation

NAME OF PERSON OR FILE: Northern States Power Company Permit Applications

ADDRESS: _____ COUNTY: Minnehaha

DATE: 10/8/91 TELEPHONE: 612 330-6732

RE: Converation with Jim Alders, Manager, New Facility Permitting

COMMENTS:

I called Mr. Alders regarding the two water permit applications from existing permitted wells submitted by Northern States Power Company. The two applications, as submitted, were to amend Water Right Nos. 561-3 and 742-3 with the old priority date retained and change use. Both of these water rights were issued for industrial purposes and the new applications stated use of water was for industrial purposes.

I recalled a meeting we had last spring with Northern States Power Company and their consultants at which time they stated the WR Nos. 561-3 and 742-3 were still be used but to a lesser extent that stated on the water license. At that time we told them that these water rights could be reissued for the actual water used and that additional water needed to operate the new plant would require a new application that would have a new priority date.

I explained the basis for water rights priority date, "first in time, first in right" and explained that it would be advantageous for the Company to retain WR Nos. 561-3 and 742-3 for that portion of water not subject to cancellation and that the additional water would need to be applied for as a new application. Mr. Alders stated that part of the problem was that he does not know the diversion rate of water that was used during periods that the plant was inactive. He did state that water was used from each of wells each year.

Mr. Alders was going to talk to some people at the plant and try to give us a reasonable diversion rate that the two water rights can be issued for. Then we will amend the applications to reflect the new appropriation of water that will take a new diversion rate. I told him I would await a call from him to clear up this issue. I also stated during that phone call I could tell him what the correct application filing fee would be.

File in Permit or other file as necessary. Use to document conversations and what the other party was told; why action or decision was made.

NAME: _____

Eric Henderson



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE SOUTH DAKOTA 57501-3181

GREAT FACES. GREAT PLACES.

November 13, 1991

James Alders, Manager
Northern States Power Company
414 Nicollet Mall
Minneapolis MN 55401

Dear Mr. Alders:

In regard to the water permit applications received on October 3, 1991, the following information needs to be clarified in order to process the applications for Northern States Power Company.

As explained in your phone conversation with Eric Gronlund, it would be advantageous for your company to retain the priority dates of Water Rights Nos. 561-3 and 742-3. The priority dates can only be retained for the amount of water that has been used on a continuous basis. This would include the time period when the plant was inactive. When this amount of water is determined, the applications can be amended to reflect the new amount of water that will have a new priority date.

When the amount of water is determined, the filing fee for these applications can be calculated. The \$675 fee is on file with the pending applications. If you have any questions, please contact Eric Gronlund of this office.

Sincerely,

Karen Schlaak
Natural Resources Analyst
605 773-3352

Water Rights Division - DENR
Conversation File Documentation

NAME OF PERSON OR FILE: Northern States Power Company

ADDRESS: 414 Nicollet Mall

COUNTY: MH

DATE: 11/18/91

TELEPHONE: 612 639-1234

RE: Conversation with Jim Alders

COMMENTS:

Mr. Alders called this office to give us a reasonable diversion rate for use of the two wells permitted by Water Right Nos. 561-3 and 742-3 since the plant has been shutdown. This information was needed in order to determine what amount of water these rights would be reissued for with priority date maintained. Also, the diversion rate and applicable filing fee for the new applications would be dependent on these amount of water that would remain on 561-3 and 742-3. This additional diversion rate would take a new priority.

1. The well permitted by WR No. 742-3 located in the NE1/4 NE1/4 Section 31, T102N, R48W has continued to be used at a rate of 50 gpm.
2. The well permitted by WR No. 561-3 located SW1/4 NW1/4 Section 32, T102N, R48W has continued to be used for drinking and sanitary use at the plant building. Mr. Alders did not have a firm diversion rate number to use for this well. I suggested and he agreed to what constitutes reasonable domestic use of water which is 18 gpm.

I told Mr. Alders that with these diversion rates, I would try to determine what the diversion rates on the new applications should be in order that are properly permitted. I said I would send him a letter reflecting how I felt the new applications should read and the appropriate application fee.

File in Permit or other file as necessary. Use to document conversations and what the other party was told; why action or decision was made.

NAME: Eric Heindel



**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE SOUTH DAKOTA 57501-3181

GREAT FACES. GREAT PLACES.

November 20, 1991

James Alders, Manager
Northern States Power Company
414 Nicollet Mall
Minneapolis MN 55401

Dear Mr. Alders:

Regarding the water permit applications submitted to amend the two existing water rights held by Northern States Power Company and your phone conversation with Eric Gronlund of this office, the following changes have been made on the applications:

The application to amend Water Right No. 742-3 will be reduced by 50 gpm leaving 100 gpm (0.22 cfs). The filing fee will be \$225.00.

The application to amend Water Right No. 561-3 will be reduced by 18 gpm leaving 532 gpm (1.18 cfs). The filing fee will be \$350.00.

Enclosed is the check originally submitted for \$675.00. The filing fee for the two amended applications will be \$575.00. Upon receipt of the fee further processing of the application will continue.

If you have any questions, please contact this office.

Sincerely,

Karen Schlaak
Natural Resources Analyst
605 773-3352



Northern States Power Company

414 Nicollet Mall
Minneapolis, Minnesota 55401-1927
Telephone (612) 330-5500



November 25, 1991

Karen Schlaak
Natural Resources Analyst
South Dakota Department of
Environment and Natural Resources
Joe Foss Building
523 East Capitol
Pierre, South Dakota 57501-3181

RE: NOVEMBER 20, 1991 CORRESPONDENCE

Enclosed is a check made out to the Water Rights Division DENR for \$575.00. This check has been reissued in accordance with your letter of November 20, 1991 regarding the filing fees for the two amended applications:

Water Right No. 742-3
Water Right No. 561-3

If you have any questions or need additional information, please call me at (612) 330-6732.

Thank you,

James R. Alders
Manager New Facility Permitting
Northern States Power Company

Enclosure

cc: Martin Bettmann, South Dakota PUC
Angus Anson, NSP South Dakota

REPORT ON APPLICATION NOS. 5596-3 AND 5597-3
for Northern States Power Company
January 14, 1992

Application No. 5596-3 proposes to appropriate an additional 1.18 cfs from one well authorized by Water Right No. 561-3. Water Right No. 561-3 diverts 0.04 cfs from the same well which is approximately 222 feet deep located in the SW 1/4 NW 1/4 of section 32, T102N R48W in Minnehaha County. The water is for industrial use at the power plant.

Application No. 5597-3 proposes to appropriate an additional 0.22 cfs from one well authorized by Water Right No. 742-3. Water Right No. 742-3 diverts 0.11 cfs from the same well approximately 170 feet deep located in the NE 1/4 NE 1/4 of section 31, T103N R48W in Minnehaha County. The water is for industrial use at the power plant.

AQUIFER - SPLIT ROCK CREEK (SRKC)

The Split Rock aquifer consists of a basal fine to medium grained sandstone overlain by organic claystones, opaline sediments and massive cherts with a total known thickness of 300 feet (Hedges, 1982). The aquifer underlies 69 square miles and contains an estimated 99,400 acre feet of recoverable water in Minnehaha County (Hedges, 1982). A project is currently underway by the South Dakota Geological Survey to evaluate the feasibility of the Split Rock Creek aquifer as a supplemental water supply for the City of Sioux Falls. The intent of this study is to quantify the effects of withdrawals from the Split Rock aquifer by closely monitoring pumping from 2 production wells and closely monitoring the observation wells in the area (Pence, oral comm., 1992). Results from this testing will be available later this year. Additional information obtained since the Hedges report indicates the aquifer underlies about 100 square miles of Minnehaha County with no further refinement of the total amount of water in storage (Barari, 1989). The original estimates are undoubtedly very conservative.

The Split Rock Creek aquifer is under confined (artesian) conditions. The Division of Water Rights monitors 11 observation wells completed into the Split Rock Creek in Minnehaha County. Water levels for these wells fluctuate in response to climatic conditions, that is, rising during wet years do to recharge and gradually declining during dry years do to discharge. In general the water level record indicates that the aquifer is capable of sustaining additional withdrawals (Water Rights, 1992).

Recharge to the Split Rock Creek aquifer has not been quantified. Since this is a buried aquifer it is likely that recharge to the aquifer is accomplished by leakage from other aquifers or formations. These include buried outwash (sand and gravel) aquifers lying above the Split Rock aquifer, the Sioux Quartzite and Quartzite wash, the Big Sioux South aquifer and leakage from the overlying till.

REVIEW OF EXISTING WATER PERMITS/RIGHTS

There are no active water permits from the Split Rock Creek aquifer within 2 miles of this proposed diversion. There are four cancelled permits that were issued to NSP at the Lawrence site for Split Rock Creek wells. One of these wells (deep well No. 4) is presently being tested by the City of Sioux Falls and reportedly has produced 167 million gallons of water since September of 1990 (Pence, oral comm., 1992). This averages about 248 gpm. These wells were reportedly plugged when the Water Rights were cancelled, but apparently this was not done properly. Because the aquifer is under artesian conditions drawdown will occur as a result of pumping. A measured cumulative affect of drawdown and natural fluctuation at observation well MA-87D (which is located in the immediate vicinity of this proposed diversion) has shown a decline of 5 to 6 feet since September of 1990. This observation well is located approximately 2 miles east of well being tested by the City of Sioux Falls. This would indicate that drawdown created by pumping will occur over a relatively large area but that interference should not be adverse to properly constructed wells.

Information included with these applications indicate the two existing wells were capable of supplying the amount of water requested and had been licensed under Water Right Nos. 561-3 (1.77 cfs) and 742-3 (.33 cfs). No recent production testing is available for these two wells and both have been used at a lesser rate for many years.

One Water Permit application No. 5084-3 which requested 1500 acre feet of water annually was denied by the Water Management Board because the applicant did not show a need for the water. Also the City of Sioux Falls has a deferred application No. 5213-3 which requested 6.7 cfs from 3 wells completed into the Split Rock Creek aquifer. The nearest proposed diversion for the Sioux Falls application is more than 4 miles to the southeast of the wells for this application. Interference should not be a problem.

Currently there are 13 active water permit/rights for ground water from the Split Rock Creek aquifer in Minnehaha County. The total diversion authorized is 2.39 cfs and a Future Use reservation of 188 acre feet per year. Of this authorized diversion, the largest is for the City of Brandon which is for 1.32 cfs from one well.

CONCLUSIONS

1. Water is available from the Split Rock Creek aquifer.
2. The Split Rock Creek aquifer is under artesian conditions and fluctuation due to pumping can be expected. Interference is not expected to be adverse. Recharge to the Split Rock Creek aquifer has not been quantified. The observation well record indicates that recharge does occur. Present diversions do cause water level declines in the aquifer.

3. The City of Sioux Falls is currently testing two wells completed into the Split Rock Creek aquifer to evaluate the potential of the formation.
4. These are existing wells which are being reactivated. The wells have been in continuous use and this request is to add additional water to the present diversion rate. These wells had been licensed for 2.10 cfs but were used at a rate of 0.15 cfs so the original use was considered abandoned and a new permit required to put additional water to use.
5. The City of Sioux Falls has a deferred permit No. 5213-3 for water from the Split Rock Creek aquifer.
6. The Water Management Board denied a permit application No. 5084-3 (future use for East Dakota Water Development District) for water from the Split Rock aquifer in this area. The reason for denial was based upon an insufficient documentation of the need for the water.
7. Northern States Power is aware of the need for and is pursuing additional environmental permits required for this facility.



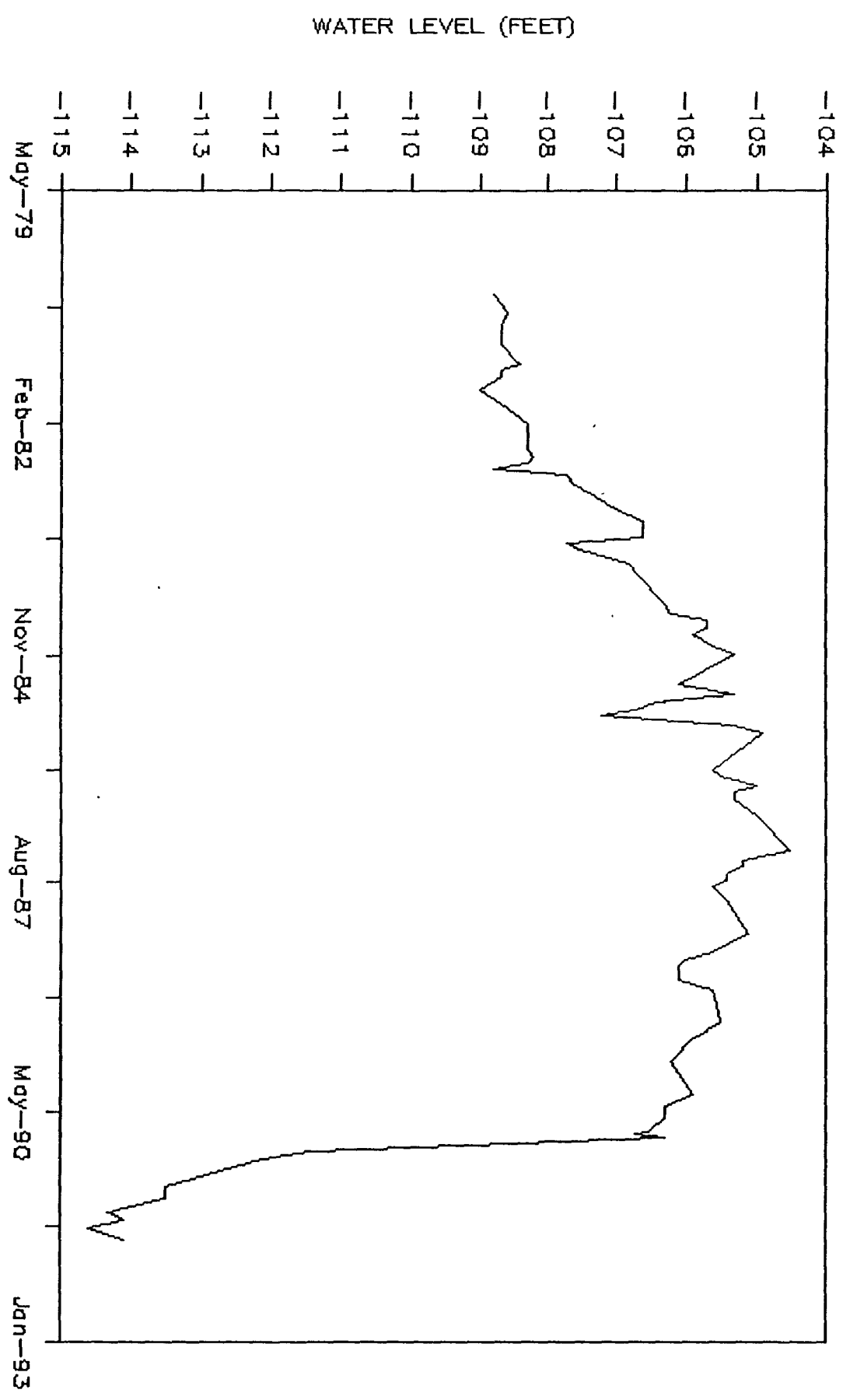
James A Goodman
Natural Resources Engineer

BIBLIOGRAPHY

- Barari, A, D.L. Illes, T.C. Cowman, 1989, Assessment of Water Resources and Conceptual Evaluation of a Regional Water Supply for Southeastern South Dakota, Open-File Report 60-UR, SD DENR, SDGS, Vermillion, SD, 57069.
- Hedges, L.S., et al, 1982, Evaluation of Ground-Water Resources Eastern SD and Upper Big Sioux River, SD and Iowa, for US Army Corps of Engineers, SD DENR, SDGS, Vermillion, SD, 57069.
- Pence, S., oral comm., 1992, "Split Rock Study", SD DENR, SDGS, Vermillion, SD, 57069.
- Water Rights, 1992, Observation Well Records for the Split Rock Creek Aquifer in Minnehaha County, SD DENR, Division of Water Rights, Pierre, SD, 57501.

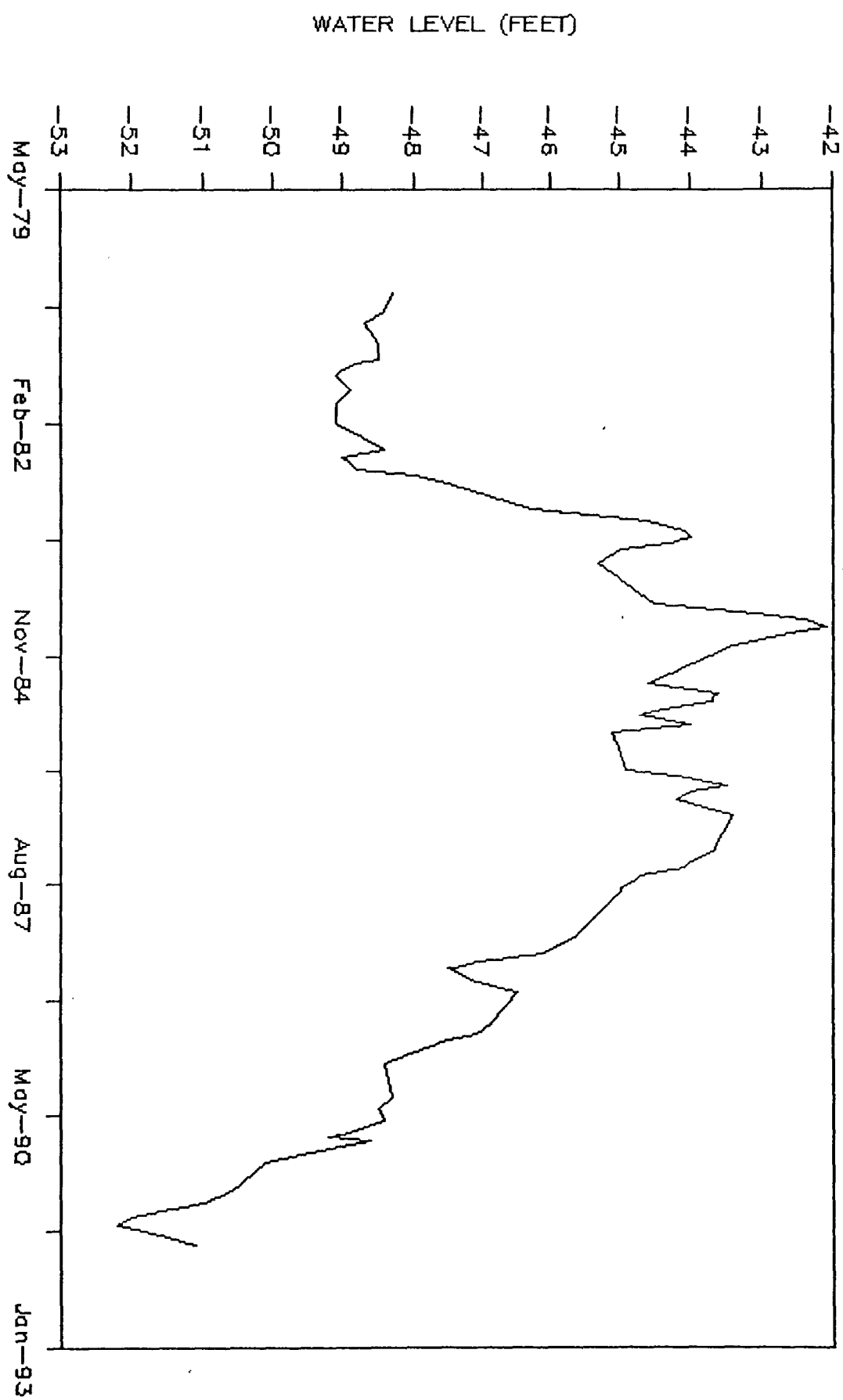
WATER RIGHTS OBSERVATION WELL

MA-80P



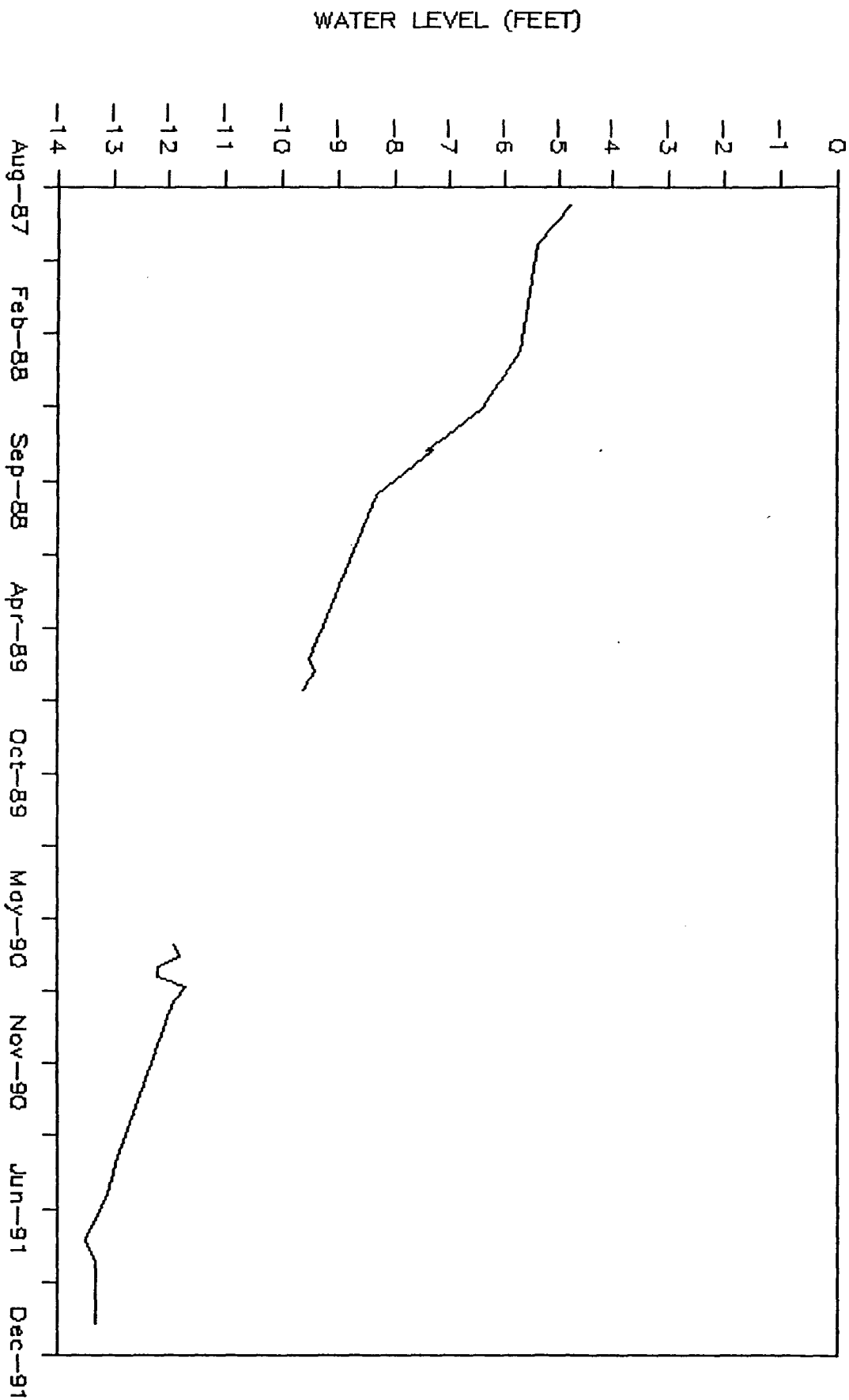
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MA-80Z



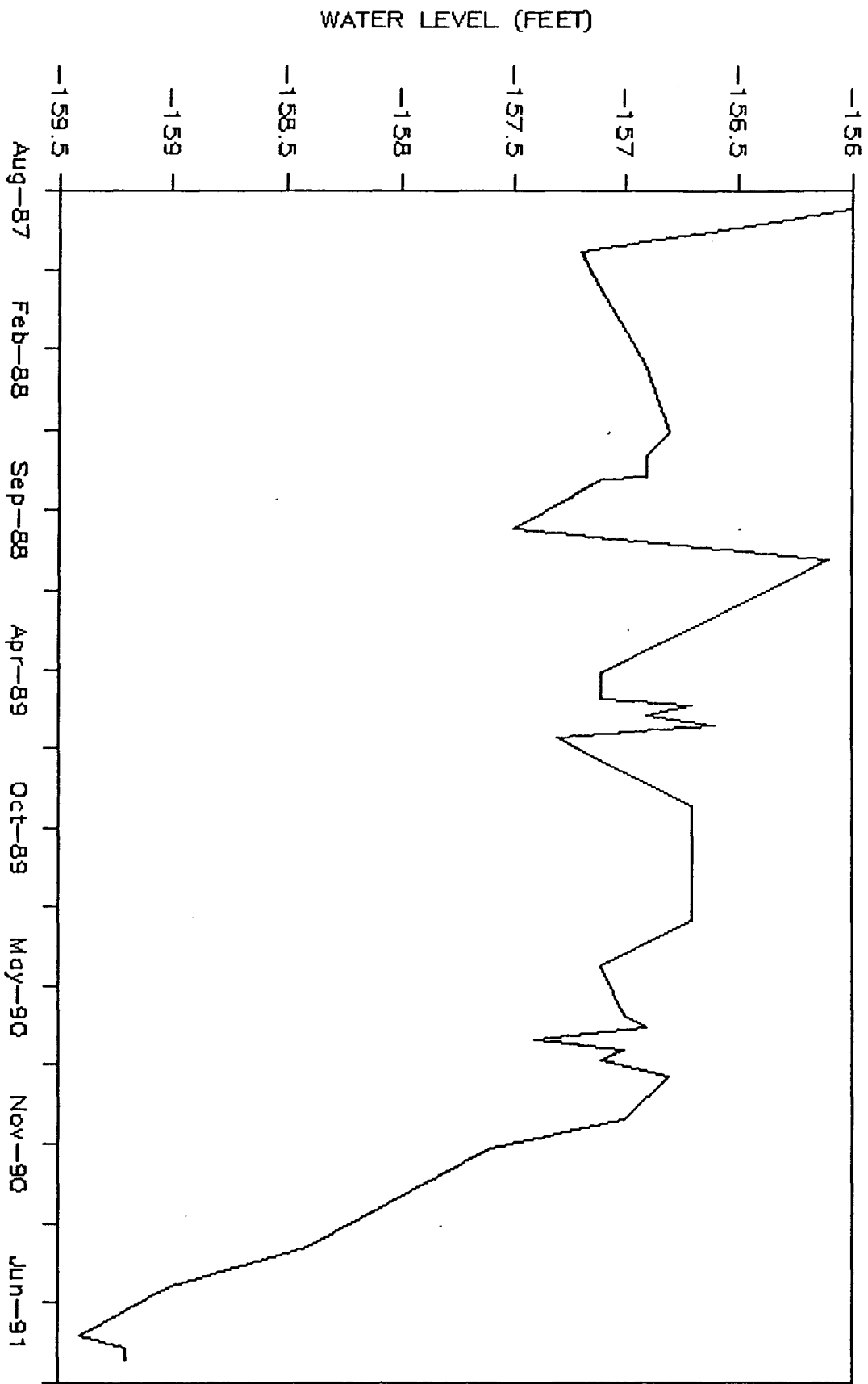
WATER RIGHTS OBSERVATION WELL

MA-87A



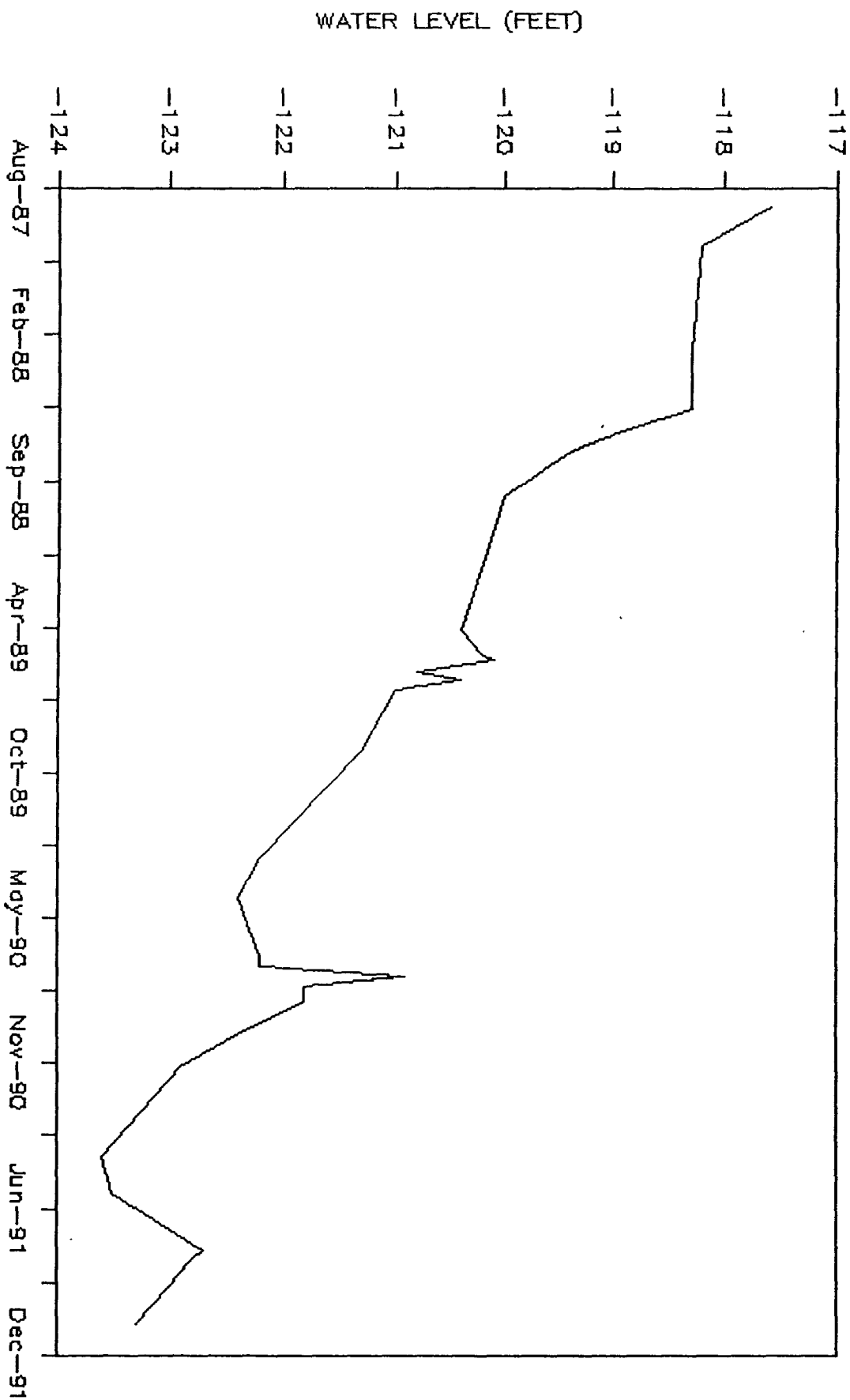
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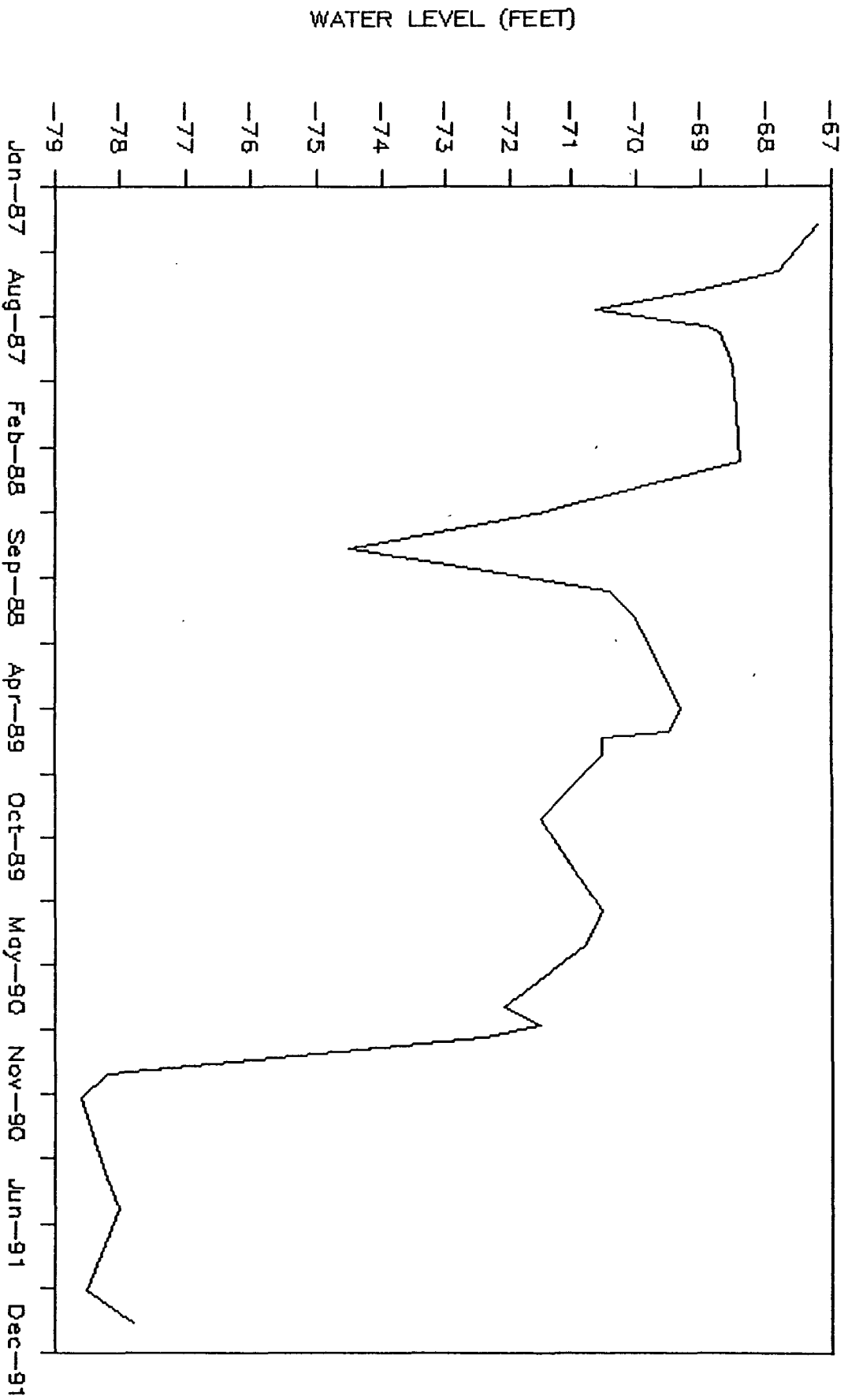
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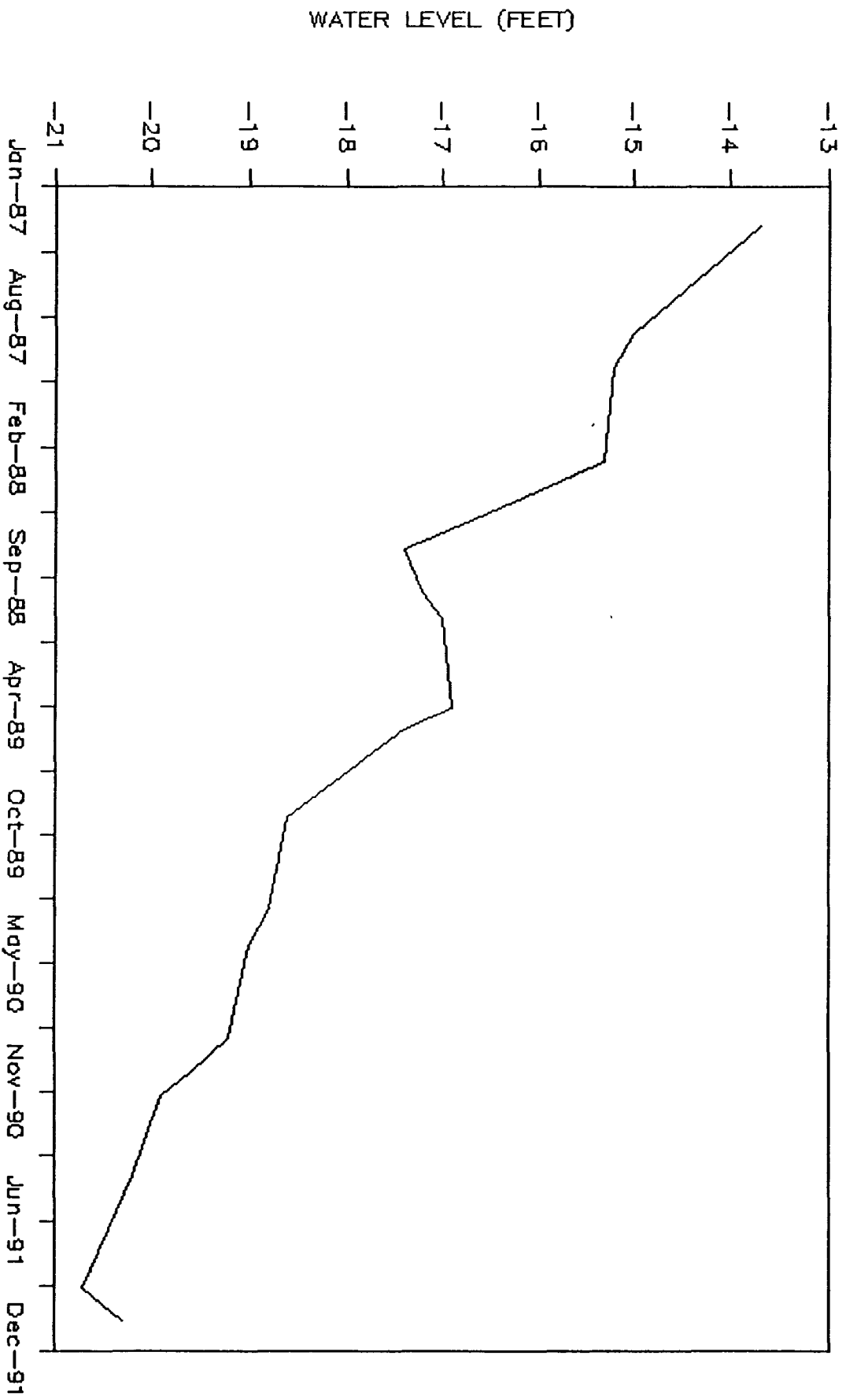
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MA-87D



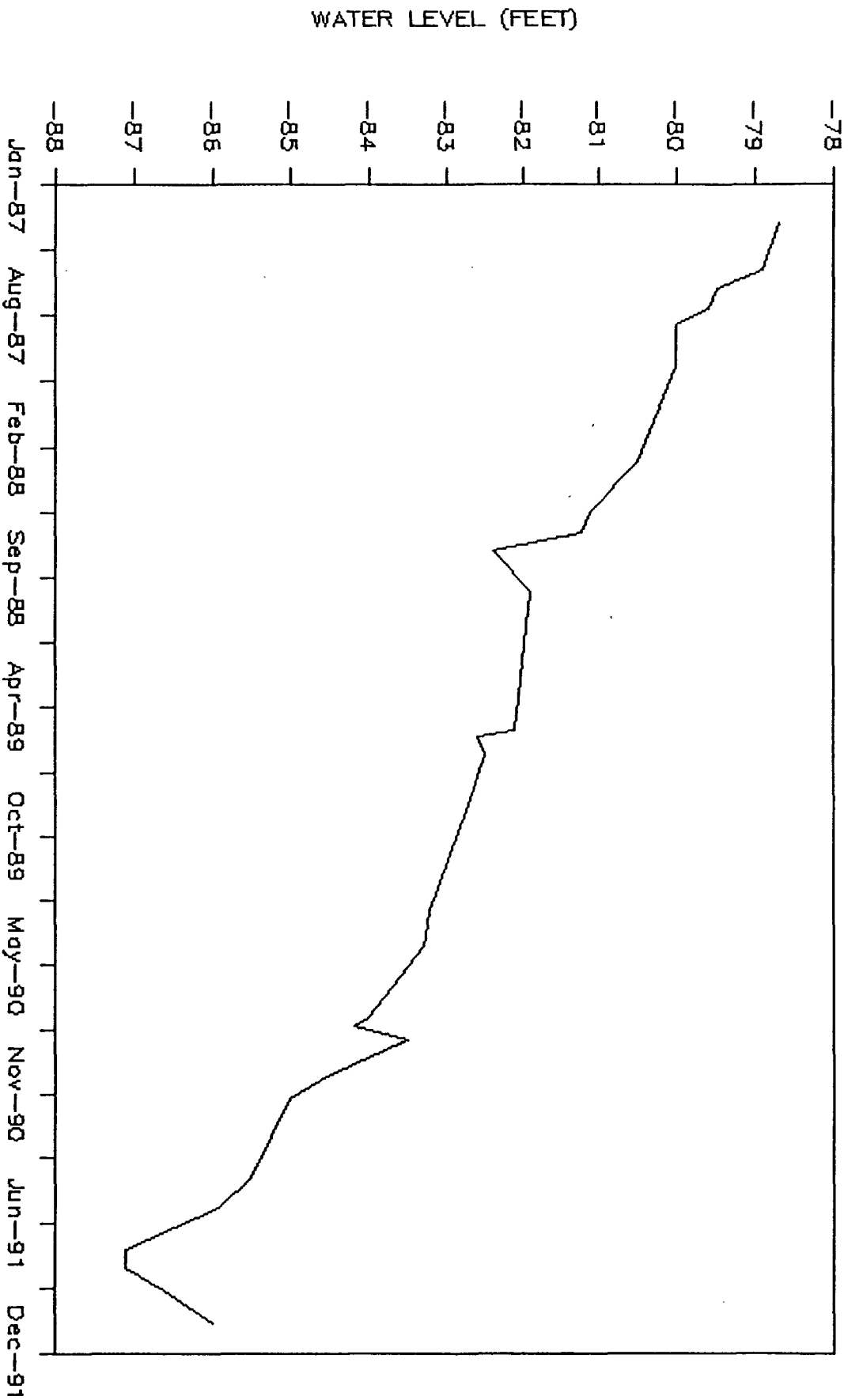
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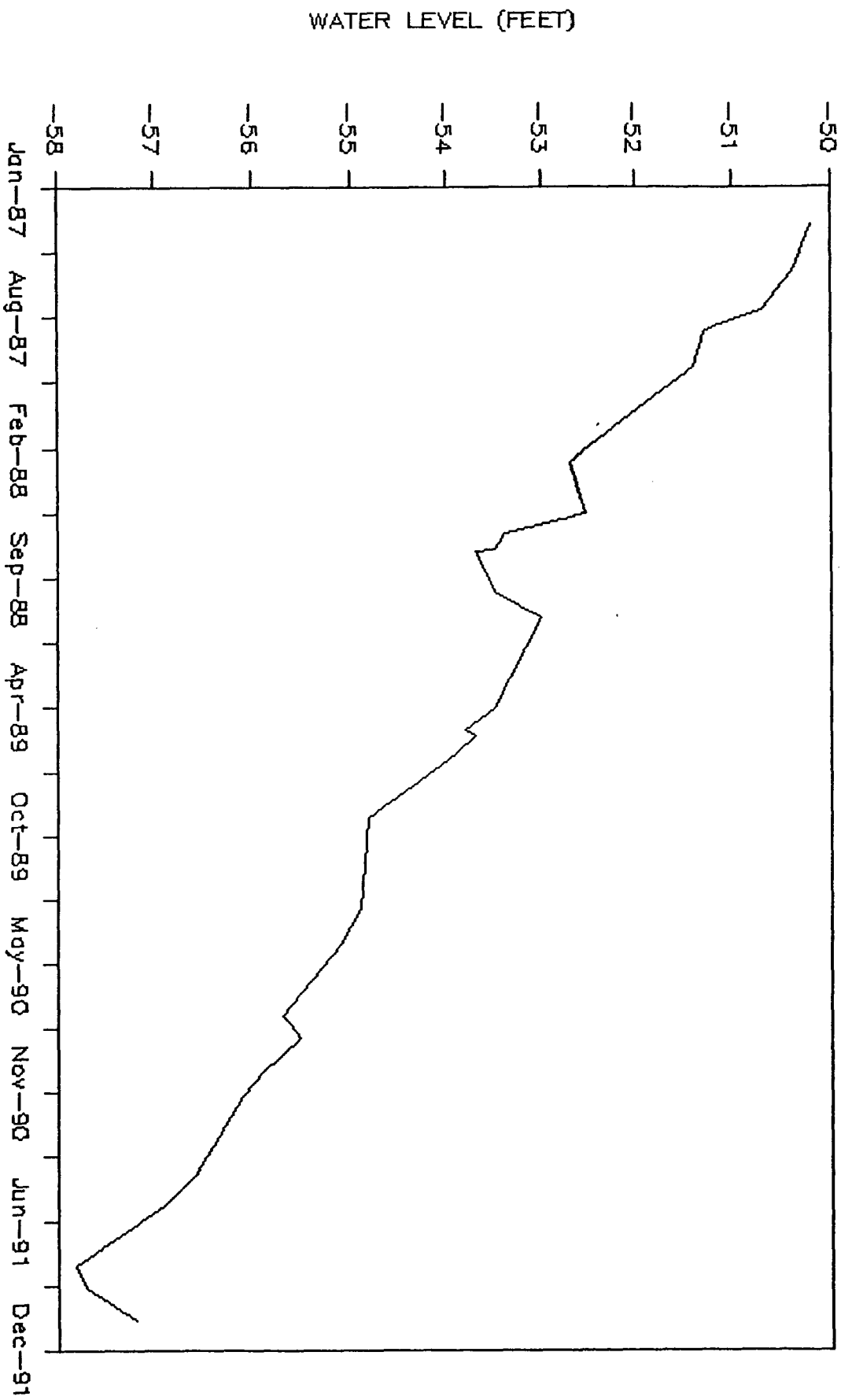
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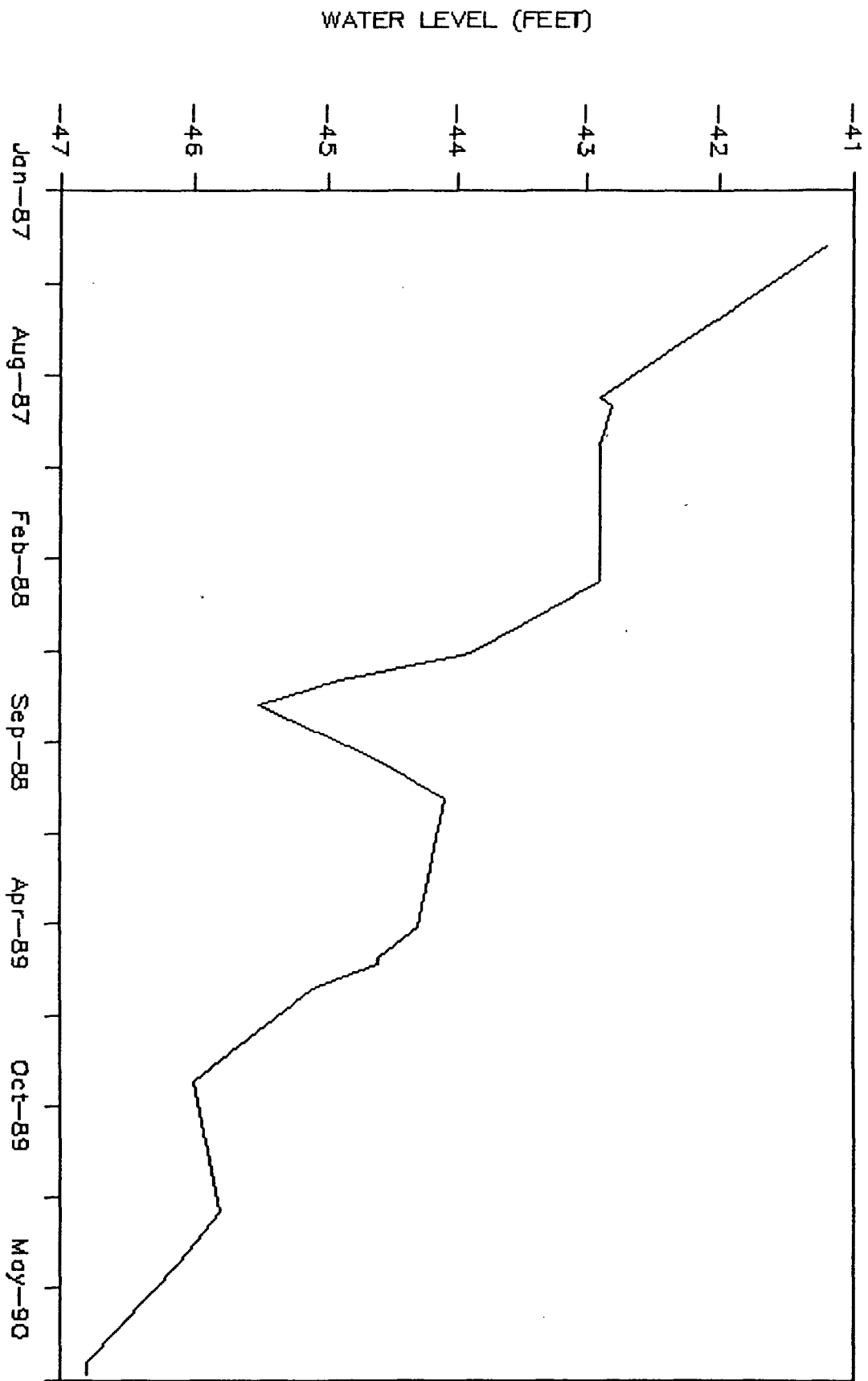
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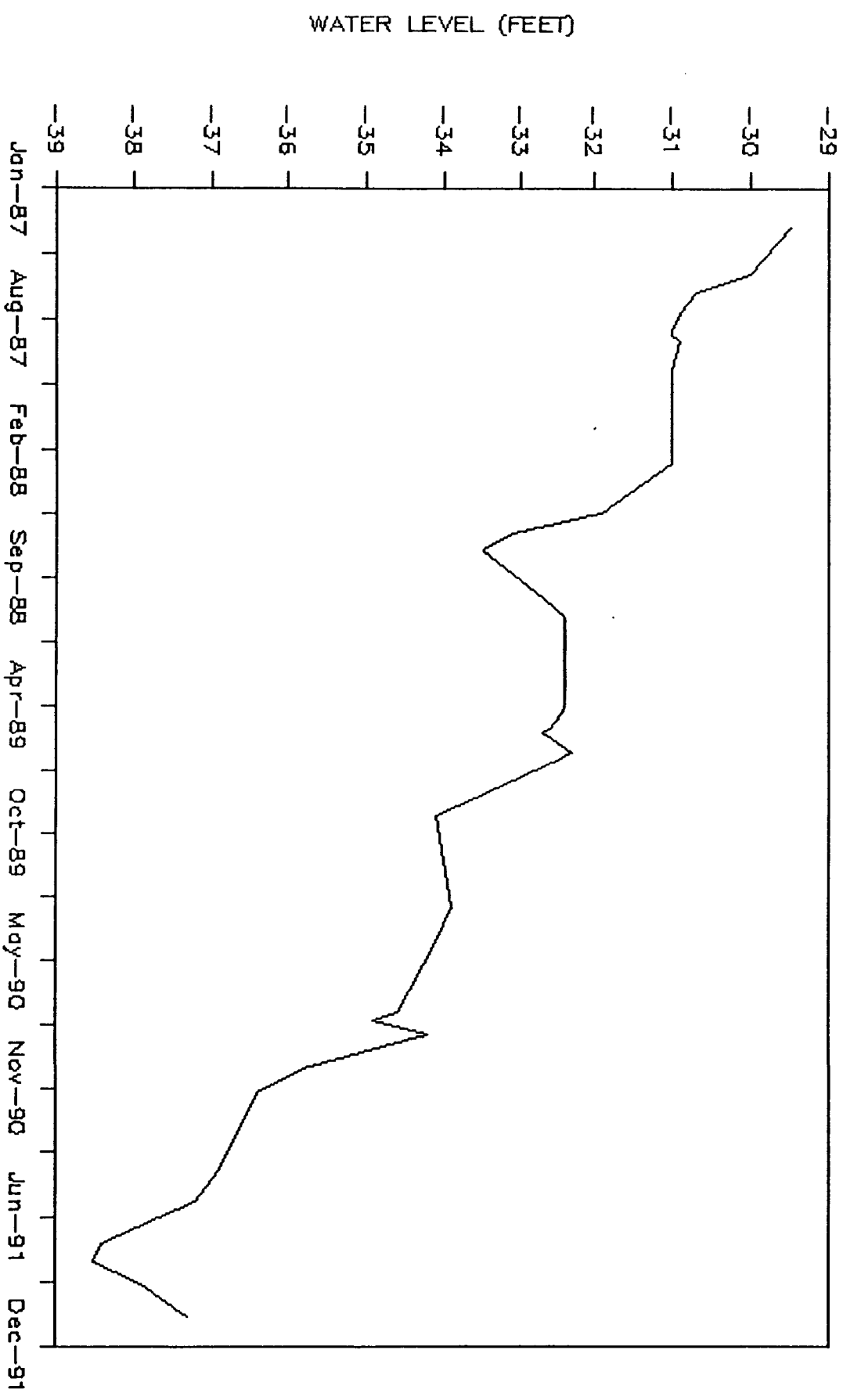
WATER RIGHTS OBSERVATION WELL

MA-87H



WATER RIGHTS OBSERVATION WELL

MA-871



DEPARTMENT OF WATER AND NATURAL RESOURCES
PERMIT LISTING

DATE 01/24/92

NR02P400

PAGE

AQUIFER = SRKC

MNGMT UNIT =

PERMIT TYPE =

USE TYPE =

PERMIT#	CNTY	PERMIT HOLDER	LEGAL	PERMIT CFS/AFS ACREAGE	USE SRC	DIVERSION SOURCE	AQFR	LICENSED CFS/AFS ACREAGE	COMPLETION DATE
561-3	MA	NORTHERN STATES POWER CO *	102N48W32BC	CFS- AFS- ACR- 1.77	IND G	GROUNDWATER	SRKC	CFS- AFS- ACR- 1.77	02/04/64
742-3	MA	NORTHERN STATES POWER CO *	102N48W31AA	CFS- AFS- ACR- .33	IND G	GROUNDWATER	SRKC	CFS- AFS- ACR- .33	10/19/63
1138-3	MA	VALLEY SPRINGS TOWN OF	101N47W03C	CFS- AFS- ACR- .33	MUN G	GROUNDWATER SEE ALSO 2113-3	SRKC	CFS- AFS- ACR- .33	01/20/66
2113-3	MA	VALLEY SPRINGS CITY OF	101N47W03	CFS- AFS- ACR- .33	MUN G	GROUNDWATER SEE ALSO 1138-3	SRKC	CFS- AFS- ACR- .33	05/13/75
4928-3	MA	CORSON VILLAGE WATER *	102N48W27AA	CFS- AFS- ACR- .01	SHD G	GROUNDWATER	SRKC	CFS- AFS- ACR- .01	01/00
4929-3	MA	CORSON VILLAGE WATER *	102N48W27AA	CFS- AFS- ACR- .05	SHD G	GROUNDWATER	SRKC	CFS- AFS- ACR- .05	00/00
5276-3	MA	BRANDON WOOD PRESERVING *	102N48W27DD	CFS- AFS- ACR- .10	IND G	GROUNDWATER	SRKC	CFS- AFS- ACR- .10	00/00
5296-3	MA	BRANDON CITY OF	102N48W35CB	CFS- AFS- ACR- .33	MUN G	GROUNDWATER	SRKC	CFS- AFS- ACR- .33	05/10/94
5372-3	MA	SWENSON TOWN OF NANCY	101N47W08BB 101N47W08BC 101N47W08BA 101N47W08BD	CFS- AFS- ACR- .06	IRR G	GROUNDWATER	SRKC	CFS- AFS- ACR- .06	03/07/95
5395-3	MA	BRANDON CITY OF	102N48W35CB	CFS- AFS- ACR- .43	MUN G	GROUNDWATER	SRKC	CFS- AFS- ACR- .43	05/24/95
5444-3	MA	VALLEY SPRINGS CITY OF	101N47W03 101N47W04	CFS- AFS- ACR- .00	MUN G	GROUNDWATER	SRKC	CFS- AFS- ACR- .00	00/00
5463-3	MA	CORSON VILLAGE WATER *	102N48W27AA	CFS- AFS- ACR- .04	MUN G	GROUNDWATER FROM F/U 4929-3	SRKC	CFS- AFS- ACR- .04	10/03/95
5507-3	MA	BRANDON CITY OF	102N48W35DC	CFS- AFS- ACR- .05	MUN G	GROUNDWATER	SRKC	CFS- AFS- ACR- .05	05/01/96
4974A-3	MA	PINELAKE HILLS HOMEOWNERS *	101N48W18AD	CFS- AFS- ACR- .06	SHD G	GROUNDWATER INC'S 4974-3	SRKC	CFS- AFS- ACR- .06	12/10/91

PARTIALLY
ABANDONED

MANURE
SPLIT
OUT
6E(1)

4929-3
FUTURE USE
SEE 5276-3

5296-3
1804-3
AND

5372-3
CANCELED PERMIT

5395-3
(AMALGAMATED)

RECOMMENDATION OF CHIEF ENGINEER FOR WATER PERMIT
APPLICATION NO. 5597-3, Northern States Power Company

Pursuant to SDCL 46-2A-2, the following is the recommendation of the Chief Engineer, Water Rights Division, Department of Environment and Natural Resources concerning Water Permit Application No. 5597-3, Northern States Power Company, 414 Nicollet Mall, Minneapolis, MN 55401.

The Chief Engineer is recommending APPROVAL of Application No. 5597-3 because 1) there is reasonable probability that there is unappropriated water available for the applicant's proposed use, 2) the proposed diversion can be developed without unlawful impairment of existing rights, 3) the proposed use is a beneficial use and 4) in the public interest with the following qualification:

The well approved under this Permit will be located near domestic wells and other wells which may obtain water from the same aquifer. The well owner under this Permit shall control his withdrawals so there is not a reduction of needed water supplies in adequate domestic wells or in adequate wells having prior water rights.

See report on application for additional information.



JOHN HATCH, Chief Engineer
January 17, 1992



GREAT FACES. GREAT PLACES.

**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE SOUTH DAKOTA 57501-3181

NOTE: TO BE SURE OF PUBLICATION ON
THE CORRECT DATES, CONTACT
THE NEWSPAPER RIGHT AWAY.

January 30, 1992

James Alders
Northern States Power Company
414 Nicollet Mall
Minneapolis, MN 55401

Dear Mr. Alders:

Water Permit Application Nos. 5596-3 and 5597-3 for industrial use have been examined and found to comply with the South Dakota Water Laws and applicable rules. A notice of hearing has been sent to the Publisher of the Argus Leader printed at Sioux Falls, SD. For your information, a copy of the notice is enclosed. Please review the notice prior to publication and notify this office, if you have any corrections or questions.

Be sure to contact the above newspaper to authorize publication of your Notice of Hearing and to arrange for payment. Early contact with the paper can eliminate delays. The publisher has been instructed to publish your notice once each week for two consecutive weeks with the last publication to occur twenty days before the board meeting. The newspaper has been instructed to send us the Proof of Publication. We must receive Proof of Publication before action can be taken on the applications.

Sincerely,

Eric Gronlund
Natural Resources Engineer
605 773-3352

enclosures

NOTE: If you plan to contest any part of the Chief Engineer's recommendations, you must file a petition pursuant to the procedures outlined in the attached notice of hearing. The Water Management Board will then consider your concerns during a hearing on the applications.



GREAT FACES. GREAT PLACES.

**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE SOUTH DAKOTA 57501-3181

January 30, 1992

Argus Leader
PO Box 5034
Sioux Falls, SD 57117-5034

ATTENTION: Legal Department

Enclosed is a Notice of Hearing on Application Nos. 5596-3 and 5597-3 to be published twice. Please publish the first notice on February 6, 1992, with the second publication 7 days later.

The APPLICANT MUST VERIFY TO YOU THAT THE NOTICE IS TO BE PUBLISHED, before you make the first publication. Please BILL the APPLICANT for the cost of publication. The APPLICANT is Northern States Power Company, 414 Nicollet Mall, Minneapolis, MN 55401.

A copy of BOTH publications must be SENT to the WATER RIGHTS DIVISION. IMMEDIATELY return the FIRST publication with the FIRST Transmittal form on the bottom of this page. The first copy is needed to check the publication for errors so any corrections can be made in the second publication. Publication errors can invalidate the public notice and cause the applicant costly delays.

Please be sure the SECOND publication is returned IMMEDIATELY with the enclosed Proof of Publication form. DO NOT WAIT until the end of the month or the billing cycle. No action may be taken on the permit application until proof of publication has been received.

Sincerely,

Eric Gronlund
Natural Resources Engineer
605 773-3352

enclosures

-----CUT HERE-----

FIRST TRANSMITTAL NOTICE

TO: Eric Gronlund
Water Rights Division
Joe Foss Building
Pierre SD 57501-3181

No. _____

Date _____

We are in receipt of your letter of _____ enclosing Notice of Hearing to
Appropriate Water by Application No. _____ which was first published in our issue
of _____. ENCLOSED IS A COPY OF THIS FIRST PUBLICATION.

Name

Newspaper

Instruction to Newspaper - Publish first Notice on February 6, 1992, with the second publication 7 days later. The applicant is responsible for payment.

NOTICE OF HEARING on Application Nos. 5596-3 and 5597-3 to Appropriate Water

Notice is given that Northern States Power Company, 414 Nicollet Mall, Minneapolis, MN 55401 has filed applications for water permits.

Water Permit Application No. 5596-3 appropriates an additional 1.18 cubic feet of water per second (cfs) from one well authorized by Water Right No. 561-3. Water Right No. 561-3 diverts 0.04 cfs from one well (Split Rock Creek Aquifer) 222 feet deep located in the SW 1/4 NW 1/4 Section 32-T102N-R48W. The water is for industrial use at the power plant.

Water Permit Application No. 5597-3 appropriates an additional 0.22 cfs from one well authorized by Water Right No. 742-3. Water Right No. 742-3 diverts 0.11 cfs from one well (Split Rock Creek Aquifer) 170 feet deep located in the NE 1/4 NE 1/4 Section 31-T102N-R48W. The water is for industrial use at the power plant.

Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of Application Nos. 5596-3 and 5597-3 because 1) unappropriated water is available, 2) existing rights will not be unlawfully impaired, 3) it is a beneficial use of water, and 4) it is in the public interest. Unless a petition is filed opposing the applications or the applicant files a petition contesting the chief engineer's recommendations, the Water Management Board will NOT CONDUCT a HEARING to consider the applications and the chief engineer will issue the permits as recommended. Petitions filed in support of the applications will NOT require the Board to hear the applications.

Any person interested in opposing or supporting the applications must file a written petition with BOTH the applicant and Chief Engineer. The applicant must also file a petition if opposed to the Chief Engineer's recommendations. The Chief Engineer's address is "Water Rights Division, Foss Building, 523 E Capitol, Pierre SD 57501 (605 773-3352)" and the applicant's mailing address is given above. A petition filed by either an interested person or the applicant must be filed by February 24, 1992. The petition may be informal, but must include a statement describing the petitioner's interest in the applications, the petitioner's reasons for opposing or supporting the applications, and the signature and mailing address of the petitioner or the petitioner's legal counsel, if legal counsel is obtained.

If a petition is filed opposing the applications or the applicant files a petition contesting the chief engineer's recommendations, the Board will consider the applications on March 4, 1992, at 10:00 am, Floyd Matthew Training Center, Joe Foss Building, 523 East Capitol, Pierre, SD 57501. If a hearing is held, the Chief Engineer's recommendations are not final or binding upon the Board. The Board is authorized to 1) approve, 2) approve with qualifications, 3) defer, or 4) deny the applications based on the facts presented at the public hearing. The March 4, 1992, hearing date will be automatically delayed for at least 20 days upon written request to the Chief Engineer from the applicant or any interested person opposing the applications. The request for an automatic delay must be filed by February 24, 1992.

Any hearing will be an adversary proceeding. Any person filing a petition and/or the applicant have the right to be represented by a lawyer and may present evidence or cross-examine witnesses according to SDCL 1-26. These and other due process rights will be forfeited if not exercised. Decisions of the Board may be appealed to the Circuit Court and State Supreme Court as provided by law. Contact the Water Rights Division to request copies of information pertaining to the applications or to assure access to the hearing by the handicapped.

These applications are made pursuant to SDCL 46-1-1 thru 46-1-9, 46-1-12 thru 46-1-16; 46-2-3.1, 46-2-9, 46-2-11, 46-2-13, 46-2-17; 46-2A-1 thru 46-2A-10, 46-2A-12, 46-2A-14, 46-2A-15; 46-5-1 thru 46-5-11, 46-5-13 thru 46-5-15, 46-5-24, 46-5-25, 46-5-30.2, 46-5-30.4, 46-5-31; 46-6-3, 46-6-3.1, 46-6-6.1, 46-6-10, 46-6-13, 46-6-14, 46-6-26; and Board Rules ARSD 74:02:01:01 thru 74:02:01:15.

PROOF OF PUBLICATION

STATE OF SOUTH DAKOTA)
) ss.
 County _____)

I, M. DEVISH

certify that the attached printed Notice was taken
 from the Argus Leader

A newspaper which during the whole time of publication of
 said notice herein after stated, has been and is printed and
 published in the _____

_____ city _____ of Sioux Falls

County of Minnehaha and State of South Dakota;
 that the said notice was published in said newspaper on the
 following two dates:

Thursday, February 6, 1992

Thursday, February 13, 1992

Mary Devish
 (Signature) *JD*

Controller
 (Title)

2/13/92
 (Date Signed)

Cost of Printing: \$119.61

These applications are made pursuant to SDCL 46-1-1 thru 46-1-9, 46-1-12 thru 46-1-18; 46-2-3.1, 46-2-9, 46-2-11, 46-2-13, 46-2-17; 46-2A-1 thru 46-2A-10, 46-2A-12, 46-2A-14, 46-2A-15; 46-5-1 thru 46-5-11, 46-5-13 thru 46-5-15, 46-5-24, 46-5-25, 46-5-30.2, 46-5-30.4, 46-5-31; 46-6-3, 46-6-3.1, 46-6-6.1, 46-6-10, 46-6-13, 46-6-14, 46-6-26; and Board Rules ARSD 74:02:01:01 thru 74:02:01:15.
 915 Feb. 6, 13, 1992

NOTICE OF HEARING on
 Application Nos. 5596-3 and 5597-3
 to Appropriate Water

Notice is given that Northern
 States Power Company, 414 Nicollet Mall, Minneapolis, MN 55401 has filed applications for water permits.

Water Permit Application No. 5596-3 appropriates an additional 1.18 cubic feet of water per second (cfs) from one well authorized by Water Right No. 561-3. Water Right No. 561-3 diverts 0.04 cfs from one well (Split Rock Creek Aquifer) 222 feet deep located in the SW 1/4 NW 1/4 Section 32-T102N-R48W. The water is for industrial use at the power plant.

Water Permit Application No. 5597-3 appropriates an additional 0.22 cfs from one well authorized by Water Right No. 742-3. Water Right No. 742-3 diverts 0.11 cfs from one well (Split Rock Creek Aquifer) 170 feet deep located in the NE 1/4 NE 1/4 Section 31-T102N-R48W. The water is for industrial use at the power plant.

Pursuant to SDCL 46-2A-2, the Chief Engineer recommends APPROVAL of Application Nos. 5596-3 and 5597-3 because 1) unappropriated water is available, 2) existing rights will not be unlawfully impaired, 3) it is a beneficial use of water, and 4) it is in the public interest. Unless a petition is filed opposing the applications or the applicant files a petition contesting the chief engineer's recommendations, the Water Management Board will NOT CONDUCT a HEARING to consider the applications and the chief engineer will issue the permits as recommended. Petitions filed in support of the applications will NOT require the Board to hear the applications.

Any person interested in opposing or supporting the applications must file a written petition with BOTH the applicant and Chief Engineer. The applicant must also file a petition if opposed to the Chief Engineer's recommendations. The Chief Engineer's address is "Water Rights Division, Foss Building, 523 E. Capitol, Pierre, SD 57501 (605 773-3352)" and the applicant's mailing address is given above. A petition filed by either an interested person or the applicant must be filed by February 24, 1992. The petition may be informal, but must include a statement describing the petitioner's interest in the applications, the petitioner's reasons for opposing or supporting the applications, and the signature and mailing address of the petitioner or the petitioner's legal counsel, if legal counsel is obtained.

If a petition is filed opposing the applications or the applicant files a petition contesting the chief engineer's recommendations, the Board will consider the applications on March 4, 1992, at 10:00 am, Floyd Matthew Training Center, Joe Foss Building, 523 East Capitol, Pierre, SD 57501. If a hearing is held, the Chief Engineer's recommendations are not final or binding upon the Board. The Board is authorized to 1) approve, 2) approve with qualifications, 3) defer, or 4) deny the applications based on the facts presented at the public hearing. The March 4, 1992, hearing date will be automatically delayed for at least 20 days upon written request to the Chief Engineer from the applicant or any interested person opposing the applications. The request for an automatic delay must be filed by February 24, 1992.

Any hearing will be an adversary proceeding. Any person filing a petition and/or the applicant have the right to be represented by a lawyer and may present evidence or cross-examine witnesses according to SDCL 1-26. These and other due process rights will be forfeited if not exercised. Decisions of the Board may be appealed to the Circuit Court and State Supreme Court as provided by law. Contact the Water Rights Division to request copies of information pertaining to the applications or to assure access to the hearing by the handicapped.





GREAT FACES. GREAT PLACES.

**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE SOUTH DAKOTA 57501-3181

January 31, 1992

James Alders
Northern States Power Company
414 Nicollet Mall
Minneapolis, MN 55401

RE: Water Permit Application No. 5596-3 and 5597-3

Dear Mr. Alders:

Enclosed please find a copy of the report and recommendations in regard to the above-referenced matter.

Sincerely,

Eric Gronlund
Natural Resources Engineer
(605) 773-3352

cc: Lyle Johnson, Utility Mgr, City of Sioux Falls, 224 W 9th Street,
Sioux Falls, SD 57102

NOTE: If you plan to contest any part of the Chief Engineer's recommendations, you must file a petition pursuant to the procedures outline in the notice of hearing you received with a letter dated January 30, 1992. The Water Management Board will then consider your concerns during a hearing on the application.



MAY 1 1992

**DEPARTMENT of ENVIRONMENT
and NATURAL RESOURCES**

JOE FOSS BUILDING
523 EAST CAPITOL
PIERRE SOUTH DAKOTA 57501-3181

James Alders
Northern States Power Company
414 Nicollet Mall
Minneapolis, MN 55401

Dear Mr. Alders:

Enclosed are Water Permit Nos. 5596-3 and 5597-3 authorizing construction of your water diversion systems and beneficial use of the water, not exceeding the limits as specified in the Water Permits.

Also enclosed is Form 10, Notice of Completion of Works and Application of Water to Beneficial Use, which you are to complete and submit to the Chief Engineer when you have completed the systems and/or have put the water to beneficial use. An inspection can then be scheduled so that the Water Licenses may be issued, thus completing your acquisition of a Water Right.

Very truly yours,

JOHN HATCH, Chief Engineer
Water Rights Division
605 773-3352

enclosures

PLEASE NOTE: Certain changes can be made in your permits within the five year construction period, usually without affecting the priority date provided an application to amend your permits are made within the five year period - i.e. changes in location or number of diversion points (wells) or location of land to be irrigated. Well locations for wells into the same aquifer can be moved up to 660 feet without application.

Applications to amend a permit after the five year construction period will be assigned a new priority date. Applications to change water sources, to add lands or increase original diversion rates, if approved will usually receive the date of the new application as a priority date regardless of the five year construction period.

Water Rights Division - DENR

Conversation or File Documentation

Name of Person: Kevin Korn, NSP File No. 5597-3 and 5861-3
Address: Pathfinder Site, Sioux Falls, SD County: Minnehaha
Date: 7-21-97 Telephone: (605)331-1212
RE: New well to be drilled.

Comments:

The new well to be drilled under 5861-3 is under contract but has not been drilled yet.
Permit Nos. 5597-3 and 5861-3 need to be inspected when 5861-3 is completed. The well
under 5861-3 is a replacement for 5597-3.



Lynn Beck
Natural Resources Engineer

This well will be replaced by a well under 5861-3
FIELD INVESTIGATION REPORT FOR PERMIT NO. 5597-3

DATE OF INVESTIGATION:	
NAME & ADDRESS OF INVESTIGATION CONTACT/ RELATIONSHIP TO PERMIT HOLDER, IF APPLICABLE	Kevin Korn Redfincher Site, Sioux Falls
NAME & ADDRESS OF PERMIT HOLDER	Northern States Power Company 414 Nicollet Mall, Minneapolis MN 55401-1927
DIVERSION POINT LEGAL LOCATION	NE ⁴ NE ⁴ 31-102-48 42' W 1270' S of NE cr. 31-102-48

Other permit(s) associated with the project: ^{Lic.} 742-3 - one well

WELL INFORMATION: Well B - domestic well to be replaced by 5861-3 not constr. yet.

- 1) Well Drilling Firm: Layne-Minnesota Company
- 2) No. of Wells 1
- 3) Depth(s) 170 feet
- 4) Well log is available Y/N Plain Fork
- 5) Comment: _____

- Casing: 12 outer
- 1) Diameter 8 inches inner
- 2) Length 155 feet
- 3) Type Carbon Steel

Screen:

- 1) Type Stainless steel
- 2) Length 15 feet
- 3) Static water level 57 feet

Pump:

- 1) Make Layne Bowler
- 2) Model _____
- 3) Size 8"
- 4) Capacity 150 GPM, 11 cfs under 742-3
22 cfs under 5597-3

Motor:

- 1) Make Allis-Chalmers Electric
- 2) Model No. H50-5
- 3) Horsepower rating 15 hp

DISTRIBUTION LINES OR CANALS:

- 1) Type _____ 2) Size 4 inches 3) Length 2500 feet

SYSTEM TYPE:

Center pivot:

- 1) Make _____ 5) End gun Y/N
- 2) Overall length _____ feet 6) High or low pressure _____
- 3) Number of towers _____ 7) Capacity _____ GPM
- 4) Distance between towers _____ feet

Gun:

- 1) Make _____
- 2) Nozzle size _____ inches
- 3) Capacity _____ GPM
- 4) Hose size _____ inches

Sideroll:

- 1) Length _____ feet
- 2) Diameter of pipe _____ inches
- 3) Sprinkler spacing _____ feet

Towline:

- 1) Length _____ feet
- 2) Diameter _____ inches
- 3) Spacing of gates _____ inches

Siphons:

- 1) Size _____ inches
- 2) Number _____

DAM INFORMATION:

- 1) Height to crest _____ feet
- 2) Height to primary spillway _____ feet
- 3) Height to secondary spillway _____ ft
- 4) Crest width _____ feet
- 5) Crest length _____ feet
- 6) Spillway length _____ feet
- 7) Spillway width _____ feet
- 8) Approx. storage _____ ac-ft
- 9) Approx. storage to crest _____ ac-ft
- 10) Date constructed: _____

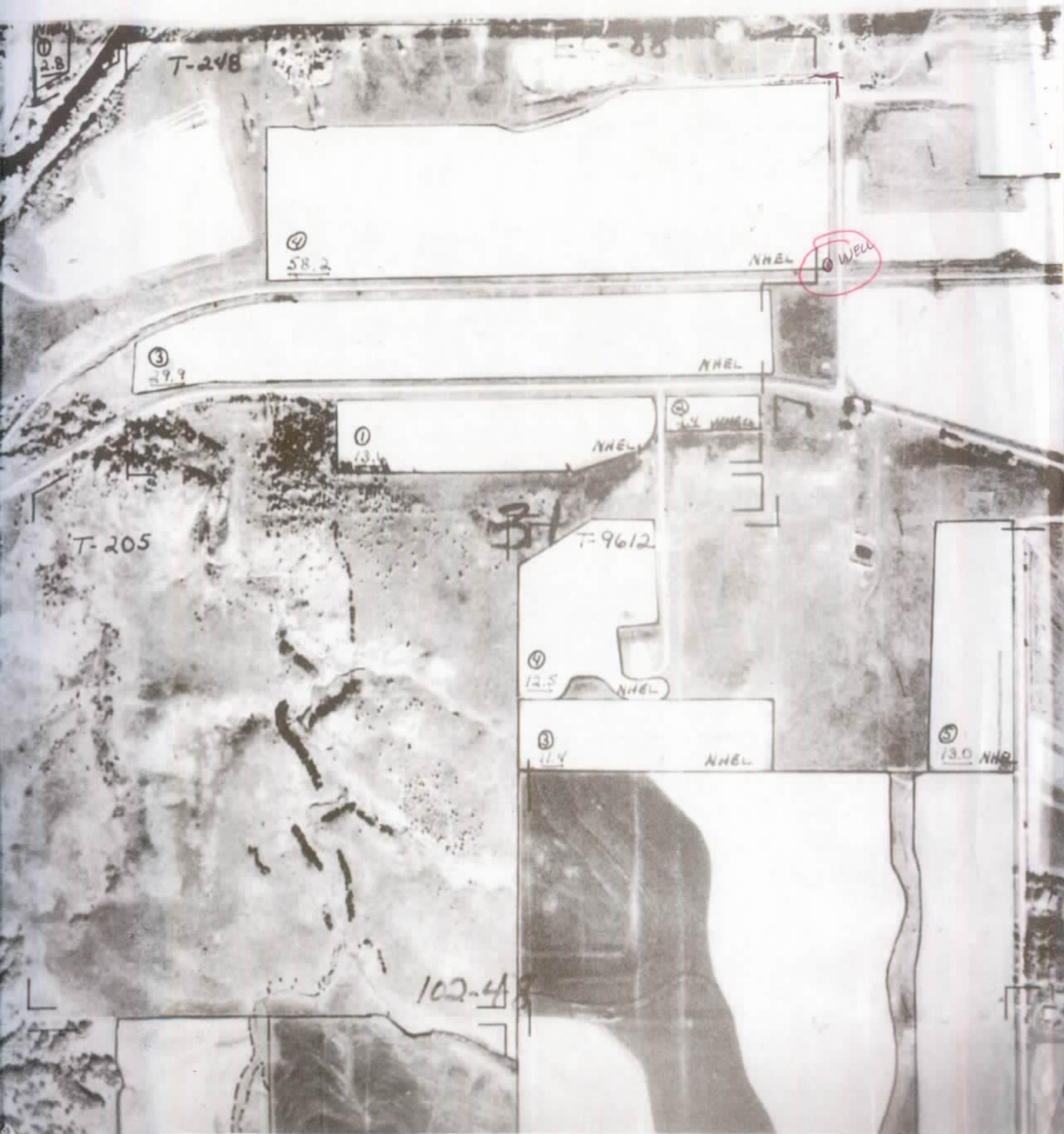
CHEMIGATION EQUIPMENT:

- 1) Does chemigate Y/N
- 2) Main line check valve Y/N
- 3) Inspection port/air relief Y/N
- 4) Low pressure drain Y/N
- 5) Discharge is 20' from source Y/N
- 6) Interlock type electrical or mechanical
- 7) Injection pump type piston or other
- 8) Injection check valve Y/N
- 9) Injection line check valve or positive displacement pump Y/N
- 10) All chemigation equipment appears to be installed in the proper position and complies with chemigation laws and rules Y/N
- 11) Comments: _____

PERMIT QUALIFICATIONS:

- 1) Special qualifications to permit being abided by Y/N
- 2) All structures, wells and lands on map Y/N
- 3) Irrigation Questionnaires checked to determine if permit owner started irrigation by the end of construction period Y/N

MAP NOT TO SCALE
THIS IS NOT AN OFFICIAL WETLAND MAP.



No 5597-3 No 742-3

STATE OF SOUTH DAKOTA

WATER LICENSE NO. 5861-3

(1) Northern States Power Company, 414 Nicollet Mall, Minneapolis MN 55401-1927 made Application No. 5861-3, December 23, 1994 for a water permit to divert an additional 1.44 cubic feet of water per second (cfs) from groundwater (one well), Minnehaha County, South Dakota for industrial purposes. Permit No. 5861-3, with a priority date of April 13, 1995 was approved July 17, 1995 and issued to the applicant for diversion of water with construction of the described water supply system to be completed on or before July 17, 2000 and for the application to beneficial use of water on or before July 17, 2004.

The permit holder submitted a *Notice of Completion of Works and Application of Water to Beneficial Use* on February 6, 1998. The *Notice* stated the diversion system was completed on September 30, 1997 and the water placed to beneficial use on January 8, 1998.

Water Right No. 742-3, with a priority date of September 17, 1960 authorized diversion of 0.11 cfs and Water Permit No. 5597-3, with a priority date of October 3, 1991 authorized diversion of an additional 0.22 cfs; both from the same well as authorized by Permit No. 5861-3. The applicable portions of Water Right No. 742-3 and Water Permit No. 5597-3 are incorporated into No. 5861-3.

(2) The water supply system has been completed and water applied to beneficial use in accordance with South Dakota State Law. Pursuant to South Dakota Codified Law 46-5-30.1, the holder and/or owner of Incorporated Water Right No. 5861-3 is issued a license, bearing priority dates of October 3, 1991 (0.11 cfs), September 17, 1960 (0.22 cfs) and April 13, 1995 (0.78 cfs) to appropriate 1.11 cubic feet of water per second from groundwater (one well) for industrial purposes.

The diversion point is located: 1,240 feet south and 50 feet east of the northwest corner of Section 32-T102N-R48W (NW ¼ NW ¼).

(3) This license is subject to South Dakota Water Law, any limitations or conditions listed in Water Permit No. 5861-3 including the following now applicable qualifications:

- The well approved under this Permit will be located near domestic wells and other wells which may obtain water from the same aquifer. The well owner under this Permit shall control his withdrawals so there is not a reduction of needed water supplies in adequate domestic wells or in adequate wells having prior water rights.
- The well authorized by Permit No. 5861-3 shall be constructed by a licensed well driller and construction shall comply with Water Management Board Well Construction Rules, Chapter 74:02:04 with the well casing pressure grouted (bottom to top) from the producing formation to the surface pursuant to Section 74:02:04:28.
- That Northern States Power Company shall report to the chief engineer annually the amount of water withdrawn each year from the Split Rock Creek Aquifer.



Garland Erbele, Chief Engineer
Water Rights Program
Department of Environment and Natural Resources

APR 23 2004

date

