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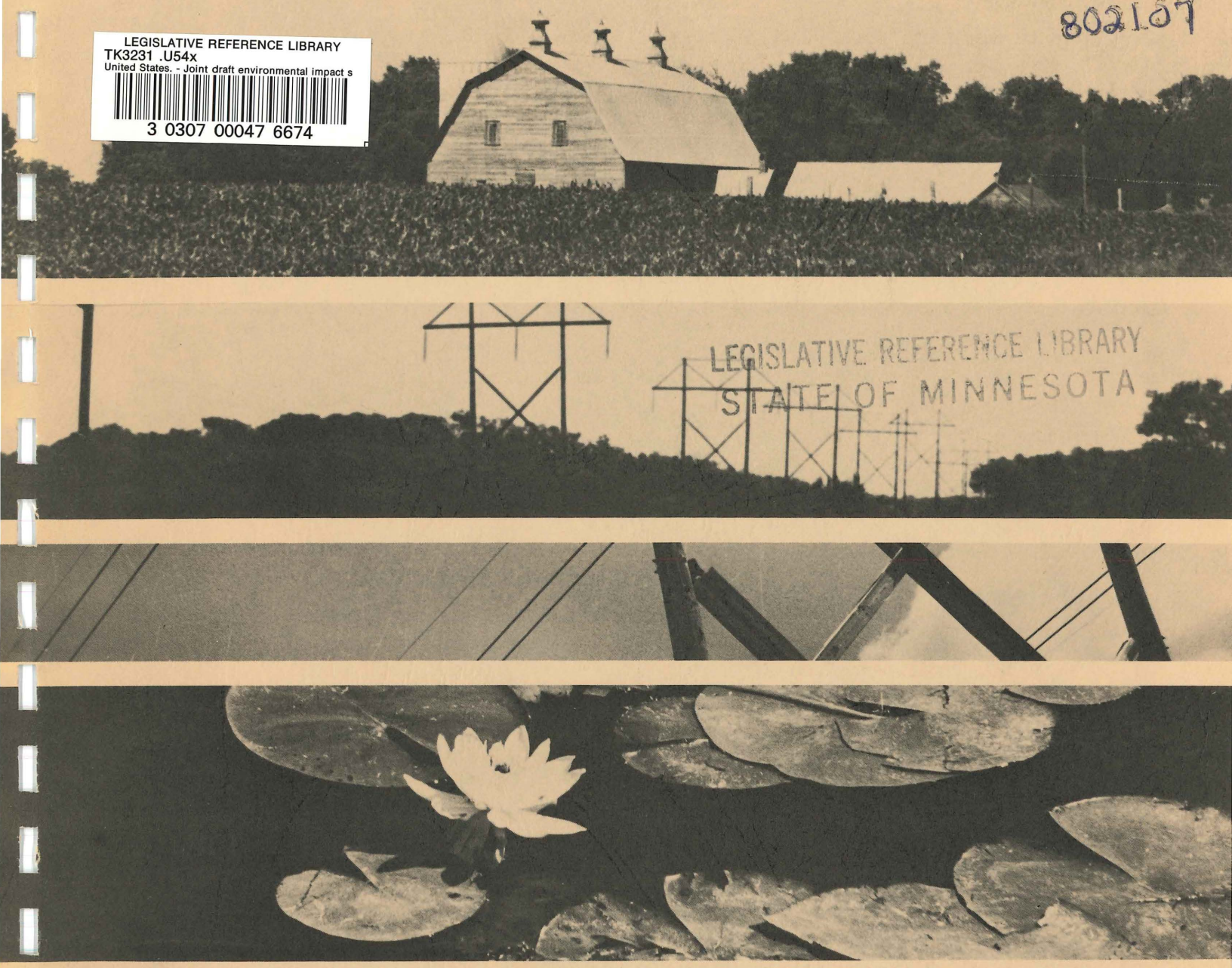

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FOR A 345kv TRANSMISSION LINE FROM SHERBURNE COUNTY TO BENTON COUNTY, MINNESOTA

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CAPITOL SQUARE BUILDING
550 CEDAR STREET
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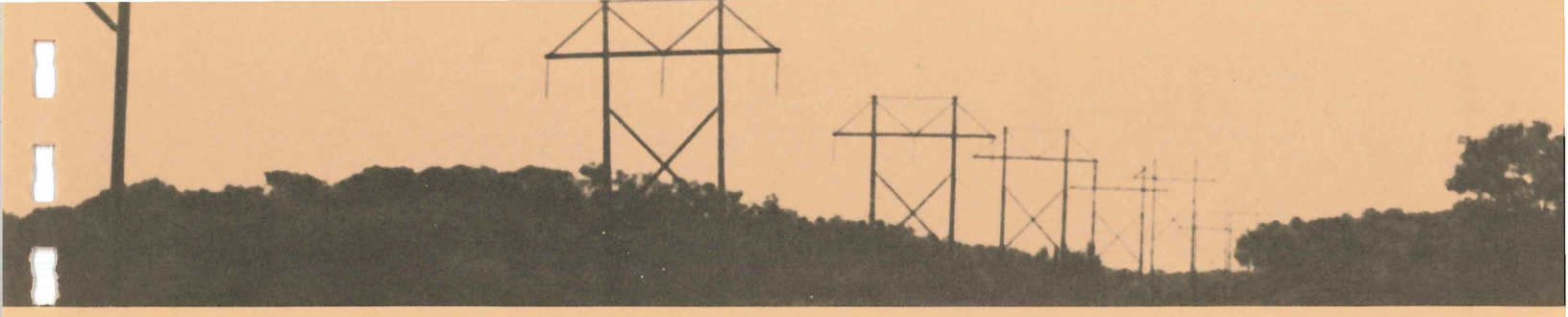

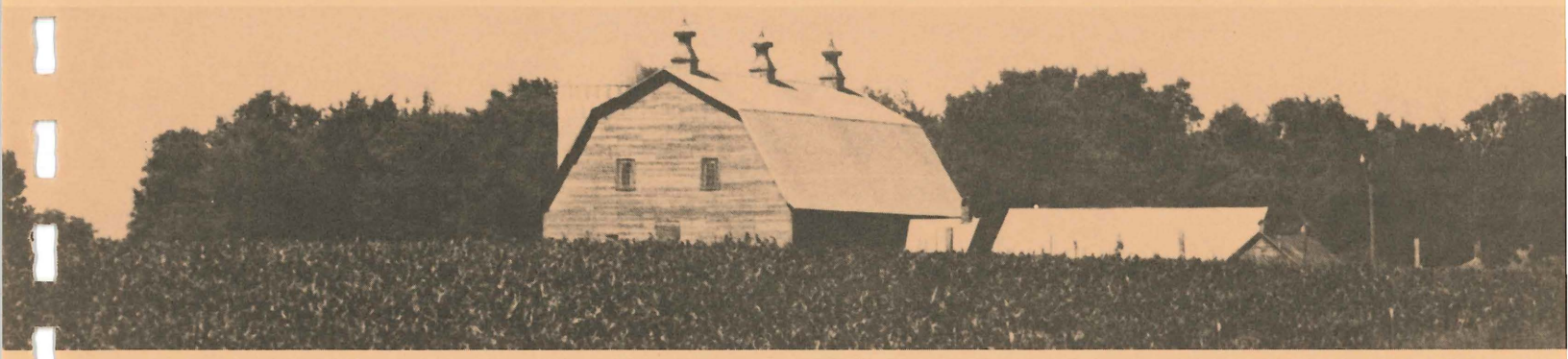

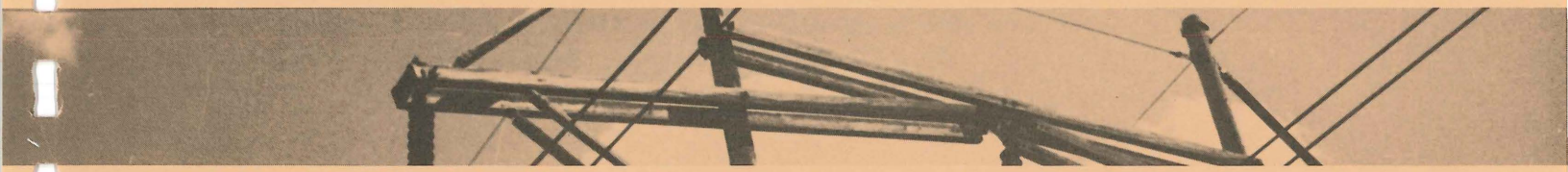

summary

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CHAPTER I
SUMMARY

1.1 INTRODUCTION

Northern States Power Company (NSP), United Power Association (UPA) and Cooperative Power Association (CPA) have jointly applied to the Minnesota Environmental Quality Board (MEQB) for a Construction Permit for a single circuit 345,000 volt (345 kV) ac transmission line pursuant to the provisions of the Power Plant Siting Act (Minnesota Statutes, Section 116.51 et seq. as amended 1977 and 1978).

Although a joint venture, NSP is acting as the regulatory coordinator responsible for obtaining necessary construction permits, undertaking right of way negotiations and other necessary actions related to the siting and construction processes. UPA and CPA have applied to the Rural Electrification Administration (REA) for a loan guarantee to construct the proposed transmission facilities. The REA has determined that construction of the proposed transmission line is a major federal action significantly affecting the quality of the human environment, thus requiring the preparation of a Federal Environmental Impact Statement (EIS).

On February 21, 1980, the MEQB accepted for public hearing the proposed routes which are included in this evaluation, and ordered the preparation of an Environmental Impact Statement. It was determined by REA and the MEQB that a joint Federal-State EIS would be appropriate for this project. Notification of intent to prepare a joint draft EIS appeared in the Federal Register on February 15, 1980, and in the MEQB Monitor on March 10, 1980.

On December 12, 1979, a Federal/State interagency meeting was held at UPA's Elk River office, to review the project and to identify the relevant environmental issues. A tour of the various route alternatives followed the interagency meeting. Representatives of the following Federal and State agencies attended:

Anoka Electric Cooperative
Cooperative Power Association
Minnesota Environmental Quality Board
Minnesota Department of Natural Resources
Northern States Power Company
Rural Electrification Administration
U. S. Army Corps of Engineers
U. S. Fish and Wildlife Service
U. S. Department of Agriculture, Soil Conservation Service
United Power Association

Three representatives of the Citizens Route Evaluation Committee were also in attendance.

The REA and MEQB were identified at the interagency meeting as the lead agencies for the preparation of the EIS. The requirements for EIS preparation are outlined in Section 102 (2)(6) of the National Environmental Policy Act of 1979, as amended; Section 1501.5 (b) of the Council on Environmental Quality regulations; and Chapter 6 MCAR Section 3.021 of the Minnesota Environmental Quality Board Rules. All attending agencies were invited to serve as cooperating agencies in the preparation of the EIS. However, there has been no formal commitment by any of the other agencies which would indicate their desire to be identified as cooperating agencies with the REA and MEQB for this project.

Potential environmental impacts are identified and discussed in this report to assure that reasonable safeguards will be included to protect the welfare of the public and to assure that all practical means of protection will be incorporated into the project. REA loan procedures and MEQB permit compliance will require NSP to comply with all applicable environmental requirements imposed by Federal, State, and local authorities.

1.2 PROJECT DESCRIPTION

The proposed 345 kV transmission line will connect the NSP Sherburne County substation, located at the Sherburne County generating facility, with the NSP Benton County substation. In the application for Construction Permit, NSP proposed Route A (Nodes: 1-5-10-11-12-15-33-24-37-26-35-40) and Route B (Nodes: 1-5-10-31-19-20-42-23-30-35-40). The Citizens Route Evaluation Committee (CREC) proposed several routes and route segments. These include Route D (Nodes: 1-5-6-11-34-18-42-72-28-29-39-40), route segment D-1 (Nodes: 22-38-29), route segment B-2 (Nodes: 19-18-24-27-26), route segment B-3 (Nodes: 20-21-22-28-30), route segment B-4 (Nodes: 23-26) and route segment B-4'(Nodes: 20-21-27-23). The Minnesota Environmental Quality Board (MEQB) also added one route and two route segments for consideration. These include: Route C (Nodes: 1-5-6-32-36-37), route segment C-1 (Nodes: 32-12) and route segment B-1 (Nodes: 31-34-33). The length of complete routes presented in this EIS range from 16.7 miles to 22.5 miles. The proposed routes, and route segments are illustrated on Figure 1-1 and in various segment maps in Chapter 5.

Environmental information has been gathered and measured for reference centerlines established by NSP, the CREC and MEQB staff. In Chapter 5, the proposed routes and reference centerlines are shown on individual route segment maps and are accompanied by narrative discussions.

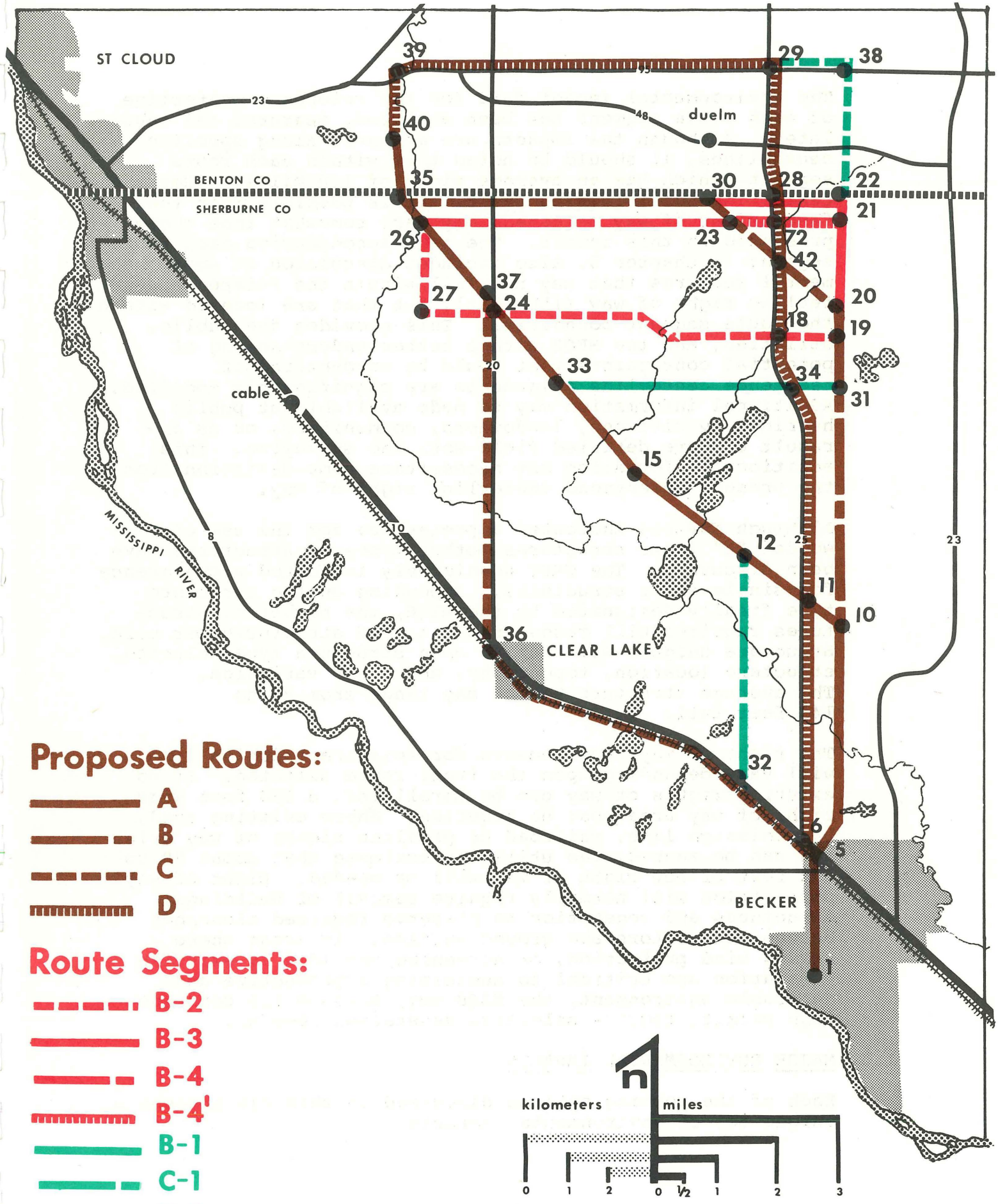

ST CLOUD
BENTON CO
SHERBURNE CO
duelm
cable
CLEAR LAKE
BECKER
MISSISSIPPI RIVER
Proposed Routes:
A
B
C
D
Route Segments:
B-2
B-3
B-4
B-4'
B-1
C-1
D-1
kilometers
miles
0 1 2 0 ½ 1 2 3

figure 1.1

The environmental impact data for the reference centerline of each route segment has been analyzed, measured and tabulated. Although the impacts are measured along specific centerlines, it should be noted that within each route segment (which has an average width of 1.0 miles), numerous centerline possibilities exist. It is possible that the final right of way selected, may vary somewhat from those presented in this report. The text accompanying each route segment in Chapter 5, also includes discussion of environmental features that may not fall within the reference centerline right of way (150 feet), but that are located within the route segment boundaries. This provides the public, utilities, and the MEQB with a better understanding of potential constraints that could be encountered if reference centerline alignments are significantly modified. Additional information may be made available at public hearings by citizens, landowners, communities, or as a result of more detailed field work and surveying. This additional information may necessitate some deviation from the present referenced centerline right of way.

Although NSP has indicated a preference for the use of wooden "k" frame structures, other types of structures have been discussed. The CREC unanimously indicated a preference for single shaft structures. Depending on the structure type finally designated by the MEQB, the number of structures required will range from 4 to 6.6 structures per mile. Structure heights will depend upon structure type selected, structure location, topography, and other variables. The average structure height may range from 85 to 145 feet tall.

The right of way requirements for this transmission line will vary depending upon the final route selected. If no existing rights of way can be paralleled, a 150 foot wide right of way area must be acquired. Where existing road, transmission line, railroad or pipeline rights of way exist and can be shared, the utilities estimate that about 80 to 110 feet of new right of way will be needed. Right of way preparation will normally require removal of buildings, structures and vegetation to preserve required clearance between conductors and ground surface. In areas where shade, wind protection, or screening provided by existing vegetation are critical to sustaining a productive and desirable environment, the MEQB may, through its construction permit, require selective vegetation removal.

1.3 MAJOR ENVIRONMENTAL IMPACTS

Each of the routing options discussed in this EIS present a unique set of environmental impacts.

Some routes may impose greater impacts on human settlement patterns than natural features while other routes may present special constraints to agriculture or transmission line reliability. The selection of a final route for the 345 kV transmission line will require some trade-offs and balancing of impacts as well as consideration of appropriate mitigative measures to reduce the potential magnitude of impacts. Table 1.1 is a summary of environmental impacts encountered along each proposed route.

The following sections summarize the major environmental issues related to the various routing options. These issues are organized in a manner consistent with the review criteria outlined in the Power Plant Siting Act. The issues summarized below are developed more fully in Chapter 5, Route Segment Analysis, of this EIS.

In addition, REA has applied criteria set forth in the Historic Preservation Act of 1966, Executive Order 11988 concerning floodplain management, Executive Order 11990 on wetlands, Section 7 of the Rare and Endangered Species Act of 1973, and the U.S. Secretary of Agriculture's Memorandum 1827 on prime farmland whenever appropriate in this analysis.

1.3.1 Existing and Projected Human Settlement

Some impacts on human settlement patterns are associated with each of the various routing options. The project will encounter some existing home sites, newly developing areas, and platted subdivisions. The magnitude of human settlement impacts are greatest where a proposed route passes through existing population centers, such as Clear Lake and the Briggs Lake region, or where routes may encounter large numbers of residential and commercial buildings.

The project study area contains two major airports (St. Cloud Airport and Clear Lake Airport) and one private landing strip. In addition, the water bodies in the vicinity of Briggs Lake are often used by pontoon planes. Several of the proposed routes are near these aircraft landing facilities. As such Minnesota Department of Transportation, and Federal Aviation Administration, rules and regulations must be satisfied to insure safe operating conditions for the region's aircraft.

1.3.2 Agricultural Land Use

The principal land use activity of the study area is agriculture. Approximately 75% of the region's land area is devoted to cultivated fields or pasture land. Only a small portion of the study area is classified by the U.S. Soil Conservation Service as prime farmland.

The only prime agricultural areas directly affected by the transmission line will be the land removed from production due to structure placement. Depending upon the structure type selected, the amount of land removed from agricultural production will range from approximately 150 square feet to 540 square feet per mile of transmission line.

Two routes would require diagonal crossing of agricultural fields and several of the routes would cross or border irrigation systems. Diagonal field crossings and interference with irrigation systems are serious constraints to agricultural activities.

The sandy loams of the region are prone to wind erosion. Miles of shelter belts and windrows have been planted to combat this problem. Some of the routes will cross and/or parallel windrows. The loss of windrows could result in higher levels of wind erosion.

1.3.3 Natural Environment Impacts

1.3.3.1 Natural Areas

The major environmental impact on natural areas and environmental systems will occur along the right of way of the high voltage transmission line (HVTL). The predominant impact anticipated is a change in vegetation from wooded areas to vegetation types dominated by low growing bushes, plants and grasses. Due to the extent of farming activities in the study area, relatively few areas remain in a "natural" state. The areas of natural vegetation which do remain in the region are in the form of small scattered woodlots and wetlands. The impact on these areas are generally proportional to the length of the proposed routes. Although none of the proposed routes cross federally established wildlife management areas, state lands, or local public parks, some areas of wildlife habitat and natural vegetation may be bordered. If small remnants of unique natural vegetation types exist in a proposed route, they can normally be spanned and left undisturbed.

1.3.3.2 Wetlands

All of the routes proposed will cross wetland areas. Wetland areas that are within the route finally selected, should be avoided or spanned if practical. Wetland areas adjacent to streams, lakes and other larger water bodies are particularly important in that they provide unique aquatic habitats and feeding areas. Adverse impacts on wetlands can be minimized by the time and manner in which construction is scheduled.

Table 1.1
ENVIRONMENTAL IMPACT SUMMARY BY ROUTE

VARIABLES	ROUTE										
	A	B	C	D	B-1	B-2	B-3	B-4	B-4'	C-1	D-1
segment length	16.7	19.2	17.2	22.1	19.1	20.1	20.3	19.3	20.2	16.3	23.8
length parallel to HVTL ROW	14.7	10.1	3.5	1.3	17.1	10.1	11.8	10.4	11.8	9.1	14.8
diagonal length	9.7	3.0	2.1	0	3.8	0.6	0.4	2.8	0.6	7.7	0.4
#property lines crossed	44	42	52	63	50	49	42	52	53	44	70
miles of property lines bordered	1.6	7.5	10.8	18.7	7.8	11.0	10.0	7.8	9.8	4.8	14.8
#of fields crossed	30	13	5	0	14	9	15	13	17	26	11
miles of fields crossed	4.1	1.8	1.1	0	2.3	1.1	1.6	2.0	2.3	3.7	1.1
miles of fields bordered	4.2	8.1	10.1	13.2	7.5	8.8	8.7	7.4	7.7	5.7	10.1
pastures crossed	1.8	1.2	0.5	0.9	1.0	0.9	0.9	1.5	1.2	0.8	1.4
prime farmland crossed	0.9	0.9	0.9	1.5	0.9	0.9	0.9	2.5	2.5	0.9	2.4
high irrigation potential	8.8	11.5	10.7	12.5	11.3	11.2	11.9	11.7	12.0	9.1	12.0
# of center pivots crossed	0	0	0	0	0	0	0	0	0	0	0
# of center pivots bordered	2	1	5	6	3	2	1	1	1	7	1
# of row irrigation crossed	2	0	2	0	1	1	0	0	0	2	0
# of row irrigation bordered	0	0	5	2	0	0	0	0	0	1	0
homes 500' of ROW	4	12	59	76	18	27	13	11	11	15	56
homes 500-1000' of ROW	22	18	24	37	19	15	20	15	15	20	19
business 1000' of ROW	0	1	7	3	1	1	1	1	1	2	3
church/cemetary 1000' of ROW	0	0	3	0	0	0	0	0	0	0	0
#platted areas crossed	2	1	1	1	1	1	1	1	1	1	2
# platted areas bordered	2	3	1	3	2	2	2	3	2	2	1
#paved roads crossed	6	6	8	8	6	5	4	5	5	6	9
# unpaved roads crossed	7	6	7	9	6	9	7	5	5	4	8
#scenic roads crossed	3	1	0	1	1	0	0	1	1	2	1
scenic road bordered	0	0	0	0	0	1.9	0	0	0	3.9	0
airport within 1 mile	2	0	3	0	2	1	0	1	1	2	0

Table 1.1 Cont.

VARIABLES	ROUTE										
	A	B	C	D	B-1	B-2	B-3	B-4	B-4'	C-1	D-1
hwy. ROW bordered	0	0	11.7	18.8	2.8	6.0	0	0	0	5.5	7.0
# of windrows crossed	12	6	9	4	8	6	6	8	10	10	1
# of windrows bordered	0.7	0.9	1.0	5.7	1.1	0.8	0.9	1.4	1.4	0.4	2.7
wood lot crossed	2.4	4.5	2.2	2.6	4.9	4.7	6.3	3.7	4.2	2.2	4.1
wetland crossed	2.7	1.4	1.4	1.1	1.5	2.2	1.4	1.7	2.1	2.2	2.1
tree farms crossed or bordered	0	1.0	0	1.0	0.7	0.9	1.0	1.0	1.0	0	0.9
steep slopes 6%	0.9	1.8	0.3	0.5	0.9	0.9	1.5	1.8	1.6	0.5	1.4
# of lakes within 1000' of centerline	4	3	6	2	2	3	3	3	3	3	2
stream crossings	10	8	3	15	8	6	8	8	8	7	18
trout streams	0	1	0	1	1	1	1	1	1	0	2
Flood Hazard Zones	1.5	0.8	0.6	1.5	0.9	0.8	0.9	1.5	1.6	1.6	1.6
public rec. crossed	0	0	0	0	0	0	0	0	0	0	0
public rec.1000' of ROW	2	1	1	2	1	1	1	1	1	2	2
pvt. rec. crossed	1	0	0	0	0	0	0	0	0	1	0
pvt. rec. 1000' of ROW	3	1	1	1	1	1	1	1	1	2	1
archaeological sites	2	0	0	0	0	0	0	0	0	2	0
wildlife refuges crossed	0	0	0	1	0	0	0	0	0	0	1
scientific/wildlife/vegetation of importance crossed	0	0	0	0	0	0	1	0	0	1	0
scientific/wildlife/vegetation of importance 1000' of centerline	1	1	1	1	2	2	2	1	1	0	2

1.3.3.3 Flood Hazard Zones

Due to the large number of rivers, streams, creeks and drainage ditches in the study area, the transmission line will cross some areas designated by the Federal Flood Insurance Agency as Flood Hazard Zones (FHZ). The exact amount of FHZ crossed will be dependent on the route selected. REA finds that there is no practical alternative for avoiding FHZs. In all instances, an attempt will be made to span designated FHZs rather than locating structures within them. If structures cannot avoid FHZs the applicants must utilize construction, filling, and flood proofing techniques consistent with the Flood Insurance Administration's minimum guidelines.

1.3.4 Wildlife

Adverse impacts on wildlife will likely occur during the construction phase. Subsequent to construction, impacts on wildlife should be limited to the results of change in habitat within the actual 150 foot right of way as it is cleared and maintained. NSP's right of way management program should encourage plant species which will provide feed and cover for wildlife. Depending upon the route selected, some waterfowl habitats could be affected. Most notable are the lakes southeast of the community of Clear Lake, and the wetlands nearest the Sherburne National Wildlife Refuge.

1.3.5 Recreational Lands

No public recreational facilities are crossed by any of the reference route centerlines. Several private recreational facilities and public recreational areas are, however, located within several of the route boundaries. The recreational use of Lake Briggs, Elk Lake and Rush Lake pose the most serious recreational constraints in the study region.

1.3.6 Recreational Waters

No large lakes are crossed by any of the proposed route centerlines. Numerous rivers, streams, creeks, and ponds are located along the centerlines of several of the routes. Several route and route segments will necessitate a crossing(s) of Briggs Creek which has been classified by the Minnesota Outdoor Atlas, as a trout stream. Line design, selective vegetation removal and construction practices along Briggs Creek should emphasize protection of this aquatic habitat.

1.3.7 Historic and Archaeological Preservation

There are no recognized historic sites within any of the proposed route boundaries. The Minnesota Historical Society notes that several recorded prehistoric archaeological sites are located in the vicinity of Briggs Lake and Elk Lake. The Historical Society further reports that there is a close correlation between prehistoric sites and permanent sources of water.

Prior to construction of the transmission line the Historical Society recommends that archaeological survey work be conducted for the following situations:

a). If the proposed transmission line utilizes existing structures, a survey will not be necessary. If however, the line parallels an existing line, areas that will be disturbed (tower locations and associated activity areas) should be surveyed.

b). Where a proposed route does not follow existing facilities a survey is recommended.

c). If a route follows a road, no survey work would be needed if the transmission line construction work takes place in areas within the existing road right of way. If the line is constructed in areas adjacent to roads that have not been disturbed, or minimally disturbed, the Historic Society would like to review the specific alignments in order to assess whether an archaeological survey of these areas should be conducted.

At this time, REA cannot make a finding of "no impact" to historical or archaeological sites that maybe within any of these route alternatives. REA will consult with the Minnesota State Historical Preservation Officer in applying the criteria of effect to the route which is designated by the MEQB.

1.4 RELIABILITY, COST AND ACCESSIBILITY

Paralleling or double circuiting the existing 230 kV Monticello to Benton County line along Route A, presents the greatest potential for transmission system reliability. No other serious reliability problems are anticipated by NSP on any of the other proposed routes. Depending on the route and tower structures selected, the cost of the project could range from approximately $3,375,000 to $7,705,000. This cost range does not

include expenditures related to right of way acquisition or special engineering costs that might be necessary to mitigate specific environmental impacts. The route segments which do not follow existing rights of way may require the development of utility access roads or trails. These routes and route segments include: route B, route segment B-3, route segment B-4 and route segment B-4'.

1.5 UTILIZATION OF SURVEY, NATURAL DIVISION AND FIELD BOUNDARIES.

Most of the route and route segment centerlines attempt to follow existing rights of way, survey lines, and field boundaries. The routes which propose diagonal field crossings will follow the least number of survey lines and field boundaries. Route A has the longest diagonal length (9.7 miles or 59% of the route).

1.6 UTILIZATION OF EXISTING RIGHTS OF WAY

All of the reference centerlines either parallel or share existing rights of way for at least 50% of their lengths. Route B and route segments B-3, B-4 and B-4' would require the establishment of new right of way corridors. The length of new right of way corridors ranges from 8 to 10 miles.

1.7 ALTERNATIVE STRUCTURES AND TECHNOLOGIES

The type of structures selected could have an effect on the magnitude of environmental impacts, including those on agriculture, human settlements, and visual and aesthetic considerations. A comparison of structure types appears in Chapter 3.

1.8 ALTERNATIVES

Alternatives to the proposed project, as discussed in Chapter 9, include alternative routes, electrical systems, and a "no build" option. Alternative routes and route segments were proposed by the Citizens Route Evaluation Committee and the MEQB Power Plant Siting staff. As discussed in Chapter 9, the "no-build" alternative is not an option available to the MEQB. The MEQB's jurisdiction is limited by state statutes to designation of a route and issuance of a construction permit for the proposed routes, or a determination that none of the proposed routes are acceptable. In case of the latter decision, the MEQB would require other routes to be submitted and evaluated. The REA, however, does have the option of finding that the line is not justified due to potential adverse impacts.

1.9 PERMITS

A number of federal, state and local agencies have review or permit-granting authority over the routing of the proposed transmission line. It is important to route the line so that responsibilities of all involved agencies are fulfilled. The application for routing the line over various lands and waters must be coordinated in order to minimize conflicts between different regulatory agencies.

The proposed project is regulated to varying degrees by federal, state and local agencies. On the federal level, the U.S. Army Corps of Engineers requires permits for placing fill in wetlands (Section 404 of the Federal Water Pollution Control Act of 1972) and for crossing navigable waters (Section 10 of the River and Harbor Act 1899). A number of wetlands exist in the study area, but they should not be adversely affected by the transmission line. Considerable care should be taken during construction of access roads, if required, and structure placement to prevent any change in the drainage systems. Approval of the final environmental impact statement will be required by federal agencies which have review and permit-granting authority over this project.

In addition to the construction permit required by the MEQB, several other state permits must be obtained. Permits for crossing state lands and waters are required by Minnesota Statute 84.415 as amended by the laws of Minnesota 1973, Chapter 479, and implemented by Chapter 51 of the rules and regulations of the Department of Natural Resources. Water crossing permits are subject to review by the Minnesota Pollution Control Agency. The permits rarely conflict with the MEQB Construction Permit. Instead, they deal more closely with the mitigation of impacts for each specific crossing. Minnesota Department of Transportation utility permits will be required for each crossing of Highways 10, 25 and 95, pursuant to Chapter 500, Article II, Section 45 of the Laws of Minnesota.

Although counties have no legal authority governing the routing of transmission lines, an effort has been made in planning this project to conform with county development patterns and regulations. Crossing of any county land will be coordinated between the utilities and the appropriate officials in Benton and Sherburne Counties.

In addition to these permits, the transmission line must not adversely affect airports or related facilities. Both the Minnesota Department of Transportation and the Federal Aviation Administration may review the final route selected for possible conflicts with required airspace or hazards to aircraft around airports.

1.10 CONTACT WITH AGENCIES, ORGANIZATIONS AND INDIVIDUALS

Considerable effort was made to contact public and private agencies, organizations and individuals, to explain the project and to obtain information and comments on the various routing proposals for this project. Appendix A includes a list of these contacts.

setting

2

2.1 GENERAL STUDY AREA - PROJECT LOCATION

On September 12, 1979, the Minnesota Environmental Quality Board accepted an Application for a Construction Permit and Route Designation for a 345 kV transmission line to extend from the substation located at the Sherburne County generating plant (Sherco) to the Benton County substation.

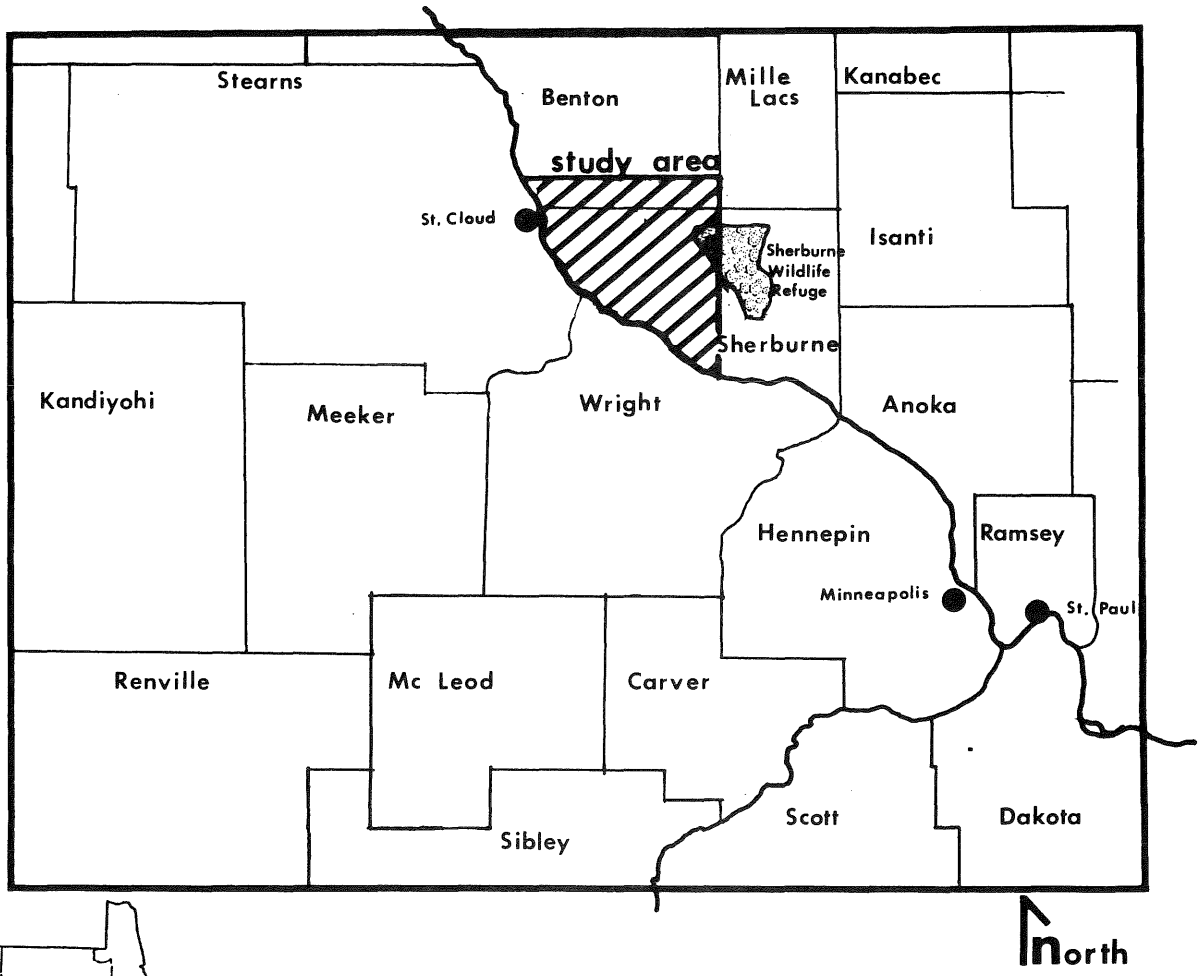
In selecting a route for the proposed 345 kV transmission line, a 175 square mile study area was identified. This study area lies approximately 50 miles northwest of Minneapolis-St. Paul in Sherburne and Benton Counties. The boundaries and shape of the study area were generally determined by both the locations of the two terminal facilities and the major natural features of the region. On the north, the study area is bounded by Minnesota State Highway 95. The southern and western boundaries of the study area are determined by the Mississippi River, and the eastern boundary of the study area is determined by the Sherburne National Wildlife Refuge. (See Figures 2.1 and 2.2.)

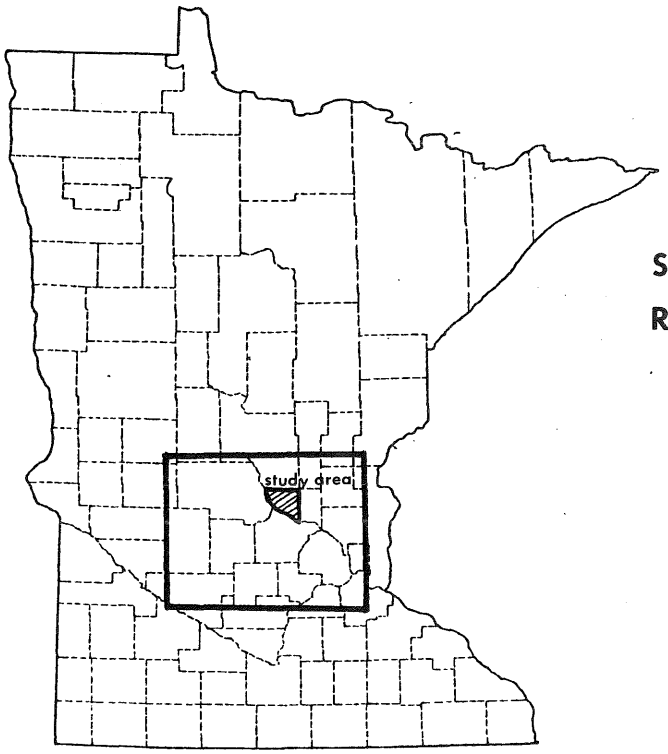
The purpose of this chapter is to provide a basic descriptive overview of the study area. This general description should provide those readers not familiar with the region with a better understanding of the study area's physical, social and economic environment.

2.2 CLIMATIC CONDITIONS

The climate in east-central Minnesota is characterized by warm, humid summers and cold winters. Throughout the year, mild dry Pacific Ocean air masses move eastward across the continent to moderate the state's climate. Hot summers are relatively infrequent and only twice in the past 20 years has the maximum daily temperature reached 100°F. During the winter months, however, upper air currents push artic air masses into the state and generate prolonged periods of sub-zero weather. Detailed meterological data has been compiled by the U.S. Weather Bureau for the St. Cloud Municipal Airport Reporting Station. A summary of the meterological data is presented in Tables 2.1, 2.2, and 2.3.

With an average of 68.3° F, the summer temperatures in the study area can be classified as moderate. July is usually the warmest month with an average daily maximum of 85°F. Winter months (December, January, and February) have an average temperature of 13.3°F, with January being the coldest month. Extreme low temperatures of -20 to -40 may be recorded in the winter months. On the average the study area receives 42 inches of snow annually. The first snowfall usually occurs in late October and the snow cover often remains until middle or late April.





STUDY AREA LOCATION–
REGIONAL SETTING

figure 2.1

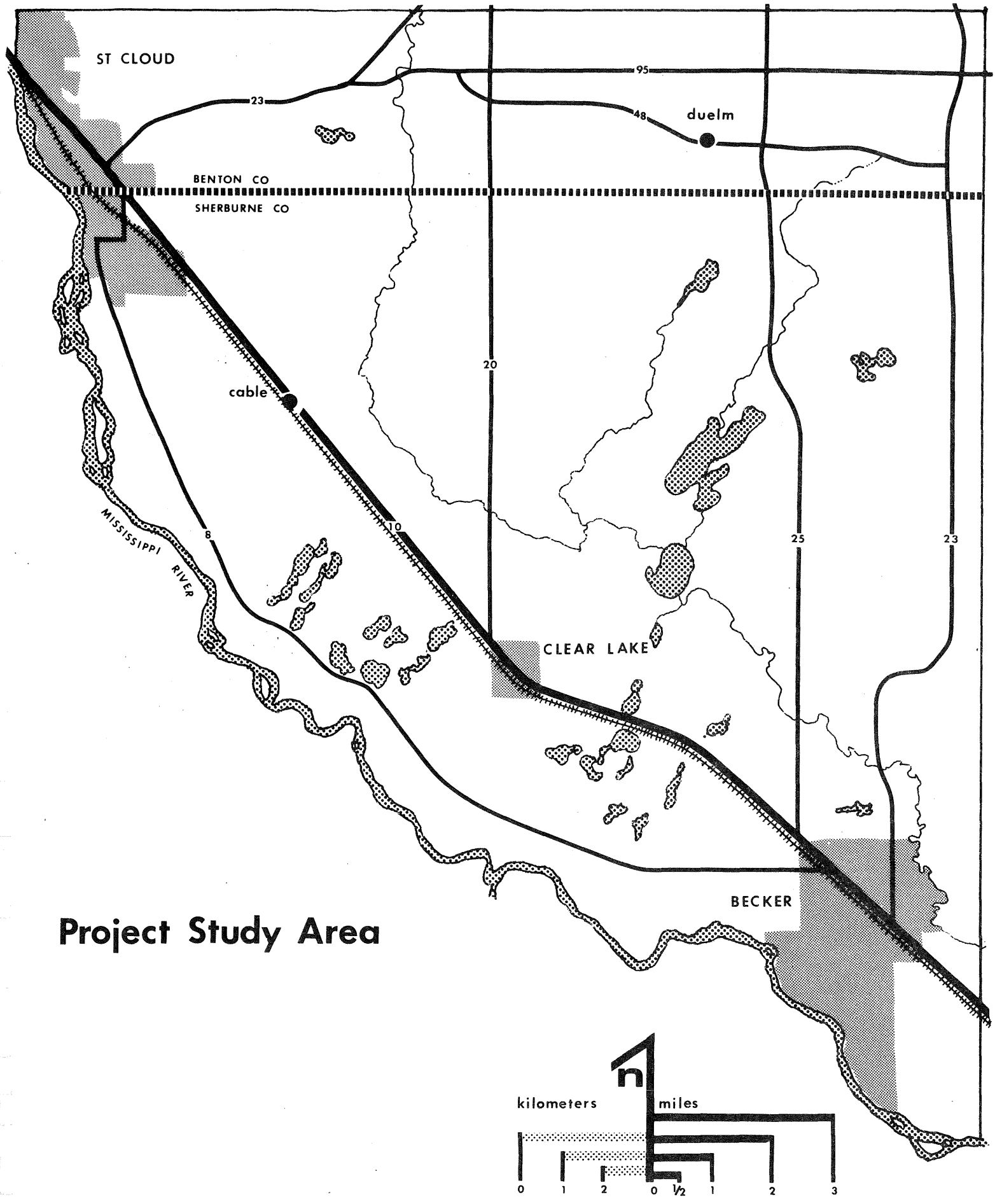

ST CLOUD
95
23
48
duelm
BENTON CO
SHERBURNE CO
20
cable
10
8
MISSISSIPPI RIVER
25
23
CLEAR LAKE
BECKER
Project Study Area
n
kilometers
miles
0 1 2 0 1/2 1 2 3

figure 2.2

Precipitation in the study area averages 26.84 inches per year, however, over two-thirds of this precipitation occurs between the months of May and September. Extended dry periods in the region are very rare. Precipitation levels of at least .01 inches can be expected on about 100 days per year. The heaviest precipitation occurs during spring and summer thunderstorms where intensities of 1.10 inches per hour have been recorded. Locally severe storms however, are usually short in duration and widely scattered. More often, summer rain storms generate between 2 and 4 inches of precipitation over a 24 hour period.

The climatic conditions of particular concern to transmission line siting are strong winds, freezing rain-ice storms, and lightning. The National Oceanic and Atmospheric Administration's National Climatic Center reports that damaging storms such as tornadoes and freezing rain are not numerous in the St. Cloud region. The frequency of tornadoes in the study area is about 1 storm every other year. The probability that a tornado will strike a given geographic point, however, is only 0.00051. Although the study area lies along the north edge of the nation's tornado belt, it rarely experiences these severe storms. The U.S. Weather Bureau further reports that on an average, ice storms severe enough to cause damage to trees and overhead wires occur less than once a year. On an average, freezing rain with ice deposits of 0.5 inches or more occur about once every two years. Lightning, however, frequently accompanies spring and summer rain storms, and may strike high standing structures such as transmission towers. During the months of June and July, an average of 8% of the days can expect to experience thunderstorm activity. The use of shield wires and proper grounding, however, can help minimize potential lightning damages.

2.3 GEOMORPHOLOGY

Examining a region's geomorphic environment can provide a broad descriptive analysis of the physical landscape. Subsurface geology, surface topography and major landform features can influence existing and potential uses of the landscape.

A review of subsurface geologic features can locate areas with limited structural bearing strength or areas with shallow depths to bedrock. These features are important because where bedrock is exposed to the surface, construction and excavation can be difficult and expensive. In addition, where geologic features with inadequate bearing strength exist, special engineering solutions will be necessary to erect and properly support the line.

TABLE 2.1

STUDY AREA TEMPERATURE

Month	Average Daily Maximum	Average Daily Minimum	Average Monthly	Highest Recorded	Year	Lowest Recorded	Year
January	19.2	-1.4	8.9	55	1942	-43	1977
February	24.4	2.2	13.3	55	1961	-35	1951
March	35.8	15.9	25.9	79	1968	-32	1962
April	53.8	32.0	42.9	88	1962	-3	1975
May	66.6	43.3	55.0	97	1969	19	1967
June	76.0	53.6	64.8	98	1963	33	1951
July	81.8	58.6	64.8	98	1963	33	1951
August	80.1	56.6	68.4	103	1940	40	1972
September	69.2	46.4	57.8	98	1978	18	1974
October	59.0	36.1	47.6	90	1953	5	1976
November	38.6	21.4	30.0	74	1978	-20	1964
December	24.6	6.8	15.8	58	1962	-34	1976
Yearly Averages	52.4	31.0	41.7				

Source: National Oceanic and Atmospheric Administration
Local Climatological Data St. Cloud, Minnesota, 1978.

TABLE 2.2

STUDY AREA PRECIPITATION
IN INCHES

Month	Normal Precipitation	Maximum Monthly	Year	Minimum Monthly	Year	Maximum 24 hours	Year
January	0.76	2.52	1969	0.02	1942	0.99	1949
February	0.78	2.76	1951	0.04	1964	1.83	1951
March	1.33	3.43	1965	0.10	1959	1.81	1951
April	2.30	5.31	1954	0.34	1959	3.15	1954
May	3.60	8.01	1962	0.32	1948	3.24	1954
June	4.64	9.34	1953	1.30	1964	3.48	1971
July	3.23	8.00	1955	0.21	1975	2.29	1962
August	3.89	7.55	1956	0.46	1950	4.62	1956
September	2.65	5.02	1941	0.07	1952	2.72	1958
October	1.69	6.16	1971	0.07	1952	3.24	1950
November	1.12	3.74	1977	0.01	1941	2.22	1977
December	0.85	2.04	1969	0.01	1943	1.05	1945
Yearly Average	26.84						

Source: National Oceanic and Atmospheric Adminstration
Local Climatological Data
St. Cloud, Minnesota, 1978

TABLE 2.3

MEAN NUMBER OF DAYS WITH:

Month	Precipitation .01 inch or more	Snow, ice pellets 1.0 inch or more	Thunderstorm activity	Heavy fog	Max. temp. 90° and above	Min. temp. 0° and below
January	9	3	0	2	0	18
February	7	2	*	2	0	13
March	9	3	*	1	0	5
April	10	1	2	1	0	*
May	11	*	5	1	*	0
June	12	0	8	1	2	0
July	10	0	8	1	4	0
August	9	0	7	2	4	0
September	9	*	4	2	1	0
October	7	*	2	2	*	0
November	8	2	*	2	0	2
December	9	3	0	3	0	8

* Less than half a day

Source: National Oceanic and Atmospheric Adminstration
Local Climatological Data
St. Cloud, Minnesota, 1978

The surface topography of a region helps to define its visual character. In addition, surface topography determines drainage characteristics and influences the processes of erosion and sedimentation. Topography also influences the height of transmission line structures and the span lengths of the line.

Landforms serve as regional reference points and are relics of the geologic past. The location, size and type of principal landforms can affect future growth and expansion in agriculture, transportation, and urban development activities.

2.3.1 Subsurface - Quaternary Geology

The Quaternary Period in the earth's history is commonly known of as the "Great Ice Age". It began about 2 million years ago and ended about 10 thousand years ago. This geologic era included the Nebraskan, Kansan, Illiniosan and Wisconsinan periods of glaciation. During the glacial advances and retreats, glacial debris was deposited over the entire study area. This debris is called drift and is composed of unconsolidated sedimentary materials deposited by water, wind, glacial ice and meltwaters. The thickness of the drift material in the project study area averages over 100 feet, however, shallow depths to bedrock are located along the Mississippi River and in the northeastern portion of the study area. From a geological perspective the Quaternary deposits consist of the most recent geologic strata and therefore have the greatest influence on topography, soils, water and land uses in the area.

Some of the glacial drift materials originally deposited by the glacial advances and retreats were quickly eroded, transported and deposited by glacial meltwaters. In fact, western Benton County and the majority of Sherburne County were outlets for some of these glacial floodwaters. As such, fine textured materials were generally washed away leaving only sorted sands and gravel materials. The terrace and outwash plain deposits found throughout the Sherburne County portion of the study area are examples of redistributed drift materials. The Minnesota State Geological Survey describes these geologic features in the following manner.

> Terrace Deposits - Stratified sand and gravel with some interbedded silt and clay occurring along stream valleys above the level of present floodplains. During glacial melting, streamflow was greater than at present, and the floodplains were built up by glacial sediments. Recent streams have cut into older floodplains leaving remnants as terraces. Terrace tops are commonly flat and well drained. They are attractive for residential and industrial development, and they also contain valuable sand and gravel resources.

> Outwash deposits - Sand, silt and gravel carried from glaciers by meltwaters and spread over wide areas. The deposits are typically sorted into discontinuous and interfingering beds of silts, sand, and gravel called stratified drift. Outwash plains have flat topography, sandy soils and many gravel lenses. Shallow ground water is commonly abundant for irrigation.

Another type of glacial drift material found in the study area, resulted from direct deposition by the glaciers. Drift deposited directly from glacial ice is called "till". Till is usually an unsorted mixture of all sizes of rock ranging from boulders to fine clay. Glacial till is stiff, stony and impervious. Most of the till materials found in the study area are located in Benton County. They were deposited from the base of the glacial ice and therefore formed a smooth to slightly undulating till cover called a ground moraine. Where the glacier ceased its advance, more till material accumulated. These areas form small "hills" and exhibit greater topography changes. The Benton County till material is identified as Superior Lobe Till. The Minnesota State Geological Survey describes this material as follows.

> Superior Lobe Till - Ice of the Superior Lobe moved out of the Lake Superior basin in several pulses, spreading westward across the Mille Lacs area and southward across the Minneapolis-St. Paul area. This till is generally reddish-brown, sandy to stony and non-calcareous; it contains abundant fragments of volcanic, granitic, gabboric, and metamorphic rocks, red sandstone and conglomerate. Where it incorporates earlier lake deposits, it is locally silty or clayey.

In addition to glacial deposits, the study area contains recent alluvium deposits along the Mississippi River. This alluvium consists of sands and gravel interbedded with silt, clay and organic material deposited over recent flood plains. The surface terrain of the alluvium is flat and the areas are prone to periodic flooding. Figure 2.3 identifies the Quaternary geologic features found in the study area.

2.3.2 Topography

The topography of the general study area ranges from 1080 feet above sea level along the region's northern boundary, to just under 960 feet above sea level in the southern reaches of the region along the Mississippi

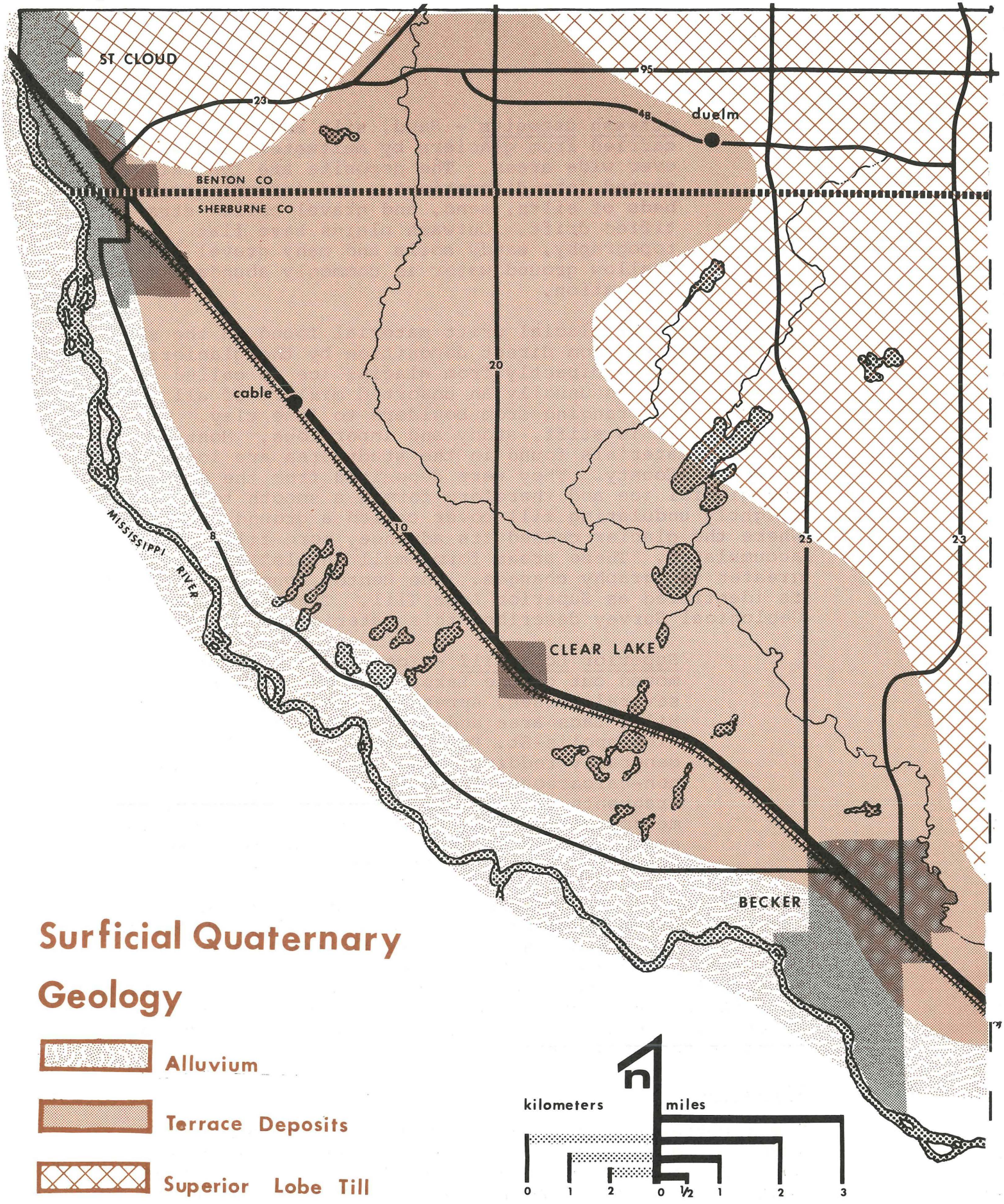

ST CLOUD
95
23
48
duelm
BENTON CO
SHERBURNE CO
20
cable
MISSISSIPPI RIVER
8
10
25
23
CLEAR LAKE
BECKER
Surficial Quaternary Geology
Alluvium
Terrace Deposits
Superior Lobe Till
kilometers
miles
0 1 2
0 ½ 1 2 3

figure 2.3

River. With an overall slope gradient of under 8 feet per mile, the land surface is flat to gently rolling. Most of the landscape consists of long smooth slopes with hills reaching heights of only 20 to 30 feet. Occasionally, more irregular broken contours interrupt the flat surface but there are generally no prominent hills or pronounced summit points in the study area.

The areas of greatest local topographic relief are generally found along stream banks and lake shores. In addition, there is a moderately rolling morainal area extending from Section 9 in Haven Township eastward through northern Palmer Township. In general, where local slopes of 6% grade or greater are found, the potential for localized erosion problems exist. Table 2.4 lists the average elevations by township found in the study area.

TABLE 2.4
AVERAGE SURFACE ELEVATIONS

Township	Feet Above Sea Level
St. George	1,060
Minden	1,050
Santiago	1,025
Palmer	1,020
Haven	1,010
Becker	1,000
Clear Lake	980

2.3.3 Landforms

The broad flat outwash plain dominates the landscape of the study area. The slight modifications in elevation within the plain partially account for the region's undifferentiated drainage patterns, wetlands and sluggish stream movements. Although the outwash plain covers essentially the entire study area, there are three additional landforms of local significance.

One of the most apparent landform features of the region is a remnant of an ancient channel of the Mississippi River. This old river valley is one of the relics of the flooded stages of the Mississippi during the last ice-age. The landform consists of a flat bottomed hollow, mostly occupied by wetlands and organic soils. Most of this old river channel lies 15 to 25 feet lower than the flat outwash plain.

Another notable landform is a small terminal glacial moraine located in northern Haven and Palmer Townships. The terminal moraine forms a rather hilly and knolly landscape feature which is markedly different from the surrounding flat outwash plain to the south and the gently rolling ground moraine of clay till to the north. The moraine has localized areas of steep slopes and is primarily composed of clay till.

A third landscape feature is the "big rock" found in Section 7 of Haven Township. The big rock feature is one of the largest surface glacial boulders found in Minnesota. The dimensions of this mass are about 20 by 35 feet and its height exceeds 20 feet. The boulder is dark mica-schist, coarsely laminated, with much black mica and many minute garnets.

Figure 2.4 identifies the principal landform features found in the study area. Some of the local features may provide important natural history and educational value.

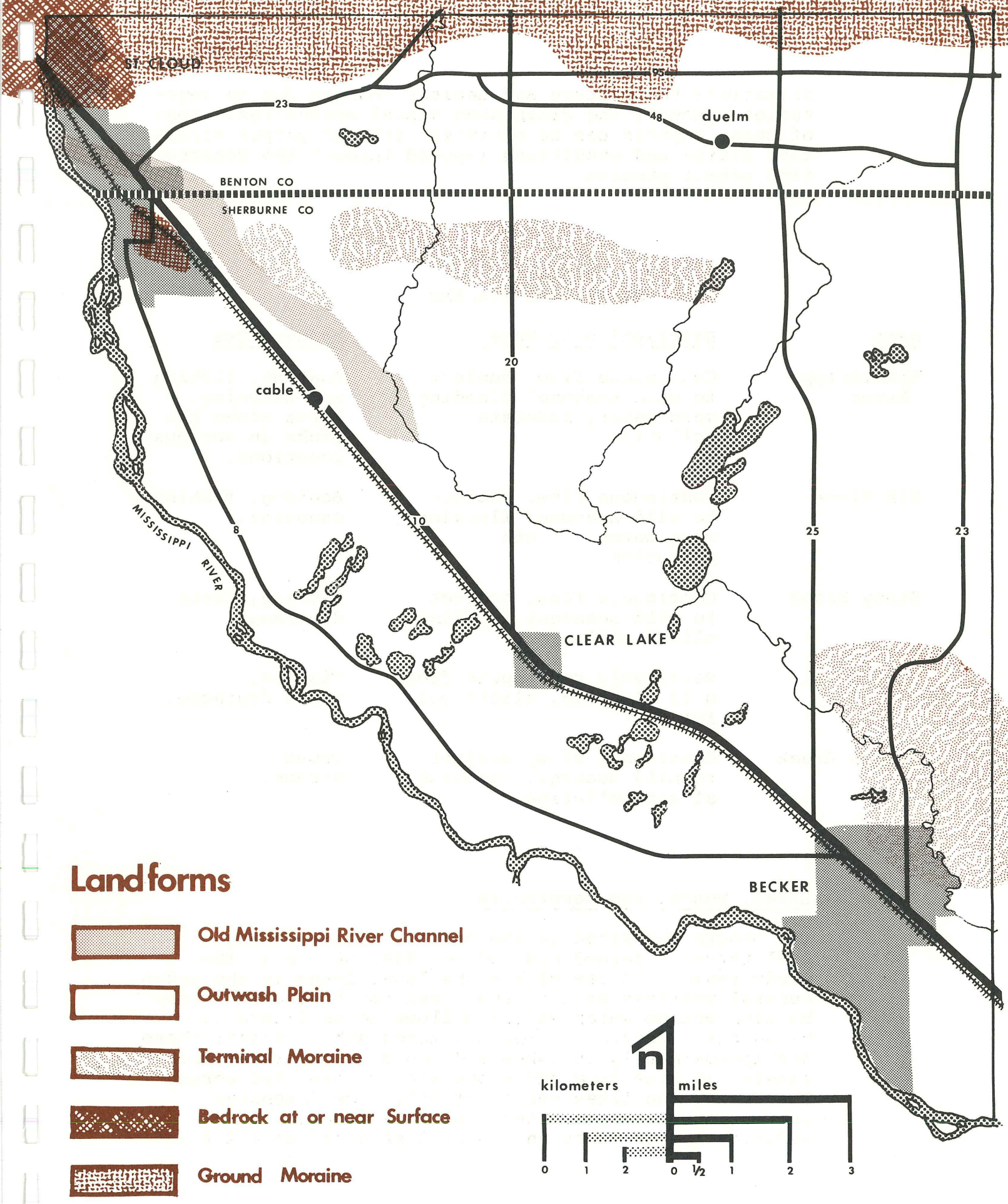
2.4 HYDROLOGY

The glacial features of the project area have greatly influenced the region's surface and groundwater hydrology. In general the surface hydrology consists of ice block lakes, sluggish streams and large wetlands scattered over the low topographic relief of the outwash plain. The groundwater hydrology of the region includes both shallow sand and gravel aquifers and metamorphic bedrock aquifers. The following sections briefly describe the various surficial and groundwater features of the study area.

2.4.1 Rivers and Streams

The project study area is completely drained by tributaries to the Mississippi River. The Mississippi River forms the southern and western boundary of the study area, however, the Elk River, a Mississippi tributary, is the principal watershed of the area. Other important rivers and streams are Briggs Creek, Rice Creek, and Stony Brook. Most of the rivers and creeks maintain a continuous base flow, however, it is not uncommon that during drought conditions the base flow rates may fall below one cubic foot per second.

High flows occur in the spring and are generally the result of snow melt and severe spring storms. Low flow conditions are usually recorded in the winter and fall months. The use of the regions rivers varies from fishing and boating to general drainage. Table 2.5 and Figure 2.5 identifies the rivers and streams of the area. The potential impacts of a transmission line on rivers and streams include: stream bank erosion; stream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duelm
BENTON CO
SHERBURNE CO
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cable
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MISSISSIPPI RIVER
25
23
CLEAR LAKE
BECKER
Land forms
Old Mississippi River Channel
Outwash Plain
Terminal Moraine
Bedrock at or near Surface
Ground Moraine
n
kilometers
miles
0 1 2 0 ½ 1 2 3

figure 2.4

siltation; temperature and habitat changes due to vegetation removal; and diminished visual ammenities. Most of these impacts can be minimized through proper structure siting and conditions imposed through the construction permit program.

TABLE 2.5
RIVERS AND STREAMS

Name	Description of Water	Present Use
Mississippi River	Continuous flow, subject to mild seasonal flooding; warm water, moderate pollution	Boating, fishing and canoeing. Parks along the banks in various locations.
Elk River	Continuous flow, subject to mild seasonal flooding, warm water, slight pollution	Boating, fishing canoeing.
Stony Brook	Continuous flow, subject to mild seasonal flooding, slight pollution	Fishing, field drainage.
Rice Creek	Relatively continuous flow, mild flooding, slight pollution.	Fishing, field drainage.
Briggs Creek	Continuous flow, subject to mild seasonal flooding, slight pollution	Trout stream.

2.4.2 Lakes, Ponds, and Reservoirs

Ice blocks deposited in the outwash plains during glacial retreats formed most of the lake basins in the study region. A few of the shallower lakes in the south central portions of the study area may have been formed by wind action which caused hollows to be literally blown out. Because of the low topographic relief, there are approximately 35 lakes and ponds in the study area ranging in size from under one acre to over 400 acres. The use of the lakes varies greatly from intensive recreational uses to water fowl management. In addition to the lakes and ponds listed in Table 2.6 and

TABLE 2.6

INVENTORY OF LAKES, PONDS AND RESERVOIRS

Name	Acres	Description of Water	Use
Clitty Lake	56	Shallow marsh area; moderate water fluctuation.	Water fowl, Muskrat habitat
Boyd Lake	125	Shallow lake, warm water, marshy; moderate water fluctuation.	Water fowl, Muskrat habitat
Rice Lake	187	Large marsh area at headwaters of Rice Creek.	Water fowl, Muskrat habitat
Camp Lake	83	Warm water lake; 30 ft. depth.	Pan fishing, Water fowl, Muskrat habitat
Prairie Lake	80	Shallow marshy lake; moderate fluctuation.	Water fowl and Muskrat habitat
Masford Lake	103	Shallow marshy lake; moderate fluctuation.	Water fowl and Muskrat habitat
Jone's Lake	77	Shallow marshy area; moderate fluctuation	Water fowl and Muskrat habitat
Crescent Lake	88	Shallow marshy area; moderate water fluctuation	Water fowl and Muskrat habitat
Eilers Lake	59	Shallow marshy area; moderate fluctuation	Waterfowl and Muskrat habitat
Elk Lake	352	Warm water lake; moderate fluctuation. 12 ft. depth	Walleyes and northern pike; Boating, Public access and swimming.

Name	Acres	Description of Water	Use
Lake Julia	137	Warm water lake; moderate fluctuation; 12 ft. deep.	Walleyes, northern pike, panfish. Public access.
Lake Briggs	406	Warm water lake; moderate fluctuation; 25 ft. deep.	Water recreation walleyes, northern pike, panfish, public access, sea plane operations.
Rush Lake	161	Warm water lake; moderate fluctuation; 25 ft. depth.	Walleye, northern pike, panfish, boating, public access
Imholt-Slough	153	Shallow, marshy area, moderate fluctuation.	Waterfowl and Muskrat habitat
Stickney's Lake	85	Shallow, marshy area; moderate fluctuation.	Waterfowl and Muskrat habitat
Fish Lake	67	Shallow, warm lake, moderate fluctation.	Waterfowl and Muskrat habitat
Clear Lake	109	Warm water lake.	Panfish, Waterfowl and Muskrat habitat
Pickerel Lake	165	Shallow, warm water lake; moderate fluctuation.	Waterfowl, northern pike, and panfish.
Long Lake	180	Shallow, warm water lake; moderate fluctuation.	Waterfowl, northern pike, panfish, public access.

Figure 2.5, there are several smaller unnamed lakes and marshes throughout the study area that may serve as wildlife habitats. The potential impacts of a transmission line on lakes include increased bank erosion; interference with seaplane operations; increased sedimentation, and reduced visual and recreational opportunities.

2.4.3 Groundwater

All of the water supply used in the project study area is obtained from groundwater sources. There are two major aquifer systems from which groundwater is obtained. There are the shallow surficial outwash/glacial drift aquifers and the undifferentiated igneous and metamorphic bedrock aquifers.

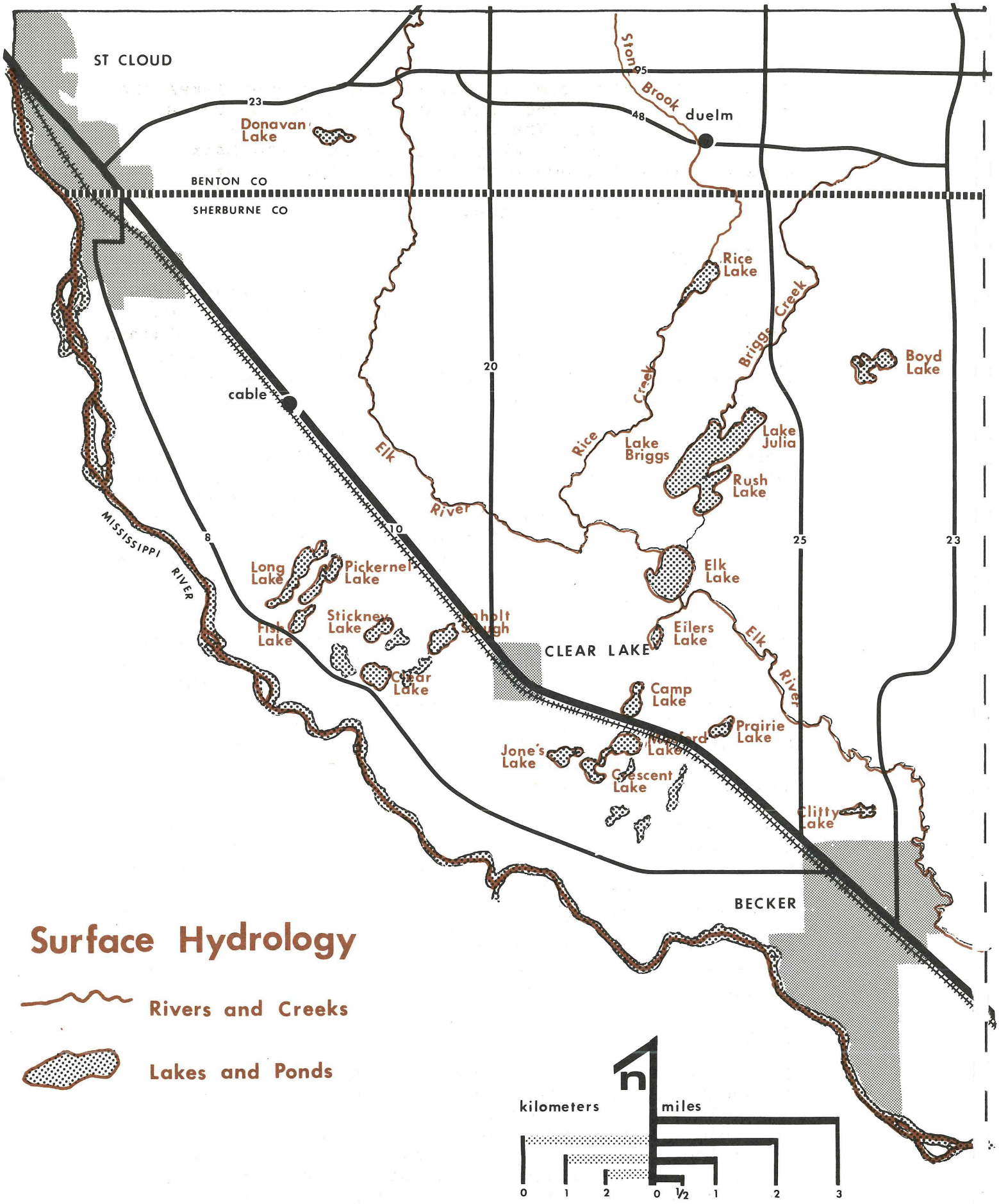
Most of the water is obtained from the outwash and drift aquifers. Wells in these aquifers range in depth from 20 to 100 feet and generate an average yield of between 100 and 1,000 gallons per minute. The highest water yields are obtained in the groundwater recharge areas along the Elk River. The lowest water yields are found in the northern portions of the study area. Figure 2.6 illustrates outwash and drift aquifer characteristics in the study area.

The bedrock aquifer system has lower yields and is less reliable as a water supply. The reason for this is that water availability is limited by the size and location of fractures and crevices which exist in the bedrock. Bedrock ground water conditions are generally uniform throughout the study region in that all of the study area bedrock is predominately composed of quality diorite, granodiorite and quartz.

The impact of the siting of a transmission line on groundwater will be minimal. The transmission line should not affect overall water use or water quality in the project area. The potential for groundwater pollution does exist in the major groundwater recharge areas. This pollution would be related to surface application of herbicides and to any oils, tars or chemicals leaching through the soil during the construction and maintenance of the line.

2.5 SOILS

Soil is a thin veneer of earthen material covering the landscape. Local differences and physical characteristics of soil types are determined by: climate, topography, soil biota vegetative cover, soil organisms, level of biological decay, parent rock material, and time. The soils in the study area consist mainly of sandy soils with local lenses of silty clay. In addition organic soils are usually found along the floodplains and wetlands.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SHERBURNE CO
Stony Brook
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Rice Lake
Briggs Creek
Boyd Lake
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cable
Rice Creek
Lake Briggs
Lake Julia
Rush Lake
Elk River
MISSISSIPPI RIVER
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Long Lake
Pickernel Lake
Elk Lake
Stickney Lake
Fish Lake
Eilers Lake
CLEAR LAKE
Clear Lake
Camp Lake
Elk River
Prairie Lake
Jone's Lake
Crescent Lake
Clitty Lake
BECKER
Surface Hydrology
Rivers and Creeks
Lakes and Ponds
kilometers
miles
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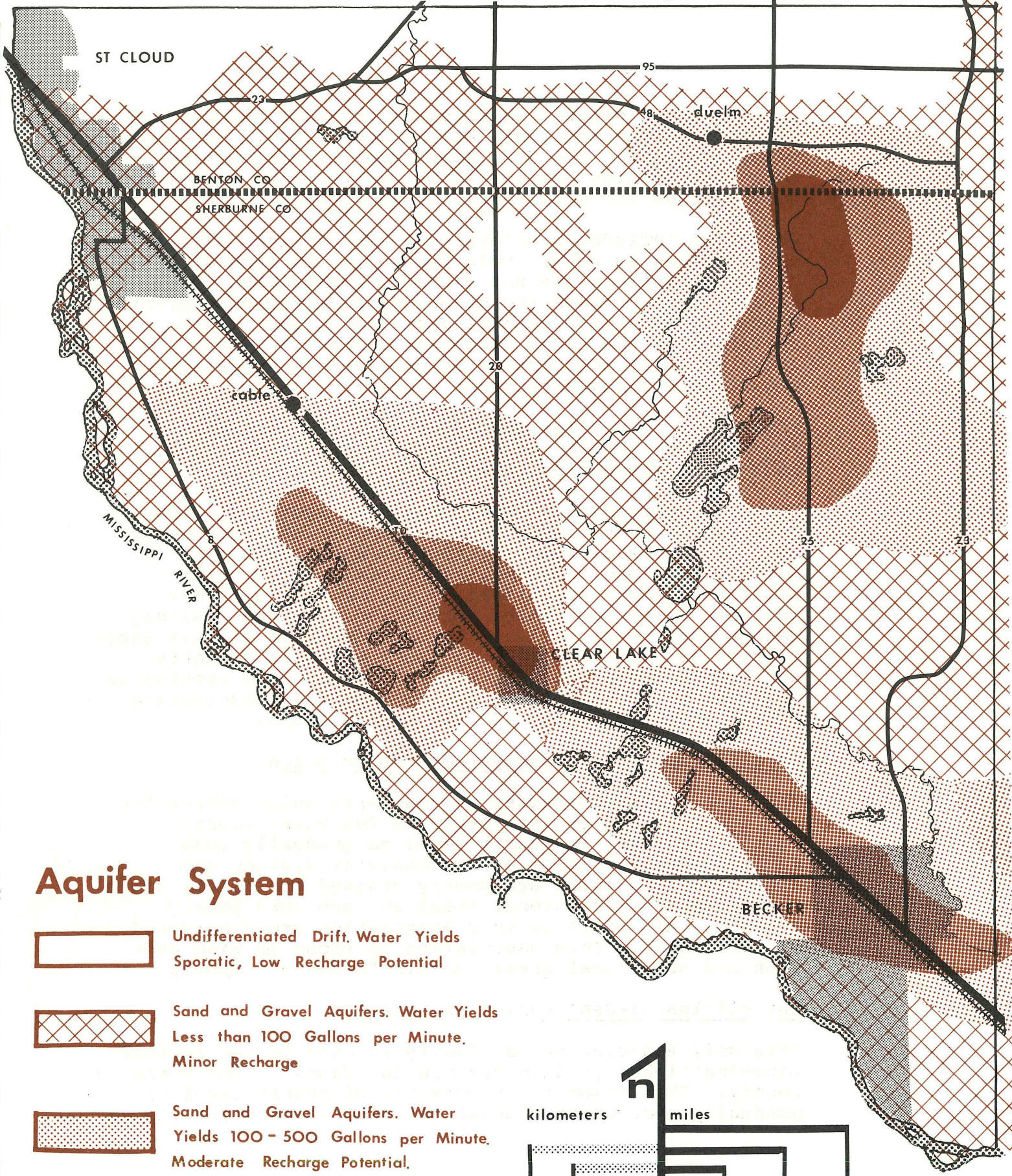
figure 2.5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BECKER
Aquifer System
Undifferentiated Drift. Water Yields Sporatic, Low Recharge Potential
Sand and Gravel Aquifers. Water Yields Less than 100 Gallons per Minute. Minor Recharge
Sand and Gravel Aquifers. Water Yields 100 - 500 Gallons per Minute. Moderate Recharge Potential.
Sand and Gravel Aquifers Water Yields 500 - 1000 Gallons per Minute. Good Recharge Potential.
Sand and Gravel Aquifers. Water Yields Greater than 1000. Prime Recharge Areas.
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figure 2.6

Despite these generalizations, an accurate description of soils can be made only at the local level, by on-site investigations. The U.S. Department of Agriculture, Soil Conservation Service (SCS) has prepared detailed soil atlases for both Sherburne and Benton Counties.

The atlas includes a generalized map showing major soil associations by area. Unfortunately, the general association groupings are not directly comparable. The similarities between the groupings are, however, great enough to provide a general overview of soil characteristics in the study area. In Chapter 5 more detailed soils information is utilized in describing constraints along each route segment.

Figure 2.7 identifies the major soil associations found in the project study area. A brief outline of each soil association is presented below.

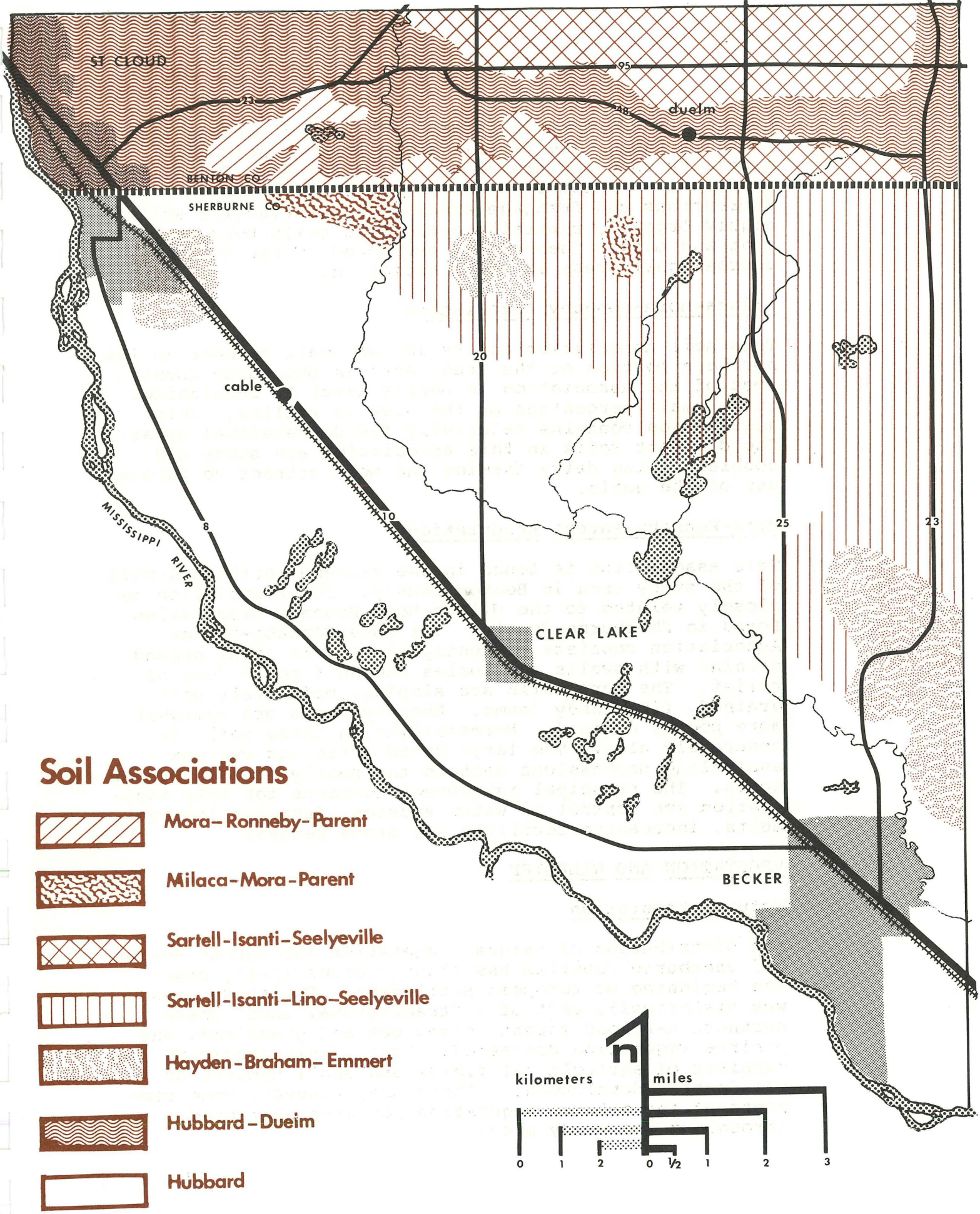
Hubbard Association - Nearly level to gently rolling sandy soils over deeply leached sand or calcareous gravel. This association exists as a sand plain 1 to 10 miles wide along the Mississippi River. This association consists predominately of Hubbard soils but includes small pockets of Esterville, Dickman, Salida, Wadena and Isanti soils. The dominant soil in this association is suited to general farming but is droughty and highly susceptible to wind erosion. Wind erosion is especially notable in the spring when the sandblasting effect of the blowing sand can damage crops.

Sartell-Lino-Isanti-Seelyeville Association

This association occupies a broad area which covers the northeastern and central parts of Sherburne County. Most of the area is nearly level to gradually undulating. Sartell soils are excessively drained and droughty, Lino soils are poorly drained and Isanti soils are found in depressional areas and are very poorly drained. All soils in this association are considered as fine sands. This association is prone to wind erosion and some local areas contain "blow-out" spots.

Sartell-Isanti-Seelyeville Association

This soil association is closely related to the Sartell-Lino-Isanti-Seelyeville Association found in Sherburne County. This association consists of nearly level to gradually undulating glacial outwash plains where slopes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CLEAR LAKE
BECKER
Soil Associations
Mora–Ronneby–Parent
Milaca–Mora–Parent
Sartell–Isanti–Seelyeville
Sartell–Isanti–Lino–Seelyeville
Hayden–Braham–Emmert
Hubbard–Dueim
Hubbard
n
kilometers
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figure 2.7

are 100 to 200 feet in length with relief ranging from 10 to 40 feet. The Sartell soils have a rapid permeability rate and are excessively drained. The Isanti soils are very poorly drained soils that occupy depressions and drainage areas. The Seelyeville soils are highly organic, partially decomposed soils bordering on peat and muck. These soils are found in the deepest depressional areas in the association.

Milaca-Mora-Ronneby Association

This soil association occurs in two small pockets in the northern portion of the study area in Sherburne County. Most of the association is nearly level to undulating, but a small percentage of the area is rolling. This association contains relatively few depressional areas. The dominant soils in this association are stony and cobbled making dairy farming the most attractive farming use of the soils.

Mora-Ronneby-Parent Association

This association is found in the extreme northern limits of the study area in Benton County. The association is closely related to the Milaca-Mora-Ronneby Association found in Sherburne County. The Mora-Ronneby-Parent Association consists of gently sloping to level ground moraine with swells and swales having 5 to 20 feet of relief. The Mora soils are sloping, moderately well drained, fine sandy loams. Ronneby soils are somewhat more poorly drained. Permeability in these soils is moderately slow. The large broad flats and regions encircling depressions contain the poorly drained Parent soils. The principal management concerns for this association are control of water erosion, drainage improvements, increasing fertility and stone removal.

2.6 VEGETATION AND WILDLIFE

2.6.1 Natural Vegetation

The distribution of natural vegetation throughout Benton and Sherburne Counties has changed dramatically since the beginning of European settlement. The study area was historically part of a "transitional zone" where northern hardwood forest, mixed oak and grassland, and prairie vegetation dominated. Today, this landscape consists of agricultural fields and small hamlets of residential development. There are, however, some remnants of the natural vegetation patterns scattered throughout the study area.

Most of the remaining natural vegetation areas are located along the region's streams, wetlands or areas with topographic limitations that restrict the use of the land for agricultural purposes. Deciduous tree species dominate woodlots in the study area with oaks, elms, maples and basswood comprising the principal species. Small shrubby species occupy many of the openings in the oak woodlots. Commonly occurring species include: prickly ash; hazelnut; choke-cherry; black and red raspberries; and other wild berries. Prairie remnants are rare but some prairie species may be found in isolated locations along the Burlington Northern Railroad right of way. The region's wetlands contain a variety of aquatic species in addition to scattered clusters of tamarack trees. Figure 2.8 identifies the general vegetation coverage for the study area.

Most of the plant communities found within the study area have been, to some degree, man-modified by grazing and field drainage improvements. A natural vegetation study prepared by Dr. Max Partch for the Minnesota Nature Conservancy however, identified some locally important vegetation regions. Dr. Partch's report described these vegetation areas as "potential candidates for preservation." (See Figure 2.8.) Although to date, no acqusition plans by the Nature Conservancy are being considered in the subject area, the vegetation areas noted by Dr. Partch warrant careful consideration in defining a final transmission line right of way. Table 2.7 lists the most commonly found vegetation species in the study area.

2.6.2 Windrows and Plantations

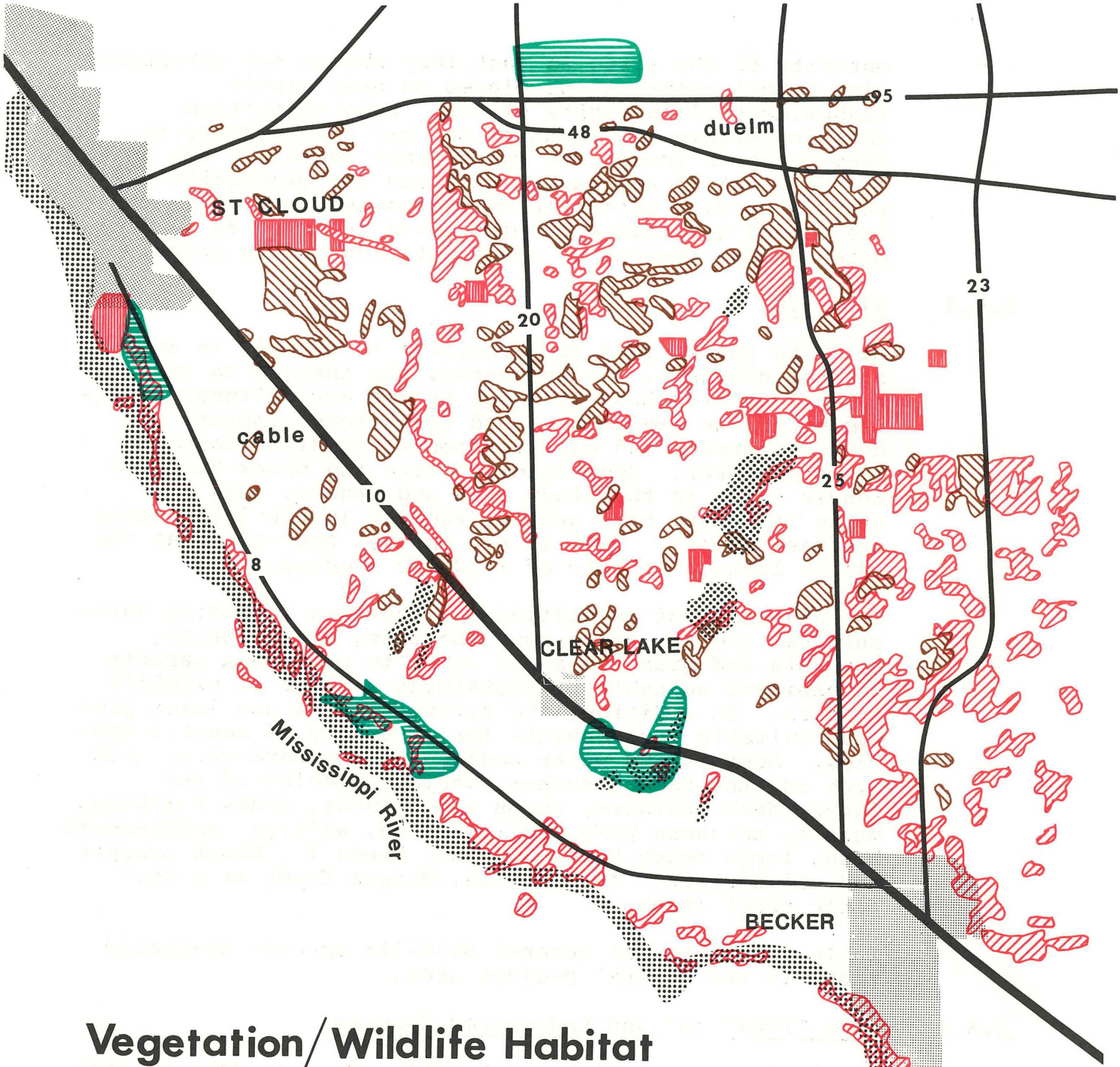
During the 1940's, an extensive program of "shelter belt/windrow" tree planting was undertaken in the study area. These plantings, mostly pine, cedar and spruce, were initiated to help abate wind erosion problems that plague the sandy soils of the region. Today, miles of shelterbelt plantings are found along field margins and roadsides. To insure that wind related erosion problems are minimized, caution should be exercised in locating transmission line rights of way in areas with significant shelter belts.

Within the general study area, several evergreen and nursery stock plantations have been establishd. Generally speaking, evergreen and nursery stock activities are compatible uses within transmission line rights of way. This is due to the fact that the trees do not grow to

TABLE 2.7

CLASSIFICATION OF PLANT COMMUNITIES IN STUDY AREA

Community Type	Major Species	Chief Associated Species	General Locations
Deciduous forest			
1. Maple-Basswood	Sugar maple and basswood.	Am. elm, red oak, ironwood, red elm with typical mesic herbs such as hepaticas, trilliums, and bloodroot.	Found only on better soil types, esp. on glacial moraines
2. Upland Oak	Bur and pin oak.	Am. elm, green oak, aspen, shrubs, such as hazelnut and dogwood.	Found on poor or sandy soils.
3. Floodplain Forests	Am. elm, silver maple.	Green ash, hackberry, black ash, butternut, cottonwood and peach	Found along flood-plains.
4. Bogs	Tamarack, alder.	Willows, dogwoods, black ash.	Relic northern bogs are only occasional this far south.
5. Prairies and Oak Savanna	Bur oak with various tall grass prairie species.	Big bluestem, reed grass, drop-seed, various prairie legumes, purple prairie clover, and blazing star.	Only small prairie remnants remain, especially on lighter soils.
6. Meadow, Marsh and Shrub Communities	Aquatic plants, sedges, willows, dogwood, alder, etc.	Varies, depending upon the community type.	Most of these communi-ties are man-modified due to grazing or haying.



Vegetation/Wildlife Habitat

Partch's Canidates for Nature Conservancy Areas

General Wood Lots

Other Areas of Wildlife

Wetlands

kilometers 0 1 2

miles 0 ½ 1 2 3

figure 2.8

maturity on the site. As such they should not interfere with height restrictions placed on uses within transmission line rights of way. Some vegetation clearing within the right of way may be necessary to permit proper access for maintenance vehicles, but most of the right of way may be utilized for plantation purposes. Special attention should however, be given to the use of herbicides in plantation areas so as to minimize adverse impacts on the plantation growth stock.

2.6.3 Wildlife

Wildlife populations are sensitive to changes in their natural habitats. Consequently, the changes in their natural setting brought about by the agricultural development of the region have had significant impacts on both the number and distribution of wildlife found in the study area. Some species, like the black bear, no longer exist in the study area and others, like the white tail deer have greatly reduced in population over the past decade. This is not to say, however, that the region lacks a variety of wildlife species.

The diversity of vegetation environments including agricultural fields, fence rows, marshes, shelterbelts, woodlots and grasslands all serve to provide a variety of habitats suitable of sustaining a range of wildlife species. In addition, the rivers, creeks and lakes provide suitable environments for a variety of aquatic species. Most of the water bodies support warm-water fish such as: the common sucker, various species of red horse, dace, shiners, chubs and minnows, black bullhead, muskie, northern pike, yellow perch, walleye, small-mouth bass, large mouth bass, sunfish, bluegill, black crappie and stickleback. In addition, Briggs Creek is a cold-water trout stream.

Table 2.8 lists the general wildlife species generally found in the general project area.

2.6.4 Rare,Threatened and Endangered Species

The United States Fish and Wildlife Service reports that based upon information currently available, no rare, threatened, or endangered, species are found within the project area.

TABLE 2.8

WILDLIFE HABITATS ASSOCIATED WITH THE
PLANT COMMUNITIES OF THE STUDY AREA

Primary Habitat	Mammals	Birds
Upland Oak Forests	White-tailed deer, gray squirrel, raccoon, white footed mouse, gray fox, woodchuck, eastern chipmunk, several bat species.	Ruffed grouse, blue jay, scarlet tanager, rose-breasted grosbeak, several woodpeck species, least flycatcher, B.C. chickadee W.B. nuthatch
Mesic Maple-Basswood Forests	Same as above with the addition of red-backed mice and short-tailed shrews.	Same as above with the of red-eyed vireo, oven bird, Red start, veery, yellow-throated vireo, cerulian warbler.
Forest Edge or Brushlands	Same as above plus, Franklin's grand squirrel, fox squirrel and pulus cottontail.	Catbird, brown thrasher, mourning dove, northern oriole, cardinal, indigo bunting, song sparrow, black-billed cuckoo, robin.
Grassland and Open Farmland	Masked shrew, lined ground squirrel, pocket mouse, prairie deer mouse, meadow and prairie moles, meadow jumping mouse, badger, skunks, red fox	Marsh hawk, American Kestrel, grey partridge, pheasant, eastern kingbird, horned lark, loggerhead shrike, western meadowlark, vesper and clay colored sparrows, bobolink.
Tamarack Bog	Artic and water shrew, bog lemming, snowshoe hare.	Several warbler species and Lincoln sparrow (usually during migration.)
Wetlands and Open Water Areas	Aquatic furbearers (muskrat, mink, beaver, and racoon).	Several duck species, herons, black tern, coots, rails.

2.7 DEMOGRAPHY

2.7.1 Population Distribution

The project study area has a predominantly rural agricultural character. Several concentrations of population, however, are located throughout the region. The greatest population concentrations are in and around the incorporated communities of Clear Lake and Becker. In addition, population centers are found surrounding the largest of the region's lakes. In general, the population of the study area has been steadily growing with the greatest percentage increases occurring in the areas of the city of St. Cloud and Becker.

In 1976, the estimated population of the seven townships in the study area was 8,200 people. This represented only 11% of the total Benton County population and about 21% of the Sherburne County population. The population density within the study area was about 47 people per square mile. The largest settlements in the region, (Becker-population 476; Clear Lake-population 457; and part of St. Cloud-population 3,867), are located along Highway 10 and the Burlington Railroad Line.

2.7.2 Population Change

Population in the study area has been growing at a moderate to rapid rate. Population projections (to the year 2000) for Sherburne and Benton Counties have been made by the Minnesota Office of the State Demographer. These projections are illustrated in Figure 2.9.

From 1960 to 1970 the population growth of the study area was moderate. Clear Lake Township was the only township which exhibited a population decrease. The greatest percentage increases occured in Haven and Palmer townships. (See Table 2.9). From 1970 to 1976 the population growth of the region increased 46%. All but three townships (Minden, St. George and Haven) exhibited a population increase of over 60%. Becker and Clear Lake Townships had the greatest percentage increases of 74.2% and 69.3% respectively. (See Figures 2.10 and 2.11.)

2.7.3 Human Settlements

The study area is experiencing rapid growth in both incorporated and rural regions. Although the majority of the study area is sparsely populated, the balance of the area's population resides in small hamlets, new rural subdivisions, lake developments and the two communities of Becker and Clear Lake.

POPULATION PROJECTIONS

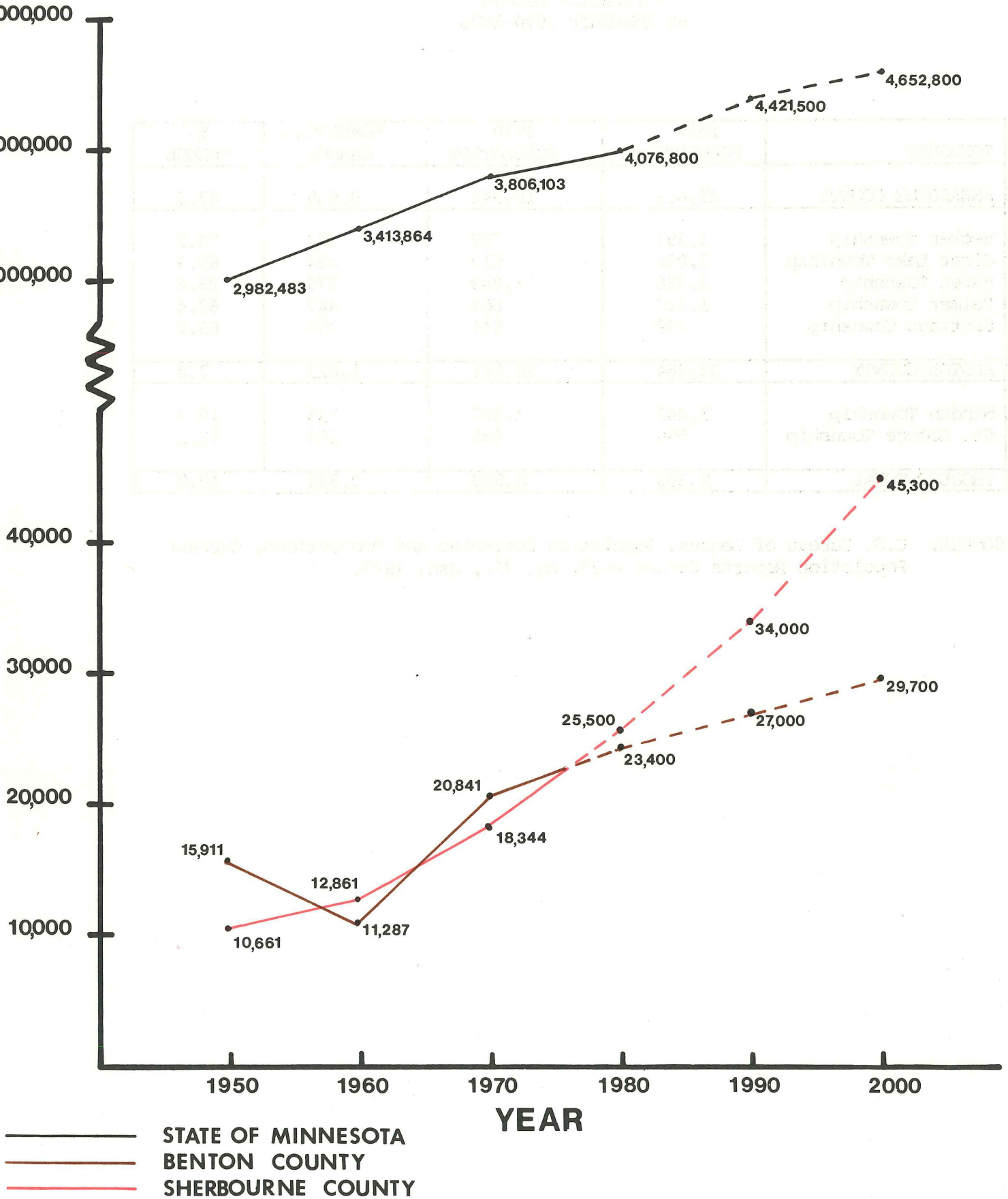


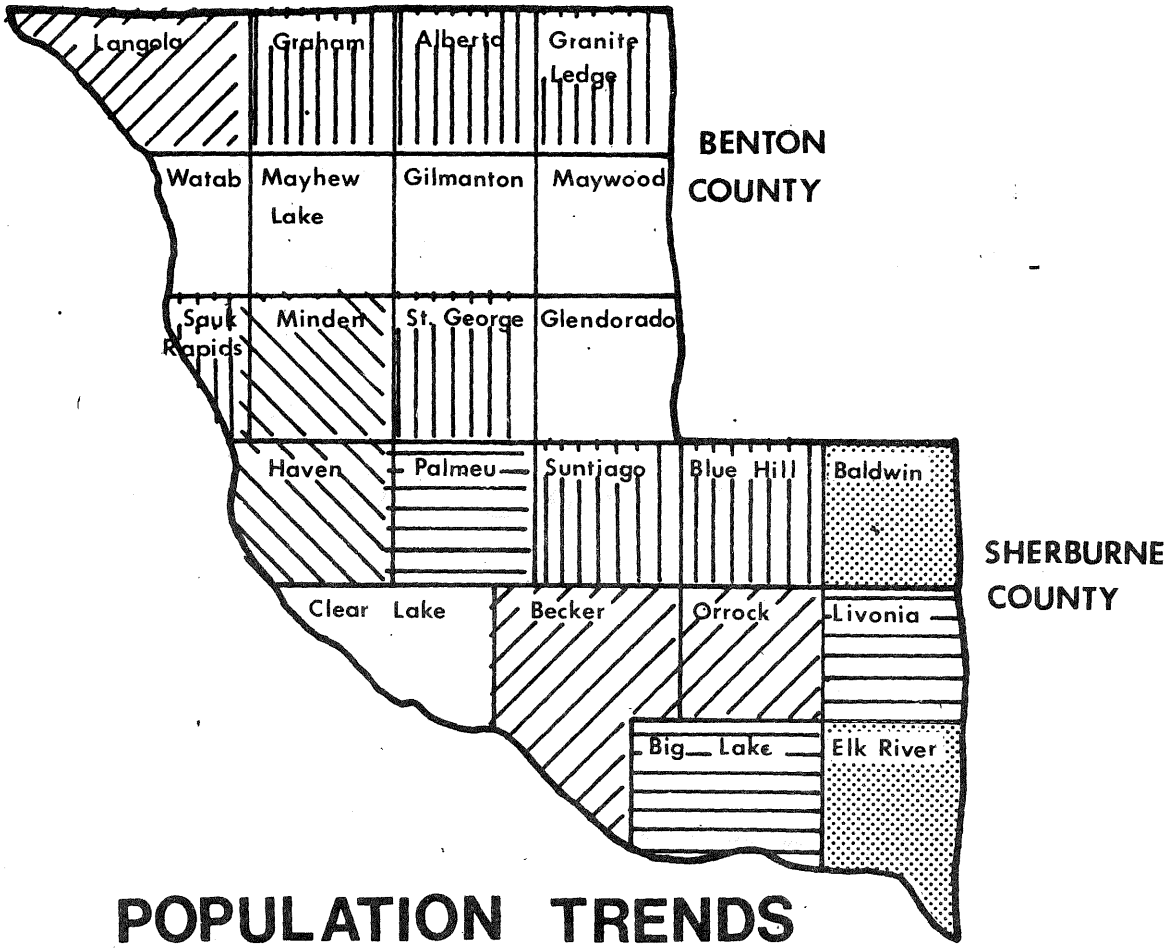
figure 2.9

TABLE 2.9

POPULATION GROWTH
BY TOWNSHIP 1970-1976

TOWNSHIP	1976 POPULATION	1970 POPULATION	NUMERICAL CHANGE	% CHANGE
SHERBURNE COUNTY	27,003	18,344	8,659	47.2
Becker Township	1,392	799	593	74.2
Clear Lake Township	1,036	612	424	69.3
Haven Township	1,328	1,049	279	26.6
Palmer Township	1,110	663	447	67.4
Santiago Township	899	541	358	66.2
BENTON COUNTY	22,464	20,841	1,623	7.8
Minden Township	1,442	1,307	135	10.3
St. George Township	996	888	108	12.1
PROJECT TOTAL	8.203	5,859	2,344	40.0

SOURCE: U.S. Bureau of Census, Population Estimates and Projections, Current Population Reports Series P-25, No. 762, Jan. 1979.

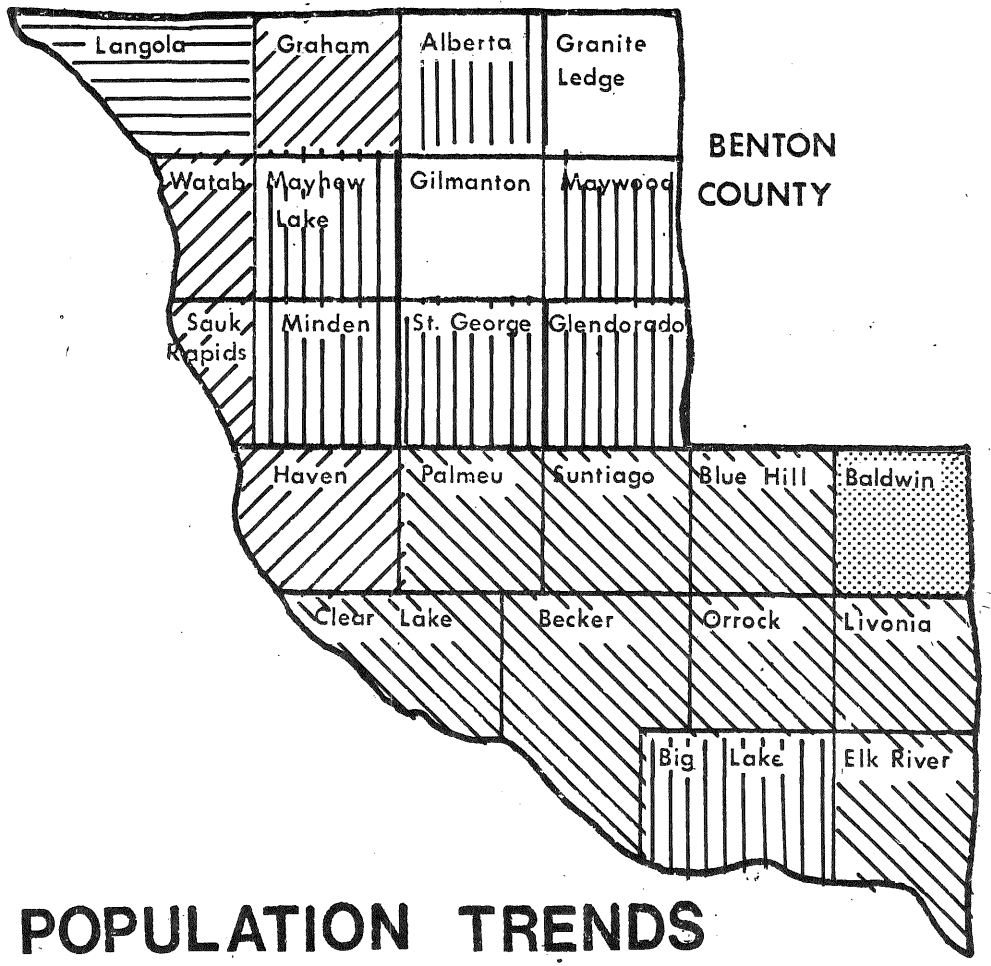


POPULATION TRENDS
1960 - 1970

POPULATION GROWTH

Decreasing Growth		20 - 40% Growth	60 - 80% Growth
0 - 20% Growth		40 - 60% Growth	80 - 100% Growth

figure 2.10



POPULATION TRENDS
1970 - 1976

Source: Central Minnesota Regional Development Commission and U.S. Bureau of the Census

POPULATION GROWTH

Decreasing Growth

0 - 20% Growth

20 - 40% Growth

40 - 60% Growth

60 - 80% Growth

80 - 100% Growth

figure 2.11

The economy of the study area is becoming more diversified as non-agricultural activities assume a larger role in the local economy. Consequently, the non-agricultural population is growing rapidly, especially in the southeastern portion of the study area. This growth is reflected in the new residential subdivisions developing in the region. In general, the human settlements of the region can be classified as: rural residences, rural junctions, rural subdivisions and towns. (See Figure 2.12.) The majority of people likely to be affected by the proposed transmission line are dispersed throughout the countryside along county roads and section lines on farmsteads and in single family homes. Depending upon the final route selected, residents in the town of Clear Lake, and residents in the unincorporated areas of Briggs Lake and Wildwood Acres could also be affected.

Other organized economic and social activities are not immediately apparent except at rural junctions where a few homes, a store, a church or a school to provide a low order foci for rural community activities. Only two such rural junctions are found in the subject area - Cable (population 10) and Duelm (population 70).

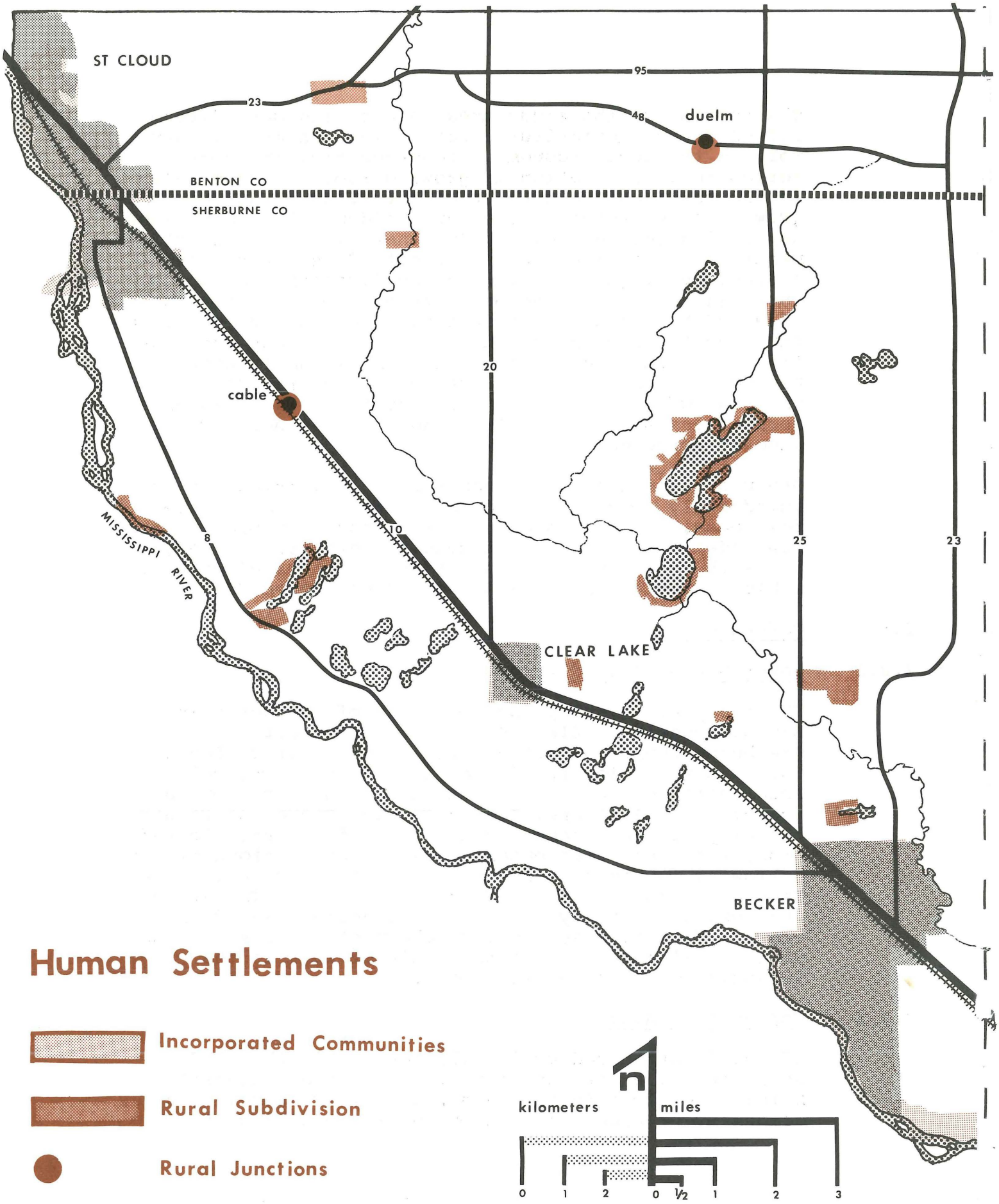
2.8 GOVERNMENT

2.8.1 Governmental Jurisdictions

The study area encompasses portions of Sherburne and Benton Counties. Elk River, the county seat of Sherburne County and Foley, the county seat of Benton County are not located in the study area. The only local units of government potentially affected by the transmission line are: Benton County, Sherburne County, the city of Clear Lake and the City of Becker. In addition, the study area encompasses all or portions of the following townships: Becker, Clear Lake, Haven, Palmer, Santiago, Minden and St. George Townships. The study area exists entirely within the planning area of the Central Minnesota Regional Development Commission. No other local jurisdiction has a direct role in the transmission line routing process.

2.8.2 Community Zoning

Of the incorporated municipalities within the study area, only the City of Clear Lake has the potential of being directly affected by a route alternative. The community of Clear Lake is presently working on the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CLEAR LAKE
BECKER
Human Settlements
Incorporated Communities
Rural Subdivision
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figure 2.12

adoption of a new zoning ordinance. At the writing of this EIS, the ordinance has not been formally adopted. The draft ordinance and zoning map under consideration are shown in Figure 2.13. The Clear Lake zoning map contains eight zoning districts. These include:

R-1 Rural Residential District
R-2 Single Family Urban Residential
R-3 Mid-Density Residential
R-4 Multi-Family Residential
B-1 Retail Business
B-2 Highway Business
I-1 Industrial
W-1 Wetland Overlay

2.8.3 Rural Zoning

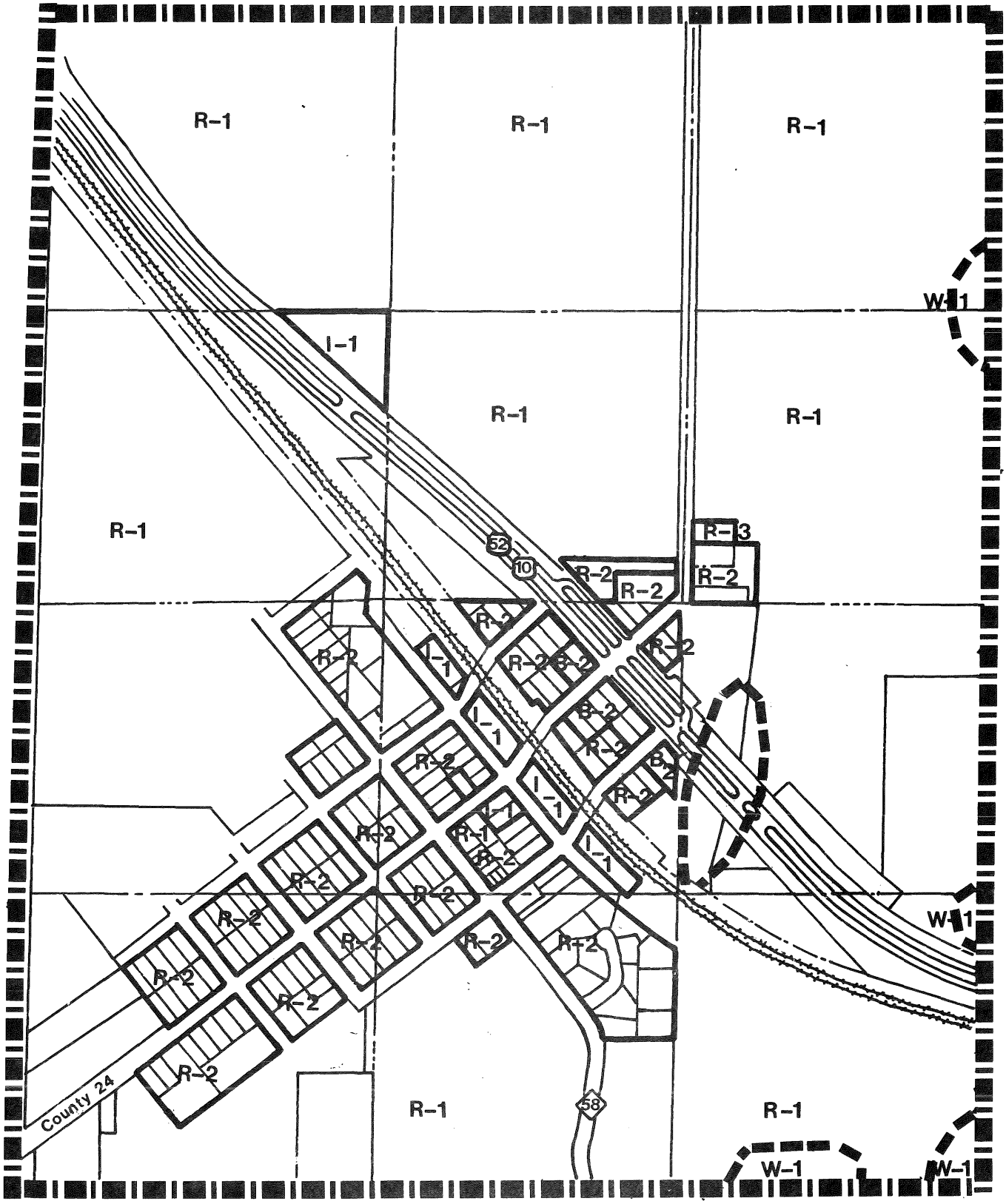
Both Benton and Sherburne Counties have rural zoning ordinances governing land use development in the unincorporated areas. The two county ordinances are simlar in their intent and content for each zoning district.

Agricultural activities are generally zoned as A-1 (Agriculture/Conservation) or A-2 (General Agriculture). The A-1 district is established to promote, preserve and maintain agricultural and non-intensive developments. Development on non-farm residence in an A-1 district is limited. In the A-2 district, agricultural uses are the primary uses, however, non-farm rural residential subdivisions are permitted. Minimum lot sizes for the rural residential lots are 2 1/2 acres.

The business zoning categories used are B-1 (Highway Service Business) and B-2 (General Business). Land uses permitted in a B-1 district are those most generally related with highway or roadway business activities such as drive-in restaurants. The B-2 district is used to depict general retail sales activities.

Industrial uses are restricted to I-1 (Limited Industry) and I-2 (General Industry). The I-1 districts are primarily used to note service activities such as gas stations or auto repair shops. The I-2 industrial category is more all inclusive of industrial processing types of uses.

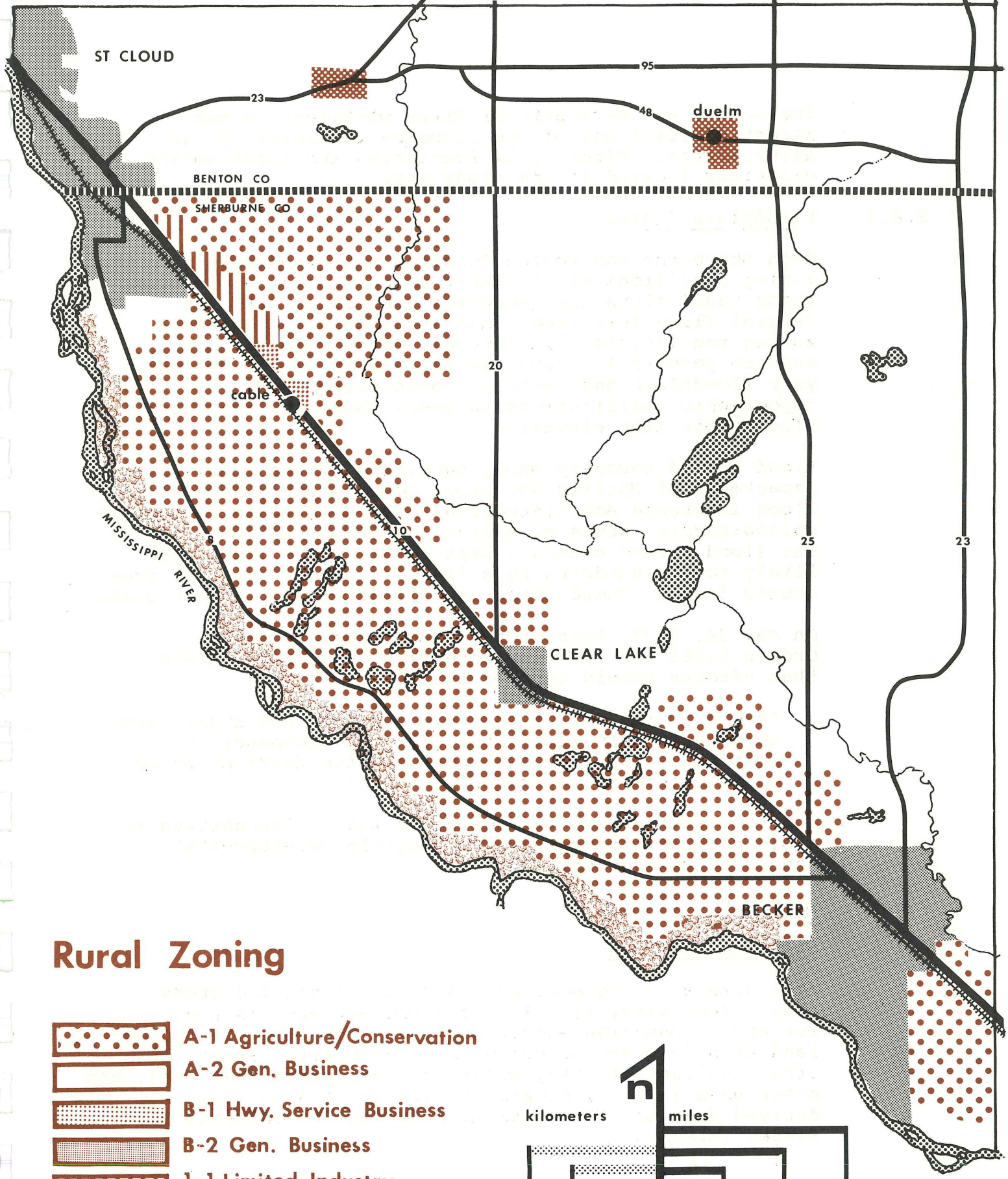
Residential zoning categories consist of R-1 (General Residence) and R-2 (Suburban Residence). The primary difference between these zoning categories is that public sewer and water is necessary in the R-2 districts.



PROPOSED ZONING JANUARY 1980 – CLEAR LAKE TOWNSHIP

R-1 Rural Residental
R-2 Single Family Urban Residental
R-3 Mid-Density Residental
R-4 Multi-Family Residental
B-1 Retail Business
B-2 Highway Business
I-1 Industrial
I-1 Wetland Overlay

figure 2.13



Rural Zoning

- A-1 Agriculture/Conservation
- A-2 Gen. Business
- B-1 Hwy. Service Business
- B-2 Gen. Business
- 1-1 Limited Industry
- R-1 Gen. Residential
- Scenic & Rec. River District

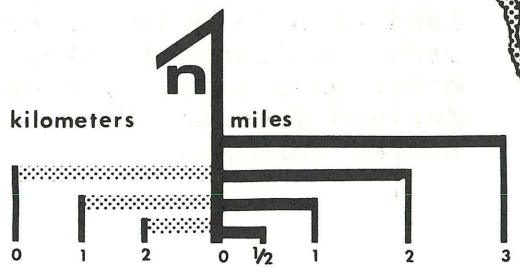


figure 2.14

The Scenic and Recreational River Districts do not directly affect any of the proposed transmission line alternatives. Figure 2.14 identifies the rural zoning districts located in the study area.

2.8.4 Floodplain Zoning

Both Sherburne and Benton Counties have floodplain zoning provisions within their county zoning ordinances. These regulations are generally consistent with the Federal Flood Insurance Administration's floodplain zoning regulations. In general, these regulations require permits for land use activities within the 100 year floodplain and restrict construction and topographic modifications to areas above the regulatory flood protection elevation.

Flood hazard boundary maps, published by the U.S. Department of Housing and Urban Development's Federal Flood Insurance Administration, have been prepared for the unincorporated areas of Benton and Sherburne Counties. The flood hazard boundary maps identify the areas most likely to be inundated by a 100 year flood, i.e., 1% frequency flood. These areas are illustrated in Figure 2.15.

On May 24, 1977, President Carter issued Executive Orders 11988 and 11990. These Executive Orders state that efforts should be made to:

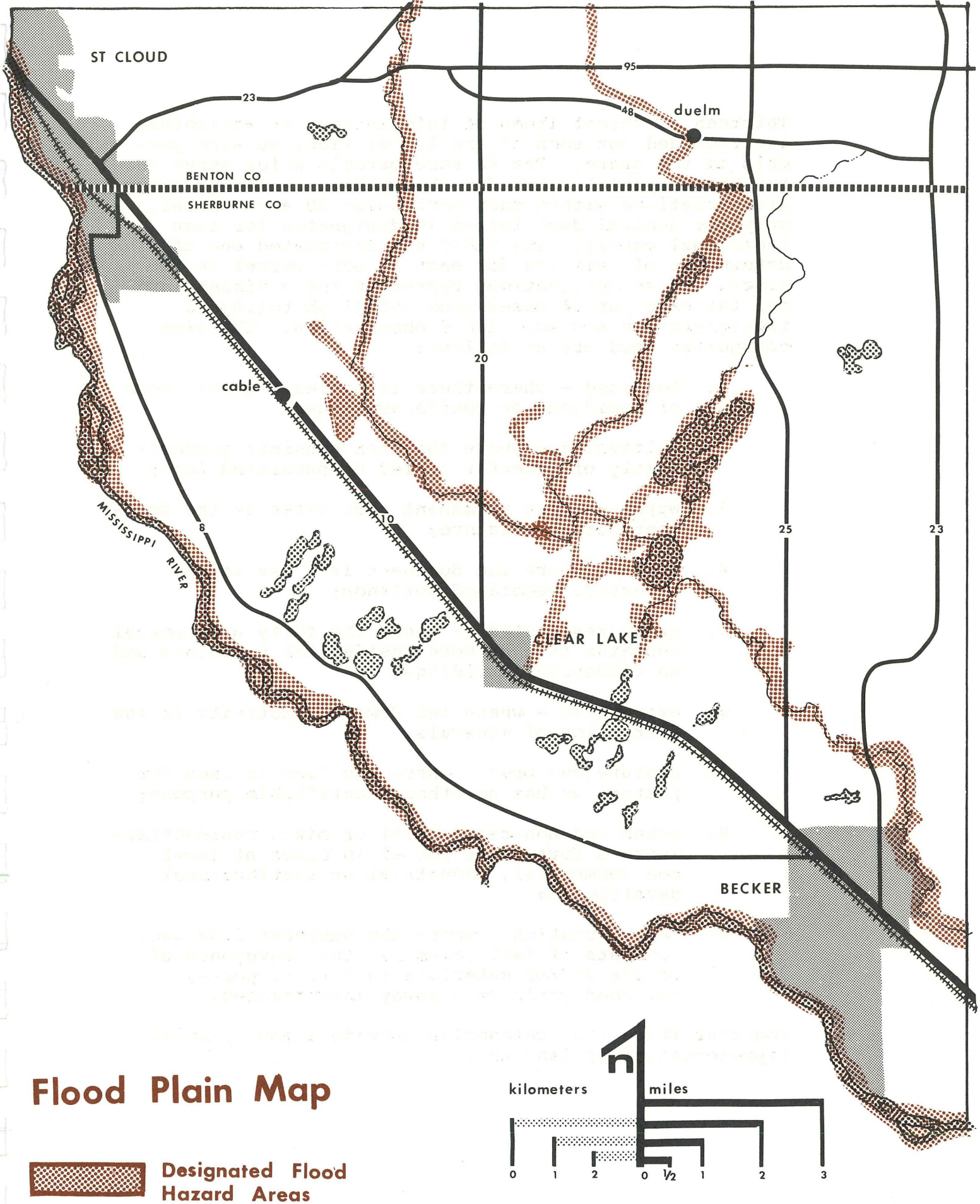
> "avoid to the extent possible the long and short term adverse impacts associated with the occupancy and modifications of floodplains; and the destruction or modification of wetlands."

The Executive Orders further state that "alternatives to avoid adverse effects and incompatible developments" should be considered.

2.9 LAND USE

2.9.1 Existing Land Use

Agriculture is the dominant land use within the study area. Approximately 74% of the project area is used for crop production and/or grazing. The other remaining land uses in order of dominance are forested areas (16%), urban residential (5%), water area and marshlands (4%), and other uses (1%). The data on general land use was derived from the Minnesota Land Management Information System (MLMIS).



Flood Plain Map

Designated Flood Hazard Areas

figure 2.15

Thirteen different items of information, or variables, are recorded for each of the 1.4 million, 40 acre parcels in the state. The 40 acre parcels which serve as the basic spatial units for the system. Although there are variations within each particular 40 acre parcel, only one general description is designated for each individual parcel. The MLMIS has designated one of nine categories of land use for each 40 acre parcel in the state. These designations represent the dominant land use for each parcel based upon aerial photographic interpretation and some field observation. The nine categories used are as follows:

1. forested - where there is at least a 10% crown of decidious or coniferous trees;

2. cultivated - where the area consists predominantly of recently tilled or harvested land;

3. water - where permanent open water is the dominant surface feature;

4. marsh - where the dominant land use is non-forested, vegetated wetlands;

5. urban residential - where the forty acre parcel contains five or more residential buildings and no commercial buildings;

6. extractive - where the dominant activity is the extraction of minerals;

7. pasture and open - where the land is used for pasture or has no other identifiable purpose;

8. urban and non-residential or mixed residential- where a forty acre parcel includes at least one commercial, industrial or institutional development;

9. transportation - where the dominant land use consists of facilities for the conveyance of people and/or materials such as airports, railroad yards or highway interchanges.

Together these nine categories provide a good general representation of land use.

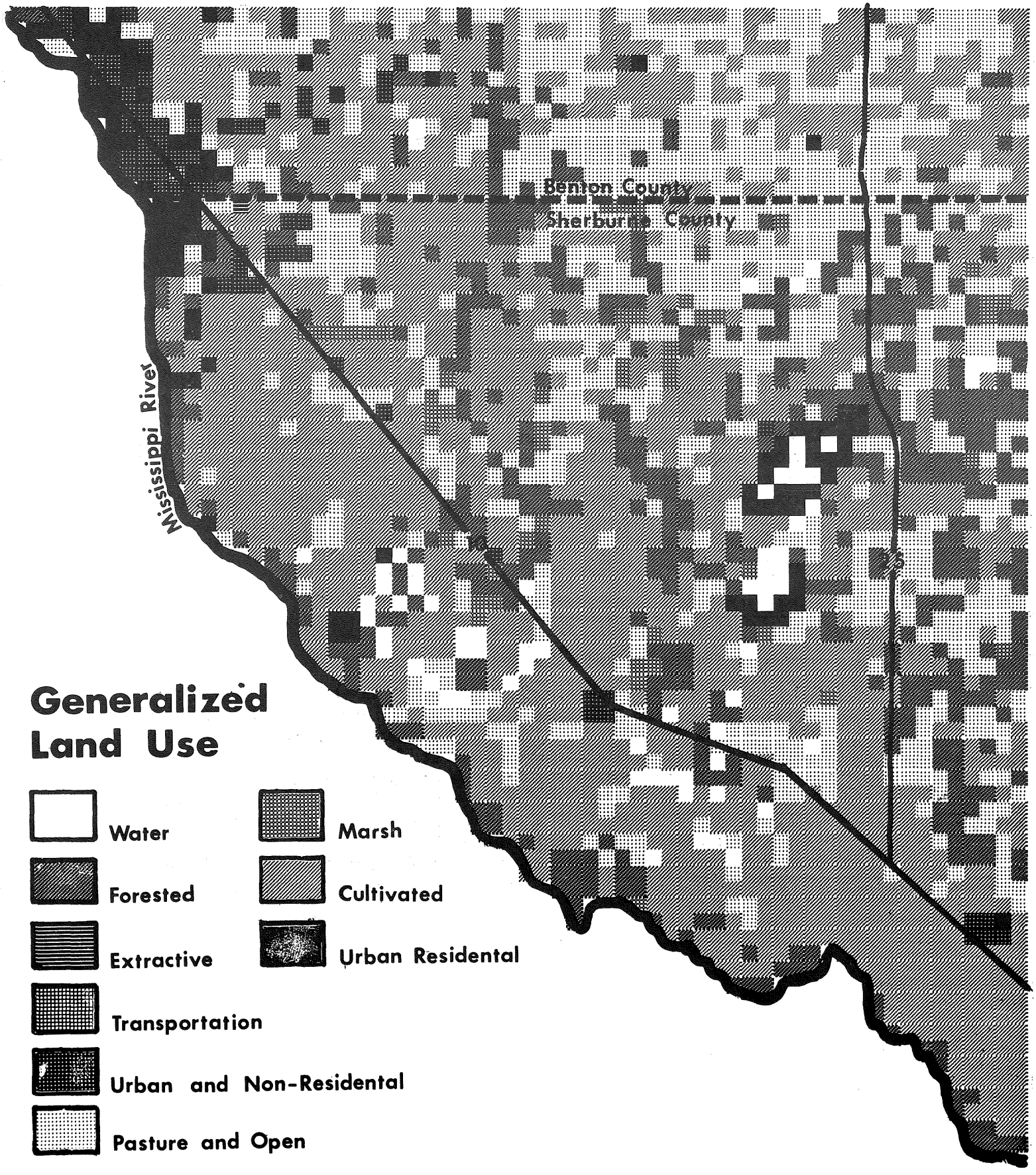

Benton County
Sherburne County
Mississippi River
Generalized Land Use
Water
Forested
Extractive
Transportation
Urban and Non-Residental
Pasture and Open
Marsh
Cultivated
Urban Residental

figure 2.16

For the purposes of this study, a general land use map was compiled based upon MLMIS land use data recorded initially on a 40 acre basis. This map, Figure 2.16, shows the distribtuion of the nine land use categories discussed above.

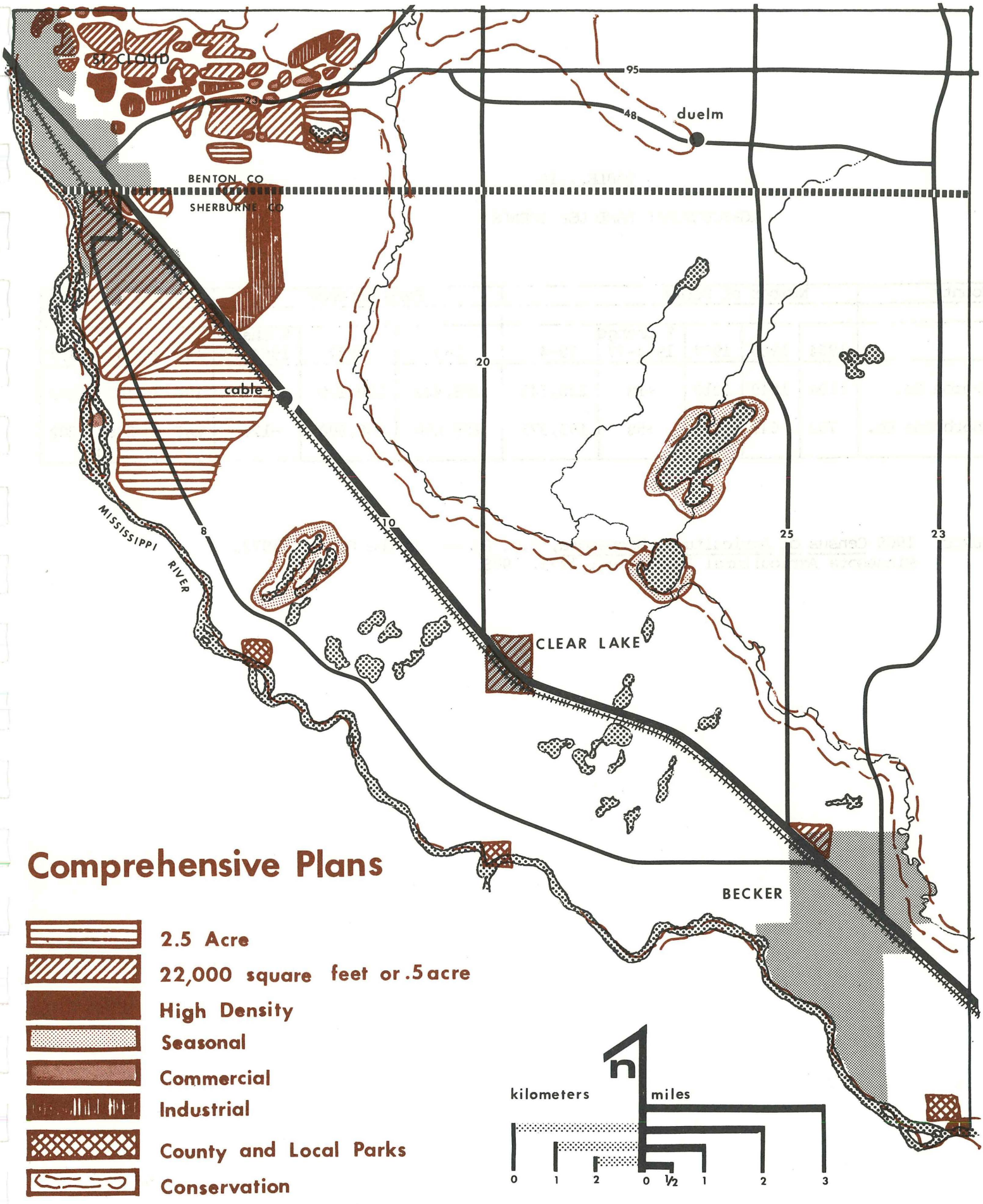
2.9.2 Land Use Plans

Communities and counties often prepare long range Comprehensive Land Use Plans to help guide and direct their future growth and development. In the project study area both Sherburne County and Benton County have adopted long range land use plans. The dominate land uses are agriculturally related. Other proposed uses include: urban residential uses surrounding Lake Briggs, Lake Julia, Elk Lake, and Rush Lake; conservation open space and recreational uses along the Mississipi and Elk Rivers; industrial uses on the west side of the St. Cloud Airport; and low density rural estate development southeast of the City of St. Cloud. The land use recommendations for the project study area are shown on Figure 2.17.

2.10 AGRICULTURAL DEVELOPMENT

2.10.1 Agricultural Land Use Trends

Agriculture has been and continues to be the leading industry in the general study area, even though there has been a steady decline in the average farm size and total farm acreage over the past 15 years. In Sherburne County a slight increase in farm acreage was noted between 1969 and 1977. This is probably due to increased use of irrigation systems. Table 2.10 illustrates the general changes in agricultural activities for Sherburne and Benton Counties. Important factors which influence agricultural activities are soil productivity and climatic factors.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CLEAR LAKE
BECKER
Comprehensive Plans
2.5 Acre
22,000 square feet or .5 acre
High Density
Seasonal
Commercial
Industrial
County and Local Parks
Conservation
n
kilometers
miles
0 1 2 0 ½ 1 2 3

figure 2.17

TABLE 2.10

AGRICULTURAL LAND USE TRENDS

County	Number of Farms				Farm Acreage				Average Farm Size		
	1964	1969	1977	% change 1964-77	1964	1969	1977	% change 1964-77	1964	1969	1977
Benton Co.	1194	1049	1210	+1%	228,545	203,422	220,100	-4%	186	187	182
Sherburne Co.	752	641	790	+5%	193,375	159,656	159,800	-12%	247	238	202

SOURCE: 1969 Census of Agriculture, Minnesota, v.s. Bureau of the Census, 1972.
Minnesota Agricultural Statistics, 1975, 1978

2.10.2 Soil Productivity

One of the principal factors in determining agricultural land use is soil productivity. Soil productivity is the physical measure of an area's agricultural potential. Consequently, although it is normally expressed only in physical terms, soil productivity is the product both of soil suitability (discussed in section 2.5) and of the economic potential for agriculture.

Two measures of soil productivity are used here. One is the climate modified soil productivity system developed by the Minnesota State Planning Agency, and described below in Section 2.10.2.1. Another measure uses soil capability groupings established by the USDA Soil Conservation Service, described in Section 2.10.2.2. These two measures of soil productivity systems are similar, but they have important differences in detail.

Both systems seek to translate a variety of factors into one index of soil productivity or agricultural potential. Both provide general surveys for regional planning purposes although they are at a scale of generalization that makes their use in local on site planning difficult. Both evaluate essentially the same list of factors, such as, soil quality, climate, slope and drainage, in order to estimate agricultural potential.

Despite these similarities, there are important differences between these two measurement systems. Field work used to develop these soil inventories, was conducted at different times using different techniques and assumptions. As such, varying sources of data were used. For example, the Soil Conservation Service uses its own county surveys while the Minnesota State Planning Agency used the Minnesota Soil Atlas for its soil data. The SCS data was collected in small, local units, and organized and evaluated on a county-by-county basis. The State Planning Agency data are organized at the 40 acre level and analyzed in the state-wide level. However, the original data collection land units were much larger than the 40 acre cells. Therefore, the precision of measurement of the Minnesota State Planning Agency is somewhat less than implied by 40 acre data preservation. Although the two soil productivity systems are simlar, they are not directly comparable. Both are presented in this report.

2.10.2.1 Climate Modified Soil Productivity

Climate modified soil productivity is a means to measure the agricultural productivity of land. Like the land use data cited above, data on climate modified soil productivity provide relative, comparative values assigned to 40 acre parcels. Figure 2.18 presents a general estimate of the cropland productivity within the study area based upon this index.

The data mapped here are taken from Minnesota Crop Land Resource. This study was prepared by the State Planning Agency to assess and inventory cropland productivity. As part of this report, a mathematical model for ranking Minnesota croplands has been prepared. The soil productivity characteristics considered include:

1. texture of soil above and below five feet from the surface;

2. natural drainage conditions;

3. color of soil as an indication of organic content;

4. slope of the soil unit;

5. depth of the rooting zone; and

6. phosphorus/potassium content.

Two climatic variables, average annual precipitation and cumulative growing season heat (growing degree days), were used in the model. Present land use and ownership were also considered. The model assumes that land in open or agricultural use under private ownership was more likely to be farmed than, for example, developed land or public lands.

After giving each of these variables a quantitative value, each 40 acre parcel inventoried by MLMIS was given a combined score, ranging from 0 to 94. These scores represent a relative value in relation to other ranks on this index. For example, a parcel of land with a score of 82 clearly has more theoretical potential as cropland than a parcel with a rank of 70. At the same time, the difference between a score of 80 and 82 is relatively slight. It is possible, for instance, for a skillful farmer to obtain higher yields on land scored at 80 than his neighbor possessing land ranked at 82. Nevertheless, these scores indicate relative differences in land quality within the study area. Most of the soils in the study area are not rated as having a high agricultural productivity level.

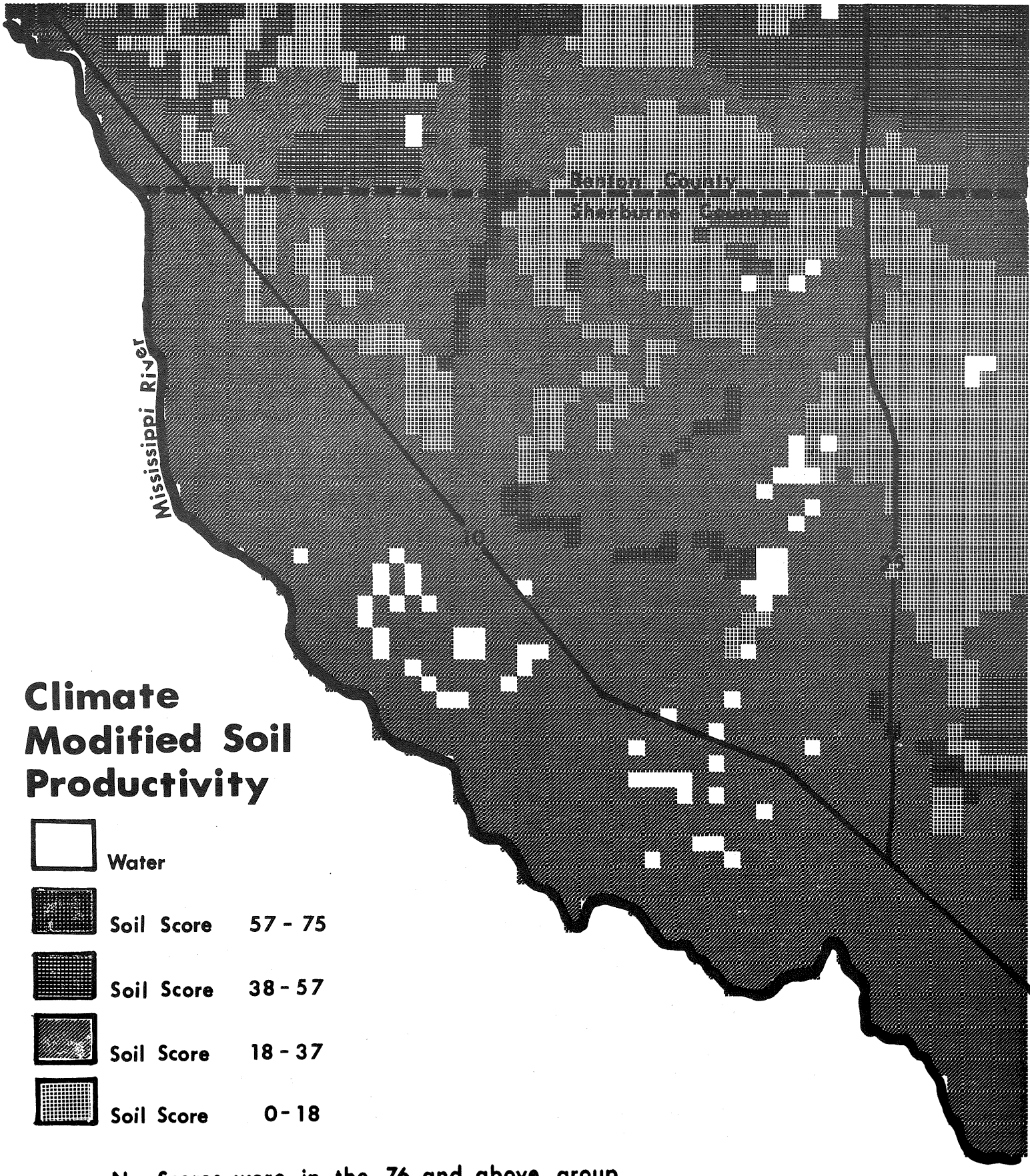
Mississippi River
Climate
Modified Soil
Productivity
Water
Soil Score 57 - 75
Soil Score 38 - 57
Soil Score 18 - 37
Soil Score 0 - 18
No Scores were in the 76 and above group

figure 2.18

2.10.2.2 Soil Capability Groupings

The Soil Conservation Service supplements its basic soil classification system with soil capability groupings which provide an index of the suitability of soils for most crops. Possible major agricultural development projects, such as large scale reclamation and specialty croplands, are possible. In general, soil quality, growing season, slope, potential for erosion, drainage and moisture supply are considered. Land is ranked in terms of its ability to economically produce sustained high yields of crops when treated and managed with modern farming methods. Data was analyzed on a county-wide basis using information derived from the Soil Conservation Service's county soil surveys.

The actual capability groups are ordered in terms of the number of limitations or restrictions to the production of high yield crops within a particular county. Thus, SCS capability classes I through VIII indicate progressively greater limitations and narrower choices for practical use.

Class I soils have few limitations that restrict their use. (None are in the study area.)
Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.
Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.
Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.
Class V soils are not likely to erode but have other limitations, that limit their use largely to pasture, range, woodland, or wildlife.
Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife.
Class VII soils have very severe limitations that make them unsuited for cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.
Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, or water supply purposes.

In addition, these capability classes are further subdivided into capability subclasses, which indicate physical limitations such as the risk of erosion, shallow soil, and adverse climate, and into capability units which combine similar groups of soils in convenient groupings for management purposes.

Figure 2.19 illustrates the distribution of "Important Farmlands for Sherburne and Benton Counties" as defined by the Soil Conservation Service (SCS). Only the Prime Agricultural Lands are depicted on Figure 2.19.

Prime Farmlands are described as:[1]

> "Soils that have the best combination of physical and chemical properties for producing food, feed, forage, fiber and oilseed crops and is also available for these uses."

Generally soils classified as Class I and Class II compatibility are listed as prime agricultural soils. The study area contains very few areas classified as prime farmlands.

Additional farmlands of statewide importance are defined as:

> "the second best soils in the county. These soil areas require more intensive management to produce high yields of food, feed, forage, etc. They may have problems due to steepness, wetness, droughtiness or being quite susceptible to wind erosion."

Generally soils in compatibility Class III are listed as additional farmland of statewide importance.

Additional farmlands of local importance are described as:

> "soil areas that are nearly level to gently sloping, excessively drained, droughty loamy sands and loamy fine sands. To produce good yields, they need a very high level of management. This high level of management will include some method of erosion control, adding organic matter to the soil, and providing supplemental water for the growing of crops besides the other common farming practices such as weed control programs.

Farmlands of local importance are generally soils classified as Class IV soils.

Other lands are defined as:

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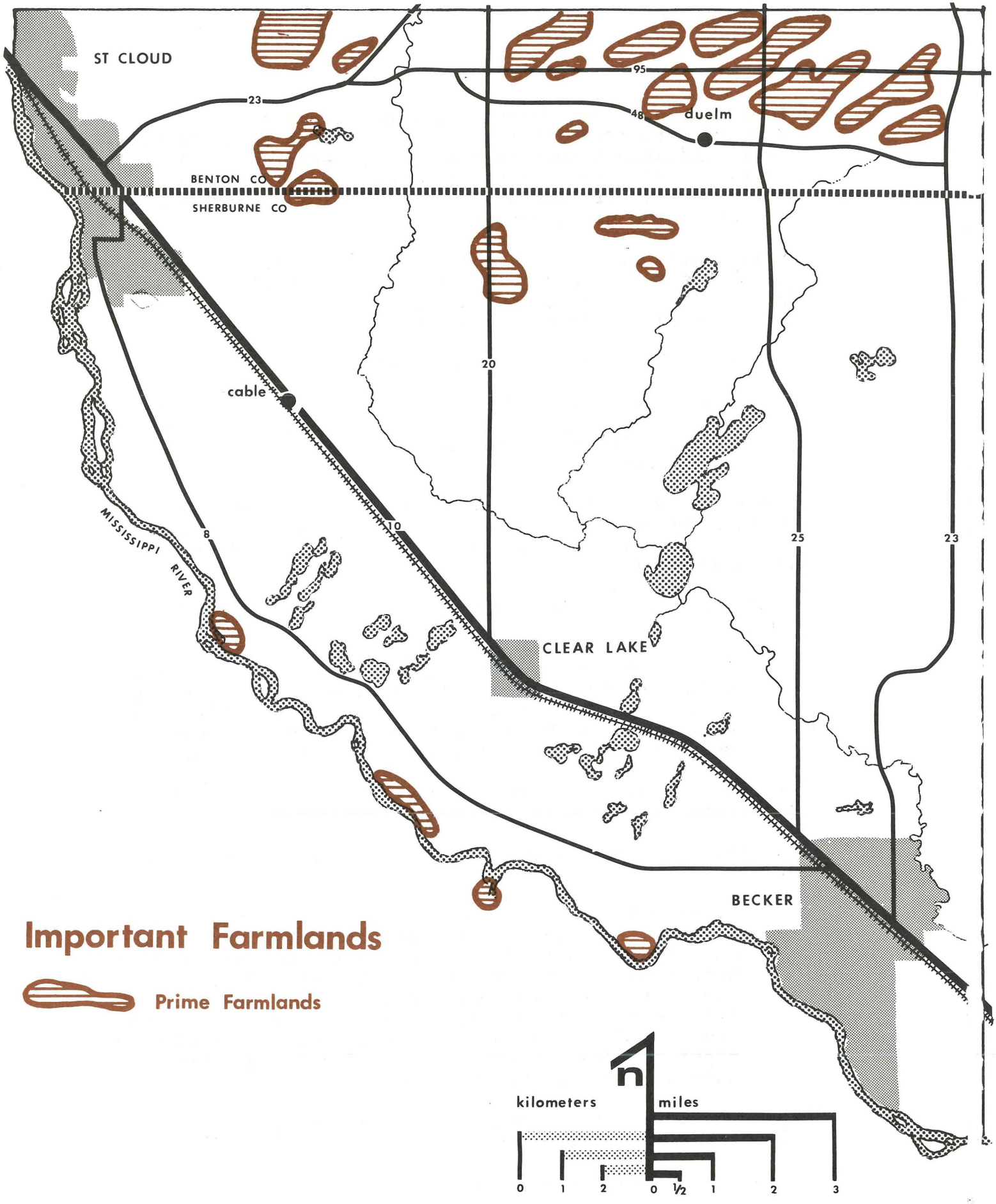
[1] "Definition; Important Farmlands Map, Benton County, Minnesota" William Harju, District Conservationist, US DA, SCS, 1979.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BECKER
Important Farmlands
Prime Farmlands
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figure 2.19

"areas that include frequently flooded land, coarse sandy and gravelly soils, steeply sloping fine sand, other steeply sloping lands, wet sands, peat and muck over sands, and peat and muck intermingled with sands."

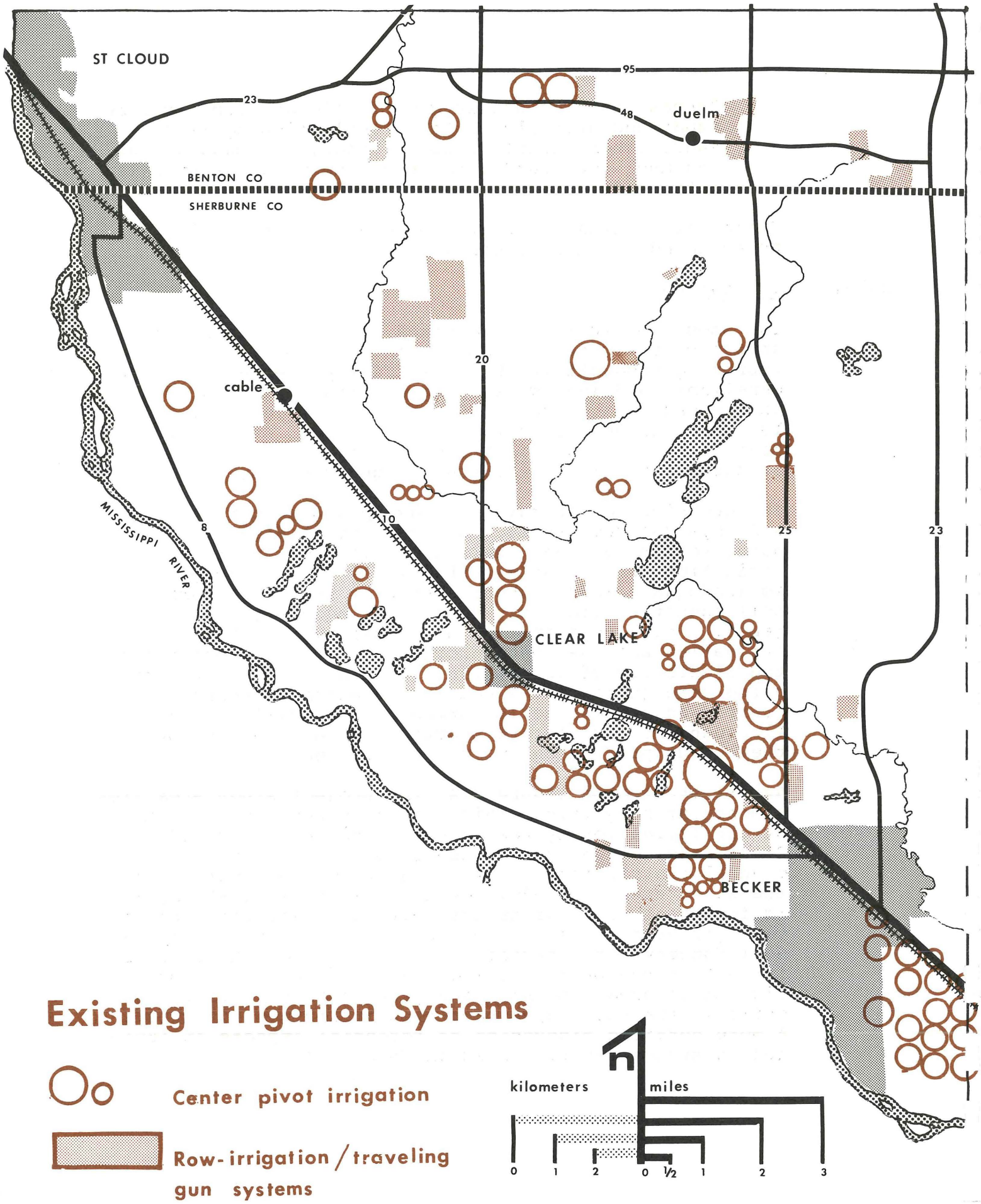
Soils with a Class VI rating generally comprise the soil types found in this category.

2.10.3 Irrigation.

The amount of irrigated farmland has been increasing steadily as farmers attempt to increase profits by improving productivity by artificially compensating for unreliable and inadequate precipitation. Irrigated land in Minnesota increased 1,490 percent between 1967 and 1977 from 25,000 acres to 397,000 acres. Over 95 percent of this acreage is irrigated mechanically with either center pivot or traveling gun systems.

The decision to irrigate depends upon a number of economic and physical factors such as farm parcel size, climate, soil types, and the availability of water. Irrigation is desirable particularly where precipitation is inadequate and/or where coarse to medium textured soil cannot sufficiently retain groundwater. In general, soil type and the availability of water for irrigation are the most important factors in determining the feasiblity of irrigation. In Minnesota, most irrigated acreage is on the coarse to medium textured prairie and forest soils formed from glacial outwash. Although these soils are scattered throughout the state, they occur predominantly in central Minnesota.

As illustrated on Figure 2.4, the project study area lies almost entirely within this glacial outwash plain. Most of the irrigation systems are located in Becker and Clear Lake Townships. Figure 2.20 illustrates the general distribution of existing irrigation systems in the study area. In addition to existing irrigation, it is important to consider agricultural areas with irrigation potential. Based upon soil types classified by the Soil Conservation Service, areas with high potential for irrigation can be identified. With the exception of floodplain areas, marshes and peat deposits, all of the soils in the study area have high irrigation potential. A more detailed discussion of potential impacts on irrigation systems is presented in Chapter 4.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BECKER
Existing Irrigation Systems
Center pivot irrigation
Row-irrigation / traveling gun systems
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kilometers
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figure 2.20

2.11 ECONOMIC BASE

The local economy of the study area consists of three basic sectors - production, distribution, and consumption. As with all local economies, the project study area is dependent upon economic conditions outside the study area. For the general study area, agriculture is the principal industry and economic base. Retail trade and industrial processing are important economic activities for Sherburne and Benton Counties, however these activities are concentrated in locations outside of the general study area. Most of the off farm employment is concentrated in Foley, Sauk Rapids, St. Cloud, and Elk River. None of the proposed transmission line routes will affect these employment centers.

2.12 TRANSPORTATION, COMMUNICATION AND UTILITIES

2.12.1 Roads

Roads provide the basic network for most of the region's travel and interaction. The major roadways serving the study area are: U.S. Highway 10, a four lane divided highway which angles diagonally across the State of Minnesota from Minneapolis-St. Paul to Moorhead; State Highway 25, which extends north through Sherburne and Benton Counties to Brainerd; and State Highway 95 which runs east and west across the study area and extends from the Wisconsin State border to the City of St. Cloud. Heaviest traffic loads are experienced on U.S. Highway 10, State Highway 25 and State Highway 95.

In addition to major roadways, several county and local roads criss-cross the study area. A functional classification system has been developed for the roadways in Sherburne County as part of the County Land Use Plan. This system is used to describe the general characteristics of the areas roadways, and their relationship to the overall regional road network.

TABLE 2.11

FUNCTIONAL CLASSIFICATION SYSTEM

Rural Principal Arterial System

- Serves corridor movements having trip length and travel density characteristics indicative of substantial statewide or interstate travel.

- Serve all, or virtually all, urban areas of 50,000 and over-population, and a large majority of those with populations of 25,000 and over.

- Provide an integrated network without stub connections, except where unusual geographic or traffic flow conditions dictate otherwise.

Rural Minor Arterial Road System

- Link cities and large towns (and other traffic generators, such as major resort areas that are capable of attracting travel of similarly long distances) and form an integrated network providing interstate and inter-county service.

- Located at intervals consistent with population density, so that all developed areas of the state are within a reasonable distance of an arterial highway.

- Provide (because of the two characteristics defined immediately above) service to corridors with trip lengths and travel density greater than those predominantly served by rural collector or local systems. Minor arterials therefore constitute routes whose design should be expected to provide for relatively high overall travel speeds, with minimum interference through movement.

Rural Collector Road System

To more clearly define the characteristics of rural collectors, this system is subclassified according to the following criteria:

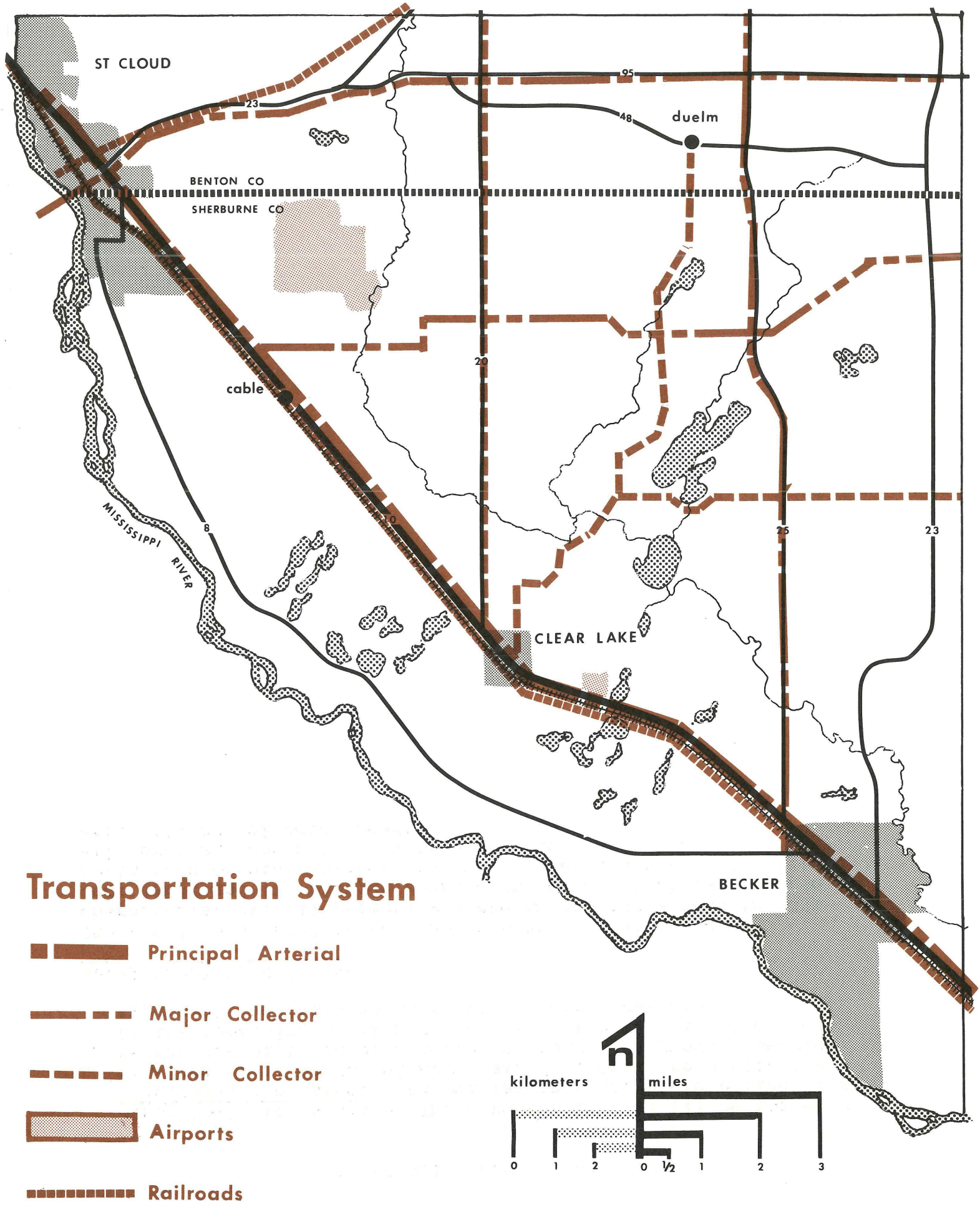
Major Collector Roads -- These routes should: (1) provide service to: any county seat not on an arterial route; to the larger towns not directly served by the higher systems; and to other traffic generators of equivalent importance, such as consolidated schools, shopping points, county parks, important mining and agricultural areas, etc.; (2) link these places with nearby larger towns or cities, or with routes of higher classification; and (3) serve the more important intra-county travel corridors.

TABLE 2.11 (continued)

Minor Collector Roads -- These routes should: (1) be spaced at intervals, consistent with population density, to collect traffic from local roads and bring all developed areas within a reasonable distance of a collector road; (2) provide service to the remaining smaller communities; and (3) link the locally important traffic generators with their rural areas.

Rural Local Road System

The rural local road system should have the following characteristics: (1) primarily serve to provide access to adjacent land; and (2) provide short distance movement as compared to collectors or other higher systems. Local roads will constitute all rural mileage not classified as principal arterial, minor arterial, or collector roads.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CLEAR LAKE
BECKER
Transportation System
Principal Arterial
Major Collector
Minor Collector
Airports
Railroads
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figure 2.21

The functional classification system serves to define the nature of this movement by recognizing the function that a particular road or street serves in maintaining a steady flow of trips through the highway network. Figure 2.21 identifies the general functional classification of roadways in the study area and Table 2.11 provides a brief definition of the classification hierarchy.

The Minnesota Department of Transportation has proposed several highway improvement projects within the proposed project area. These projects involve resurfacing, grading, and bridge replacements. The estimated construction dates range from 1980 to 1983. Table 2.12 lists the known road improvement projects for the project study area. If a route is selected which parallels one of these roadways, construction schedules for the 345 kV line and the highway improvements need to be coordinated.

All crossings of arterial and major collector roads should be coordinated with the Minnesota Department of Transportation to insure that clearance heights to accommodate semi-trailer trucks and related cargo vehicles are adequate.

2.12.2 Railroads

The Burlington Northern Railroad maintains a rail line that parallels the southern boundary of the study area. The railroad right of way ranges in width from 50 to 150 feet. This railroad consists of two main tracks which are predominantly used to carry long distance freight traffic. In addition, AMTRAC operates two passenger trains per week between Seattle, Washington, and Chicago, Illinois. The passenger train makes local stops in St. Cloud and Minneapolis. The total rail traffic using the Burlington tracks averages between 25 and 26 trains per day.

2.12.3 Airports

Within the general study area there is one public airport, one private airfield and one private landing strip. The Minnesota Department of Transportation also notes that seaplanes frequently use the water bodies in the Briggs Lake region. To protect the safety of aircraft and their passengers; federal, state and local units of government seek to regulate land use and structure heights near airport landing facilities. Toward this end a "clear zone," within which strict land use regulations and height restrictions apply, extends out-

TABLE 2.12

MINNESOTA DEPARTMENT OF TRANSPORTATION
PROPOSED ROAD IMPROVEMENTS

LOCATION	TYPE OF IMPROVEMENT	POSSIBLE CONTRACT YEAR
Hwy. 10 from Benton-Sherburne Co. line to Elk River City Limits	Bituminous shoulders, turn lanes, cross-over closures, and inter-section improvements	1981
Hwy 95 from Junction Hwy 23 to 3.1 miles east of junction Hwy 25	Resurfacing	Deferred Status (1981)
Hwy 95 3.8 miles east of junction 23	Bridge replacement over Stony Brook. Possible realignment of Hwy. 95 to parallel 100 feet south of north section line of Section 26, T36N, R30W.	1981-1982
Hwy 95 0.8 miles west of Junction 23	Bridge replacement over Elk River	1981

SOURCE: Minnesota Department of Transportation

ward from the end of existing runways. The area encompassed by clear zones is partially determined by the approach glide slope to the landing field. The glide slope is defined as the rate of descent used by aircraft when landing. The glide slope is usually expressed as the ratio of horizontal distance traveled to the vertical drop in elevation. For example a glide slope of 20:1 means that for every 20 feet of horizontal distance traveled, the aircraft changes vertical elevation by 1 foot.

Airports pose a special constraint to transmission line siting in that transmission lines should not be located within the clear zones. In addition, if a transmission line is to be located within close proximity of an airfield, the applicants must work with the Federal Aviation Administration and the Minnesota Department of Transportation to insure consistency with aviation regulations and promote public safety.

St. Cloud's Whitney Memorial Airport, located 1 mile east of St. Cloud, is the most important aeronautical facility in the region. Presently, the airport has two runways--Runway 13-31 and Runway 5-23. The longest runway (Runway 13-31) is 5,200 feet long and is oriented along a northwest/southeast axis. The auxilliary runway (Runway 5-23) is 3,000 feet long and is oriented in a southwest/northeast direction. Detailed statistics concerning runway characteristics are listed in Table 2.13. The City of St. Cloud has indicated that expansion plans for the airport are under consideration. Future plans for the airport include runway expansions and the development of a precision instrument approach system. Table 2.14 lists the various expansion plans anticipated for the runways. One of the proposed transmission line route segments may conflict with safe operation of the main runway (Runway 13-31). In addition, the City of St. Cloud has expressed a concern that several other route segments may pose a conflict with the expansion plans for Runway 5-23. A detailed discussion of airport impacts are presented in section 4.11 of this report. Figure 2.22 is a general site plan for the St. Cloud Airport.

ST CLOUD AIRPORT

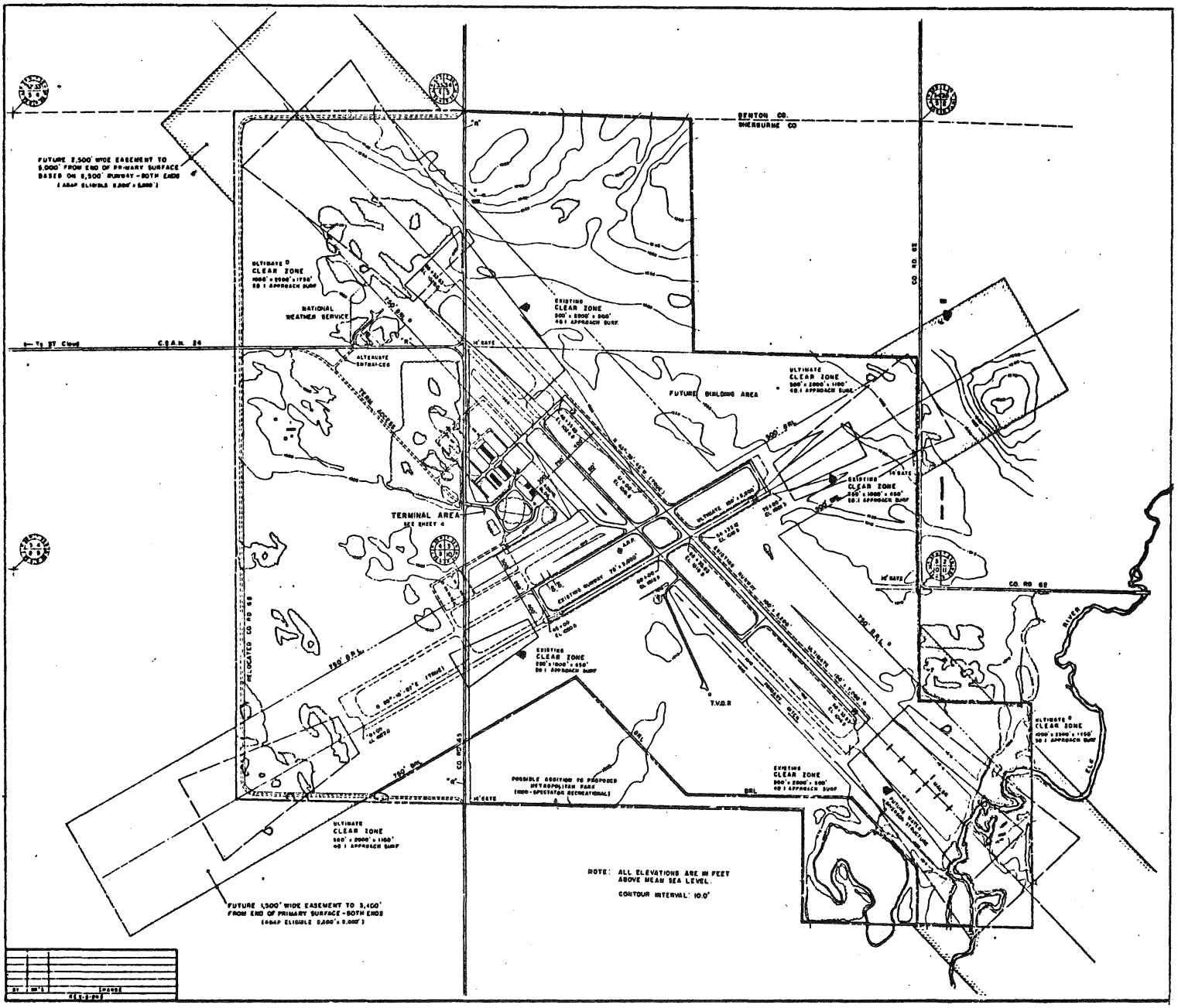


figure 2.22

TABLE 2.13

ST. CLOUD AIRPORT RUNWAY STATISTICS

	Runway 13-31		Runway 5-23	
	Existing	Proposed	Existing	Proposed
Instrument Runway	Non-Precision	Precision Instrument	Non-Precision	Same
Approach Glide Slope	40:1	50:1	20:1	40:1
Lighting	MIRL	Same	MIRL	Same
Marking	Non-Precision	Precision Instrument	Non-Precision	Same
Navigational Aids	REIL,MALSR	REIL, MALSR VASI	---	VASI

Source: Minnesota Department of Transportation.

CLEAR LAKE AIRPORT

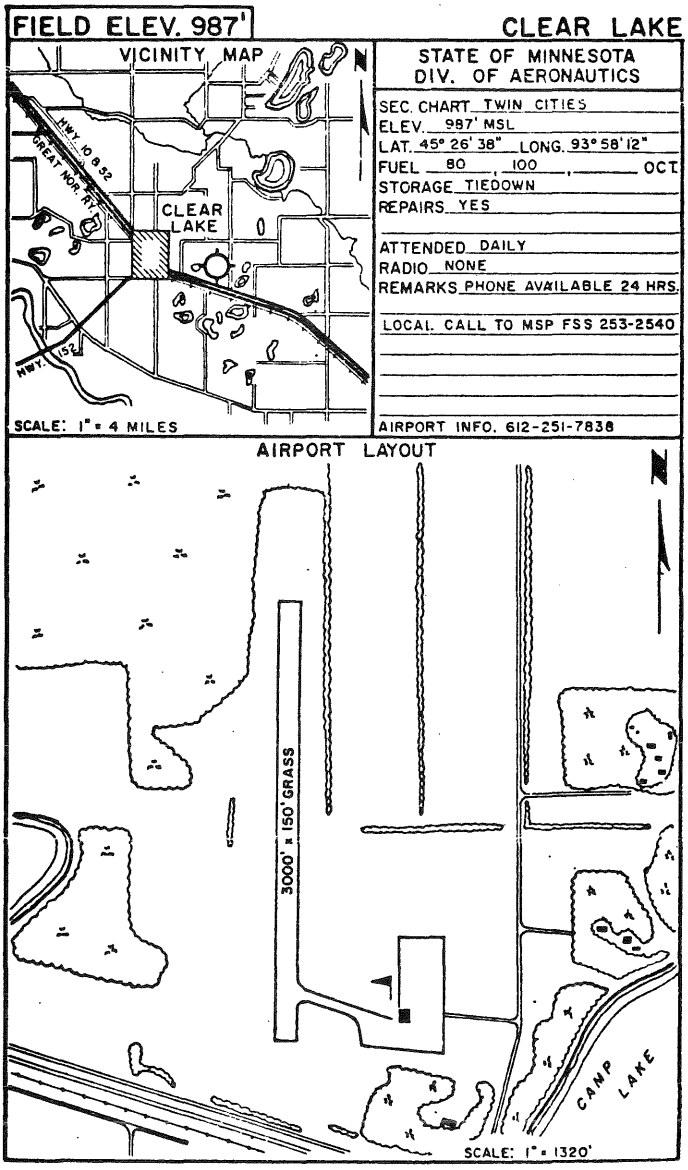


figure 2.23

Leader's Clear Lake Airport is a privately owned landing field located north of Highway 10 and west of County Road 55. The airport has a 3,000 foot by 150 foot grass runway which is oriented along a north/south axis. The end of the runway is approximately 700 feet from the northbound lane of State Highway 10. (See Figure 2.23.) One of the proposed transmission line routes would parallel State Highway 10. This routing option would necessitate the construction of a transmission line structure in the general approach pattern to the airfield. The construction of transmission line facilities along Highway 10 presents a safety hazard to aircraft using Leader's Clear Lake Airport. (See Section 4.11.)

The Minnesota Department of Transportation (MNDOT) notes that a personal-use landing strip south of State Highway 10 and west of County Road 53 has been proposed. MNDOT states that the placement of a transmission line along State Highway 10 would prevent the airstrip from being constructed.

2.12.4 Transmission Lines

In addition to local electrical distribution lines, the following trasmission lines are found within the study area:

a. a 230 kV line extending in a northwest to southeast from the Monticello generating station to the Benton County substation.

b. a 115 kV transmission line extending from the Monticello generating station to the City of St.CLoud. This transmission line parallels County Highway 8 and the Mississippi River.

c. a 69 kV transmission line extending north from the Sherco substation to the community of Foley.

d. a 69 kV transmission line extending east-west along County Road 48 from Cable to Boyd Lake.

e. a 115 double circuit kV transmission line extending west from the Benton County substation to the City of St. Coud.

The general alignment of these transmission lines are illustrated on Figure 2.24.

2.12.5 Radio and Television Stations

The following television stations serve the study area:

KCMT, Alenxandria, Channel 7, 316 kw visual, 63.1 kw auditory;

KMSP, Minneapolis-St. Paul, Channel 9, 187.26 kw visual, 191.76 kw auditory;

KSTP-TV, Minneapolis-St. Paul, Channel 5, 100 kw visual, 15.1 kw auditory;

KTCA, Minneapolis-St. Paul, Channel 2, 100 kw visual, 20 kw auditory;

WCCO, Minneapolis-St. Paul, Channel 4, 100 kw visual, 15.1 kw auditory;

WTCN, Minneapolis-St. Paul, Channel 11, 316 kw visual, 45.7 kw auditory.

The following local radio stations serve the study area in addition to numerous ones from the Minneapolis-St.Paul area:

KABG (FM), 105.5 mhz, Cambridge, 3 kw;

KASM (AM), 1150 khz, Albany;

WQPM (AM), 1300 khz, Princeton, 1 kw;

WQPM (FM), 106.3 mhz, Princeton, 3 kw;

KCLD (AM), 1450 khz, St. Cloud, 1 kw;

KCLD (FM), 104.7 mhz, St. Cloud, 100 kw;

WJON (AM), 1240 khz, St. Cloud, 1 kw;

WWJO (FM), 98.1 mhz, St. Cloud, 100 kw;

WHMH (FM), 101.7 mhz, Sauk Rapids, 3 kw;

WVAL (AM), 800 khz, Sauk Rapids, 250 kw;

The problems of possible radio and television interference due to the construction of 345 kV transmission line are presented in Section 4.9.3.

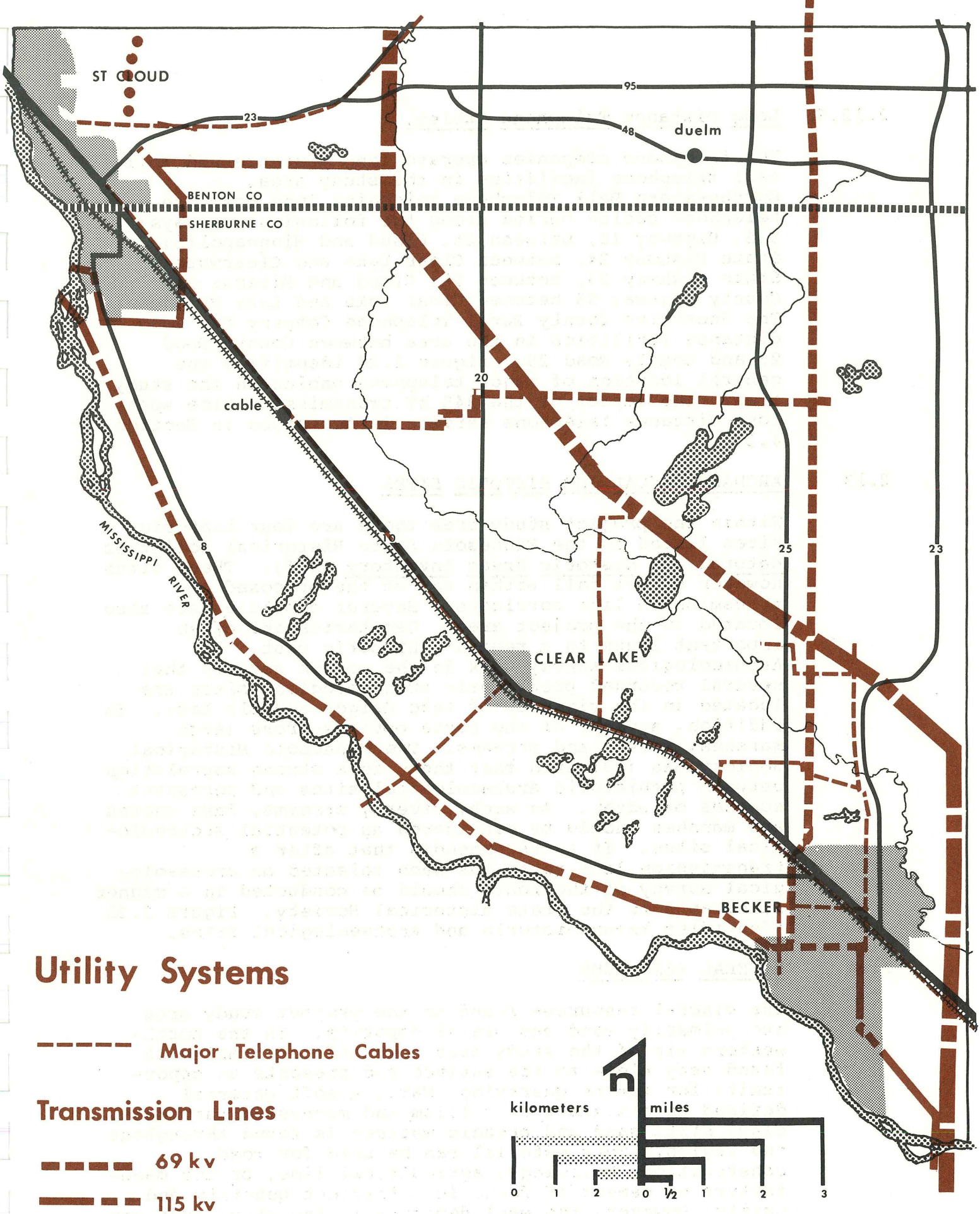

ST CLOUD
95
23
48
duelm
BENTON CO
SHERBURNE CO
20
cable
MISSISSIPPI RIVER
8
10
25
23
CLEAR LAKE
BECKER
Utility Systems
Major Telephone Cables
Transmission Lines
69 kv
115 kv
230 kv
Pipe lines
kilometers
miles
0 1 2 0 ½ 1 2 3

figure 2.24

2.12.6 Long Distance Telephone Cables.

Two telephone companies operate long distance and toll call telephone facilities in the study area. Northwestern Bell Telephone maintains long distance telephone cables buried along the following roadways: U.S. Highway 10, between St. Cloud and Minneapolis; State Highway 24, between Clear Lake and Clearwater; State Highway 23, between St. Cloud and Milaca; and County Highway 55 between Clear Lake and Lake Briggs. The Sherburne County Rural Telephone Company has long distance facilities in the area between County Road 23 and County Road 25. Figure 2.24 identifies the general location of major telephone cables in the study area. The impact of the 345 kV transmission line upon long distance telephone service is discussed in Section 4.2.

2.13 ARCHAEOLOGICAL AND HISTORIC SITES

Within the project study area there are four historic sites listed in the Minnesota State Historical Societies Natural and Historic Areas Inventory (NTI). These sites however do not fall within any of the proposed transmission line corridors. Several cemetries are also located in the project area. Cemetaries are often important links to a region's historic past. Archaeological survey work in the region reveals that several recorded prehistoric archaeological sites are located in the vicinity of Lake Briggs and Elk Lake. In addition, several of the route options cross large marshes, rivers and streams. The Minnesota Historical Society has indicated that there is a strong correlation between prehistoric archaeological sites and permanent sources of water. As such, rivers, streams, lake shores and marshes should be considered as potential archaeological sites. It is recommended that after a transmission line route has been selected an archaeological survey of the route should be conducted in a manner acceptable to the State Historical Society. Figure 2.25 identifies known historic and archaeological sites.

2.14 MINERAL RESOURCES

The mineral resources found in the project study area are primarily sand and gravel deposits. In the northwestern tip of the study area some bedrock granite is found very close to the surface and presents an opportunity for future quarrying. Marl, a soft material defined as a mixture of calcium and magnesium carbonate, clay, silt, sand and organic mattrer is found throughout the region. This material can be used for road construction, buildings, agricultural lime, or the manufacture of cement if found in sufficient quantity and purity. However, the marl deposits in the study area are

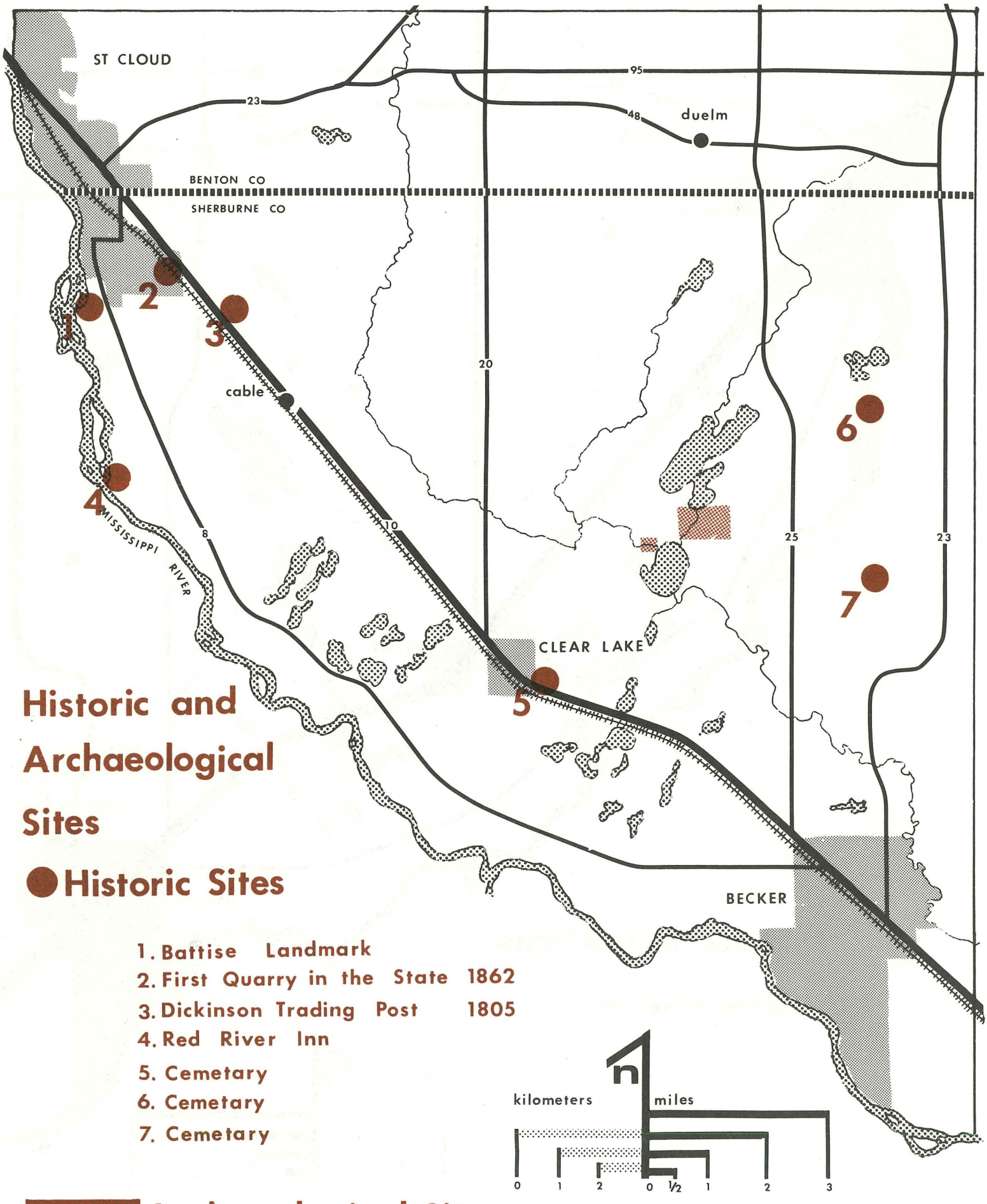

ST CLOUD
95
23
48
duelm
BENTON CO
SHERBURNE CO
1
2
3
cable
20
6
4
MISSISSIPPI RIVER
8
10
25
23
7
CLEAR LAKE
5
BECKER
Historic and Archaeological Sites
Historic Sites
1. Battise Landmark
2. First Quarry in the State 1862
3. Dickinson Trading Post 1805
4. Red River Inn
5. Cemetary
6. Cemetary
7. Cemetary
kilometers
miles
0 1 2 0 ½ 1 2 3
Archaeological Sites

figure 2.25

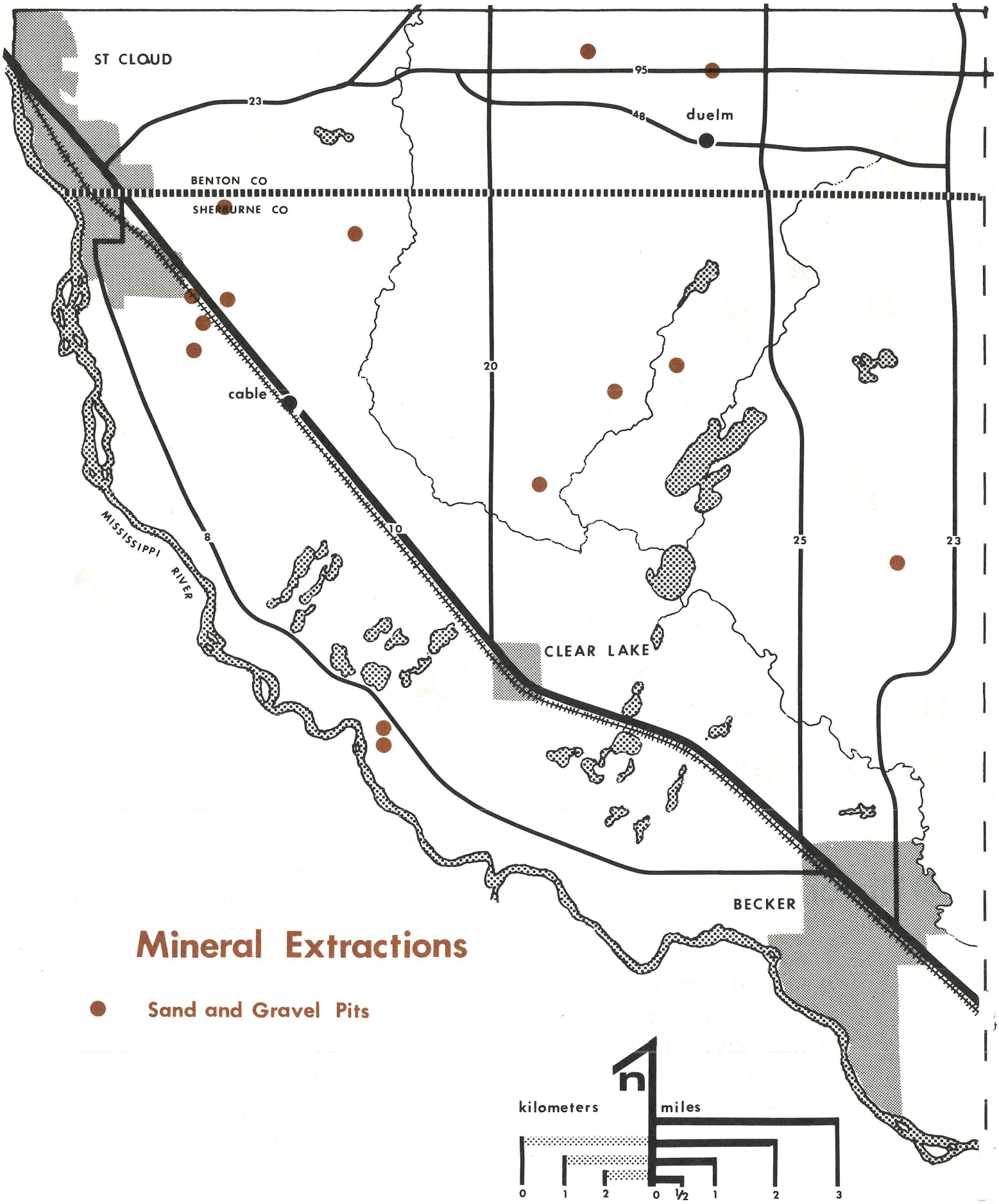

ST CLOUD
95
23
48
duelm
BENTON CO
SHERBURNE CO
20
cable
10
8
MISSISSIPPI RIVER
25
23
CLEAR LAKE
BECKER
Mineral Extractions
Sand and Gravel Pits
n
kilometers
miles
0 1 2
0 ½ 1 2 3

figure 2.26

not of sufficient quality to be considered an important mineral resource. Figure 2.26 identifies known mineral extraction areas.

2.15 RECREATION, NATURAL AREAS AND WILDLIFE MANAGEMENT AREAS

The general study area has several public and private recreation areas. Most of these recreation sites are located around the region's larger lakes and rivers. The type of recreational facilities found in the region are varied and include trap shooting, fishing, boating, camping, picnicking, and swimming. In addition to recreation areas, the study area has one national wildlife refuge and two wildlife management areas. A summary of the study area's recreation and natural areas is provided in the following sections.

2.15.1 Federal Lands

The Sherburne National Wildlife Refuge is located on the eastern most boundary of the project study area. The Refuge is one of 380 National Wildlife Refuges owned and operated by the U.S. Department of the Interior's Fish and Wildlife Service. The Refuge consists of approximately 30,000 acres of land reserved for the management and preservation of forest land and migratory waterfowl habitat. The Sherburne National Wildlife Refuge is approximately three miles away from the nearest proposed transmission line route. As such, there should be no direct adverse impact on the Sherburne National Wildlife Refuge by any of the proposed transmission line corridors.

2.15.2 State Lands

The only state designated natural areas located in the study area are the lands adjacent to the Mississippi River between St. Cloud and Clearwater. This area has been designated as a State Scenic and Recreational River under the Minnesota Wild and Scenic Rivers Act. No routing option has been proposed that would involve the use of any portion of the Mississippi River protected by the Act. The centerline of route segment 1-5, (which is common to all of the proposed routes) does abut the river corridor. Any placement of structures near the Mississippi River should be coordinated with the Minnesota Department of Natural Resources.

2.15.3 Local and Private Natural Areas

In addition to the large formally designated recreational areas, there are numerous smaller areas that provide a recreation and wildlife management function. Dr. Max Partch, former Biology Professor at St. Cloud State University surveyed the natural areas of

Benton and Sherburne Counties for the Minnesota Nature Conservancy. Dr. Partch identified several parcels within the study area with locally unique features worthy of preservation by the Nature Conservancy. The Nature Conservancy, however, does not have immediate plans to acquire or manage any sites in the study area.

Private landowners often organize themselves for the express purpose of protecting wildlife and enhancing local habitats. The Stony Brook Wildlife Management Area, a 1,600 acre reserve in St. George Township, is an example of a private reserve. Two other private reserves include the St. Cloud Game Refuge and Clear Lake Game Refuge. Only the Stony Brook Wildlife Management Area is within a transmission line route alternative examined in this report.

2.15.4 Local and Private Recreation Areas

The primary recreation areas in the study area are lakes and the fishing, boating and swimming opportunities that they provide. In addition, several campgrounds and resorts with special recreational faciltieis such as trapshooting and golfing add to the region's recreational amenities. Within the project area there are several public parks providing access to Briggs Lake, Lake Julia, Elk Lake, Camp Lake, Long Lake, and Rush Lake. All of these lakes are about 50 acres in size and of sufficient depth to support a varirety of fish species. In addition to the lakes with public access, there are several smaller lakes which serve the recreational needs of private lake front cottages. Table 2.14 identifies the recreational lakes in the study area their size. Several of the proposed routes cross lands adjacent to recreational lakes. Chapter 5 outlines the specific impact on recreation areas by each route segment.

Other local recreation facilities include resorts, trapshooting areas, public waysides and campgrounds. Table 2.15 and Figure 2.27 identify the recreational areas found within the project study area.

TABLE 2.14

RECREATION LAKES

Recreation Lakes with Public Access

	LAKE	SIZE (ACRES)	LOCATION
1.	Elk Lake	360	3 miles northeast of Clear Lake
2.	Briggs Lake	377	5 miles northeast of Clear Lake
3.	Camp Lake	79	2 miles northeast of Clear Lake
4.	Lake Julia	142	5 miles northeast of Clear Lake
5.	Long Lake	182	6 mies south of St. Cloud
6	Rush Lake	142	5 miles north of Clear Lake

Recreation Lakes without Public Access

7.	Clear Lake	119	2 miles west of Clear Lake
8.	Pickerel-Fish Lake	121	3 miles northwest of Clear Lake
9.	Round Lake	37	3 miles northwest of Clear Lake
10.	Stickney Lake	88	2 miles west of Clear Lake

SOURCE: Sherburne County National Resource and Existing Land Use Report.

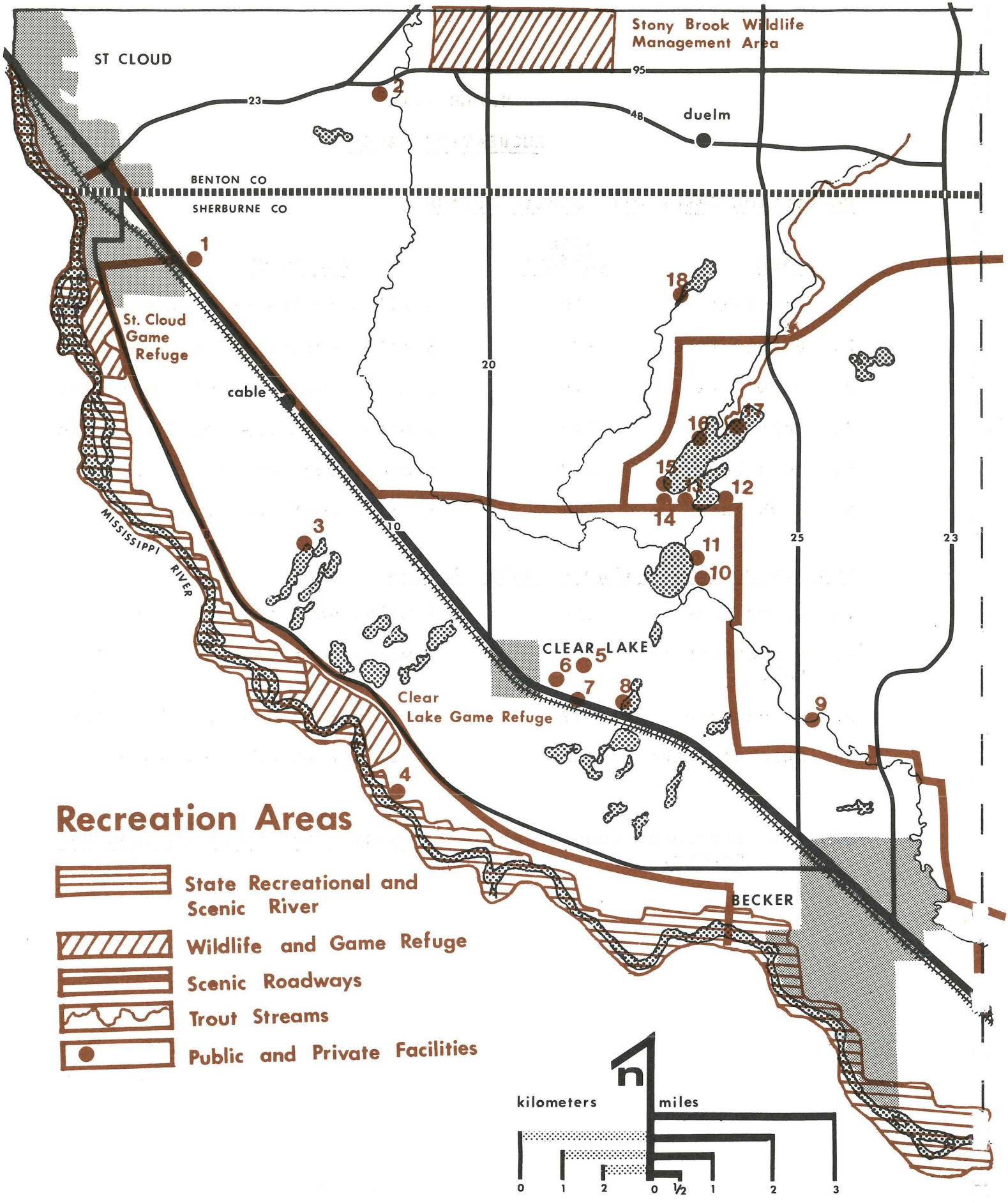

Stony Brook Wildlife Management Area
ST CLOUD
95
23
48
duelm
BENTON CO
SHERBURNE CO
St. Cloud Game Refuge
cable
20
10
25
23
MISSISSIPPI RIVER
CLEAR LAKE
Clear Lake Game Refuge
BECKER
Recreation Areas
State Recreational and Scenic River
Wildlife and Game Refuge
Scenic Roadways
Trout Streams
Public and Private Facilities
kilometers
miles
0 1 2 0 ½ 1 2 3

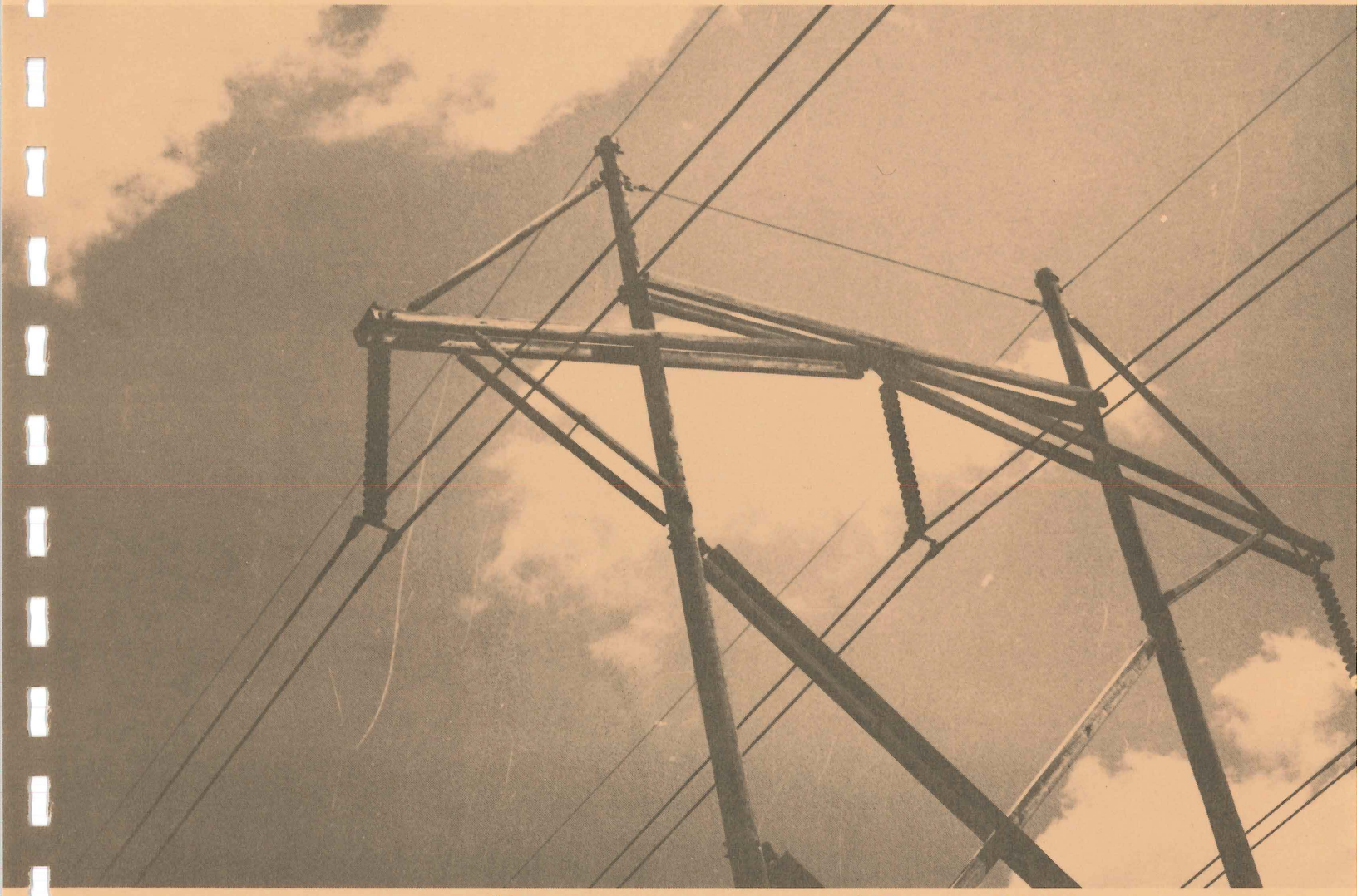
figure 2.27

TABLE 2.15

PUBLIC AND PRIVATE

RECREATION FACILITIES

Map Location Number	Name of Recreation Area	Ownership	Facilities
1	Wayside Park	State	Historic Marker
2	Community Sports Park	County	Ball fields, play fields
3	Long Lake access park	County	Public lake access
4	Stickney Wayside Park	State	River access, picnicking
5	Airstream Campgrounds	Private	Campgrounds, golf course
6	Travelers Country Club	Private	Campgrounds
7	Lil Acorn Deer Park	Private	Campgrounds
8	Lake access	State	Lake access
9	Riverwoods Camp	Private	Campgrounds
10	Elk Lake access	County	Public lake access
11	Elk Lake Cove	Private	Lake resort
12	Rush Lake access	State	Public lake access
13	Sportsmans Club	Private	Trapshooting
14	Cottonwood	Private	Lake resort
15	Private lake access	Private	Lake access for new subdvn.
16	Elk Lake access	State	Public lake access
17	Lake Julia access	State	Public lake access
18	Rice Lake access	State	Public lake access



description

3

CHAPTER 3

3.1 PROJECT SUMMARY

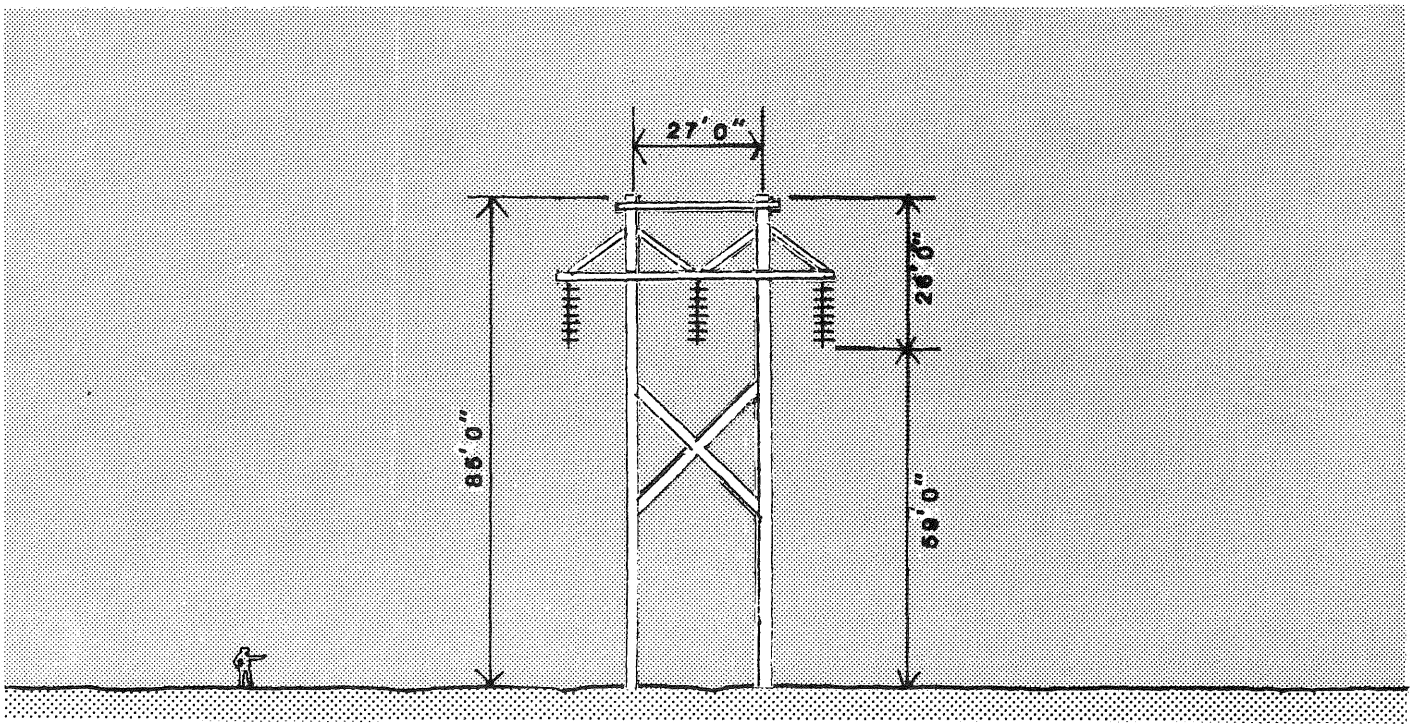
An "Application for Construction Permit and Route Designation" for a single circuit 345 kV alternating current, high voltage transmission line and associated facilities was jointly submitted to the Minnesota Environmental Quality Board (MEQB) by Northern States Power Company (NSP), United Power Association (UPA) and Cooperative Power Association (CPA). The application and route selection process used in siting the transmission line are outlined in the Minnesota Power Plant Siting Act of 1973, as amended in 1977 and 1978. (6 MCAR § 3.071-3.082). The year long routing process started on September 20, 1979 when the MEQB formally accepted the utilities application.

3.1.1 Transmission Line

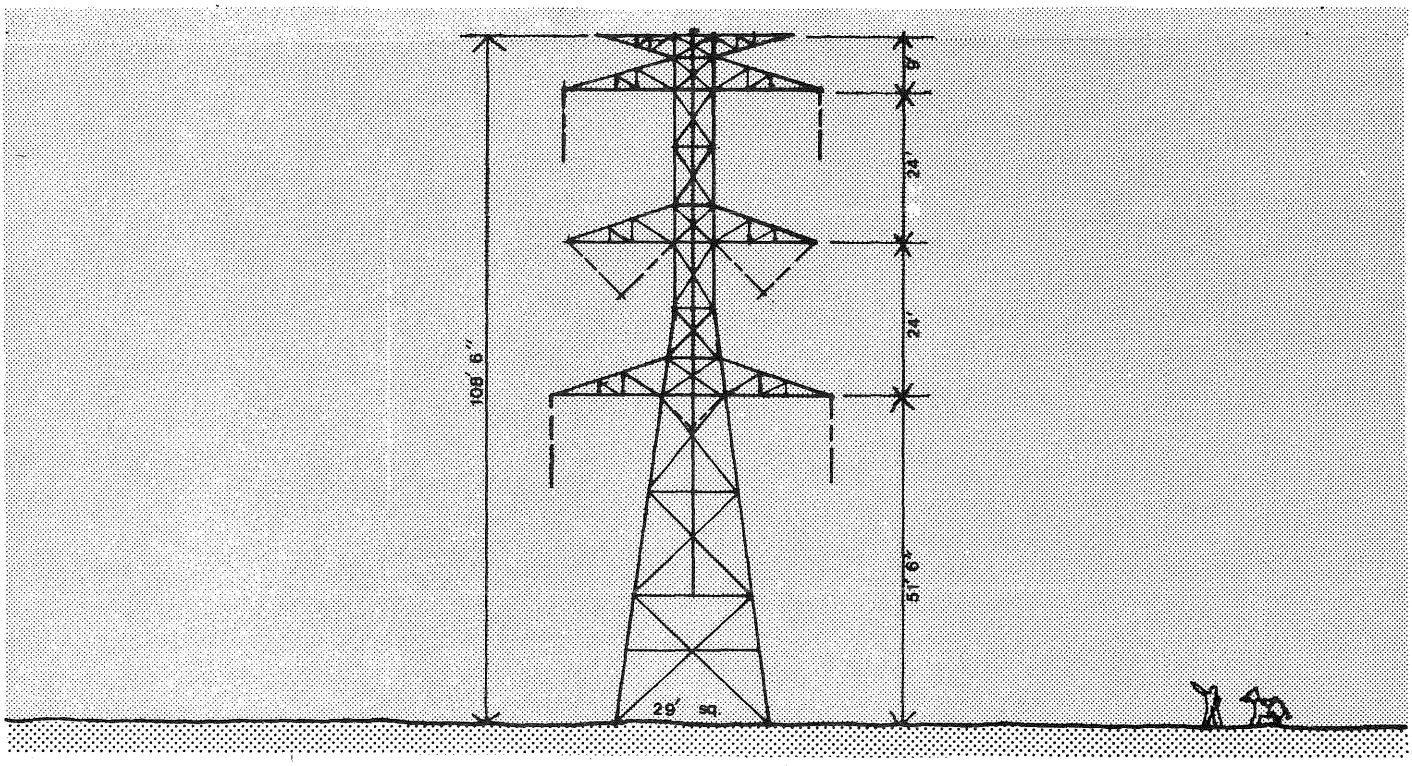
The proposed 345 kV transmission line will interconnect the Sherburne County Substation, located at the NSP Sherco generating station in Becker, with the NSP Benton County Substation. Depending upon the final route selected, the approximate length of the proposed line will range from 16.3 miles to 22.9 miles. The transmission line itself will consist of three conductors (phases) and two shield wires for lightning protection. The design parameters, size and standards for the transmission line conductors are discussed in greater detail in section 3.3. In all cases structures will be designed to comply with or exceed minimum strength requirements and loading criteria established in the National Electrical Safety Code (NESC).

3.1.2 Structures

In their application, NSP has proposed the use of double wood pole "k" frame structures to support the conductors and shield wires. The precise type of structure to be used, however, will be specified by the MEQB in the construction permit. It should be noted that a wide variety of structure types exist. (See Figure 3.1, 3.2.) The Citizens Route Evaluation Committee, in its review of the application and routing options, unanimously recommended the use of single pole structures for the entire transmission line.



TYPICAL SINGLE CIRCUIT WOOD STRUCTURE



TYPICAL DOUBLE CIRCUIT LATTICE STRUCTURE

figure 3.1

TABLE 3.1

345 kV SINGLE CIRCUIT WOODEN K FRAME STRUCTURE

Structure materials: Two wooden poles with wooden cross members.

Structure height: Structure height will vary depending upon topography, span lengths and structure placement. Average structure height is approximately 25 feet.

Structure base measurements: Base consists of two buried wooden poles. Distance between base poles is approximately 27 feet. Land area per base is 44 to 88 square feet.

Typical span distance: Span lengths will very dependng upon topography and structure placement. Average span lengths will range from 800 to 1,000 feet.

Average number of structures per mile: 5.3 to 6.6 structures per transmission line mile.

Average amount of agricultural land removed from production:* Approximately .22 acre per transmission line mile.

Average construction cost: Approximately $175,000 per transmission line mile.

345kV SINGLE CIRCUIT METAL LATTICE STRUCTURE

Structure Materials: Structural steel frame with metal cross members.

Structure height: Structure height will vary depending upon topography, span lengths and structure placement. Average structure height is approximately 108 feet.

Structure base measurements: Base measurements will vary but usually covers an area over 800 square feet.

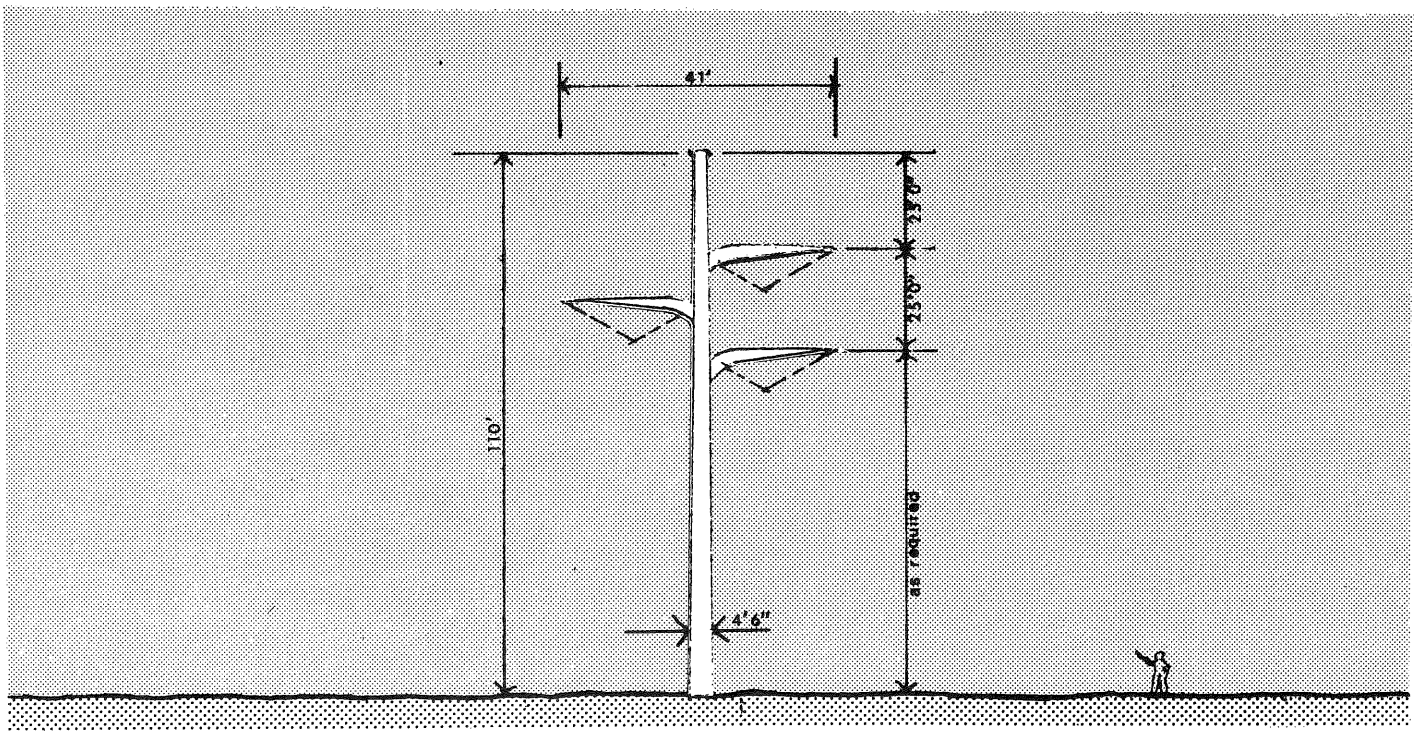
Typical span distance: Span lengths will vary depending upon topography and structure plaement. Average span lengths will range from 800 to 1,200 feet.

Average number of structures per mile: 4.4 to 4.6 structures.

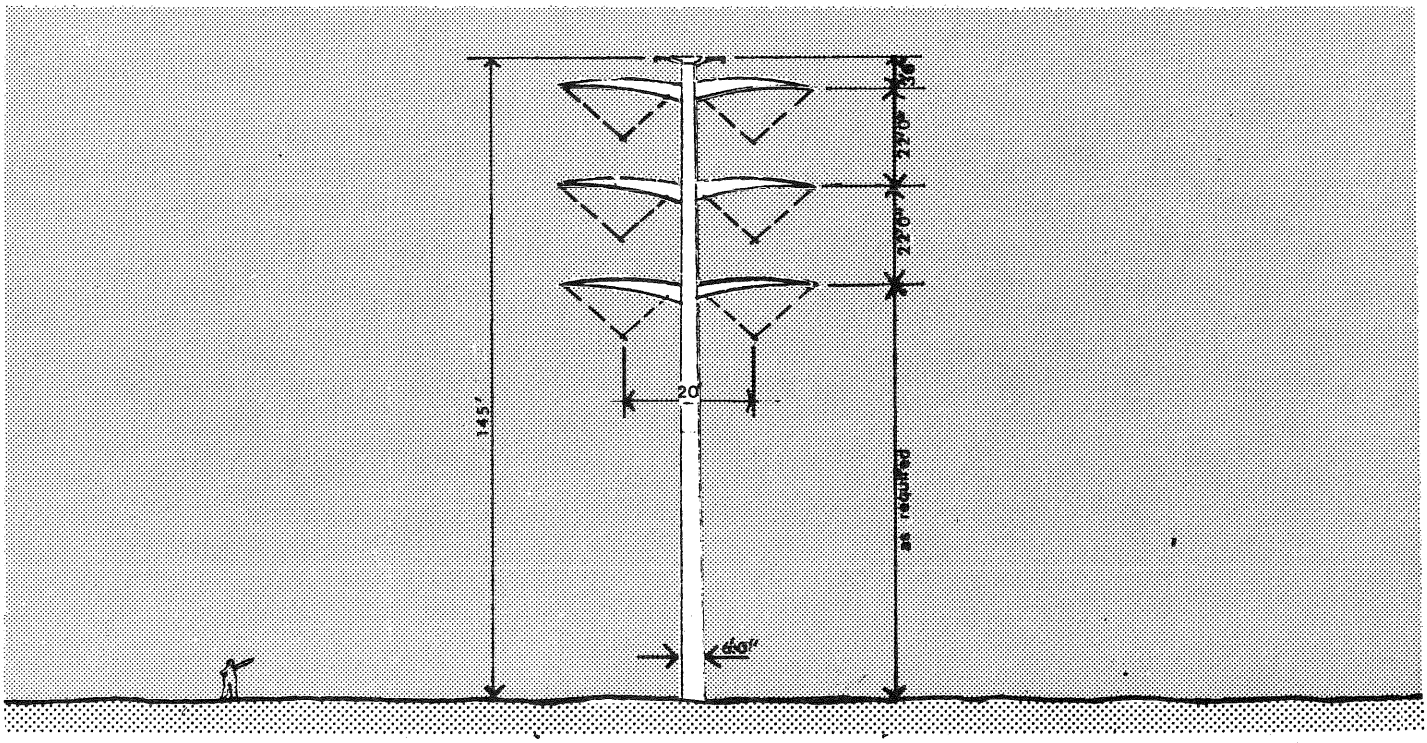
Average amount of agricultural land removed from production:* Approximately .23 acre per transmission line mile.

Average construction cost: Approximately $161,000 per transmission line mile.

*An Investigation of Electric Power Transmission and Agricultural Compatibility in MAPP Region, Gustafson, et. al, University of Minnesota, Ag. Ext. Service, 1978.



TYPICAL SINGLE CIRCUIT STEEL STRUCTURE



TYPICAL DOUBLE CIRCUIT STEEL STRUCTURE

figure 3.2

TABLE 3.2

345 kV SINGLE CIRCUIT STEEL POLE

Structure materials:	Single structural steel pole anchored in concrete footings.
Structure height:	Structure height will vary depending upon topography, span lengths and structure placement. Average structure height is approximately 110 feet.
Structure base measurements:	Single 6-foot diameter pole placed in concrete footings. Land area per base is 28-50 square feet.
Typical span distance:	Span lengths will vary depending upon topography and structure placement. Average span lengths will range from 800 to 1,200 feet.
Average number of structures per mile:	4.4 to 6.6 structures per mile.
Average amount of agricultural land removed from production:*	Approximately .04 acre per mile.
Average construction cost:	Approximately $275,000 per mile.

345 kV DOUBLE CIRCUIT STEEL POLE STRUCTURE

Structure materials:	Single structural steel pole anchored in concrete footings.
Structure height:	Structure height will vary depending upon topography, span lengths and structure placement. Average structure height is approximately 145 feet.
Structure base measurements:	Single 6-foot diameter pole placed in concrete footings. Land area per base is 28-50 square feet.
Typical span distance:	Span lengths will vary depending upon topography and structure placement. Average span length will range from 1,000 to 1,200 feet.
Average number of structures per mile:	4.4 to 5.3 structures per mile.
Average amount of agricultural land removed from production:*	Approximately .04 are per mile.
Average construction cost:	Double circuiting the 69 kV line is approximately $362,000 per transmission line mile. For double circuiting the 230 kV line, estimated construction costs are $500,000 per transmission line mile.

*An Investigation of Electric Power Transmission and Agricultural Compatibility in MAPP Region, Gustafson, et. al., University of Minnesota, Ag. Ext. Service, 1978.

The Committee further noted that although the single pole structures are more expensive than "k" frame structures (See Section 3.2.6), the single pole structures are warrented because they will reduce and minimize adverse agricultural impacts. The Committee also recommended that where the 345 kV transmission line follows the same general alignment as an existing transmission line, the two transmission lines should be double circuited on a single structure.

The clearance or distance between the ground and the point of maximum conductor sag will vary over time. Conductor sag changes depending upon the temperature of the conductors. Conductor temperature is a function of air temperature, wind speed, and amount of electrical current being transmitted. According to the National Electric Safety Code, the minimum clearance under worst case conditions is 32'. NSP states in their application that a minimun clearance of 32'-6" will be maintained.

The 345 kV transmission line requires a minimum right of way width of 150 feet. This means that a one mile length of 345 kV right of way will require 18.2 acres of land. Right of way width requirements for the new transmission line can be reduced if the proposed transmission line parallels and shares existing rights of way. This reduction of right of way requirements results from the transmission line's ability to overlap and share the right of way with other linear facilities. Another way to reduce right of way requirements is to double circuit with existing transmission lines. This is done by placing two transmission line circuits on the same set of structures. In this case only one right of way area is needed. The right of way width requirements are based upon the right of way needs of the highest voltage system. Three existing transmission lines exist in the project study area that are potentials for right of way sharing and/or double circuiting. These transmission lines are the 230 kV Monticello to Benton County line; the 69 kV Cable to Boyd Lake line; and the 69 kV Becker to Foley line.

The 230 kV Monticello to Benton County transmission line has an existing 130 foot right of way. If the proposed 345 kV line parallels the 230 kV line, only 80 to 90 feet of additional right of way width would have to be acquired. This means that a one mile length of shared 345-230 kV right of way would require only 9.7 to 10.9 acres of new right of way. The 345 kV transmission line can be double circuited with the 230 kV line, however, because the 230 kV line is the principal bulk energy supplier to central Minnesota, special construction sequences must be employed. First, 80 to 90 feet of

additional right of way must be acquired adjacent to the 230 kV right of way. Second, new double circuit structures must be erected and new 345 and 230 kV conductors strung. Third, upon completion of the conductor stringing, the new lines must be energized and the old 230 kV line de-energized. Fourth, the old 230 kV system must be dismantled and a portion of the old right of way returned to adjacent property owners. Although 80-90 feet of new right of way width is required to construct the double circuited structures, the net new right of way width requirements, (after portions of the old right of way is returned to adjacent property owners), is only about 20 feet or 2.4 acres per mile. The net right of way savings achieved by double circuiting or paralleling the 230 kV line, however, must be balanced against the higher transmission line construction costs (section 3.4) and system reliability (section 3.2.3).

The two 69 kV transmission lines have 70 foot right of way widths. If the 345 kV line parallels either 69 kV line, only 115 feet of additional right of way width will be required. This means that a one mile length of shared 345-69 kV right of way will require about 13.9 acres of new right of way. If the 345 kV transmission line is double circuited with a 69 kV line, only 80 feet in width or 9.7 acres of new right of way width will be required per route mile.

The double circuiting and right of way paralleling benefits described above should be weighed against cost and reliability factors (sections 3.2.3 and 3.4). Table 3.3 summarizes the various right of way requirements under different right of way sharing and double circuiting options. The total amount of land needed for right of way requirements for each route alternative is discussed in Chapter 5 Route Segment Analysis.

3.1.3 Associated Facilities

Construction of the 345 kV transmission line, will necessitate expansion of the Benton County substation. The expansion will consist of new transformers, breakers, and bus bars.

Northern States Power states in their application that the Sherburne County substation will not have to be expanded to accomodate the transformer, breakers, and other equipment needed for line operation.

3.2 NEED AND RELIABILITY

In assessing transmission line need, two major factors must be considered. These factors are consumer demands and the ability to maintain adequate interconnecting capacity with other regions of the state.

TABLE 3.3

RIGHT OF WAY REQUIREMENTS FOR A 345 kV TRANSMISSION LINE

	New right of way width to be acquired	Acres of right of way needed per mile of transmission line constructed
No double circuiting or right of way sharing	150 feet	18.2 acres
345-230 kV right of way sharing	80-90 feet	9.7 to 10.9 acres
345-230 kV double circuiting	20 feet	2.4 acres
345-69 kV right of way sharing	115-120 feet	13.9 to 14.5 acres
345-69 kV double circuiting	80 feet	9.7 acres

3.2.1 Consumer Demand

There are four general consumer demand areas that will be served in part by the proposed 345 kV transmission line. These areas include: the St. Cloud Area; West-Central Minnesota Area; East-Central Minnesota Area; and Northern Minnesota (see Figure 3.3).

Overall, electrical demand in the project load area is winter peaking, that is, more electrical energy is required during the winter months than during any other period of time. Peak electrical requirements in the project load area according to the applicants, have increased by 33% since the 197374 winter season.

The following paragraphs describe the demand growth rates in each of the four consumer demand areas as reported by the applicants.

1) St. Cloud Area

NSP is responsible for providing electrical service to consumers in and around St. Cloud. Peak winter demand in the St. Cloud area has increased by 23% from the 1973-74 season to the 1978-79 season. Based upon population and economic growth rates, NSP expects demand in the St. Cloud region to increase by 22% during the next five years.

2) West-Central Area

CPA and NSP both supply electrical energy to the West-Central Area. The winter peak demand in this area has increased by 42% over the past five years. NSP and CPA expect energy demand in this region to continue increasing, however, at a slower growth rate of 31% over the next five years.

3) East-Central Area

Service for the East-Central Area is the primary responsibility of UPA. UPA reports that peak winter demands in this area have increased from 51 MW in 1973-74 to 71 MW in 1978-79. This is an increased demand of 39% over the past five years. UPA expects a 30% increase in demand over the next 5 year period.

CUSTOMER DEMAND LOAD AREAS

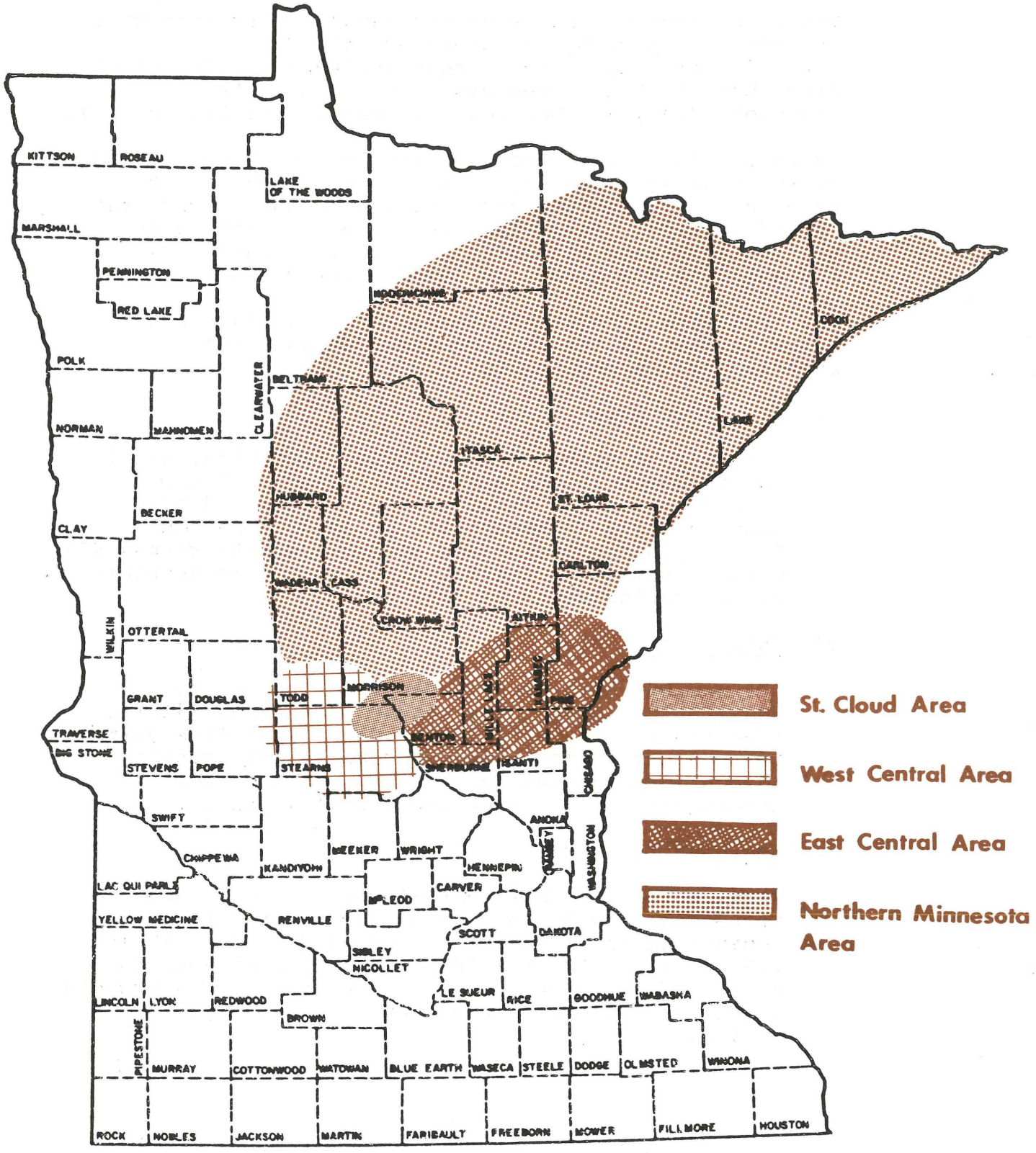


figure 3.3

4) Northern Minnesota Area

The northern Minnesota region is serviced by Minnesota Power and Light (MP&L), UPA and CPA. The latter two utilities generally provide service to the rural regions. MP&L maintains its own generating plants in northern Minnesota to supply energy for its customers. Conversely, UPA and CPA transmit most of their power into the region from generating centers located outside the local area. Peak winter demand in northern Minnesota has increased 32% during the past five years. The utilities report an anticipated growth of another 36% during the next five year period.

3.2.2 Transmission Needs

In addition to consumer demand, various outage conditions must also be considered in determining additional transmission line capacity needs. Electrical power generators and transmission facilities can be out of service at any given time. These service disruptions can be a result of routine maintenance shutdowns, equipment failure, human error, or weather.

The St. Cloud and central Minnesota service areas are currently served by three principal transmission lines. These lines are the Monticello-St. Cloud 115 kV line, the Monticello-Benton County 230 kV line and the Riverton-Benton County 230 kV line. (See Figure 3.4.)

During the winter season the bulk power supply follows the Monticello-Benton County 230 kV transmission line and the Monticello-St. Cloud 115 kV transmission line. The Riverton-Benton County 230 kV line can not be considered as a bulk power supply to the St. Cloud region during the winter period because that line has a winter season power flow from south to north.

To accurately assess transmission capacity needs, various facility outage contingencies must be examined. Figure 3.5 plots the minimum and maximum weekday peaks of consumer demand levels during peak winter seasons under various outage conditions.

If the reliability of electrical service is to be maintained, it is important that sufficient transmission capacity is always available to meet the maximum daily demand levels. Should adequate capacity not be available, the regional electrical needs cannot be met.

EXISTING TRANSMISSION NETWORK SERVING ST CLOUD AND CENTRAL MINNESOTA

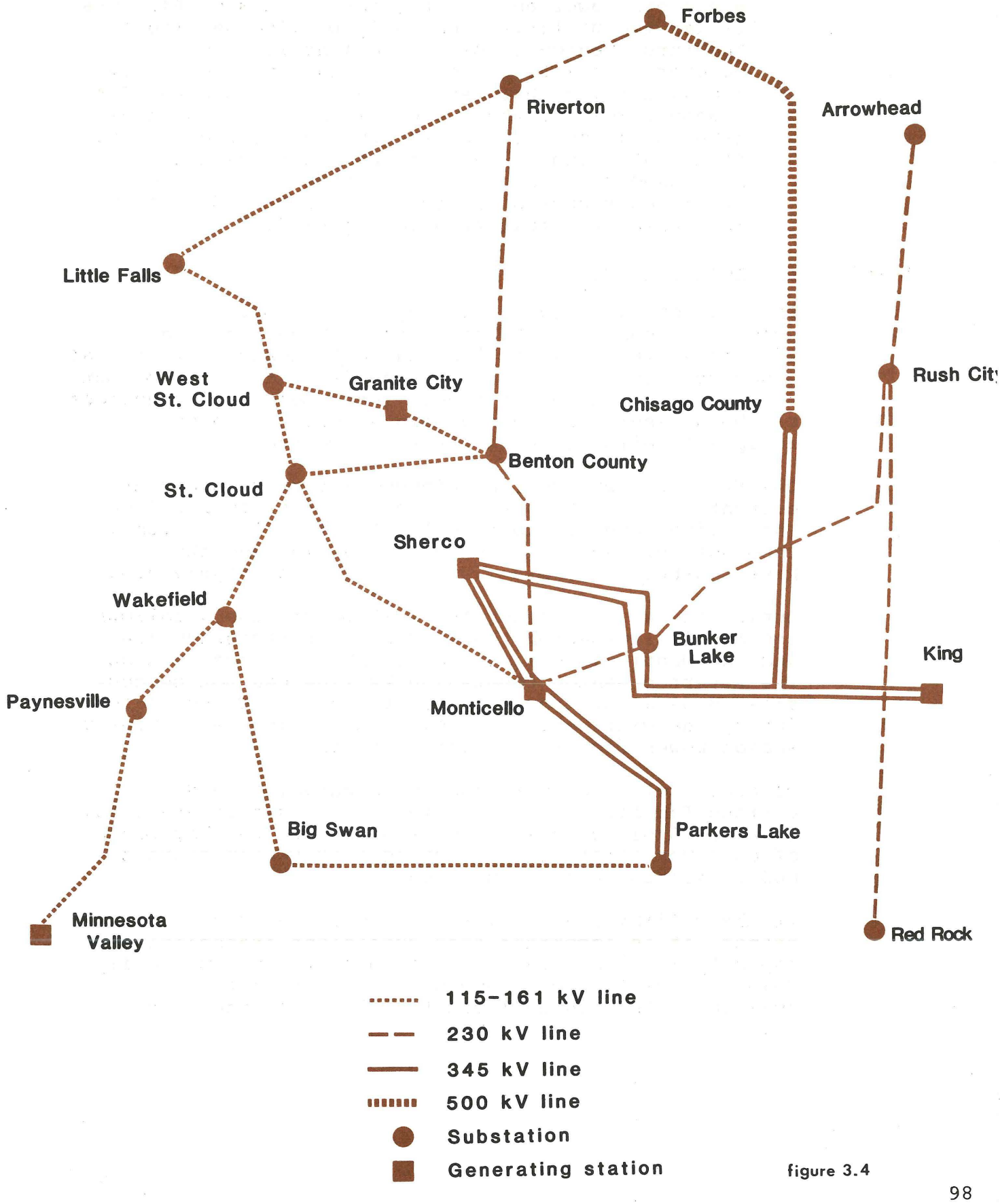


figure 3.4

TRANSMISSION SYSTEM CAPABILITY WITHOUT THE SHERCO-BENTON 345 kV LINE

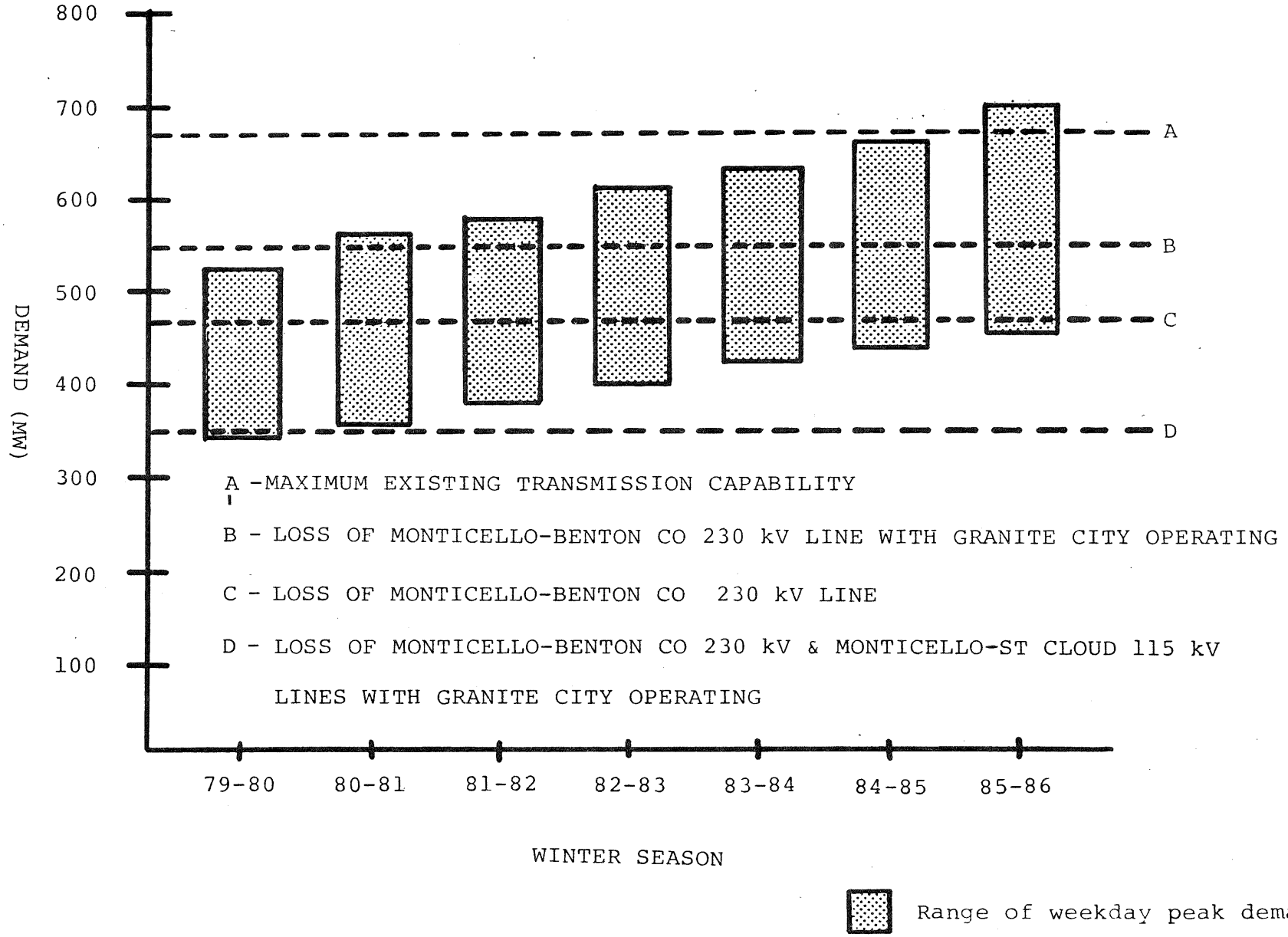


figure 3.5

For the existing transmission system serving the project area, the single most important feature is the 230 kV Monticello-Benton County transmission line. A loss of service to the 230 kV line could lead to a loss of electrical service in central and northern Minnesota. In their application, NSP reports that during peak demand periods of the early 1980s, an overload on the Monticello-St. Cloud 115 kV line could range from 120 to 125% of the line's thermal capacity. This condition is likely to occur when power is being transferred to northern Minnesota and the 230 kV Monticello-Benton County line is out of service. By bringing the Granite City oil-fired generators into service, the overload to the 115 kV line could be reduced to approximately 110%.

NSP has stated that the Monticello-St. Cloud 115 kV line can, in emergency cases, be loaded up to 120% of its thermal capacity for a total period of 4 hours. Once the line has experienced a load beyond its thermal capacity for four cumulative hours, NSP states that the line has permanently lost its emergency transfer capacity. Based upon load growth projections, NSP reports that by the mid-1980s, the Granite City generators will not be able to reduce overloads on the 115 kV line below the line's emergency capability if the 230 kV Monticello-Benton County line experiences a loss of service.

Should both the Monticello-Benton County 230 kV line and the Monticello-St. Cloud 115 kV line be out of service at the same time, NSP states that the only measure that could be taken to restore service would be to start up the Granite City generator which can produce a maximum of 80 MW of power. This would serve less than 15% of the winter peak customer demand in the project area. To bring the Granite City generator into operation would require about two hours. The time to restore service to the entire area would depend upon the type of outage experienced. For example, if the 115 kV line is damaged before it can be removed from service, or if there is damage to structures on the 230 kV line, it could be weeks before all facilities are back in service. If failure is only due to an equipment malfunction, service may be restored the same day.

In addition to providing bulk power to St. Cloud and central Minnesota, the 230 kV Monticello-Benton County transmission line provides an important interconnection between the Twin Cities and northern Minnesota. This interconnection with northern Minnesota provides a backup system when generating stations, or transmission facilities serving northern Minnesota are out of service.

In summary, the applicants expect the line to satisfy several major needs in the study area. First, the line should provide sufficient bulk power to meet both local and central Minnesota needs. Second, the line should help supplement CPA and UPA loads in northern Minnesota. Finally, the 345 kV line should improve interconnecting capacity between the Twin Cities and northern Minnesota.

3.2.3 System Reliability

Part of the determination of need is based upon the electrical system's ability to maintain an acceptable level of service. This service level is defined as system reliability. Reliability can be measured by considering the amount of time during the year that adequate electrical service cannot be provided to all of a utility's customers. In assessing service reliability it is assumed that one or more components of the transmission system are not in operation. Loss of the existing 230 kV Monticello-Benton County line would pose the most serious disruption in electrical service for the region since it is the major existing bulk power source for central Minnesota. Presently, the Granite City generators must operate at peak demand periods to ensure that adequate electrical capacity is available for central Minnesota. By the early 1980s, it appears that if the 230 kV line is out of service, there will be about 836 hours during the winter season when sufficient transmission capability to serve both the interconnection and consumer demand functions of the 230 kV line, will not be available. With the addition of the proposed Sherco-Benton County 345 kV transmission line, sufficient reserve capacity in the transmission system should be available to maintain electrical service reliability even if the 230 kV were out of service.

Route selection for the Sherco-Benton County 345 kV line should consider potential impacts on the reliability of the region's transmission system. These impacts however, must be weighed against other considerations such as land use, environmental and economic factors. For example, paralleling the right of way of an existing transmission line can often reduce the land use impacts and the total amount of additional right of way required. Although some impacts may be reduced, parallel placement of two transmission lines may jeopardize long term service reliability if both transmission lines provide bulk power to the same geographic area.

3.2.3.1 Reliability of Paralleling Existing Transmission Line Rights of Way

One of the functions of the proposed 345 kV line will be to provide an additional source of winter power supply to St. Cloud and central Minnesota. The additional bulk

power source not only insures that sufficient power supplies can be transmitted into the area but also provides a back-up to the existing principal supply source for the region (the Monticello-Benton 230 kV line). Should there be a service disruption on the 230 kV line, the 345 kV system would continue to supply the energy demands of the region with little or no service disruption. If the 345 kV line is constructed parallel to the existing 230 kV line, the role of the 345 kV line as an independent, emergency back-up system, is reduced. This is because the 230 kV and 345 kV lines propose to serve the same general load areas and the risk of system-wide failure is enhanced if both lines were to experience an outage simultaneously.

NSP reports that the effect of an outage to both the 345 kV and the 230 kV lines would result in widespread service disruption to both St. Cloud and central Minnesota. In this instance, the ability of the new 345 kV line to relieve any service problems associated with an outage of the existing 230 kV line, is potentially limited.

The other two existing transmission lines in the area which could be paralleled are 69 kV lines. Because of the low capacity of 69 kV lines, the level of impact on service disruption should the 345 kV line and one of the 69 kV lines simultaneously experience an outage, would be less severe. The 69 kV lines are local load serving lines rather than bulk power sources to large areas. As such, alternative routing of electrical power via the 230 kV, 115 kV and local distribution lines could minimize service disruptions resulting from a joint 345 kV and 69 kV outage.

Depending upon which routing option is designated, there is a potential for the two major power supply lines to central Minnesota sharing up to 11 miles of common right of way. A single event such as a tornado, icestorm, lightning storm, collisions with poles, or other activity is more likely to affect service on both lines where the lines are in close proximity to one another.

3.2.3.2 Reliability of Double Circuiting Existing Transmission Lines

As an alternative to paralleling an existing transmission line, two transmission lines can be placed on a single set of structures. This is termed double circuiting. In general, less right of way is required than in the case of paralleling. In addition, fewer structures need to be constructed. The benefits and limitations of double circuiting an existing transmission line are dependent upon several variables such as: the age of the existing transmission lines;

capacity of existing lines; service areas for the lines to be double circuited; and reliability.

In the project study area, there are three existing transmission lines that offer double circuiting opportunities. These transmissions lines are:

a. 230 kV Monticello-Benton County line.
b. 69 kV Cable/Boyd Lake line.
c. 69 kV Becker/Foley line.

The 230 kV transmission line poses some unique problems if it is to be double circuited. First, the 230 kV line is presently the major bulk energy supplier for central Minnesota. As such, the transmission line cannot be out of operation for any extended length of time without imposing serious distribution problems for central Minnesota residents. Secondly, some spot shortages might result during the construction phase because of the utilities' general inability to meet peak demands without the additional transmission capabilities of the 345 kV line. Therefore, to double circuit the 230 kV line, NSP reports that a new 80 foot right of way adjacent to the existing 230 kV right of way (130 feet) must first be acquired. On the newly acquired right of way, NSP would construct single pole double circuit structures. New 345 kV and 230 kV conductors would then be placed on the structures. When conductor stringing is completed, the lines would be energized and placed into service. The existing 230 kV wooden "k" frame structures would then be dismantled and removed from the site. Finally the old 230 kV right of way would be restored and approximately 60 feet of the old right of way width would be returned to adjacent landowners.

The construction costs for double circuiting the 230 kV line are estimated to be approximately $500,000 per mile. This is nearly three times more expensive than paralleling the 230 kV line with wooden "k" frame structures and twice as expensive as paralleling with single circuit steel poles. Total estimated cost for double circuitng the 230 kV line is $7,505,000. Aside from the higher costs related to double circuiting the 230 kV line, the issue of system reliability must also be considered. As noted in Section 3.2.3.1, placing the 230 kV line and the 345 kV line in close proximity for long distances, poses the highest risk to system reliability.

The two existing 69 kV transmission lines present minor problems for double circuiting. Because of their low voltage loads, the disruption to service during the construction phase would be minimal. In the case of the Cable/Boyd Lake 69 kV line, double circuitng would require the removal of a relatively new line (less than 5 years old). In addition, 80 feet of new right of way

width along the entire route would have to be acquired. Several residential structures would be affected by the new right of way acquisitions. Total estimated construction cost for double circuiting this 69 kV line is about 1.6 times higher than if the line were paralleled with wooden "k" frame structures. Estimated construction cost is $6,295,000.

The Becker/Foley 69 kV line is a much older transmission system. It has been in operation for over 20 years and therefore amortization of the structures is a less serious problem. Construction of double circuit structures can be accomplished in stages which should not cause any service disruptions. The existing 70 foot wide right of way of the 69 kV line would have to be widened by 80 feet. The actual land affected by structure placement, however, can be minimized. In fact, the construction of a double circuited 69 kV line could reduce the total number of transmission line structures constructed. This reduction can be as high as 12.3 structures per mile. As such, some land previously used for transmission line structures could become available for agricultural, tree farming, or other uses compatible with a transmission line right of way. Estimated construction cost for double circuiting this 69 kV line is approximately 1.6 times the cost of paralleling the line with wooden "k" frame structures. Total cost for double circuiting this 69 kV line will range from $6,630,000 to $7,705,000 depending upon which route using the 69 kV right of way might be selected.

3.3 DESIGN PARAMETERS AND STANDARDS

The following information on design parameters is based upon NSP's application. Final selection of structure type and materials will be made by the MEQB and incorporated into the MEQB's construction permit.

3.3.1 Structures

In its application, NSP proposed the use of wooden "k" frame structures. These structures consist of two wooden poles 85-100 feet high with wood crossmembers. The actual height of the structures will depend upon local topography and span requirements. Where soil conditions permit, poles are buried directly in the ground. Pilings and footings are used in those locations where soil and surface conditions may not securely support the weight and pressure of the structures and conductors.

The Citizens Route Evaluation Committee has reviewed several different structure types and unanimously recommended the use of single pole steel structures. Figures 3.1-3.2 and Tables 3.1-3.2 list design parameters for other structure types. The final determination as to the structure type to be used, will be made by the MEQB and incorporated into the construction permit.

3.3.2 Conductors and Shield Wires

The applicant suggests that each phase will consist of a two-conductor bundle with 18 inch sub-conductor spacing. The conductor will be at least 795,000 circular mil aluminum reinforced steel, consisting of seven steel core strands and 26 outer aluminum strands. Two shield wires will be installed above the conductors for lightning protection. The shield wires, as proposed, will be 3/8 inch diameter extra high strength galvanized steel.

3.3.3 Line Design

A minimum clearance of 32'-6" between the ground and the conductor at a conductor temperature of 120° F will be maintained. The spacing between structures could vary depending on the topography, environmental constraints and structure type used. Tables 3.1 - 3.2 list the parameters for different structure types.

3.3.4 Right of Way Requirements

For a single circuit 345 kV transmission line, the required right of way width is 150 feet. A one mile length of right of way 150 feet wide will consume 18.2 acres of land. Where the proposed transmission line can parallel or share an existing right of way, the amount of additional right of way needed can be reduced. For example, NSP estimates that if the 230 kV Monticello-Benton County line were paralleled, right of way requirements could be reduced by about 70 feet or 8.5 acres per linear mile of line. If the 230 kV line is paralleled by the 345 kV line, the centerline of the 345 kV line would be about 80 feet from the centerline of the 230 kV line. If the 345 kV line parallels a 69 kV line, an additional 115 to 120 feet of right of way or 13.9 to 14.5 acres per mile would have to be acquired. (See Table 3.3 for right of way requirements under varying conditions.) The centerline of the 345 kV line would be about 40 feet from the centerline of the 69 kV line.

3.3.5 Material Requirements

Construction of the proposed transmission line and associated facilities will require the use of both

renewable and nonrenewable resources. Renewable resources would include wooden poles, crossarms and braces utilized in the "k" frame structures. If other structure types are designated by the MEQB, materials such as steel, concrete or other materials may be used.

3.4 TRANSMISSION LINE COST

The total cost of the 345 kV transmission line will largely depend upon the final route length, structure type, and environmental constraints. A route by route cost estimate assuming a variety of structure types, is discussed in Chapter 5.

3.5 CONSTRUCTION SEQUENCE AND PROCEDURES

The following material is based on information contained in NSP's Application for Construction Permit. In developing right of way management programs, the utilities will seek to establish programs that are consistent with concepts and findings expressed in U.S. Departmernt of Agriculture and U.S. Department of Interior report Environmental Criteria for Electrical Transmission Systems (1972).

3.5.1 Centerline Alignment

Following MEQB designation of a route, a centerline for the HVTL will be established and a plan and profile drawing of the area traversed by the HVTL. In areas of dense ground cover or where additional information is required to adequately describe the location of the transmission line, field survey crews will be used. NSP right of way agents will obtain written permission from affected property owners prior to conducting any ground survey work.

3.5.2 Right Of Way Acquisition

Once the exact alignment has been established, NSP will identify the owners of all land for which easements will be required for construction of the HVTL. Right of way agents from NSP will contact each property owner and attempt to acquire an easement by negotiation. In the event a satisfactory settlement cannot be reached, NSP will initiate condemnation proceedings to acquire the easements in accordance with Minnesota Statutes.

3.5.3 Ground Survey

NSP has stated that following right of way acquisition, the major construction activities will commence and proceed in as continuous a manner as possible. The first activity will be a ground survey to establish and stake the centerline of the transmission line. Right of way staking for clearing purposes will also be done at this time.

3.5.4 Right of Way Clearing

In general the 80 to 150 foot right of way for the 345 kV line will be cleared of trees and structures. "Danger" trees outside the transmission line right of way may also be removed. A "danger" tree is defined as a tree that because of its height and proximity to energized conductors could pose hazards to the safe operation of the line. Where the right of way goes through areas of low-growing brush and wetlands, the right of way clearing can be reduced in width to approximately the center one-third of the right of way. In areas where orchards or tree plantations must be crossed, care should be taken so as to encourage the multiple use of the right of way whenever possible. At major roads and stream crossings, selective cutting of existing vegetation should be used. Where trees and brush have been removed as part of the right of way clearing activities, grasses, undergrowth or ground-covers should be immediately planted so as to reduce the potential of soil erosion. In all cases, NSP should coordinate right of way clearing activities with property owners so as to minimize impacts.

3.5.5 Foundation Installation

Concrete foundations for transmission line structures may be required at some locations. In addition, foundations for anchors used with guy wires may be required for angle structures. The foundations will generally consist of reinforced concrete placed in drilled shafts.

The shafts would be dug using a vehicle mounted drilling rig capable of augering holes three to eight feet in diameter. During the drilling, the hole would be kept open by means of either temporary steel casing or a bentonite slurry. When the hole has been drilled to design depth, the reinforcing steel would be placed, and ready mix cement trucks would deliver concrete to the site. The 15 to 40 cubic yards of soil excavated for each structure site would be leveled evenly around the site, or if necessary, it will be hauled away and disposed of. Alternate foundations types, such as spread foundations or foundations supported on pilings, may be required at structure sites where soil conditions would not support the basic foundation type. Any excess soil will be leveled or hauled away in a manner consistent with the conditions of the construction permit issued by the MEQB.

3.5.6 Structure Erection

The assembly and erection of structures is a two step process involving two work crews of eight to ten individuals per crew. First, unassembled structures are transported to the site. Next an area of approximately

150 square feet adjacent to the foundations will be required to assemble the structures. If the site is uneven, some site grading may be required.

The time necessary for structure assembly will depend somewhat on the type of structure being used. NSP estimates that it will take between two to three days to assemble each structure. After the structure has been assembled on the ground, the assembly crew will move on to the next site and an erection crew will place the structure on the foundation or in the augered holes. The erection work is completed with the assistance of a 75 to 90 ton crane. Structures can be erected at an average rate of between two to four structures per day.

3.5.7 Conductor Stringing

Prior to the stringing operation, stringing dollies, which are neoprene lined sheaves, must be hung on each structure along with the required insulator assemblies. Temporary structures, known as "guard poles", consisting of two wood poles with a crossarm between, are placed at all locations where the transmission line crosses roads, railroads or existing overhead facilities. Lead lines of polypropylene rope are then installed between the structures in the section to be strung and are placed in the stringing dollies.

The stringing and sagging of the shield wires and conductors require 20 to 30 workers and specialized equipment. A normal stringing operation will entail stringing 2 to 4 miles of line in one equipment setup, and will require one to three weeks to complete. At one end of the operation, the tugger, mounted on a truck or semi-trailer, is moved into position. The tugger consists of a series of motor driven drums and reels that pull the conductors into position. At the other end of the set-up, the tensioner, also mounted on a truck or semi-trailer, is moved into position along with the conductor trailers, reel strands and reels of conductor.

Before the conductors are strung, steel cables and shield wires are attached to the lead lines, and the tugger reels up the lead line, pulling the steel cable and shield wires into position. Temporary anchors are used to secure them until the set-up is completed. The conductors are then strung, one phase at a time. When all conductors and shield wires have been pulled into position, they are pulled up to the proper sag, and final attachments are made at each structure.

The construction activities will be performed sequentially. It will take several months to complete all construction activities in any one section of line. Activities will not be continuous but will occur periodically as different crews move from site to site.

3.5.8 Right of Way Cleanup

Construction cleanup will be conducted on a continuous basis and will include: removing excess materials and general construction debris; repairing damages done on the right of way; removing temporary guard poles; and such other activities which may be required by the MEQB in the construction permit. Construction damage settlements will be negotiated between NSP and the individual property owners.

3.6 RIGHT OF WAY AND LINE MAINTENANCE

Following construction cleanup, the right of way will be restored. Restoration practices will include: grading to restore natural ground surfaces; seeding of cleared right of way with low growing species that will not endanger the line and benefit wildlife. In addition, NSP should restore and seed temporary access roads that will not be retained by landowners. When the centerline of the HVTL crosses cultivated cropland or pasture land, the right of way will be available to the landowner for agricultural use.

The right of way restoration and maintenance programs seek to stabilize soils and control vegetation by preventing the re-establishment of tall-growing species that could create a safety hazard to the HVTL. The applicant should consult with the local offices of the Soil Conservation Service regarding erosion control and seeding requirements on steep slope areas.

Supplemental plantings of clover and grass mixtures with potential wildlife food value should be used where desirable grasses are lacking. The outer portions of the right of way will be managed to encourage a variety of shrubs and low growing trees which have a potential value to the wildlife found in the area. Special management practices may be used in certain locations such as wetlands.

Line maintenance will include routine and emergency maintenance and repair of electrical equipment, conductors and structures. NSP's maintenance program is based on a knowledge of local conditions and regularly scheduled inspections.

3.6.1 Vegetation Maintenance

Vegetation maintenance consists of chemical and mechanical vegetation control. This is usually done at intervals of from 3-5 years. It is desirable establish a grass and herbacious plant community along the right of way. Once established, these plant communities inhibit the growth of tall growing species. During initial clearing

operations and during ensuing maintenance operations, the stumps of freshly cut trees are treated with herbicide to kill the root system of the plant and prevent regrowth. Only U.S. Environmental Protection Agency, and Minnesota Department of Agriculture approved herbicides, applied according to stated directions, will be used.

When undesirable woody vegetation grows in the right of way or regrowth occurs from stumps, a basal spray herbicide may be applied. The chemical presently used by NSP for this purpose is Amchem Weedone 170. The first application is generally made within 2-3 years of initial clearing. Intervals between applications lengthen as the objective of establishing a new shrub community is achieved.

In the basal spray application, herbicide is mixed with an oil carrier and applied by hand to the root collar and the lower 12-24 inch of the stem using a low pressure spray system. Hand cutting using saws, power clippers, and power saws, is also done in areas where herbicide application is not appropriate. Occasionally large power equipment, such as brush mowers or hydro axes, may be used. Herbicides will not be used within 100 feet of any open water body and special care will be exercised to avoid herbicide material from reaching open water through spray drift.

Herbicides are not used in meadows, pastures, or cultivated fields. In fact, herbicides will only be used where the landowner agrees to their use. Written permission for the use of herbicides is obtained in the easement document and NSP states that it is their practice to obtain verbal permission from each property owner to spray herbicides on their property prior to any application. In addition, efforts to coordinate herbicide application with adjacent property owners that might be affected should be undertaken by NSP to insure that the use of herbicide agents are compatible with adjacent land uses.

3.6.2 Abandonment and Restoration of Right of Way

In the event that the 345 kV transmission line should no longer be needed in the future, the transmission line will be removed. All towers will be dismantled and the conductors and other materials will be removed from the right of way. Following the removal of the line, structure foundations will be removed to a minimum depth of 3 feet below ground level. In areas where this activity may create a potential for soil erosion, grading and reseeding operations will be undertaken by NSP.

3.7 CONSTRUCTION PERMIT

The construction permit issued by the MEQB will formally establish the specific standards to which the applicant must adhere in terms of choice of structures, use of materials, construction practices, and right of way and conductor maintenance.

impacts

4

CHAPTER 4

GENERAL ENVIRONMENTAL IMPACTS

4.1 INTRODUCTION

The construction, operation and management of a high voltage transmission line can generate a wide range of impacts on the human environment, human settlement patterns, natural features and general economic activities. There are many impacts which may apply to all route alternatives under consideration. These impacts are said to be non-site specific, in that the impacts are not necessarily unique to any one route alternative. The purpose of this chapter is to identify and describe the non-site specific impacts associated with the proposed 345 kV transmission line. The site specific and route specific impacts that might be generated by the proposed transmission line are discussed in Chapter 5 - Route Segment Impacts.

4.2 GENERAL IMPACTS ASSOCIATED WITH ELECTRICAL PHENOMENA

The transfer of electrical energy by overhead conductors gives rise to three electrical and environmental phenomena. These are corona discharge, electric fields, and magnetic fields. The major known environmental effects of these phenomena are summarized in the following text. Where known, potential mitigating measures are also presented.

4.2.1 Corona Discharge - Description

Corona discharge is an electrical phenomenon that occurs around a conductor and related hardware whenever electrical field strength at a conductor surface exceeds the electrical breakdown strength of the surrounding air. As this occurs, the molecules and atoms in the air react with electrical energy from the line. The end result is the formation of gaseous chemicals, visable light, audible noise, and/or electromagnetic interference. All of these electrical effects represent a loss of electrical energy being transferred by the transmission line. As a result, corona discharge decreases the transfer efficiency of a high voltage transmission line.

The occurrence of corona discharge varies with line voltage, electric field strength, conductor geometry and condition, and weather conditions. Corona is more likely to occur where the electric field is concentrated by conductor surface irregularities such as nicks, scratches, contaminants, insects, water droplets, or dust.

Considerable research has been conducted on various side effects of transmission line corona discharges. Four general effects are of particular note. These are gaseous effluents, audible noise, radio interference and television interference.

4.2.1.1 Corona Discharge - Effects

Corona discharges from high voltage transmission lines can result in the production of ozone and nitrogen oxide. The precise amount and concentration of these elements generated however, varies with atmospheric conditions and the design and operational characteristics of the transmission line.

Ozone is a reactive gas which consists of three oxygen atoms. This reactivity is due to the tendency of the gas to lose one oxygen atom to other chemical elements. As the oxygen atoms dissociate they combine with oxidizable materials. This process is commonly known as oxidation. If the oxidation process is highly concentrated, it can potentially affect a wide range of chemical and biological processes. Table 4.1 shows some of the biological effects of ozone at different concentration levels. Estimates for ozone production are between 0.5 to 5.0 grams of ozone per kilowatt-hour of corona energy lost. For a 345 kV ac transmission line it is estimated that the maximum one hour concentration of ozone will be approximately 0.007 parts per million (ppm). This is well below the National Ambient Air Quality Standard of 0.12 ppm for oxidants. This level is also below the more stringent standards of 0.07 ppm set by the State of Minnesota's Pollution Control Agency for oxidants. Based upon ozone studies conducted by the U.S. Department of Health Education and Welfare, it does not appear that the 345 kV transmission line will impose serious health hazards due to ozone production.

TABLE 4.1

A SUMMARY OF THE BIOLOGICAL EFFECTS OF OZONE

Concentration (ppb)	Effect
10	Olfactory threshold for keen smell
15	Normal human threshold
20-40	Sensitive plant injury (8 hour exposure) -- 5% injury
60-12	Sensitive plant injury (8 hour exposure) -- 20% injury
100-300	Dryness and burning in nose and throat
200	Blood changes in animals
150-250	Sensitive plant injury (1 hour exposure) -- 5% injury
200-350	Sensitive plant injury (1 hour exposure) -- 20% injury
250-500	Reduced visual acuity and darkness adaption
300-1700	*Recurrent headaches, fatigue, and breathing difficult after two-week exposure
500	*Chronic irritation of bronchial tissues
600-1000	Choking and coughing (1+ hours)
1000	Hemoglobin changes in man
9000	Acute pulmonary edema

*Long term exposure effect.

SOURCE: Michigan Public Service Commission Health and Safety Effects of EHV Transmission Lines. 1979

In addition to ozone, corona discharges can produce nitrogen oxides. The amount of nitrogen oxide produced by a high voltage transmission line is usually one order of magnitude smaller than for ozone. Nitrogen oxides may reach concentrations of only 0.1 to 2.0 parts per billion (ppb) at ground level near a transmission line. Nitrogen oxides (NO_2) are generally less toxic to plants than other oxidants. The level of potential plant damage resulting from NO_2 is closely related to NO_2 concentration and exposure time. Figure 4.1 is a threshold curve indicating the NO_2 doses that result in the death of plants, foliar lesions, and metabolic effects. The various threshold levels are concentrations emitted by the transmission line.

4.2.1.2 Corona Discharge - Audible Noise

Another side effect of corona discharge is the emission of audible noise from the transmission line. The noise can be described as either crackling, sizzling or humming sounds. The level and frequency of noise emissions are dependent upon conductor conditions, line voltage, and weather conditions. Generally speaking, the loudest and most frequent noise emissions occur during heavy rainstorms or other wet conditions.

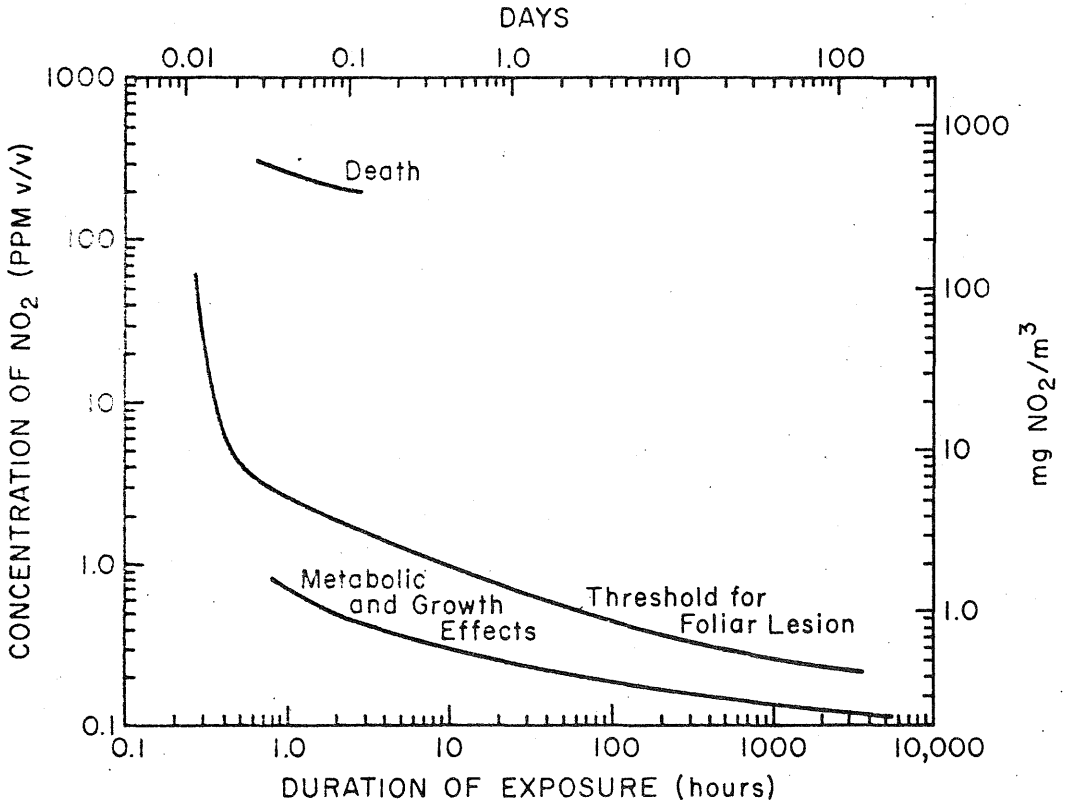
Based upon past experiences and the results from a recent noise study conducted on 765 kV transmission lines, NSP has stated that even under the most adverse conditions, the proposed 345 kV transmission line will produce a maximum audible noise level of 45.5 decibels (db) and will not exceed 43.0 db at the edge of the right of way. This noise is within acceptable noise limits established by the Minnesota Pollution Control Agency (See Table 4.2 for Ambient Noise Standards).

Although the average sound level does not appear to be excessively loud, people have different tolerance levels to noise and even low level sounds could be annoying to some individuals.

4.2.1.3 Corona Discharge - Electromagnetic Interference with Communication Equipment

Corona discharges can produce electromagnetic fields which may interfere or disrupt the efficient operation of communication equipment. Although this disruption is not a direct health or public safety problem, "static" or "snow" interferences can be annoying to radio listeners or television viewers.

NO_2 IMPACT ON VEGETATION



Source: USEPA Interagency Energy/Environment R&D Program Report, Environmental Effects of Increased Coal Utilization, Ed. N.R. Glass June, 1978.

figure 4.1

TABLE 4.2

MINNESOTA AMBIENT RECEPTOR NOISE STANDARDS

	Day (7 am - 10 pm)		Night (10 pm - 7 am)	
NAC	L_{50}	L_{10}	L_{50}	L_{10}
1	60db	65db	50db	55db
2	65db	70db	50db	55db
3	75db	80db	75db	80db

NAC-1 (Noise Area classification-1) includes the following land use categories: Residential, hospital, educational and religious activities, designated camping and picnicking areas, cultural activities and natural exhibits.

NAC-2 includes: Railroad, bus, airport and marine terminals, retail trades, commercial services, governmental services, parks and recreational activities.

NAC-3 includes: Manufacturing, transportation, fairgrounds, amusement parks, agricultural, mining and fishing activities.

L_{50}: Noise level not to be exceeded more than 50% of the time.

L_{10}: Noise level not to be exceeded more than 10% of the time.

Interference related to transmission line operation can originate from two sources: gap discharge and corona discharge. Gap discharges are electrical discharges across small gaps resulting from loose transmission hardware or connections. As such, gap discharge interference can usually be located and eliminated. Gap discharge, should not therefore pose any long-term impacts on reception or transmission of radio or television. Corona discharge produces short bursts of current which can cause electromagnetic energy to be generated over a wide range of radio frequencies. This corona energy can be carried as induced current for long distances by the conductors. Thus, if a radio or television receiver is located near a transmission line, a corona discharge that originates at distant points on the line can still cause reception interference.

The impact of transmission lines upon radio signal reception depends upon three factors: radio signal strength, ambient radio noise level, and the line-generated radio noise level. The quality of reception under ambient conditions depends upon the difference between the radio signal strength and the ambient radio noise level. This reception quality is measured by an ambient signal-to-noise ratio (ASNR). High quality reception will result from either a high signal strength or low ambient noise levels. The level of interference that a transmission line may impose is measured as the difference between the radio signal strength and the line-generated noise level. This ratio is described as the signal-to-noise ratio (SNR).

If both ASNR and SNR are high, the quality of signal reception will also be high and the transmission line should have no noticeable effect. If both ratios are low, existing poor reception should not be made worse by the line. However, if ASNR is high and SNR is low, impact on signal reception may be noticeable. In general, the nature of radio frequency interference from transmission lines is such that the interference diminishes rapidly as a function of distance away from the line. Therefore, interference is usually a localized problem.

Most of the impacts on communication equipment can be minimzed by altering antennas or other receiving equipment. NSP states in their application that should the operation of the 345 kV transmission line cause disruptions in communication equipment, NSP will be responsible for correcting the problems.

4.2.2 Electrical and Magnetic Field Effects

The operation of alternating current (ac) overhead transmission lines produces electric and magnetic fields. Both fields have the ability to "couple" with objects located within them and transfer electrical energy to the objects without direct physical contact. This energy transfer is known as induced voltages and currents. These voltages and currents can couple or interact with objects that exist within the transmission lines electrical fields. The "coupled" objects can be: living organisms such as people, animals or plants; or inanimate conductive objects such as fences, vehicles or other metallic items. If induced directly onto living tissues, these voltages and currents can cause direct biological, physiological or psychological effects if the currents and voltages are sufficiently large enough. Voltages and currents induced onto inanimate objects are also of concern. This is because of the potential shock hazard present when a person or animal comes into contact with the electrified object. Induced currents can also adversely affect the normal function performance of different types of objects. For example, concentrated fuel vapors may be ignited or electronic equipment may be affected.

The induction of voltages and currents by a transmission line can be divided into the effects due to electrical fields, termed electrostatic induction impacts, and effects due to magnetic field effects, termed electromagnetic induction impacts.

4.2.2.1 Electrostatic Field Impacts

An electric field can induce a voltage and current on conductive objects located within the field. The voltage and current present whenever the line is electrically energized, and the fields strength,is a function of the line geometry and voltage. The voltage that the field will induce on an object depends on the size and shape of the object, the strength of the field, how well the object is grounded, and the location of the object relative to the line.

According to NSP, the maximum electric field at ground level caused by the proposed line will be 5.67 kV/m (kilovolts per meter). The ground level field strengths decrease with increased line height; therefore, maximimum field strength would occur generally near the center of each span. Also, the ground level electric field decreases with an increased distance from the line. (see Figure 4.2 and Table 4.3.) For reference, the Minnesota Environmental Quality Board (MEQB) has established 8

kV/m as the maximum electric field strength at one meter (or 39.37 inches) above the ground for some transmission lines. It would appear that the field strength associated with the 345 kV line will fall below the MEQB's maximum standard.

The principal problem with induced voltage is that large metallic objects such as farm equipment, vehicles, structures with large metal components, wire fences, etc. can conduct and transfer the current. If a metal object is not adequately grounded when a person touches it, a current can flow through the person's body to the ground. The sensation experienced by the individual touching the metal object may be an annoying shock similar to "carpet shocks." Whether these currents will be induced by the electric fields associated with the 345 kV transmission line will depend upon the factors discussed in the first paragraph of this section.

Adequate grounding of conductive objects near the transmission line can eliminate potential shock hazard. Electric and non-electric wire fences, metal buildings and other stationary structures can, where necessary, be readily grounded to reduce the level of shock current. Electrostatic and Electromagnetic Effects of Overhead Transmission Lines, REA Bulletin 62-4, provides standards for this grounding. Because multiple use of transmission line rights of way for agricultural, transportation and other compatible uses is encouraged, it is quite possible that certain types of vehicles and machinery will be exposed to the electrostatic fields. The vehicle or machinery will collect induced currents and may transmit the current to an individual. The current transmitted will depend on the size of the vehicle, how well the object is insultated from the ground, and the strength of the induced current in which the object is located. Generally speaking, the larger the object, the greater the potential short circuit current level. Table 4.4 lists estimated induced current levels that may be delivered to a grounded person under a 345 kV line from different types of agricultural and construction equipment.

The voltage built up on an ungrounded vehicle has the theoretical possibility of causing fuel ignition. If a vehicle near the line were refueled from a metal can, there is a possibility of a spark jumping from the vehicle to the can, thus, igniting fuel vapors. There are currently no regulations relating to refueling under a transmission line but NSP recommends in their application, that no refueling be done within the right of way.

If the ground level electrostatic field is a problem, its strength can be reduced by lowering the line's operating voltage, by moving the conductors further away from the ground, or by adding shielding between the line

TABLE 4.3

ELECTRICAL FIELD STRENGTH AT
VARYING DISTANCES FROM THE
CENTERLINE OF A 345 kV TRANSMISSION LINE

Distance from Centerline in Feet	Electrical Field Strength in kV/m.(1)
0	1.97
25	5.34
30	5.66
50	3.87
75	1.65
100	0.79

(1) Field strength calculated under the followng conditions:

a) 10% average
b) midspan location
c) conductor clearance of 32.5 feet
d) field strength one meter above the ground.

Source: NSP Application

ELECTROSTATIC GRADIENTS

345 kV TRANSMISSION LINE

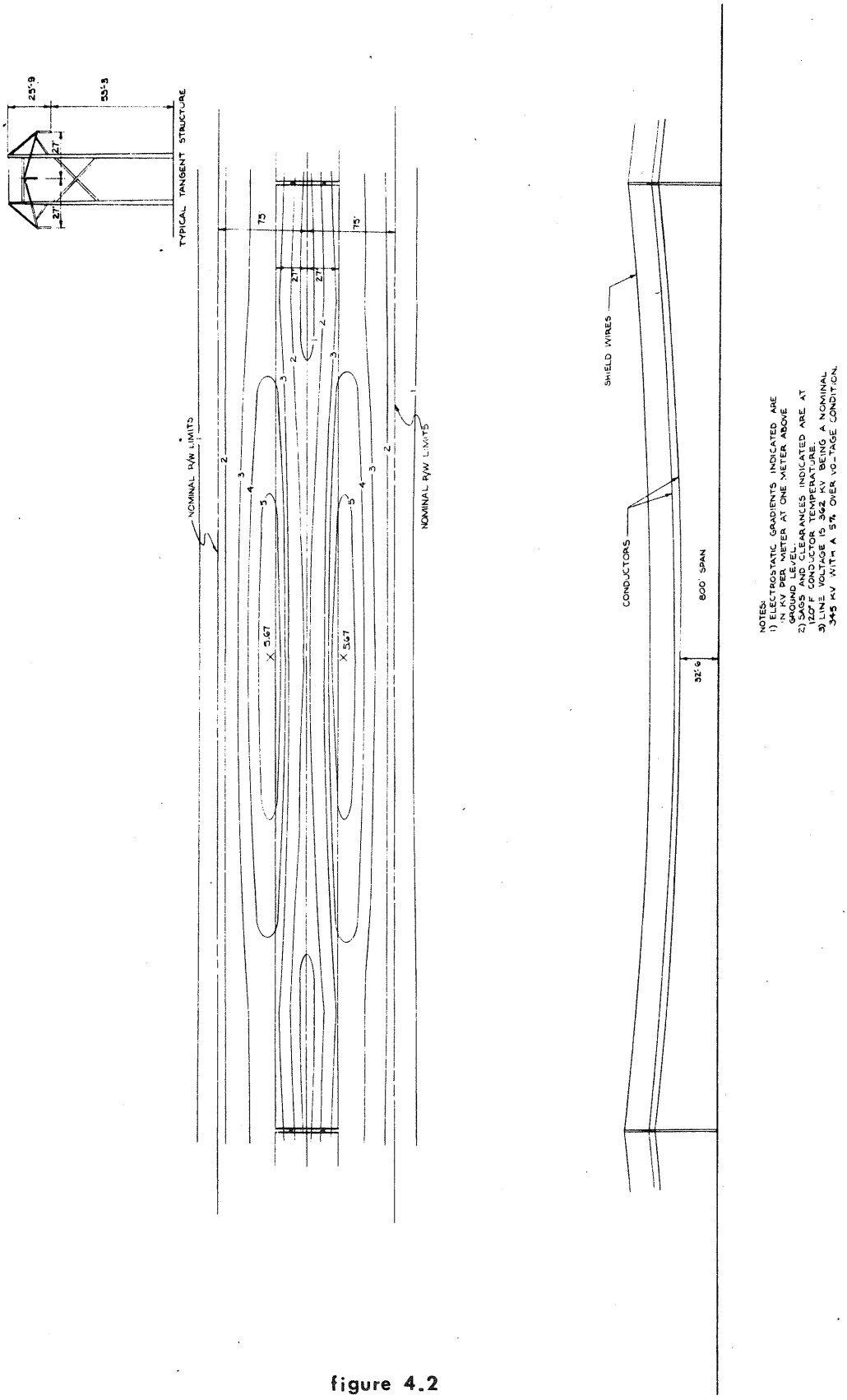


figure 4.2

TABLE 4.4

INDUCED CURRENTS DELIVERED TO A GROUNDED PERSON
UNDER A 345 KV LINE
(WORST CASE CONDITIONS)

Test Vehicle	mA/(kV/m)	Current (mA)	
		Worst Case*	Typical
Tractor-Trailer	0.59	3.35	0.27
School Bus	0.41	2,32	0.19
Tractor-Tanker	0.40	2.27	0.18
Combine	0.39	2.21	0.18
Farm Tractor with Wagon	0.31	1.76	0.14
Pickup Truck	0.10	0.57	0.05
Station Wagon	0.08	0.45	0.04
Compact Sedan	0.07	0.40	0.03

*Assumes a:

1. Well grounded person (artificially grounded through a metal rod)
2. Highly insulated vehicle (free from of dirt, dust, moisture or carbon particles on tires which might conduct current to the ground)
3. High ambient temperature (40°C, or 104°F)
4. High relative humidity (90% or higher)
5. Maximum operating voltage.

Source: Matias, T.R., and H.L. Colbeth. Record Proceedings Cases 26529 and 26559, New York Public Service Commission, January 16, 1978.

and the ground. Because the electric field of a transmission line is a function of the voltage of the transmission line, reducing the voltage of the line will reduce the electric field caused by the transmission line. However, this would require an increase in the current carried by the line (assuming the capacity for transmitting power is to remain the same). This increased current would require larger conductors (increasing the cost of the line), increased energy losses of the line, and increased magnetic fields caused by the line. Because of the greatly increased costs and energy losses accompanying a reduction in voltage, this method of reducing the electric field strength is normally not utilized.

The electric field strength under a transmission line is roughly proportional to the inverse of the distance from the transmission line conductors to the ground. Therefore, the higher the conductors are, the lower the field strength at ground level will be. Another commonly used method of controlling exposure to the electric fields is to increase the width of the right of way to reduce the electric field strength at the edge of the right of way.

The third way to control the ground level electric field strength is to install ground wires between the conductors and the ground. These wires "shield" the ground from the electric field. This method is normally used only in extreme cases.

4.2.2.2 Electromagnetic Field Impacts

The currents carried in each of the conductors of the 345 kV transmission line will generate a magnetic field. This magnetic field can induce currents and voltage in long, parallel conductors such as fences or telephone cables. The induced voltage is dependent on: line geometry, the current carried on the line; the distance to the conducting object; the distance that the conducting object is parallel to the transmission line; the grounding of the conducting object; and the shielding of the conducting object. According to the applicant the maximum calculated ground level magnetic field produced by the 345 kV line under normal operating current would not exceed .3 gauss.

In general, electromagnetic induction effects are only of concern or importance where long conducting objects such as metal fences or wire parallel the transmsission line. There are two conditions of concern where electromagnetically imposed voltage on a parallel conductor may pose special problems:

1. Partially Grounded Parallel Conducting Circuits.

   Major difficulties arise in the case of very long conductors close to the ground, such as a telephone circuit which parallels a transmission line and is only grounded at one end. Through induction gradients, a voltage will develop at the end of the circuit opposite the ground. This can cause a significant current to flow to a person coming into contact with the partially grounded conduit. This is principally a problem for construction crews installing parallel transmission lines or other services on a common right of way.

   The procedure followed by the power companies on grounding fences or other similar objects can effectively minimize the problem for the general public.

2. Long Objects Below the Ground.

   The issue of whether ac voltages induced on underground pipelines cause increased pipeline corrosion is highly debatable. The overall work on this problem is still in progress and no definitive results are yet available.

The operation of telephone cables and other cable communication systems can be affected by both the magnetic fields occurring during normal operations and the much larger magnetic fields occurring during a fault. Some concern has also been raised regarding potential long term health impacts. These impacts are discussed in greater detail in section 4.2.2.3.

One other concern that is often expressed is the possible interference with cardiac pacemakers. Pacemakers in operation today are usually unaffected by magnetic fields of less than 1 gauss. The proposed transmission line will create a maximum field at the edge of the right of way at ground level of 0.15 gauss.

When the normal magnetic fields caused by a high voltage transmission line are a problem, the only ways of reducing the field strength at the object, short of reducing the current in the transmission line, are to either move the conductors further away from the object experiencing the problems or to shield the object from the magnetic field.

As in the case of the electric field, increasing the distance between the transmission line conductors and the object affected by the magnetic field will reduce the strength of the magnetic field. This can be done either by increasing vertical or horizontal distance between the conductors and the object, or by moving the object. If this is not a practical solution, the object, e.g., a communications cable, can be electrically shielded by a metallic sheath. The exact combination of measures used depends on the specific conditions encountered.

As mentioned previously, the magnetic field during a ground fault is much greater than during normal operations. Besides using the mitigation measures mentioned above, the effects of these magnetic fields can be reduced by insuring that the transmission line is de-energized as quickly as possible when a fault occurs. NSP states that available protection equipment will accomplish this in less than a quarter of a second.

4.2.2.3 Public Health Impacts from Electric Fields

Adverse health effects resulting from the direct exposure of humans to the high voltage overhead transmission line field environment are a matter of considerable public concern. Although it is not possible to say that there is no risk, the Minnesota Department of Health (MDOH) Public Health and Safety of High-Voltage Overhead Transmission Lines (1977), states that thus far both epidemiological and laboratory studies have failed for various reasons to indicate that the energy transferred directly from transmission lines to humans is a health hazard. The authors of the MDOH study conclude that there is no evidence suggesting any effect on health or upon one's sense of well-being from the intermittent exposure experienced in the transmission line environment. No theoretical basis for the presumption of effects has been postulated. This is a particularly important point, for it forces research into the biological effects of power frequency fields to be exploratory or observational, rather than rigorous experimental studies designed to accept or reject specific hypotheses.

While ac electric fields are not strong enough to cause tissue heating or nerve stimulation, the possibility of more indirect effects has prompted research in this area. Human and animal studies on the biological effects of ac electric fields have generally yielded conflicting results. One major reason for discrepencies is differing experimental exposure parameters, i.e. frequency, gradient and exposure duration. In addition, many experiments have not had adequate experimental design, or controls for extraneous variables, and statistical analyses of experimental data.

Biological effects, if they exist, are likely to be subtle. Recognition of true effects demands investigation utilizing a systematic, interdisciplinary approach to assure well-designed, closely controlled research. At the time of this analysis, such a comprehensive study is not available.

Another potential health hazard is related to accidental contact with the transmission line or flashover. Accidental direct contact of a conducting object with the conductor of a high voltage transmission line, or by accidental flashover from a conductor to a conducting object, can cause electrocution. The hazards associated with accidental contact or flashover are summarized below in a quote from a University of Minnesota study on compatibility of transmission lines with agricultural activities. The summary concentrates on agricultural operations, since it is the major area of concern in the study area, but it also applies to any similar operations.

> "Accidental contact of a grounded conducting object with a conductor presents an obvious safety hazard. . . . Contact can result in a current passing from the conductor through a person to ground. This problem is not unique to high voltage lines. Local distribution lines present more potential problems for contact because they are located much closer to the ground. Movement of tall objects, such as elevators or grain augers which may be near any electrical lines, require caution. Handling of irrigation pipe is another instance where caution to avoid contact is necessary. If clearance requirements for flashover . . . are met, direct contact with EHV transmission lines should not be encountered . . . [a utility] has recommended that no part of the equipment or load pass any closer to the conductors than 8 feet for 115 kV, 10 feet for 230 kV, and 15 feet for 500 kV."[1]

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[1]Robert J. Gustafson, etal., Report on an Investigation of Electric Power Transmission and Agricultural Compatibility in the MAPR Region, Agricultural Experience Station, University of Minnesota, 1978, pp. 72, 74.

By adding the clearance requirements, in this case 15 feet, to the height of the largest farm equipment that is likely to be used under the transmission line, the minimum safe conductor clearance can be calculated. Based on the University of Minnesota report, the maximum equipment height expected to be used for farming under a transmission line is 15 feet; this translates to a 30 foot minimum clearnace for a 345 kV transmission line. NSP has proposed a 32 foot 6 inch minimum clearance for the 345 kV line.

4.3 HUMAN SETTLEMENT IMPACTS

4.3.1 Population Centers

Development activities and building structures place numerous constraints on transmission line routing. The National Electrical Safety Code and the Minnesota State Electrical Code specify minimum safety clearances that must be maintained between transmission line conductors and all buildings and structures. These clearance standards vary with the type of building structure and land use activity. Generally the actual right of way area of a transmission line must be clear of buildings and/or structures. The location of transmission line routes through areas with dense building coverage therefore often necessitates the acquisition and removal or relocation of existing structures. Because of the minimum safety clearance requirements, any building construction activity within a 345 kV transmission line right of way is usually precluded.

In addition to the direct impact that a transmission line right of way imposes on existing and proposed population centers, there are several construction related impacts which must be considered. These impacts include: increased noise; traffic congestion; dust; and physical disruptions to public services such as water, sewer and road construction. Although many of these impacts are temporary, they may constitute inconveniences and short term negative environmental impacts. Construction related impacts, however, can be addressed more thoroughly in the MEQB's construction permit program.

4.3.2 Land Use

High voltage transmission lines can influence urban land use development patterns in a variety of ways. The impact on land use development trends, however, is most noticeable in areas that are not yet fully developed.

The actual degree to which a transmission line may influence land use development patterns is difficult to measure because of the wide range of economic, political, social and geographic variables associated with land use development activities. Nonetheless, high

voltage transmission lines constitute a physical and psychological barrier to development that presents major construction and urban design constraints for future land uses. In addition, the presence of a high voltage transmission line can affect the overall desirability of adjacent property for some categories of land uses.

The land use related consequences of a transmission line right of way, however, need not be entirely negative. In some situations, it may be possible to combine careful line routing with effective land use planning so as to take advantage of the linearity of transmission line as a buffer or as a transition between different and/or conflicting land uses.

The impact of a high voltage transmission line on land use will depend upon the perceived compatibility of the line with the surrounding land use setting. The greatest adverse impacts will be associated with the placement of HVTLs in locations with low intensive land uses such as residential areas. Other areas where potential land use conflicts may arise include sites that present unique passive and aesthetic amenities or sites that serve a recreational use. Conversely HVTLs pose the least potential impact upon areas of more intensive use or areas in which greater noise, odor, light and dust levels are perceived as acceptable. Such areas might include industrial lands, certain institutional uses, liquid and solid waste disposal lands or major transportation corridors.

4.3.3 Easements and Land Values

The construction of a high voltage transmission line can change the use and character of the land over which it passes, and the acquisition of a utility right of way will alter the landowner's rights to his property. But it is not entirely clear to what extent the presence of the transmission line and the utility easement will influence the future real estate value of the property. The existing land use and the potential for future land use changes are critical factors to consider.

Once the precise location of the transmission line is determined, the utility must acquire, whether by voluntary sale or by involuntary eminent domain proceedings, an easement (i.e. legal property rights), for the use of required rights of way. Since the transmission line occupies only a portion of the land over which it passes, fee simple ownership is not always necessary. However, negotiated easement prices can be equal to or more than the normal

purchase price for the land itself, and may include additional payments based on the number and type of poles on a parcel of land. In addition, the utility is liable for specific damages to crops, other physical properties, or land damage caused by construction and maintenance of the transmission line.

The most immediate legal consequence of granting an easement to the utility is the loss of certain rights of the use of the land. Thus, when the landowner sells property having utility easements, he is selling something less than what he originally purchased. The purchaser of land with utility easements is also obligated to abide by the restrictions and limitations imposed by the easement. In this respect, because the easement restricts full and uninhibited use of the land, the real estate value could be preceived as being diminished.

Aside from these legal implications, the actual presence and operation of the transmission line may have an influence upon the selling price of the property. As discussed in Section 4.8, transmission lines may create land management difficulties when located on agricultural land. The landowner must adjust his operations in order to minimize safety hazards, loss of productive crop land and loss of time. In addition, the transmission line is an obstacle which may make future changes such as the installation of a new irrigation system or the subdivision of property for housing difficult or impossible. The consequent loss of future opportunities could have an impact upon the value of the land, especially for a new owner who may wish to alter the present land use.

Finally, the impact of transmission lines upon aesthetic values, especially in residential and scenic areas, may have an important influence upon future land values. Since few potential buyers are likely to perceive transmission lines to be aesthetically pleasing, the existence of the line may depress land values in areas where visual considerations are an important selling feature.

Overall, studies of the impact of utility easements upon land values have been inconclusive. Due to the large number of variables which affect land value, no reliable quantitative measure is yet available. Nevertheless, it is likely that the presence of high voltage transmission lines will not contribute to improved land values.

4.4 TRANSPORTATION SYSTEMS

Airports and communication facilities may be affected by the location of transmission lines. The Federal Aviation Administration and Minnesota Department of Transportation have established relatively complex restrictions on the distance and orientation of any structure located within airport approach zones. Power line equipment may also affect ground-to-air communication and navigation systems as well as other types of communication facilities, such as: radio and television towers; microwave communications; VORTAC; and VOR nondirectional beacon systems. Transmission lines can affect these facilities by: absorption and consequent re-radiation of radio waves; attenuation of radio waves caused by the physical obstruction of transmission equpment; and potential reflection of certain frequencies of waves.

Transmission lines may also affect existing and potential ground transportation networks, particularly highways. In certain cases it may be desirable to construct HVTLs adjacent to highways in order to reduce the amount of land needed for the right of way, and to avoid impacts on other land uses. However, transmission lines constructed on or immediately adjacent to a highway right of way may interfere with highway expansion or improvement plans, and may require costly future relocation of the HVTL towers. In addition, access to a transmission line which is located along a controlled access roadway is often difficult and may require the construction of additional access roads over private property. Transmission lines which parallel major highways can also adversely affect the scenic value of these highways. Where scenic roadways have been identified, the routing of a HVTL parallel to the highway may conflict with the scenic qualities of the roadway. Finally, Federal laws and regulations continue to restrict the placement of HVTL structures on the right of way of federally funded limited access highways.

4.5 SIGNIFICANT HISTORICAL AND ARCHAEOLOGICAL SITES

The potential impact that a HVTL may have upon an historical or archaeological site depends upon the individual characteristics of the site, and the amount of disruption caused by the line. The general impact upon the area's historical and archaeological resources depends also upon the relative significance of the individual site.

Physical destruction or the need to relocate or salvage the resource are the most serious consequences of the construction of a transmission line. In other instances, the impact can be more subtle. The visual impact of a HVTL within the vicinity of an historical site, although secondary and subjectively measured, can be important. This is especially true where the historical feature has unique architectural significance or where preservation of the surrounding landscape in a relatively natural setting is important, such as in the example of historic battlegrounds or Indian encampments.

Where archaeological sites exist, the construction of a transmission line can do destroy the archaeological value of a site. Clearing rights of way and the place ment of structures in undisturbed or minimally disturbed locations can adversely affect the scientific value of these sites. This is less likely to happen where road construction and other modern developments have already disturbed the ground. Accordingly, the Minnesota Historical Society is specifically concerned about lines that may be built in undisturbed areas. The State Historic Preservation Offier may request that an archaeological site survey be conducted before any construction is initiated on the right of way. This survey may lead to minor right of way location changes or salvage archaeology, where necessary.

4.6 VISUAL AND AESTHETIC VALUES

Aesthetic values are difficult to define because "beauty" and visual amenities are functions of individual perceptions. Nevertheless numerous efforts to quantify aesthetic values consistently list diversity in vegetation, topography, ground cover, existence of water bodies and distance of vistas as reliable indicators of visual diversity.

High voltage transmission lines can adversely affect the visual quality and aesthetic intregrity of a region. The visual impact of a transmission line is greatest where the line is in a prominent location and highly visable for long distances. In addition, visual impact is proportional to the number of individuals that can visually observe the line. Structure type, structure height, topography, and vegetation screening all influence the potential visual impact of a transmission line.

4.7 SOCIO ECONOMIC EFFECTS

The socio-economic effects of a transmission line during the construction phase are generally considered to be minimal. The impact of the construction on the local labor force is negligible since almost all the work is done by non-local personnel. Because work on a high

voltage transmission line is constantly shifting in location and is relatively short in duration, the impact on an area's housing and public services is usually not noticeable. As a result, expenditures in any one locality during the construction period are comparatively small and limited to food and lodging, gasoline and entertainment.

Once the HVTL is operational and if the line is properly maintained, local economic impacts are generally negligible. A relatively small number of utility personnel will be required to maintain and inspect the line. In fact, much of the inspection may actually be done by air.

The effect on the local tax base is proportional to the size of an area's tax valuation prior to the construction of the HVTL. In rural areas with relatively small tax bases, the added valuation resulting from transmission lines can be significant. The exact amount of taxes contributed to the local economy by a HVTL depends on several factors. These include: the total value of the line; the proportion of total transmission line value located within a specific taxing unit; and the mile levy of the taxing unit. In addition, state personal property tax laws specify, by formula, the allocation of taxes by various local taxing units.

4.8 IMPACT ON ECONOMIC ACTIVITIES

A HVTL can generate a variety of adverse impacts affecting the economic operation of commercial, industrial and agricultural activities. The greatest potential economic impact in the project area will be on agricultural operations. The number and distribution of other economic activities in the region are relatively insignificant. The impact of the construction and operation of transmission lines on productive farmland has been the subject of an increasing number of studies. These studies are in response to the growing conflicts which have arisen over the routing of public utilities those impacts which are felt to affect farm operations from an economic standpoint. Other impacts, specificaly health and safety effects, and the impact on agricultural land values, are discussed in sections 4.2.2.3 and 4.8.2.2 respectively.

4.8.1. Potential Temporary Impacts From Construction Activities

Agricultural land is primarily susceptible to the following kinds of temporary impacts generated during the construction and maintenance of transmission facilities: 1) soil compaction, 2) soil erosion, and 3) interference with cropping or planting operations.

4.8.1.1 Soil Compaction

Excessive compaction alters soil structure. Soil structure is critical to the physical soil properties which influence the soil water content, water exchange capabilities, level of aeration, transfer of gasses, and the ability of a soil to transmit or retain heat. Adverse soil conditions resulting from the impairment of any of these properties can affect plant growth and reduce crop yields.

Compaction of soil is a general and ongoing problem in most types of cropland. This is a result of todays mechanized farming practices and the trend toward larger and heavier farm machinery. However, compaction associated with transmission line construction can be particularly severe along a right of way where traffic from heavy construction equipment and trucks is more intensively concentrated. This intense concentration subjects soil to stresses which often are much greater than those associated with typical farm machinery. Table 4.5 compares compaction pressures of typical construction equipment and farm machinery.

On transmission line construction sites, soil compaction damage is predominantly the result of heavy truck traffic. The trucks used in the construction process are usually laden with construction materials and often have to make several trips across agricultural fields. Other kinds of machinery which are typically used in the construction of a transmission line include, cranes and augers. These vehicles however, are used less frequently. The first pass of a wheel on loose soil accounts for about 80 percent of the total compaction which might result from four passes over the same spot. However, subsequent passes of equipment frequently affect untouched soil, so that the percentage of soil area compacted can increase with each pass of a vehicle.

The condition of the soil at the time of construction can affect the amount of compaction which occurs. Freshly tilled and very wet soils are particularly susceptible to severe compaction because of their plasticity. Proper construction scheduling can help to mitigate this problem.

4.8.1.2 Erosion

Right of way clearing, grading, and other disturbance of the soil during construction can increase the possibility of soil erosion. A number of different factors including slope, type of soil, vegetation, and local rainfall all influence the potential for soil erosion. In general, steep, silty, impermeable and unconsolidated soils are most prone to erosion. These soils are often

TABLE 4.5

COMPACTION PRESSURES OF TYPICAL CONSTRUCTION & FARM EQUIPMENT

EQUIPMENT	WEIGHT (POUNDS)	GROUND PRESSURE (psi)
50 Ton Crane and Auger	125,000	7.65
955 Cat Loader	32,000	11.10
35 Ton Crame	74,920	7.59
60 Ton Crane	128,940	9.80
90 Ton Crane	234,325	12.10
D8 Cat W/Blade	70,000	12.50
D8 Sag Cats	75,000	12.13
2 Wheel Tractor (without dual tires)	15,000	9.5
2 Wheel Tractor (with dual tires)	15,000	5.3
4-Wheel Drive Tractor	30,000	11.3

SOURCE: Minnesota Department of Agriculture: High Voltage Transmission Lines: Agricultural Issues and Impacts, 1979.

associated with present and former river systems, with some glacial outwash deposits, and with rugged terrain.

Specific practices can be used during construction to minimize erosion. These practices include: soil contouring, backfilling, seeding, and mulching of disturbed soil. In addition, careful consideration of where construction vehicles should be driven and prompt filling and grading of any deep tire tracks can minimize soil rutting and gullying.

Right of way preparation and clearing can also accelerate wind erosion problems if critical windrows are removed. Figure 4.3 illustrates areas within the proposed route segments which have been identified by the Soil Conservation Service as having potentially vulnerable erosion hazards. In general, an area with a topographic slope greater than 6% can, if unprotected, experience erosion problems. Wind erosion can occur on any sandy surface where winds are not blocked or the ground surface is not sheltered. Erosion problems on a segment by segment basis are discussed in Chapter 5.

4.8.1.3 Vegetation

The effects of construction on pasture vegetation are usually short term. Field crops, however, are usually severely damaged in the right of way and along those areas where construction equipment must travel across fields. Within the study area there are several conifer plantations and a nursery stock farm. The construction related impact that a transmission line may impose is related to the maturity of the existing trees. Root compaction by heavy equipment could stunt or kill some tree species. In addition, limbs may be damaged or broken by the movement of construction equipment through the area. All damaged trees should be treated and/or removed so as to prevent disease. The use of herbicides for right of way maintenance could present an environmental hazard to some tree plantation species. Where tree plantations are present, special care should be exercised in selecting and using any herbicidal material. Where the transmission line ROW crosses woodlots or windrows a 150 foot right of way it may be necessary to clear tall growing species.

All vegetation damages should be compensated for by the applicants and made a requirement of the MEQB's construction permit.

4.8.1.4 Other Temporary Impacts

The movement of heavy vehicles across fields can damage or destroy drainage tiles unless the location of the tile network is known and avoided by equipment opera-

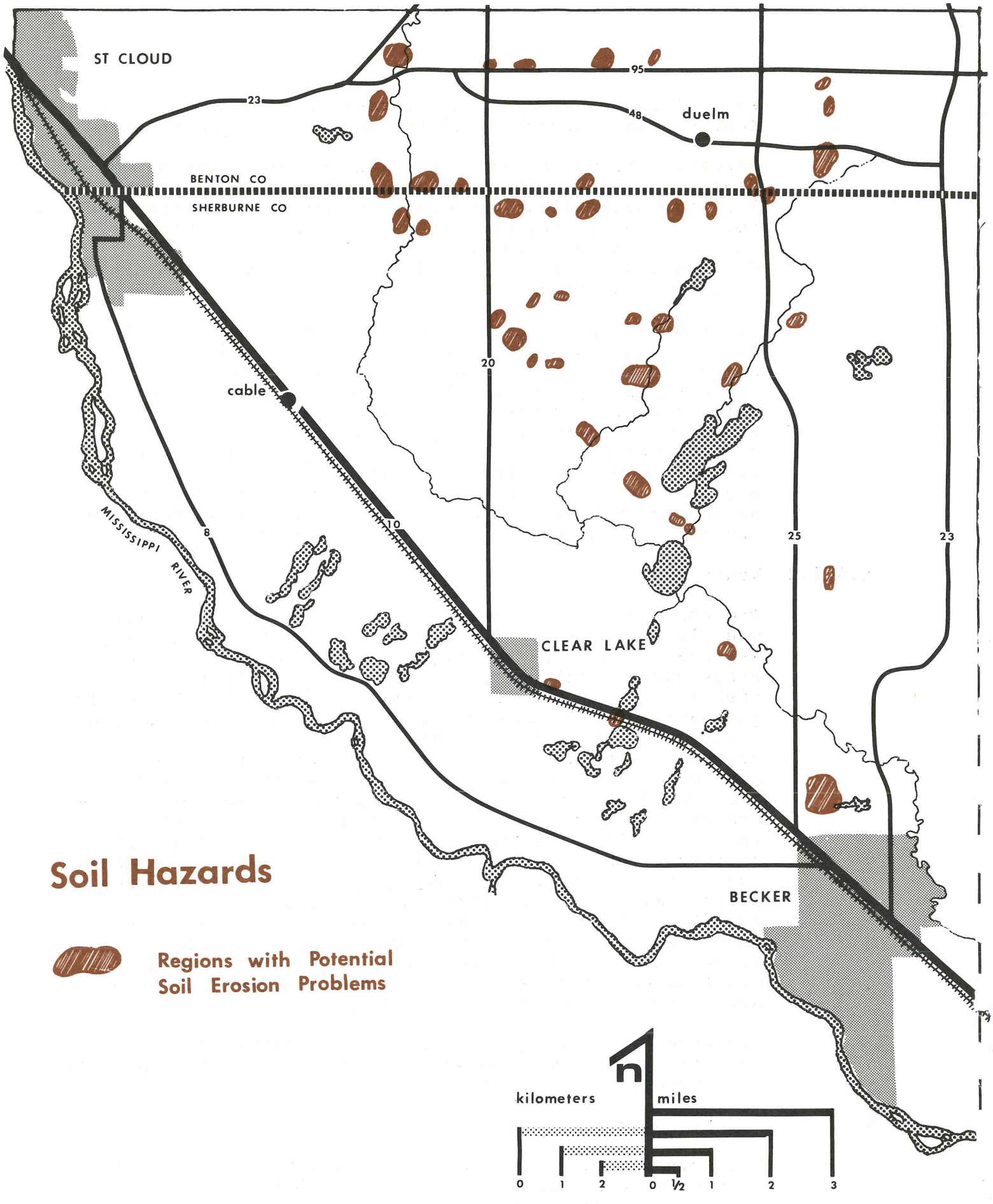

ST CLOUD
95
23
48
duelm
BENTON CO
SHERBURNE CO
20
cable
MISSISSIPPI RIVER
8
10
25
23
CLEAR LAKE
BECKER
Soil Hazards
Regions with Potential Soil Erosion Problems
kilometers
miles
0 1 2 0 ½ 1 2 3

figure 4 3

tions during the construction of a transmission line. While the utility must repair all damaged tiles, a broken tile may not be readily apparent to the farm operator. Ensuing drainage problems could develop in affected fields and result in damaged crops or reduced yields. Precautionary or remedial measures on the part of the construction contractor to locate, protect, and avoid drainage tiles will reduce this impact. Where tiles have been damaged, NSP will be responsible for replacing them.

4.8.2 Potential Long-Term Impacts

4.8.2.1 Cropland Lost to Production

The amount of cropland removed from production due to the construction of a transmission line structure varies widely with: 1) the size and type of the tower or pole; 2) structure location; 3) line orientation; 4) crop and cropping patterns; 5) topograpny; 6) equipment; and 7) farming operations.

In a recent study of compatiblity between agriculture and transmission lines, researchers at the University of Minnesota have estimated the amount of land that will be lost to production once a transmission line is constructed. These estimates are shown in Table 4.6.

Table 4.6 shows that the area lost to production increases as the size of the structure increases for H/K frame structures; the area increases and then remains relatively constant for lattice towers. It remains approximately constant for single shaft poles as their size increases; however, data for single shaft poles was very limited in this study. Losses for structures in row crops tend to be larger than those in small grains and forages. This is due in part to the differences in farm equipment used for row crops.

The presence of guy wires, which are commonly used to support corner or angle structures with H/K frame and single shaft poles, greatly increses the amount of land lost to production. The comparision between the results measured for different structure types is in Table 4.7. Guy wires appear to have additional effects on field operating patterns and also present a safety hazard. Use of stubbed guys (pole-mounted guy wires) is one way of diminishing the interference and hazards associated with guying.

TABLE 4.6

AVERAGE LAND LOST FROM PRODUCTION BY GENERAL CROP TYPE AND STRUCTURE TYPE AND SIZE

Structure Type	Structure Width (Ft.)	Land Lost From Production (Ft^2)					
		Tangent Structures			Corner Structures		
		Row Crop	Small Grain	Forages	Row Crop	Small Grain	Forages
H/K Frame	0-19	636	360	302	-	-	-
	20-24	732	604	366	-	-	-
	25-29	1,051	316	310	-	-	-
	35-	77	-	-	-	-	-
Single Pole	0-19	97	99	93	-	-	-
Steel Lattice	0-19	1,734	1,061	570	-	-	-
	20-24	2,012	1,127	785	2,604	-	618
	25-29	2,812	2,004	1,830	4,015	-	4,426
	30-34	2,514	1,557	1,538	3,635	787	1,756
	35-	2,562	1,145	1,658	1,651	-	-
Modified* H/K Frames	0-19	-	-	-	-	-	630
	20-24	1,167	2,269	-	-	-	112
	25-29	1,587	821	-	3,968	-	168
	30-34	5,871	885	10,080	2,818	1,300	860
	35-	4,680	-	900	2,543	-	-

* Structures commonly used as corners for H/K Frame lines. Consist of two or more poles located on a straight line possibly with supporting guy wires.

SOURCE: Report of an Investigation of Electric Power Transmission and Agricultural Compatibility in the MAPP Region, University of Minnesota Agricultural Experiment Station, 1978.

TABLE 4.7

AVERAGE AREA LOST FROM PORDUCTION (FT^2) BY STRUCTURE TYPE AND LOCATION

Structure	No Boundary within 100 ft	Boundary within 100 ft	Head-land**	Straddling Boundary	Adjacent to Boundary	In Corner	In Corner
161							
H/K	487(88)*	536(96)	630(19)	481(42)	687(91)	701(12)	208(4)
Modified H/K Frame	1,425(3)	3,900(5)	1,300(1)	580(1)	2,090(8)	5,510(2)	—
230							
H/K Frame	678(60)	545(158)	576(40)	380(13)	929(23)	491(35)	—
Lattice	2,454(143)	1,893(63)	2,274(13)	2,271(43)	2,060(23)	2,263(13)	1,920(2)
Modified H/K Frame	1,918(2)	2,396(7)	2,626(2)	2,548(1)	—	1,017(3)	—
345							
H/K Frame	988(337)	799(167)	1,009(37)	1,264(2)	954(50	1,170*18)	146(2)
Lattice	1,557(80)	1,835(56)	1,114(3)	1,597(16)	1,743(6)	1,554(11)	—
Modified H/K Frame	—	1,487(4)	4,678(3)	3,310(1)	4,878(4)	1,480(3)	—
Single POle	112(13)	88(8)	—	80(2)	91(1)	—	—

* Bracketed numbers indicate numbers of observations.
** A headland is the area at the end of a field commonly used for turning.

SOURCE: Report of an Investigation of Electric Power Transmission and Agricultural Compatibility in the MAPP Region, University of Minnesota Agricultural Experiment Station, 1978.

4.8.2.2 Impacts on Field Operations

Transmission line structures placed on the edge or within cultivated fields may require a farmer to spend additional time to undertake various field operations. The amount of additional time required is a function of the number of interruptions and extra trips required to maneuver machinery around the structures.

There are several studies which estimate the additional time spent to work around transmission line structures. One study, prepared by Doane Agricultural Services, Inc. indicates that farmers estimate each transmission line structure can add between 30 minutes to 2 hours of field work. The most common response reported in the Doane report was one hour. Larger and more complex farm machinery could conceivably increase the time needed to maneuver transmission line structures. A summary of time loss estimates are shown in Table 4.8.

The location of structures within cultivated land also increases the problem of soil compaction from farm equipment. The increased number of passes necessary to till, plant, cultivate and harvest crops through and around pole structures is likely to create paths around the towers with excessively compacted soil. In addition, field operations around and through structures increase the risk of damage to equipment. If damage does occur, there are costs to the farmer in terms of repair of the equipment, inconvenience, and loss of valuable time during critical farming periods.

Weed problems normally occur around transmission line towers and poles where weed control through cultivation is impossible. These areas must be hand sprayed to prevent the propagation and spread of weeds throughout the field. The extra time and labor involved in the hand operations can raise production costs.

4.8.2.3 Impacts on Irrigated Farmland

The potential conflict between irrigation systems and rights of way for transmission lines constitutes one of the most significant agriculturally related impacts in the study area. In recent studies conducted by the University of Minnesota School of Agriculture, the possible effects of transmission line rights of way on irrigated land, irrigation costs, monetary return to the farmer, and safety of operations have been evaluated. The results of this analysis are summarized in the following paragraphs.

TABLE 4.8

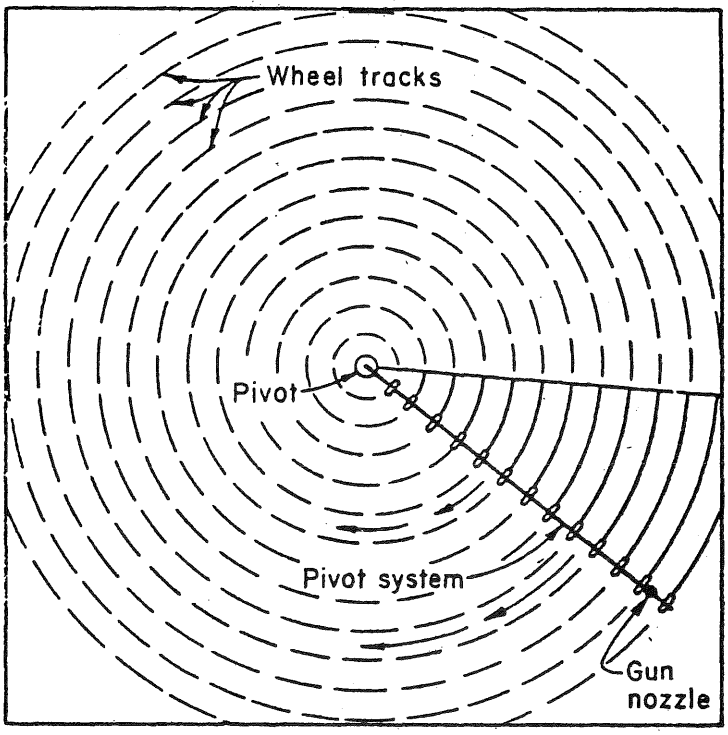
TIME LOSS STUDIES RESULTS

Operation	Location	Structure Type	Extra time/tower
Plowing	Illinois	Steel towers	6 minutes
Harrowing	Missouri	Steel towers	50 seconds
Corn Planting (4-row planter)	Illinois	Steel towers diagonally in field	5 min., 28 sec.
Corn Planting (4-row planter)	Missouri	Steel towers Open legs*	1 min., 10 sec.
Corn Planting (4-row planter)	Indiana	Steel towers	2 min., 9 sec.
Corn Planting (6-row planter)	Iowa	2-pole structures	3 minutes
Discing (12 ft. disk)	Illinois	H-poles, parallel	10 seconds
Discing & Harrowing (Tandem)	Illinois	2-pole structures	40 seconds
Cultivation (soybeans	Indiana	Steel towers diagonally in field	49 seconds

*Operator was able to work under the strucutre.

SOURCE: A Preliminary Study of Powerline Damages, Doane Agricultural Service, Inc. St. Louis, Missouri, 1969.

CENTER PIVOT SYSTEM



Typical Irrigation Systems

TRAVELING GUN SYSTEM

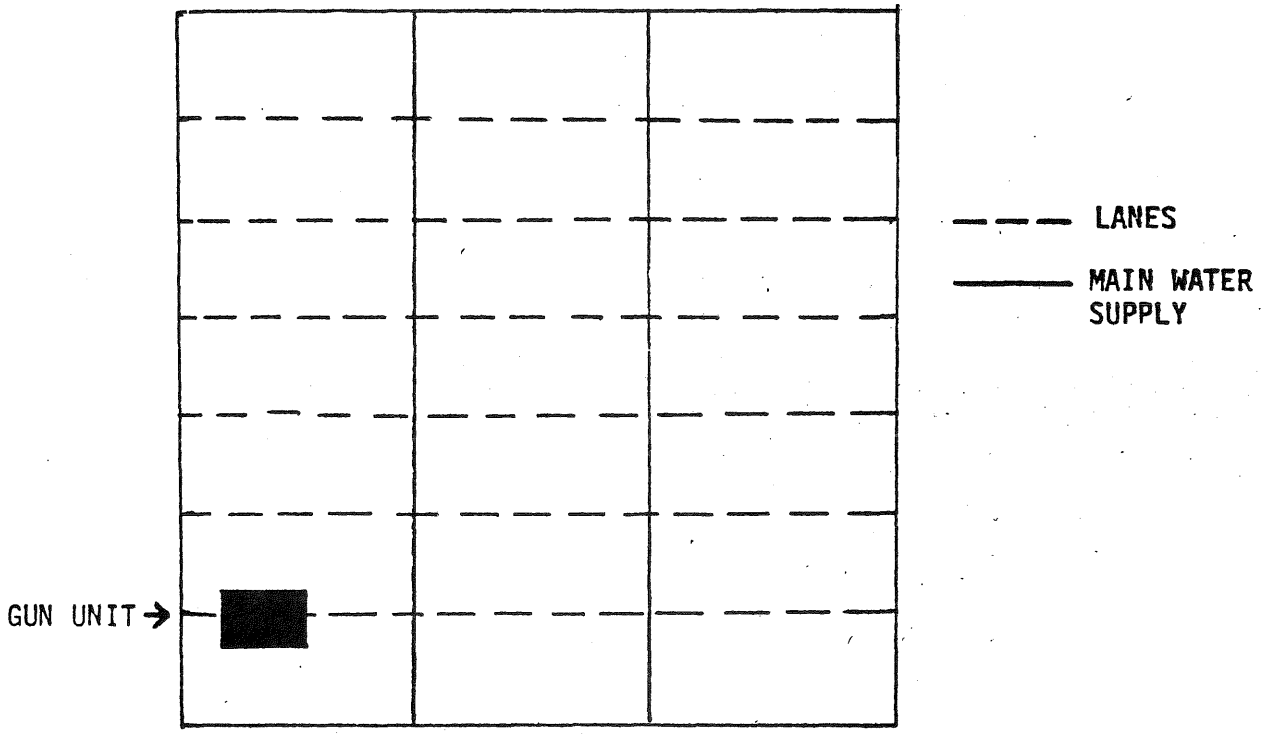
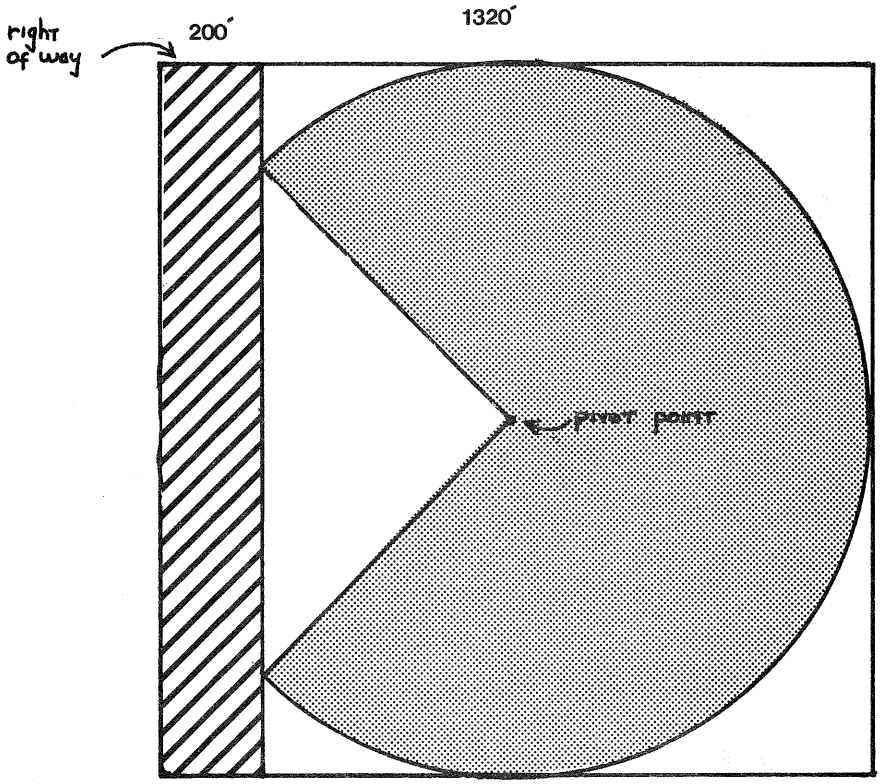


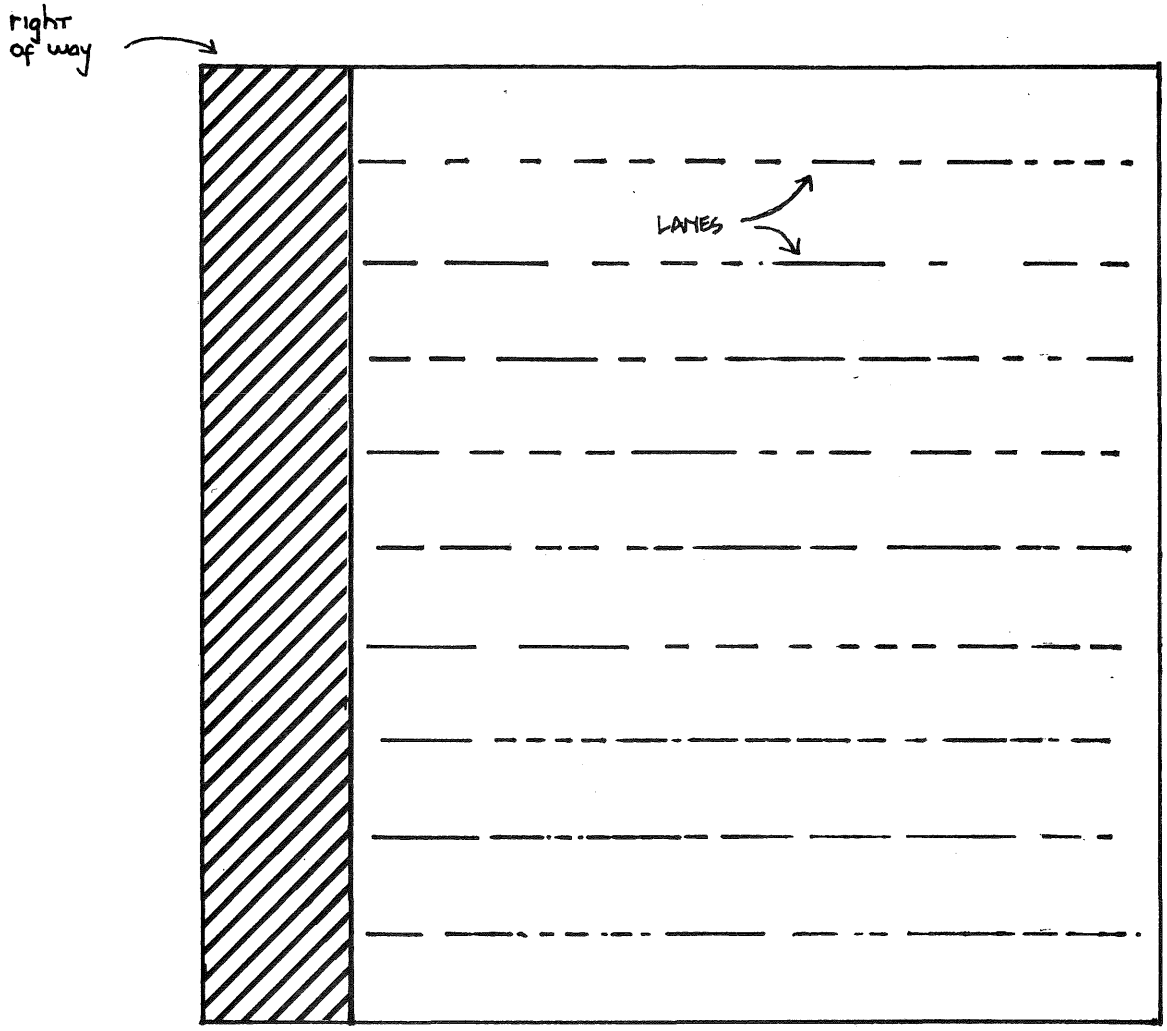
FIGURE 4.4

Worst Case Situation
ROW Parallel to Boundary;
Pivot Point Fixed at Field Center



ACRES ADEQUATELY IRRIGATED (72.2% OF IRRIGABLE AREA)

FIGURE 4.5



Worst Case Situation

Traveling Gun Irrigation System and

Transmission Line ROW

FIGURE 4.6

Center pivot and traveling gun row irrigation systems are the irrigation methods most commonly used in the study area. Center pivot systems consist of an anchored pivot point, a water supply pipe supported on electric or hydraulic powered drive unit, and sprinklers located on a support pipe 10 to 15 feet above the ground. Center pivot irrigation systems may also have an end gun located on the outer end of the supply pipe. In order to maximize the amount of crop area watered, center pivot systems are most effective when used in square, rather than rectangular or odd shaped fields. Typically one center pivot system will cover 126 acres (80%) of a square 160 acre field.

The traveling gun system consists of a high water pressure gun mounted on a movable carriage. The carriage consists of, a water supply hose and a power supply unit, a motorized winch, and a spool of cable. The carriage is pulled in a straight line across the field by means of attaching one end of the cable to an anchor point located at the opposite end of the field. The winch and power unit are then allowed to wind up the cable. The lanes in which the carriage travels are usually 10 to 12 feet wide and are commonly spaced such that 8, 9, or 10 lanes will allow the gun system to irrigate 80 acres. Figure 4.4 shows the typical application of each of these systems to a quarter section field.

a. Land Lost to Irrigation Due to Transmission Line Right of Way

The amount of land lost from irrigation due to the presence of a transmission line right of way varies with right of way width, right of way alignment, and the orientation and type of irrigation system used. When using center pivot systems, the greatest land loss occurs when the full right of way is located on the field boundary, and the center pivot is fixed at the center of the field. In avoiding the right of way, the center pivot creates a sprinkling pattern which leaves a pie-shaped wedge adjacent to the right of way unwatered (see Figure 4.5).

For row irrigated fields, a greater portion of a field can be irrigated when the lanes run parallel to the right of way than if they are perpendicular to it. The least amount of impact on a gun irrigation system occurs when the centerline of the right of way coincides with a field boundary and the irrigation lanes parallel the right of way. Conversely, impact on traveling gun irrigation systems are greatest when the right of way is parallel to, but not on the field boundary, and the lanes run perpendicular to the right of way. (See Figure 4.6.)

While the amount of land that cannot be irrigated due to the presence of a transmission line along the edge of an irrigated field is significant, the added annual operating costs of irrigation are not noticeably affected. The average annual costs for irrigating an acre of land are relatively constant. A reduction in irrigated acreage is accompanied by reductions in the size or amount of equipment needed and energy used to irrigate that acreage. A transmission line can, however, increase operating costs if the right of way is placed diagonally across the field. In this case, the field must be irrigated by two center pivot systems.

b. Monetary Impact of a Right of Way Crossing Irrigated Land

To determine the approximate financial impact of a transmission line on irrigated farmland, researchers at the University of Minnesota evaluated nine possible interactions. The study used a variety of assumptions about: the location of the right of way; type of irrigation system; and the status of the loan used to finance the capital cost of the system.

The study concluded that the loss of revenues associated with the location of a transmission in the right of way on irrigated land is much more significant than that for non-irrigated land. It also concluded that the location of a transmission line right of way centerline along property lines has less total effect than the placememt of the full right of way on either side of the property lines.

c. Safety of Irrigation Operations Near a Transmission Line Right of Way

Potentially hazardous situations can develop when an irrigation system is located parallel, and in close proximity to, a high voltage transmission line. Accidental contact between conductors and irrigation equipment is an obvious hazard. This safety hazard can be avoided by controlling or selecting irrigation systems that maintain adequate clearances. When a stream of water ejected from a high volume irrigation nozzle is directed into a high voltage transmission line, flashover from the conductor to the irrigation tower can be initiated. By preventing a steady stream of water from hitting transmission line conductors and by maintaining adequate clearance between individual irrigation systems and nearby conductors, the possibility of flashovers can be minimized. The probability of the irrigation equipment carrying leakage currents

can be enhanced when fertilizers or other substances are present in the irrigation water. These water additives can reduce the electrical resistivity of water. Dangerous levels of electric current can be avoided by sufficient grounding of the equipment or by maintaining adequate clearance between the water spray irrigation equipment and the conductor.

4.8.2.4 Impacts on Aerial Application of Pesticides and Fertilizers

The construction of transmission lines can reduce the effectiveness of fertilizer and pesticide treatment in areas where these treatments are applied by aerial spraying. Pilots must pull up sooner to avoid lines located at the edges of fields, thus, creating greater drift of the applied material and resulting in poorer coverage. This can be compensated for with double applications, but the cost of additional pesticide or fertilizer, and the additional time involved, increases the cost per acre of treating such fields.

Transmission lines also pose a real safety hazard to the pilots treating the crops. Lines which cross fields diagonally are a particular problem because it is more difficult for a pilot to judge the location of the lines as he flies over a field.

4.8.2.5 Removal of Windrows

Locating a transmission line right of way along field boundaries lined with mature trees can have long term adverse impacts on agricultural activities. This is especially true where the trees were specifically planted to function as shelter belts to protect farm fields from wind erosion. In most cases windrow trees exceed the height limitations placed on objects permitted within a transmission line right of way. As such, the trees would have to be removed or "topped" during the right of way clearing phase of the high voltage transmission line construction.

In areas such as central Minnesota, where the land is relatively flat and open, wind can cause a significant amount of soil erosion. Removal of the windrow trees along the right of way of a transmission line damages or eliminates the protection which these trees provide, greatly increasing the potential for wind erosion.

Little can be done to minimize this long term impact. It may be possible to replace the original windrow trees with species which, at maturity, do not exceed height limitations. To achieve maximum efficiency, however, the trees take 20 to 30 years to develop. A second

measure could be to locate the right of way adjacent to, rather than centered on, field boundaries when windrows are present. Such an action however could result in increasing another type of impact i.e., loss of cropland.

4.8.2.6 Effect of Transmission Lines on Other Farming Practices

The presence of transmission lines may restrict the farmer's ability to modify or expand farming operations. In particular, transmission lines may: prevent or limit the consolidation of fields for more efficient management and operation; prohibit the use of larger, more efficient equipment; and restrict installation or expansion of irrigation equipment.

Transmission line construction, operation and maintenance can have a negative impact on poultry farms. Turkey farming is particularly vulnerable because of the nature and temperment of turkeys. Turkey farms also require large buildings which could be affected by right of way alignment.

4.9 COMMUNICATIONS

Whenever a communications cable is parallel and close to a high voltage transmission line, the transmission line may "induce" a voltage and current on the communications cable. Induced voltage and current vary depending upon the voltage of the transmission line, the current on the transmission line, the separation between the transmission line and the communication cable, and the distance that the transmission line parallels the telephone cable.

4.9.1 Telephone Operations

Induced current occurs on all telephone cables that parallel high voltage transmission lines. However, it is much more of a problem on "toll" or long distance service cables than on distribution cables serving individual subscribers. This is because the electronic equipment used with toll cables are much more sensitive to extra voltage and current than equipment used with cables serving individual subscribers. In addition, telephone companies are often unable to use protective devices on toll cables that are available for cables serving local subscribers. Toll cables are continuous, while subscriber cables end in each town. Since the effects of high voltage transmission lines are cumulative over the entire length of the cable, this can result in higher voltages on toll cables. Further, if induced voltage or current interferes with service on a toll cable, a greater number of people are affected than if a cable that services individual subscribers goes out of service.

All telephone cables are protected to some extent from these induced voltages and currents. A metal sheath surrounding the cable usually provides electrical shielding. "Protectors," similar to lightning arresters, can also be used to protect the individual wires of the cable from high voltages.

Northwestern Bell Telephone Company operates several toll and long distance cables in the study area. The only toll line that may be directly impacted by a proposed route is the St. Cloud to Minneapolis cable. This cable is buried along the north shoulder of Minnesota State Highway 10. In addition, the Sherburne County Rural Telephone Company maintains major distribution lines in the southeastern corner of the study area. (See Figure 2.24.)

A major problem that may be caused by transmission lines is related to the current and voltage that would appear on the toll cable when there are "faults" (lightning strikes, short circuits, etc.) on the transmission line. These faults cause larger amounts of current to appear on the transmission line. This current, in turn, induces large currents and voltages on the toll cable. While the voltage and current caused by these faults may not harm the cable itself, it could cause the electronic equipment to fail, thus isolating the communities along the cable from telephone service to any other towns. The time without service could range from a few seconds, where automatic corrections can solve the problem, to at least a day where equipment replacement is needed. Extra noise or interference on the toll cable may also be caused by the normal voltage and current on the transmission line.

4.9.2 Railroad Communications

Electrical interference with railroad communications may occur where a HVTL is located near railroad facilities. On a railroad system such as that in the study area, the communications and signalling systems are 12 volt dc. Should the Highway 10 route alternative be selected, some mitigative measures would be required in order to minimize the susceptibility of these systems to the fields produced by the transmission line.

4.9.3 Radio Interference

In most circumstances, the level of transmission line induced radio interference is not significant in comparison with the strength of the broadcast signal. Most radio stations have sufficient broadcast signal-to-noise ratios to insure that interference is not a problem.

If radio interference from transmission line corona does occur, satisfactory reception from AM radio stations presently providing good reception can be obtained by the addition to, or appropriate modification of, the receiving antenna system.

Interference to FM broadcast station reception is generally not a problem because: 1) corona generated radio frequency noise currents decrease in magnitude with increasing radio frequencies and are quite small at the FM broadcast band frequencies of 88-109 MHz; and 2) the excellent interference rejection properties inherent in FM radio systems make them virtually immune to amplitude disturbances.

4.9.4 Television Interference

Corona generated radio frequency noise is quite small in comparison to the very high frequency range used for television transmission. As a result, TV interference from a corona discharge will generally be negligible. Loose and/or damaged hardware may also cause TV interference. If television or radio interference is caused by the HVTL in those areas where good reception is presently obtained, NSP may will be required to take such action as may be necessary to restore reception to the present level including the appropriate modification of receiving antenna systems.

4.10 RAILROAD OPERATIONS

Railroad corridors are often considered as suitable locations for transmission line routing. This is because railroads offer existing linear rights of way that can be easily paralleled. Some problems, however, can arise if high voltage transmission lines are placed too close to actively used railroad routes. The level of negative impact on railroad operations is usually proportional to: the distance which a transmission line parallels a railroad line; the volume of traffic or activity along the railroad line; the type of cargo transported along the railroad line; and the size and voltage of the transmission line. In general, the types of problems which might be encountered by railroads in the study area include:

1. Transmission line poles and/or conductors within a railroad right of way could interfere with proper track and right of way maintenance. A safety hazard to railroad employees could result if metal maintenance equipment comes in direct contact with energized conductors.

2. Transmission line structures pose a potentially hazardous obstacle to derailed railroad cars. In addition to passenger trains, freight trains often transport tank cars carrying flammable substances which are susceptible to sparks from a downed line.

3. Although the electrical field generated by the transmission line may interfere with train signals, crossing guards, and train communication systems, these impacts can be easily mitigated.

The Burlington Northern Railroad operates a major rail line along the south side of Highway 10. The railroad reports that passenger service along the line operates on a frequency of one train every other day. Freight service, however, averages approximately 25 trains per day. The railroad reports that each train has the potential of carrying flammable materials.

4.11 AIRPORT OPERATIONS

Three airport facilities are in operation in the project study area. These are St. Cloud's Whitney Memorial Airport, Leader's Clear Lake Airport and a private landing strip. Depending upon the final route selected for the 345 kV transmission line, there may be serious safety and operational impacts imposed on the region's airport facilities.

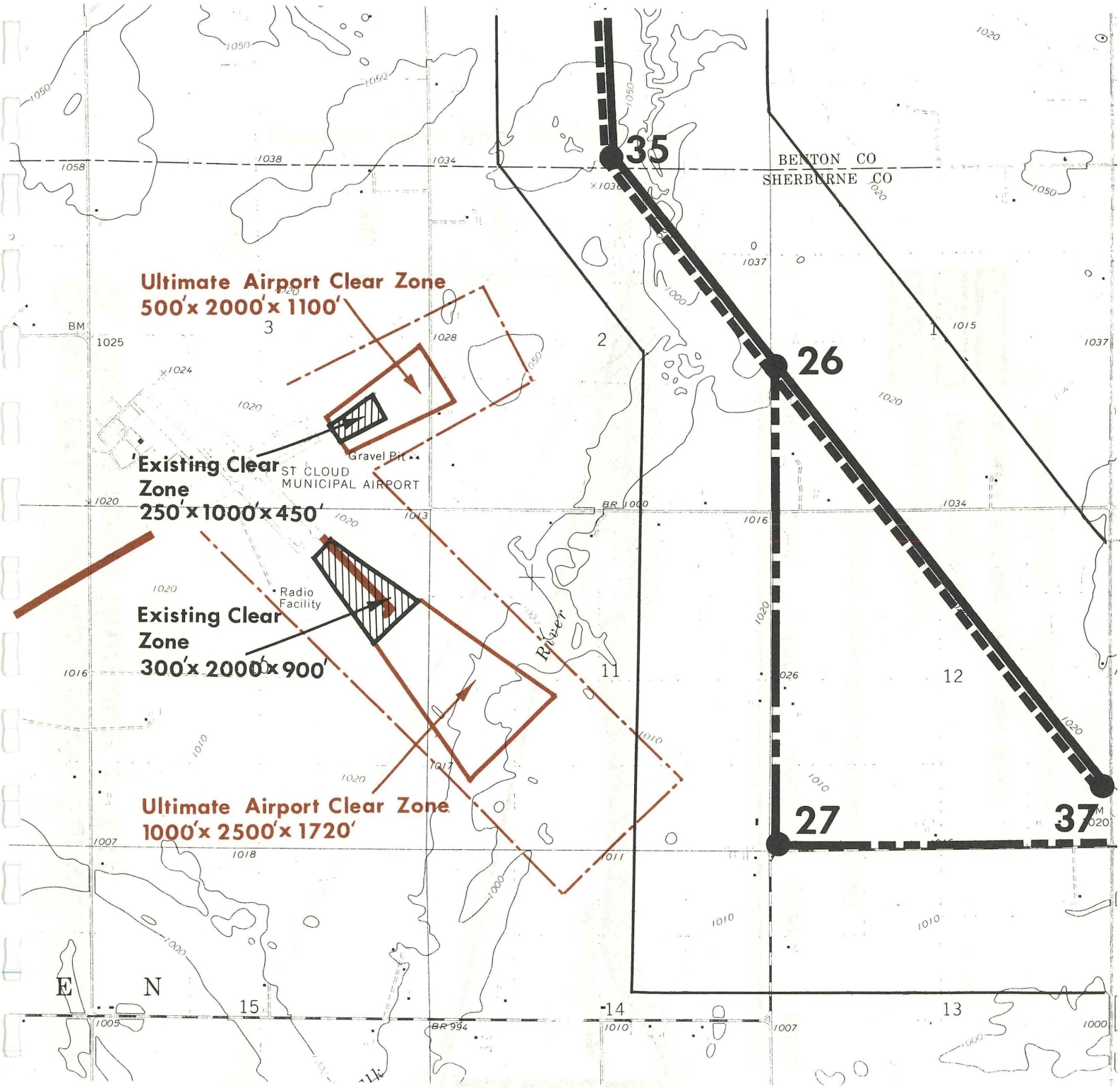
4.11.1 St. Cloud's Whitney Memorial Airport

The St. Cloud Airport is a public landing field located approximtely 1 mile west of the City of St. Cloud. This airport is the most important aeronautical facility in the region. The airport has two runways. The main runway (15-31) is presently 100 feet wide and 5,200 feet long. The airport plans to expand this runway to 7,000 feet in length and 150 feet in width. The auxiliary runway (5-23) is 75 feet wide and 3,000 feet long. This runway will ultimately be expanded to 100 feet wide and 5,500 feet long. The clear zones for both the existing runway length and proposed expansions are shown on Figure 4.7. The most serious impact to airport operations is the potential interference of transmission line structures height with approach clear zones. Average structure heights for a 345 kV transmission line are: 85 feet for wood "k" frame structures; 110 feet for single circuit steel pole structures; and 145 feet for double circuit steel pole structures. With the expansion of the main runway, an approach glide slope of 50:1 will be used. The clear zone for the expanded main runway is listed in the Airport Master Plan as 2,500 feet

from the end of the new runway, and 1,750 feet wide. Figure 4.7 illustrates the clear zone's relationship to the closest proposed route segment. It is conceivable that if the the main runway at the St. Cloud Airport is expanded, the selection of a transmission line route using segment 27-26 would conflict with FAA and State of Minnesota safety requirements for airports. With the expansion of the main runway, the western boundaries of route segment 27-26 fall within the airport's building restriction zone.

Expansion of the auxiliary runway would result in a clear zone 2,000 feet long and 1,100 feet wide. The glide slope for the auxiliary runway would be 40:1. The approach to the auxiliary runway would go directly over route segment 26-35. This route segment is approximately 6,300 feet from the end of the existing runway. The airport plan for expansion indicates that the auxiliary runway would be extended in a southwestern direction. As such the clear zone for this runway would be 4,300 feet (.8 mile) southwest of the nearest route segment. Route segment 26-35 would not be located within a designated clear zone. Using an approach glide slope of 40:1 the maximum height of a structure located 6,300 feet from the end of the auxiliary runway would be 157.5 feet above a base surface elevation of 1021.3 feet above sea level (the elevation at the end of the runway). The approximate elevation between nodes 26-35 is 1010 feet above sea level. It would appear that even the use of the tallest structure type (double circuit steel pole) in segment 26-35 would be 23.5 feet below the maximum height restrictions. Structure heights expressed above are average values and may vary depending on topography, property lines and other variables.

Although the location of a transmission line parallel to the existing 230 kV line does not to interfere with the 40:1 glide slope or airpoirt clear zones, the City of St. Cloud and the St. Cloud Airport Advisory Board have expressed a concern over the desirability and long term safety of an additional transmission line near the airport. If a route is selected which utilizes segment 26-35 NSP should work closely with the Minnesota Department of Transportation, the FAA and the City of St. Cloud to minimize potential airport hazards.



St. Cloud Airport Clear Zones

- Node Numbers
- Existing 230 KV line
- Route Segment Boundaries
- Reference Centerlines
- Ultimate Building Reconstruction Line
- Runways Expanded

figure 4.7

Cross Section of Approach Surfaces to the St. Cloud Airport (Runway 5-23)

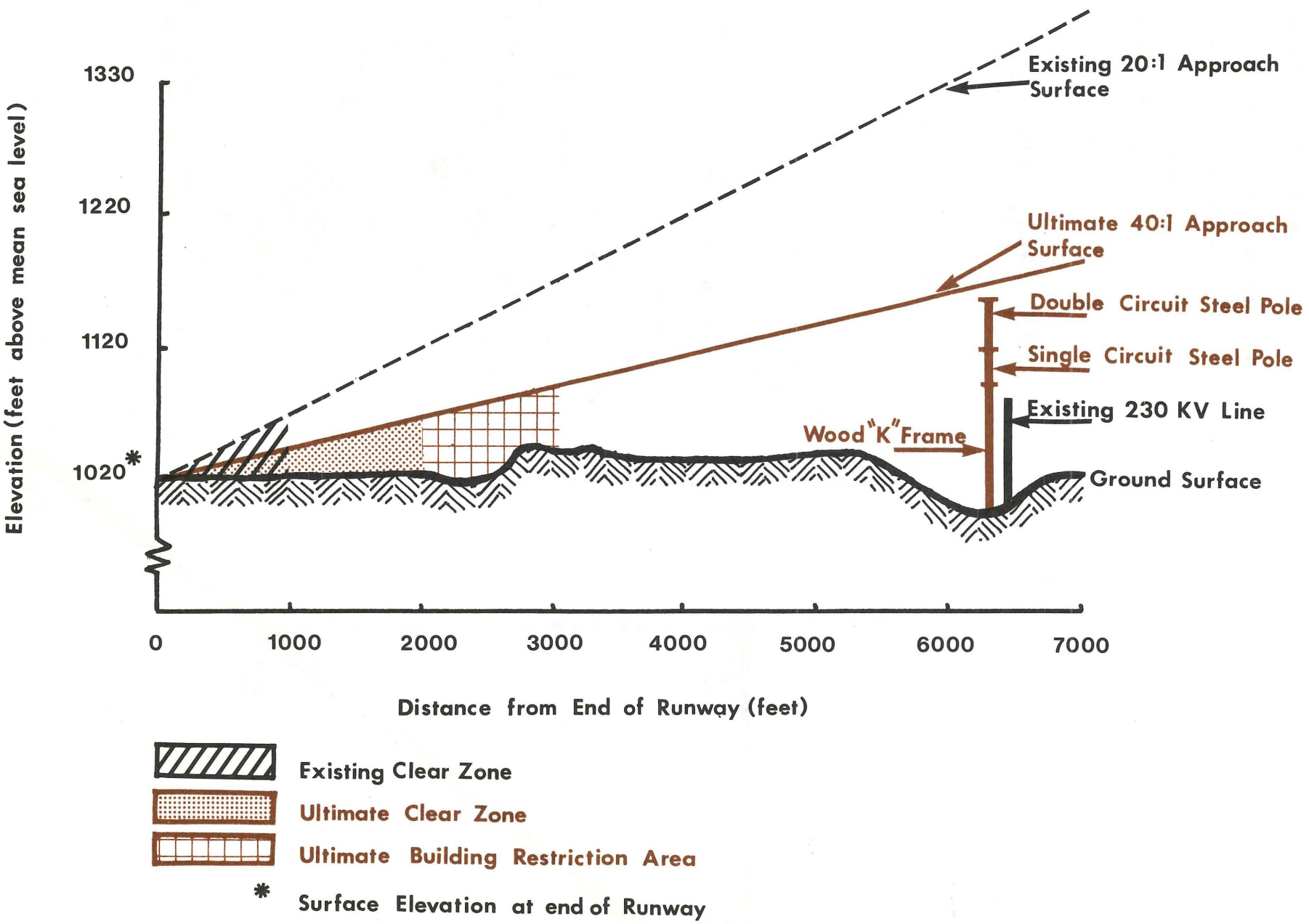


figure 4.8

4.11.2 Leader's Clear Lake Airport

Leader's Clear Lake Airport is a privately owned landing field located north of Minnesota Highway 10 and west of Sherburne County Road 55. The airport has a single 3,000 by 150 feet grass runway, oriented along a north-south axis. Presently, the end of the runway is only about 600 feet from the northbound lane of Highway 10. Aircraft using the airport pass over the highway on both take-offs and landings. The approach surface to the airport is 20:1. The distance from the end of the airport's runway to the Burlington Northern Railroad right of way is approximately 825 feet. Maximum clearance height for a 20:1 approach slope at the edge of the railroad right of way is 41.25 feet. The shortest structure type (single circuit wooden "k" frame structure) would seriously impact the approach zone to the airport. For the transmission structure to be within safe clearance of the airfield's approach pattern, the line would have to be located approximately 975 feet south of the railroad. This would place the structure in the middle of an agricultural field. The Minnesota Department of Transportation has noted that the use of the Highway 10 route alternative could jeopardize the licensing status of the airport.

4.12 IMPACTS ON THE NATURAL ENVIRONMENT

High voltage transmission facilities, wherever they are located, necessitate some alterations in the existing natural environment. These changes are brought about by: construction processes; the location of the line; operation, maintenance and repair of the facilities; or by right of way maintenance. The level of impact varies both with the type of activity, and with the nature of the existing environmental features.

4.12.1 Soil Impacts

The most significant impact imposed by a transmission line on soils occurs during the right of way clearing and transmission line construction. The range of impacts include: soil compaction and rutting due to heavy vehicle use (see Section 4.8.1.1); topsoil stripping; topsoil and subsoil mixing; soil pollution; and surface erosion. Erosion is a particular problem because not only is topsoil lost and gullies established, but the resultant sedimentation which occurs can generate numerous adverse impacts on aquatic environments.

Several control measures are available to minimize most soil related impacts. These measures include: careful scheduling of construction activities so as to minimze equipment movement; restricting construction activities during wet periods; immediate seeding, mulching or other such protective actions to protect exposed slopes; prohibiting topsoil and subsoil mixing; and prohibiting equipment cleaning, such as washing-out of cement trucks, in right of way areas. The removal of windrows or other vegetative cover providing protection against wind erosion can also be minimized.

4.12.2 Impacts on Vegetation

Impacts on vegetation within a transmission line right of way are unavoidable because vegetation must be either altered or removed to maintain the minimum clearances required under a transmission line. In addition, some clearing or modification of vegetation outside the right of way may also be necessary.

Depending upon the age, species, degree of exposure to wind and sunlight, and other variables, vegetation located along the fringe of a transmission line right of way may be impacted. Vegetation impacts experienced during the operation and maintenance of a transmission line are generally more subtle. This is because the management of the right of way may require occasional cutting of non-compatible species, and/or the application of herbicides to control weeds and undesirable species. In developing a right of way management program, NSP will consult and coordinate with property owners. Periodic maintenance or repair of the line, requires repair vehicles to enter the right of way. This may result in some temporary damages to vegetation. NSP will compensate property owners for any vegetation damage that might result from routine righ of way maintenance.

In wooded areas, the number of trees that will be eliminated is of principal concern. Important considerations include the frequency of distribution, life span, and time to maturity of the affected trees. It is potentially more serious to eliminate stands of long-lived slow-growing trees requiring many years to reach full maturity than fasttgrowing vegetation that will replace itself more readily.

Finally, certain types of vegetation, such as wetlands, are particularly susceptible to damage during construction of a transmission line. Wetlands are extrememlly productive communities that provide breeding and spawning grounds for many species of birds and other wildlife. In addition, wetlands perform many other necessary functions within the local ecosystem. They

are quite fragile and should be preserved as closely as possible in their natural state. Damage from construction vehicles and intrusion by access roads could easily disrupt the water and nutrient circulation and subsequently ruin large parts of the wetland. In addition, filling or sedimentation of wetlands can adversely affect drainage patterns and result in increased flooding damages. For these reasons, it is desirable for transmisison lines to span wetland areas completely so as to preclude the possibilty of significant impacts.

4.12.3 Impacts on Wildlife

The most significant impact of a transmission line on wildlife is related to the destruction of habitat during construction of the line. Wildlife can also be affected by the maintenance of cleared rights of way. Most studies however, indicate that these impacts tend to be temporary, with the original wildlife populations gradually reestablishing themselves or even expanding along rights of way after construction activity has ceased. Transmission line rights of way, due to their edge effect, can provide food and valuable cover for many species of wildlife. This benefit can be enhanced in wooded areas by the use of selective cutting, rather than clear cutting techniques.

The use of herbicides in right of way maintenance can have can have both positive and negative impacts. Studies conducted for Edison Electric Institute (1976) assessed chemically sprayed tansmission line rights of way for actual and potential wildlife use. The results indicated that rights of way were comparable or superior in wildlife foods than adjacent unsprayed plots. Other studies, however, indicate that on clear cut rights of way, which have had a long history of spraying, an "herbicide climax" consisting of dense low-growing species can develop and dominate.[2] As a result, the vegetative diversity of the right of way diminshes, and a corresponding reduction of the number and types of animals using the area is usually noted. This impact can often be avoided by selective clearing and by carrying out a sleective herbicide spraying program for right of way maintenance.

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[2]Kenneth L. Carvell, "The Effects of Herbicidal Management of Electric Transmission Line Rights of Way on Plant Communities," Proceedings of the First National Symposium on Environmental Concerns in Right of Way Management, 1976.

4.12.3.1 Impacts on Bird Populations

Documented impacts of transmission lines on birds range from a temporary disturbance of bird life during construction of a line to marked reduction of populations due to destruction of habitat, and death caused by electrocution or collision with the towers and conductors. The magnitude of the potential impacts on bird populations depends on the type of habitat crossed and the size and type of the original bird population. Important mating, feeding or nesting grounds, and bird sanctuaries represent the most sensitive areas. The Minnesota Department of Natural Resources states that the lakes east and southeast of the Town of Clear Lake are frequently used by waterfowl during spring and fall migrations. During the fall of 1976 an estimated 4,000-5,000 waterfowl used these lakes. During periods of bad weather and reduced visibility the potential for waterfowl collisions with the transmission line could be a serious problem. Line and right of way maintenance which occurs during the breeding season can be hazardous to bird life in and near the transmission line rights of way, since most species are particularly vulnerable at this time. Impacts from these activties include destruction of nests and young birds, and the secondary effects of drifting herbicide spray which can injure fauna as well as flora.

4.12.4 Impacts on Aquatic Life

Aquatic ecosystems which are located near, or crossed by transmission lines can sustain damage during the construction process or be adversely affected by changes in water quality as a result of activities during construction and right of way maintenance. Potential impacts include: the introduction of sediment and other pollutants during construction; increased runoff pollutants (including herbicide residues), and the possibility of temporary shore or channel modification where construction equipment has to enter the body of water. Most of these impacts are relatively temporary, being restricted to the constructoin phase, and can be mitigated with adequate care during right of way design and construction. Estuaries and wetlands adjacent to fishing lakes and streams are particularly sensitive areas because they serve as important breeding and food supply zones.

4.12.5 Impacts on Recreational Resources

The impact of high voltage transmission lines on recreational lands and waters is primarily a visual impact. The degree of impact depends on the topography, vegetative cover, the size and type of towers, distance of the line from the recreational area, and subjective factors such as the attitude of the viewer toward

transmission lines. In addition the desirablity of future recreational or open space acquisitions and facil-ities in an area traversed by a transmission line can be diminished. Conversely some recreational activities that require a linear network of open areas such as hiking or bicycling can be a compatible multiple use for a transmission line right of way.

The greatest potential for recreational impacts in the study area occur around the Briggs Lake region and Briggs Creek. Briggs Lake, Lake Julia, Rush Lake, and Elk Lake are all intensively used for boating, camping, fishing, and swimming. Large portions of these lake shores are lined with seasonal homes and cottages. The existing 230 kV transmission line already imposes a visual impact on the region and serves to soften any visual impacts that might result from the construction of a new transmission line. Nevertheless, the construction of a new line in this recreational area will further degrade the visual and recreational environment. Briggs Creek has been identified in the Minnesota Outdoor Atlas as a trout stream. Construction activities associated with the placement of a transmission line could affect the aquatic environment of the creek. Special attention to selective vegetation removal along the creek's banks and soil erosion/sedimentation controls during construction of the line can help to minimize potential impacts along Briggs Creek.

segments

5

CHAPTER 5

ROUTE AND ROUTE SEGMENT ANALYSIS

5.1 DEFINITION OF KEY TERMS

A transmission line "route" is defined in the Power Plant Siting Act as ". . . the location of a high voltage transmission line between two end points [with] a variable width of up to 1.25 miles" (Mn. State Stat., Sec. 116.51 et seq., as amended 1977 and 1978). The two end points for this 345 kV transmission line are: the Benton County substation, located east of the City of St. Cloud; and the Sherburne County substation, located at the Sherco generating station. A transmission line route, therefore, maybe any continuous and distinct path serving to interconnect these two end points.

A transmission line route is composed of a series of "route segments." A route segment is a section or connecting link between two specific points within a transmission line route. Route segments are identified and distinguished by using numbers to depict the two end points of a segment. These end points are called nodes. Generally a node is a common point of intersection between two or more route segments. Any specific route or route segment can be easily identified by sequentially listing the nodes that comprise the route. (e.g. Route A is identified as route 1-5-10-11-12-15-33-24-37-26-35-40.).

The "universe of routes" is the entire number of routes and route segments considered and evaluated as part of this environmental impact statement. The universe of routes is the end result of concerted efforts by the applicants, the Citizens Route Evaluation Committee, other citizens, and the Minnesota Environmental Quality Board's Power Plant Siting staff to identify all reasonable and prudent transmission line route alternatives. (See Section 5.2 for more detail on the route selection process.) The detailed environmental features included in this chapter are limited to those routes and route segments identified in the universe of routes. Figure 1.1 illustrates the universe of routes examined for this 345 kV transmission line.

The route and route segments illustrated in Figure 1.1 have widths of 1 to 1.25 miles. The actual transmission line right of way, however, will not exceed 150 feet in width. In order to assess the potential impact of a given route and to provide some general indication of possible alignments of the transmission line, a reference centerline has been identified. Reference

centerlines are rough estimates of right of way placement and were defined by NSP, the Citizens Route Evaluation Committee and the MEQB Power Plant Siting staff.

The reference centerlines do not necessarily represent the final right of way alignments that will be utilized in constructing the transmission line. Detailed engineering design and discussions with individual property owners may dictate some modifications in the right of way placement. The purpose of a reference centerline in this environmental analysis is largely to provide a means for assessing the relative potential impact of alternative routing options. While it is recognized that the environmental features and potential impacts discussed in this chapter may vary slightly from those associated with a specific right of way, the relative comparisions of impacts likely to be encountered in one routing option versus another, should be reasonably accurate. Where certain critical impacts or highly sensitive regions exist, the MEQB may designate the route width to constrain the final centerline location to whatever degree is necessary.

5.2 ROUTE SELECTION PROCESS

Routes and route segments were identified by NSP, the Citizens Route Evaluation Committee and MEQB staff, in a manner consistent with the route selection process required by the Power Plant Siting Act and the MEQB "Rules for Routing High Voltage Transmission Lines and Siting Large Electric Power Generating Plants" (6 MCAR § 3.071). The Act and Rules specify that the applicant must submit two alternative routing options for the construction of a high voltage transmission line. On September 20, 1979, the MEQB accepted an application jointly submitted by NSP, UPA and CPA for a construction permit for a 345 kV high voltage transmission line. In the application, two routes were identified. These routes are identified on Figure 1.1 as Route A (Nodes: 1-5-10-11-12-15-33-24-37-26-35-40) and Route B (Nodes: 1-5-10-31-19-20-42-23-30-35-40).

In addition to the routing options submitted by the utilities, a Citizens Route Evaluation Committee (CREC) was established by the MEQB and charged with reviewing the application and recommending additional routing possibilities. The CREC was composed of 31 residents and property owners in the general study area. During 16 public meetings the CREC discussed alternative routing options and analyzed the benefits and constraints of those options. On February 21, 1980, the CREC submitted to the MEQB five routes and route segments for further evaluation and public hearing. These routes are identified

on Figure 1.1 as: route segment B-2 (nodes: 19-18-24-72-26); route segment B-3 (nodes: 20-21-22-28-30); route segment B-4 (nodes: 23-26); route segment B-4' (nodes: 20-21-72-23); route segment D-1 (nodes: 22-39-29); and route D (nodes: 1-5-6-11-34-18-42-72-28-29-39-40). The CREC was further charged with recommending a preferred route, an alternative route, and preparing a committee report. On April 28, 1980, 15 of 21 committee members voted to recommend Route B, using segments B-4 and B-4' (Nodes: 1-5-10-31-19-20-21-72-23-26-35-40) as the preferred route. One member voted for a "no build" alternative. The alternative route selected was Route B using segment B-4 (nodes: 1-5-10-31-19-20-42-23-26-35-40).

Three additional route and route segments were presented for MEQB consideration. These routes were submitted by the MEQB Power Plant Siting staff. These route and route segments are identified on Figure 1.1 as route C (Nodes 1-5-16-32-36-37-26-35-40) route segment C-1 (Nodes: 32-12) and route segment B-2 (Nodes 31-34-33). These routes and route segments were proposed by MEQB staff to insure that a complete universe of feasible and prudent routing alternatives were identified and considered.

Each of the route and route segments proposed by NSP, CREC and MEQB staff are evaluated in the following sections of this chapter. The information generated by these reviews, together with information and studies submitted during the public hearing process, will be transmitted to the MEQB for consideration in selecting a final transmission line route.

5.3 IMPACT ASSESSMENT PROCEDURES

The MEQB Rules for Routing High Voltage Transmission Lines specify that, in evaluating the placement of a high voltage transmission line route, impacts in the following categories must be considered:

1. Human settlement, including development patterns;

2. Economic operations, including agricultural, forestry, recreational and mining operations;

3. The natural environment and public land, including natural areas, wildlife habitats, waters, recreational lands and lands of historical and/or cultural significance; and

4. Reliability, cost and accessibility.

The Rules further specify that "In selecting a route with the least adverse impact, the Board shall make an evaluation of each of the following categories:

1. Existing land use or management plans, and established methods of resource management;

2. Routes along or sharing existing rights of way;

3. Routes along survey and natural division lines and field boundaries so as to minimize interference with agricultural operations;

4. Structures capable of expansion in transmission capacity through multiple circuiting or design modifications to accommodate future high voltage transmission lines; and

5. Alternate structure types and technologies."

Much of the basic impact data has been generated in the previous chapters of this report. The impact of a route segment can be measured by summing the total impacts encountered in the route segment. By adding the impacts of all the segments comprising a route and comparing the impacts of one route versus another, the relative impact of a given route, can be determined. For example, in the case of agriculture, impacts can be measured by summing the total number of: cultivated fields crossed; the miles of agricultural land crossed; the number of irrigated fields crossed; or other variables which might be affected by the location of a transmission line. The variables used in assessing route impacts are identified in Section 5.4.

5.4 IDENTIFICATION OF SPECIFIC IMPACTS

In order to assess the relative impacts of one routing alternative versus another, a segment by segment environmental evaluation was carried out. This investigation used information obtained from:

a. Cartographic review of the routes using USGS 7 1/2" quadrangle topographic maps and aerial photos at a scale of one inch - 2000 feet;

b. Field survey and data check by automobile and foot;

c. CREC discussions;

d. Citizen and property owners in the project study area.

e. NSP's application.

f. City, county, state and federal agencies.

A check list of environmental, land use, topographic, agricultural, soil, transportation and line design features was used to help measure relative impacts. Table 5.1 lists the various factors considered in evaluating each route segment. Data compiled for each segment were based upon the location of the reference centerline. Table 5.2 is a tabulation of the relative impacts associated with each complete route. All lengths in Table 5.2 are expressed in miles. The area (acres) of land affected will depend upon right of way width requirements. (See Table 3.3 for right of way requirements for a 345 kV transmission line under varying conditions). Section 5.4 through 5.9 is a narrative summary of the data collected for each route segment. A USGS map showing the route segment and route segment centerline, follows the narrative discussion.

Due to the map scale and the variety of information sources used, some minor discrepancies in data may be present. These discrepancies, however, should be relatively insignificant.

The narrative discussion for each segment includes comments on segment length, land use, homes, roads, recreation areas and vegetation. Comments on soil conditions are based on the USDA Soil Conservation Service soil maps and Important Farmlands Maps. Identification of flood hazard regions is based upon the U.S. Department of Housing and Urban Development's Flood Insurance Administration Maps # FIA 270435-0005A, 270435-0006A, 270435-0002A, and 270019-0100.

The route segment discussions focus first on the four major complete routes proposed. These are: Route A (1-5-10-11-12-15-33-24-37-26-35-40); Route B (1-5-10-31-19-20-23-30-35-40); Route C (1-5-6-32-36-37-26-35-40); and Route D (1-5-6-11-34-18-42-72-28-29-39-40). The varous segments comprising these routes are discussed sequentially in their entirety. Segments which are common to more than one route are only discussed in detail under the first route in which they occur. In the evaluation of the other routes, the reader will be referred to the section in which the segment is discussed in detail.

TABLE 5-1
ENVIRONMENTAL IMPACT CHECKLIST

1. Length of route in miles
2. Length of route parallel to existing right of ways
3. Diagonal length of route
4. Number of property units crossed
5. Miles of property lines bordered
6. Number of cultivated fields crossed
7. Length, in miles, of cultivated fields crossed
8. Length, in miles, of cultivated fields bordered
9. Length, in miles, of pasture crossings
10. Miles of prime farmland crossed
11. Miles of high irrigation potential crossed
12. Number of center pivot irrigation systems crossed
13. Number of center pivot systems bordered
14. Number of row irrigation systems crossed
15. Number of row irrigation systems bordered
16. Homes within 500 feet of centerline
17. Homes 500-1,000 feet of centerline
18. Businesses within 1,000 feet
19. Churches and cemetaries within 1,000 feet
20. Miles of platted areas crossed
21. Miles of platted areas bordered
22. Number of paved roads crossed
23. Number of unpaved roads crossed
24. Number of scenic road crossings
25. Miles of scenic roads bordered
26. Miles of roadways bordered
27. Airport clear zones within 1 mile
28. Number of windrows crossed
29. Miles of windrows bordered
30. Miles of woodlots crossed
31. Miles of wetlands crossed
32. Miles of orchards and/or tree farms crossed or bordered
33. Miles of high erosion potential crossed
34. Number of lakes crossed
35. Number of creek crossings
36. Number of trout stream crossings
37. Miles of FIA Flood Hazard Zones crossed
38. Public recreation areas crossed
39. Public recreation areas within 1,000 feet of the centerline
40. Private recreation areas crossed
41. Private recreation areas within 1,000 feet of the centerline
42. Areas of archeological interest
43. Wildlife refuges crossed
44. Areas of scientific, wildlife or vegetation interest crossed
45. Areas of scientific, wildlife or vegetation interest bordered within 1,000 feet of reference centerline

Table 5.2
Environmental Summary Table

VARIABLES	ROUTE										
	A	B	C	D	B-1	B-2	B-3	B-4	B-4'	C-1	D-1
segment length	16.7	19.2	17.2	22.1	19.1	20.1	20.3	19.3	20.2	16.3	23.8
length parallel to HVTL ROW	14.7	10.1	3.5	1.3	17.1	10.1	11.8	10.4	11.8	9.1	14.8
diagonal length	9.7	3.0	2.1	0	3.8	0.6	0.4	2.8	0.6	7.7	0.4
#property lines crossed	44	42	52	63	50	49	42	52	53	44	70
miles of property lines bordered	1.6	7.5	10.8	18.7	7.8	11.0	10.0	7.8	9.8	4.8	14.8
#of fields crossed	30	13	5	0	14	9	15	13	17	26	11
miles of fields crossed	4.1	1.8	1.1	0	2.3	1.1	1.6	2.0	2.3	3.7	1.1
miles of fields bordered	4.2	8.1	10.1	13.2	7.5	8.8	8.7	7.4	7.7	5.7	10.1
pastures crossed	1.8	1.2	0.5	0.9	1.0	0.9	0.9	1.5	1.2	0.8	1.4
prime farmland crossed	0.9	0.9	0.9	1.5	0.9	0.9	0.9	2.5	2.5	0.9	2.4
high irrigation potential	8.8	11.5	10.7	12.5	11.3	11.2	11.9	11.7	12.0	9.1	12.0
# of center pivots crossed	0	0	0	0	0	0	0	0	0	0	0
# of center pivots bordered	2	1	5	6	3	2	1	1	1	7	1
# of row irrigation crossed	2	0	2	0	1	1	0	0	0	2	0
# of row irrigation bordered	0	0	5	2	0	0	0	0	0	1	0
homes 500' of ROW	4	12	59	76	18	27	13	11	11	15	56
homes 500–1000' of ROW	22	18	24	37	19	15	20	15	15	20	19
business 1000' of ROW	0	1	7	3	1	1	1	1	1	2	3
church/cemetary 1000' of ROW	0	0	3	0	0	0	0	0	0	0	0
#platted areas crossed	2	1	1	1	1	1	1	1	1	1	2
# platted areas bordered	2	3	1	3	2	2	2	3	2	2	1
#paved roads crossed	6	6	8	8	6	5	4	5	5	6	9
# unpaved roads crossed	7	6	7	9	6	9	7	5	5	4	8
#scenic roads crossed	3	1	0	1	1	0	0	1	1	2	1
scenic road bordered	0	0	0	0	0	1.9	0	0	0	3.9	0
airport within 1 mile	2	0	3	0	2	1	0	1	1	2	0

Table 5.2 Cont.

VARIABLES	ROUTE										
	A	B	C	D	B-1	B-2	B-3	B-4	B-4'	C-1	D-1
hwy. ROW bordered	0	0	11.7	18.8	2.8	6.0	0	0	0	5.5	7.0
# of windrows crossed	12	6	9	4	8	6	6	8	10	10	1
# of windrows bordered	0.7	0.9	1.0	5.7	1.1	0.8	0.9	1.4	1.4	0.4	2.7
wood lot crossed	2.4	4.5	2.2	2.6	4.9	4.7	6.3	3.7	4.2	2.2	4.1
wetland crossed	2.7	1.4	1.4	1.1	1.5	2.2	1.4	1.7	2.1	2.2	2.1
tree farms crossed or bordered	0	1.0	0	1.0	0.7	0.9	1.0	1.0	1.0	0	0.9
steep slopes 6%	0.9	1.8	0.3	0.5	0.9	0.9	1.5	1.8	1.6	0.5	1.4
# of lakes within 1000' of centerline	4	3	6	2	2	3	3	3	3	3	2
stream crossings	10	8	3	15	8	6	8	8	8	7	18
trout streams	0	1	0	1	1	1	1	1	1	0	2
Flood Hazard Zones	1.5	0.8	0.6	1.5	0.9	0.8	0.9	1.5	1.6	1.6	1.6
public rec. crossed	0	0	0	0	0	0	0	0	0	0	0
public rec.1000' of ROW	2	1	1	2	1	1	1	1	1	2	2
pvt. rec. crossed	1	0	0	0	0	0	0	0	0	1	0
pvt. rec. 1000' of ROW	3	1	1	1	1	1	1	1	1	2	1
archaeological sites	2	0	0	0	0	0	0	0	0	2	0
wildlife refuges crossed	0	0	0	1	0	0	0	0	0	0	1
scientific/wildlife/vegetation of importance crossed	0	0	0	0	0	0	1	0	0	1	0
scientific/wildlife/vegetation of importance 1000' of centerline	1	1	1	1	2	2	2	1	1	0	2

Table 5.3

IMPACT SUMMARY ROUTE A

VARIABLES	ROUTE SEGMENTS										
	1-5	5-10	10-11	11-12	12-15	15-33	33-24	24-26	26-35	35-40	Total
segment length	2.0	4.0	0.6	1.0	2.1	2.3	1.2	1.9	0.3	1.3	16.7
length parallel to HVTL ROW	0	4.0	0.6	1.0	2.1	2.3	1.2	1.9	0.3	1.3	14.7
diagonal length	0	0.4	0.6	1.0	2.1	2.3	1.2	1.9	0.2	0	9.7
#property lines crossed	1	8	3	5	6	6	3	8	1	3	44
miles of property lines bordered	0	1.6	0	0	0	0	0	0	0	0	1.6
#of fields crossed	0	5	0	2	4	11	3	4	0	1	30
miles of fields crossed	0	0.6	0	0.2	0.5	1.3	0.4	1.0	0	0.1	4.1
miles of fields bordered	1.6	1.8	0	0	0	0	0.2	0	0	0.6	4.2
pastures crossed	0	0.3	0.5	0.4	0.1	0.3	0.1	0	0	0.1	1.8
prime farmland crossed	0	0	0	0	0	0	0	0	0.2	0.7	0.9
high irrigation potential	1.3	1.8	0.4	0.6	1.4	1.0	1.2	1.1	0	0	8.8
# of center pivots crossed	0	0	0	0	0	0	0	0	0	0	0
# of center pivots bordered	0	1	0	0	1	0	0	0	0	0	2
# of row irrigation crossed	0	0	0	1	0	0	0	0	1	0	2
# of row irrigation bordered	0	0	0	0	0	0	0	0	0	0	0
homes 500' of ROW	0	1	0	0	2	0	0	0	0	1	4
homes 500-1000' of ROW	2	4	2	0	4	3	1	4	0	2	22
business 1000' of ROW	0	0	0	0	0	0	0	0	0	0	0
church/cemetary 1000' of ROW	0	0	0	0	0	0	0	0	0	0	0
#platted areas crossed	0	1	0	0	1	0	0	0	0	0	2
# platted areas bordered	0	1	0	0	0	0	0	0	0	1	2
#paved roads crossed	2	0	1	1	1	0	1	0	0	0	6
# unpaved roads crossed	0	3	0	0	1	2	0	1	0	0	7
#scenic roads crossed	0	0	0	1	2	0	0	0	0	0	3
scenic road bordered	0	0	0	0	0	0	0	0	0	0	0
airport within 1 mile	0	0	0	0	1	0	0	0	1	0	2

IMPACT SUMMARY ROUTE A

VARIABLES	ROUTE SEGMENTS										
	1-5	5-10	10-11	11-12	12-15	15-33	33-24	24-26	26-35	35-40	Total
hwy. ROW bordered	0	0	0	0	0	0	0	0	0	0	0
# of windrows crossed	0	5	0	0	0	2	4	0	0	1	12
# of windrows bordered	0.4	0.3	0	0	0	0	0	0	0	0	0.7
wood lot crossed	0.1	0.7	0	0	0	0.3	0	1.0	0	0.3	2.4
wetland crossed	0	0.2	0	0.6	0.9	0.2	0.3	0.3	0.2	0	2.7
tree farms crossed or bordered	0	0	0	0	0	0	0	0	0	0	0
steep slopes 6%	0	0.4	0	0	0	0.1	0.1	0	0	0.3	0.9
# of lakes within 1000' of centerline	0	1	0	0	3	0	0	0	0	0	4
stream crossings	0	1	2	1	2	2	1	0	0	1	10
trout streams	0	0	0	0	0	0	0	0	0	0	0
Flood Hazard Zones	0	0.2	0	0	0.8	0.1	0	0	0.2	0.2	1.5
public rec. crossed	0	0	0	0	0	0	0	0	0	0	0
public rec.1000' of ROW	1	0	0	0	1	0	0	0	0	0	2
pvt. rec. crossed	0	0	0	0	1	0	0	0	0	0	1
pvt. rec. 1000' of ROW	0	1	0	0	2	0	0	0	0	0	3
archaeological sites	0	0	0	0	2	0	0	0	0	0	2
wildlife refuges crossed	0	0	0	0	0	0	0	0	0	0	0
scientific/wildlife/vegetation of importance crossed	0	0	0	0	0	0	0	0	0	0	0
scientific/wildlife/vegetation of importance 1000' of centerline	0	0	0	0	0	0	0	1	0	0	1

Following the evaluation of the major routes, each additional route segment proposed is evaluated. A summary table is placed at the end of each section depicting the number and type of impacts encountered. It is important to note that the criteria and considerations represented in the impact check list have not been ranked or prioritized as to relative importance.

Any transmission line routing option will generate some environmental impact. Therefore, in siting a transmission line, various tradeoffs and compromises between various environmental factors must be considered.

5.5 ROUTE A

Route A (Nodes: 1-5-10-11-12-15-33-24-37-26-35-40) was one of the original routes proposed by NSP. The route, as proposed, would parallel the existing Becker-Foley 69 kV transmission line north from Highway 10 to the Monticello-Benton County 230 kV line. At the point of intersection with the 230 kV line, the proposed route would parallel, in a northwesterly direction, the 230 kV line to the Benton County substation.

The proposed route has the advantage of using existing transmission line rights of way for most of its length. As such, additional right of way width required along this route would be approximatley 80 feet. A disadvantage of the route is that much of the route's length would diagonally cross cultivated fields. In addition, the general issue of system reliability and the vulnerability of two principal bulk supply lines being located adjacent to one another is a concern. (See section 3.2.3).

The following review of route segments assumes the placement of the 345 kV line on the west side of the existing transmission lines. The review further assumes that the routes would be paralleled and not double circuited. Because paralleling versus double circuiting a line generally requires more land area and therefore greater land disruption, paralleling the existing lines are considered worst case conditions. Double circuiting of the 345 kV line with both the 69 kV and the 230 kV line could modify and reduce several impacts, particularly those related to agricultural activities. (See Sections 3.12 and 3.2.3.2. for discussion on double circuiting.)

5.5.1 Route Segment 1-5

Route segment 1-5 is a 2.0 mile segment which is common to all of the routes presented in this EIS. The segment extends north from the Sherburne substation to State Highway 10. The land crossed by this route segment is owned by the applicants and is leased for agricultural purposes.

Although the route segment will parallel 1.6 miles of agricultural fields, it should not be necessary for the segment to cross any cultivated areas. Soils within the route segment are predominately Hubbard sands. These soils are not considered by the U.S. Soil Conservation Service as "prime farmland." Approximately 1.3 miles of the route segment cross soils listed by the Soil Conservation Service as having high irrigation potential. Presently however, no irrigation systems would be affected by this route segment.

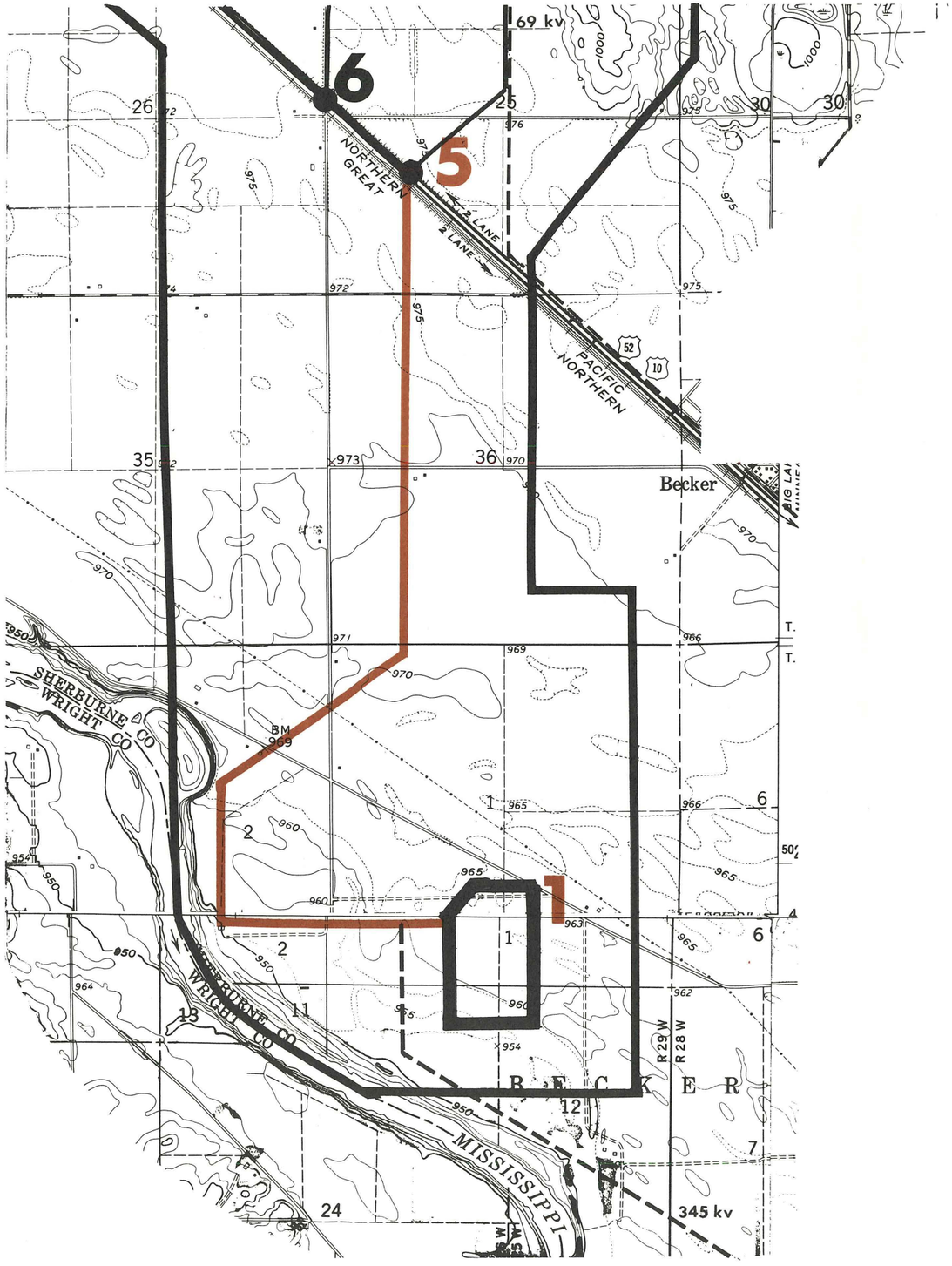
The route segment falls totally within the Becker City Limits but no major residential or commercial activities are located in the vicinity of the route segment. There are, however, two rural home sites that are located between 500 to 1,000 feet from the reference centerline. The route segment will cross two public roadways. One roadway is a two lane paved county road and one roadway, (Highway 10), is a four lane divided highway. The crossing of Highway 10 will require a utility crossing permit from the Minnesota Department of Transportation. (MNDOT)

Three windrows extending for a distance of approximately .4 miles would be located within the transmission line right of way. Depending upon final centerline placement, these windrows might have to be removed. Another vegetation area potentially affected by this route segment a small woodlot. The reference centerline crosses .1 mile of the woodlot.

Route segment 1-5 does not cross any creeks, streams, wetlands, archaeological sites or public recreation areas. Approximately .4 mile of the route segment, however, does abut the Mississippi Recreation and Scenic River Corridor. Careful structure sting should be exercised in this area to minimize adverse visual and recreational impacts along the Mississippi River.

5.5.2 Route Segment 5-10

Route segment 5-10 is a 4.0 mile segment common to both routes A and B. The reference centerline parallels the west side of the Becker-Foley 69 kV transmission line right



kilometer .5

0 mile .5

north

route boundary

reference centerline

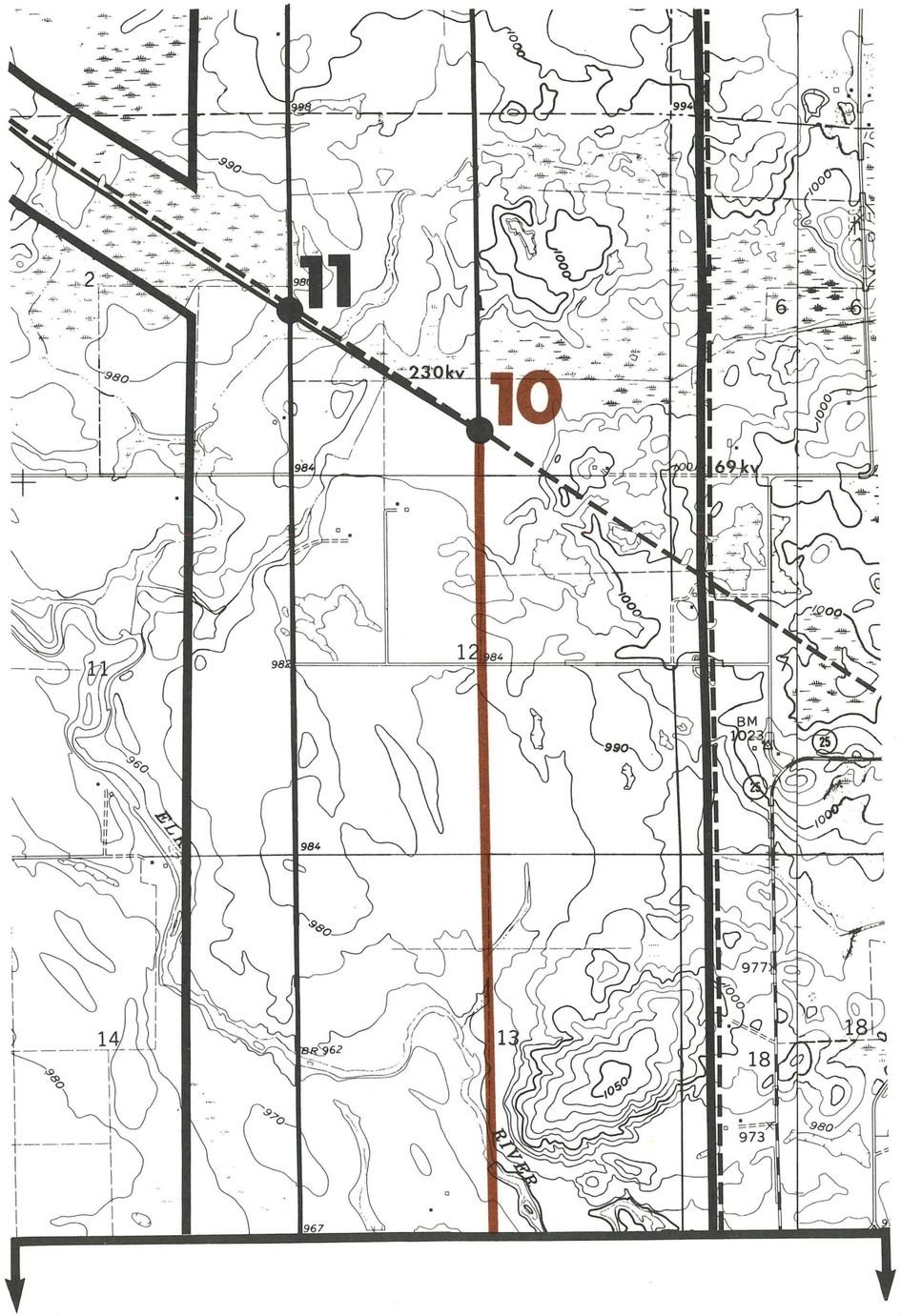
node

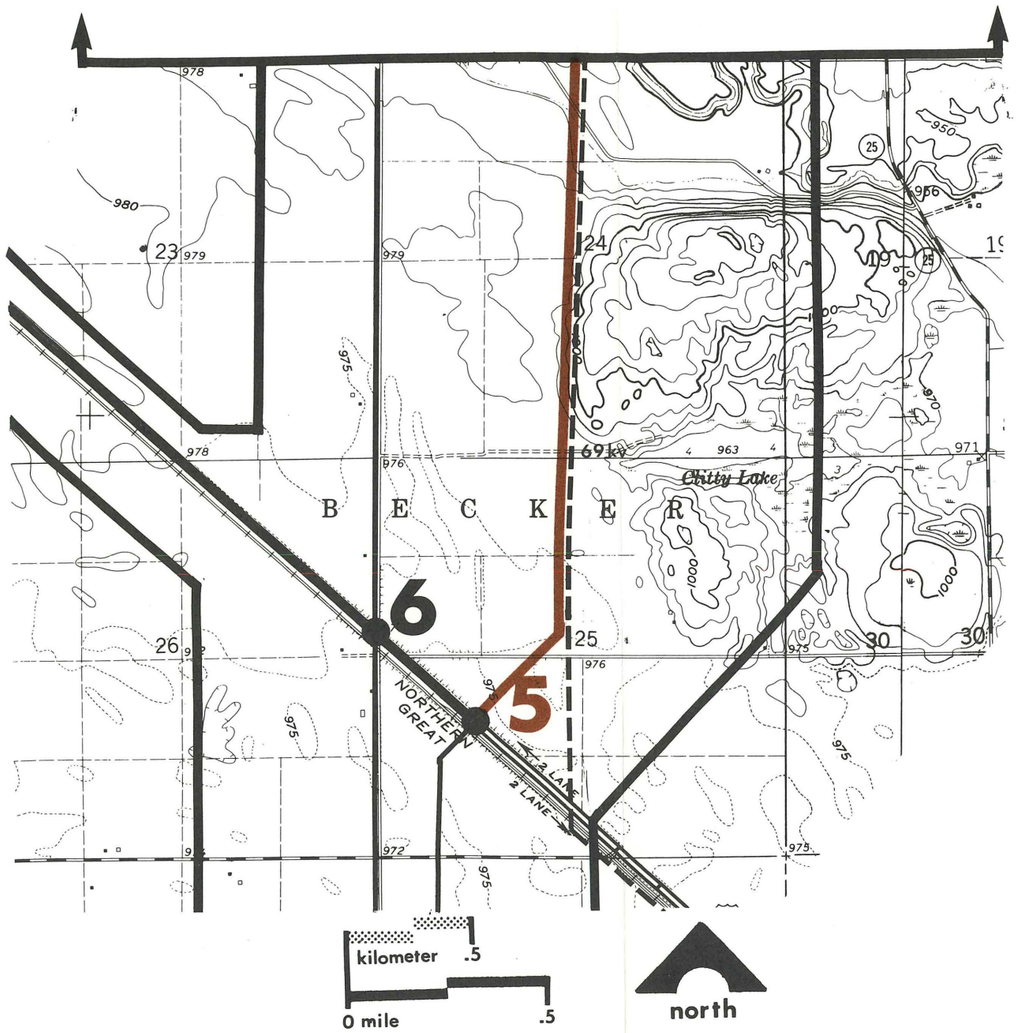
existing line

segment centerline

proposed route segment

1-5





route boundary
reference centerline
node
existing line
segment centerline

proposed route segment 5–10

of way north from Highway 10 to the Monticello-Benton County 230 kV transmission line right of way. The land crossed by the reference centerline is a mixture of cultivated agricultural fields, pasture land, rural subdivision, woodlots, wetlands and floodplains.

The reference centerline crosses .6 mile of cultivated farmland and .3 mile of pasture land. The agricultural land that is crossed is located in five fields that are scattered along the 4 mile route segment. Soils within the proposed right of way are predominately Hubbard sandy loams. Soils in this route segment are not classified as prime farmland, however, 1.8 miles of land crossed do include soils with high irrigation potential. Presently no irrigation system exists within the right of way, but one center pivot irrigation system would border the transmission line right of way.

There are no churches, cemetaries or major commercial activities located within 1,000 feet of the reference centerline. The route segment will cross and abut approximately .7 mile of a rural subdivision known as Wildwood Acres. The reference centerline will generally follow the back lot lines of the residential lots in Wildwood Acres. Of the 44 single family residences presently constructed in the subdivision, four homes would be located between 500 to 1,000 feet of the centerline. Only one home would be within 500 feet of the centerline and it may be necessary, depending upon final right of way alignment, to remove or relocate that structure.

Placement of a HVTL through a residential area can result in negative visual impacts. The densely wooded character of the subdivision however, should screen the transmission line from most of the residents of Wildwood Acres. In addition to Wildwood Acres, a newly subdivided area called Highland Pond is approximately 1,000 feet from the reference centerline. No residential structures in the Highland Pond subdivision should be directly affected by the transmission line.

Route Segment 5-10 will cross three, unpaved roadways. Two of these roadways are frontage roads that provide access to residential subdivisions and as such, the transmission line crossings will be visible to a number of residents in the corridor.

The vegetation within the route segment right of way varies. Five conifer windrows would be crossed. These crossings would necessitate clearing of an 80 to 150 foot wide area to accomodate the transmission

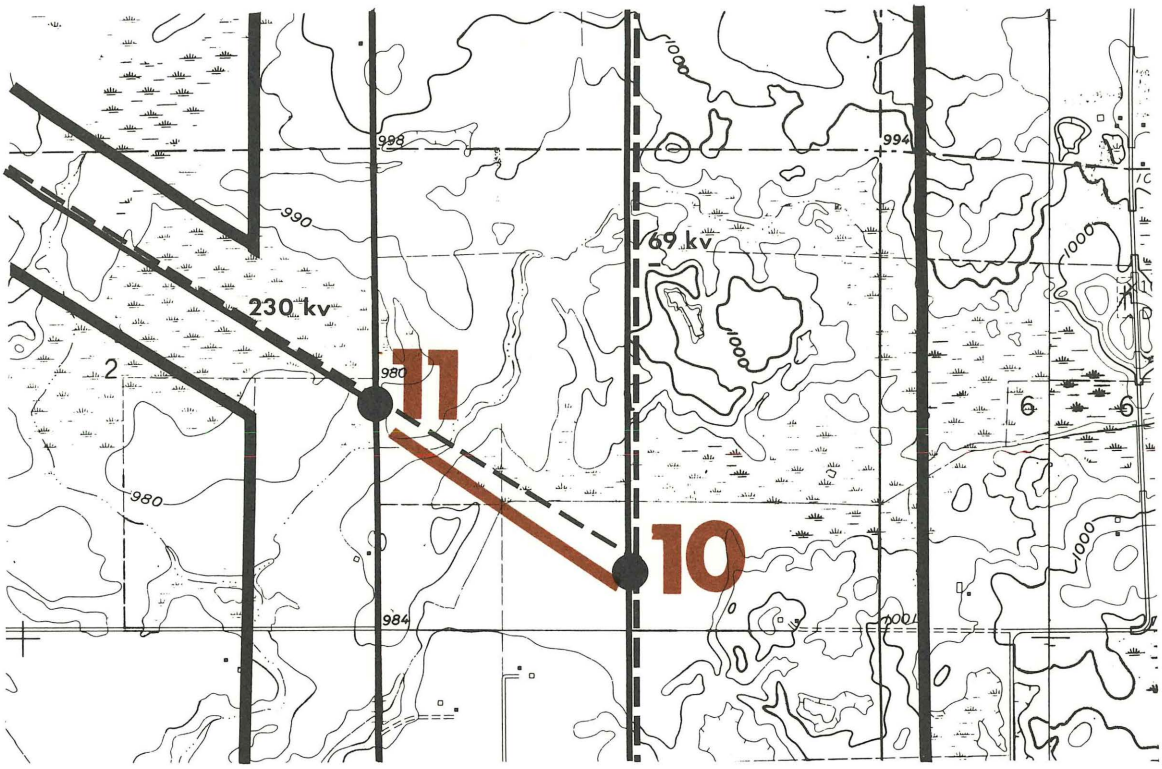
line. In addition, approximately .3 mile of windrows would be paralleled and probably removed. The removal of windrows could expose agricultural fields to severe wind erosion problems. Aside, from windrows, the route segment would cross .7 mile of woodlots and .2 mile of wetlands and floodplain. Some of the wooded areas are on slopes which exceed 6% slope. This level of topograhic relieve may be subject to erosion problems. Careful structure placement and rapid replacement of vegetation along the right of way should be considered when crossing slopes in excess of 6% grade.

Route segment 5-10 would necessitate a crossing of the Elk River. Careful structure placement and selective vegetation removal along the banks of the river can help minimize potential visual, erosion and other impacts to the river. In addition to crossing the Elk River, the centerline would cross .2 mile of floodplain. This floodplain area has been identified by the U.S. Flood Insurance Administration (FIA) as a Flood Hazard Zone. This area is subject to rules and regulations regarding construction, filling, and flood proofing. The requirements recommended by the FIA and the County zoning ordinance should, at a minimum, be satisfied.

The right of way for segment 5-10 would border one private recreational area. This area, known as Riverwood Camp, is a campgrounds area with river access. The transmisison line and its associated right of way should not adversely affect the recreational activities of the Camp but may pose a visual intrusion. No other recreation, archaeological site, scientific areas or unique wildlife habitats are known to exist in the route segment.

5.5.3 Route Segment 10-11

Route segment 10-11 is a short .6 mile segment extending from the existing 69 kV transmission line right of way northwesterly to State Highway 25. The route segment centerline would parallel the southern boundary of the existing 230 kV Monticello to Benton County transmission line. The entire .6 mile length of the route segment will be a diagonal crossing of 3 property units used for pasture. Soils along the proposed centerline are predominately Hubbard sandy loam. This area has not been identified as prime farmland, however, .4 mile of the route length contains soils with high irrigation potential. Presently, no irrigation systems exist or border the reference centerline of this route segment.



kilometer .5

0 mile .5

north

route boundary

reference centerline

node

existing line

segment centerline

proposed route segment

10-11

There are no residential, commercial or farm structures located within 500 feet of the reference centerline. Two residential structures do exist, however, between 500 and 1,000 feet of the reference centerline.

This route segment will necessitate the crossing of State Highway 25. Highway 25 is a major roadway in Sherburne County and the road crossing will be visible to many roadway users. The existing 230 kV line which already crosses the highway, however, will lessen the general visual impact on the roadway. In any case, the crossing of State Highway 25 will require a utility crossing permit from the Minnestoa Department of Transportation.

No significant vegetation areas would be crossed or impacted within this route segment.

Route segment 10-11 will cross two unnamed drainage ditches which are part of the Elk River's tributary system. These drainage ditches have been artificially straightened, widened and dredged in the past to promote field drainage. As such these waterways do not present significant recreational or aquatic wildlife management opportunities. No areas identified by the FIA as Flood Hazard Zones are affected by this route segment.

No recreation, archaeological sites, scientific areas or unique wildlife habitats are known to exist within this route segment.

5.5.4 Route Segment 11-12

Route segment 11-12 is 1.0 mile in length and extends from State Highway 25 to County Road 53. Although the reference centerline parallels the existing 230 kV transmission line, no natural or property division lines would be followed. The 1.0 mile segment would diagonally cross .2 mile of cultivated fields and .4 mile of pasture land. The soils crossed by this route segment are Hubbard, Lino and Zimmerman sandy loams. Several pockets of peat, muck and other water saturated soils are also crossed. The soils in segment 11-12 are not classified as prime farmland, however .6 mile of the route segment has soils with high irrigation potential. Presently a row irrigation system exists in the route segment. The proposed reference centerline would diagonally cross .2 mile of this row irrigated field.

No residential or farm structures are located within 1,000 feet of the reference centerline of this segment and no roadways are crossed or paralleled by this segment.

The route segment crosses .6 mile of wetlands. No major slope areas subject to erosion are found in this route segment.

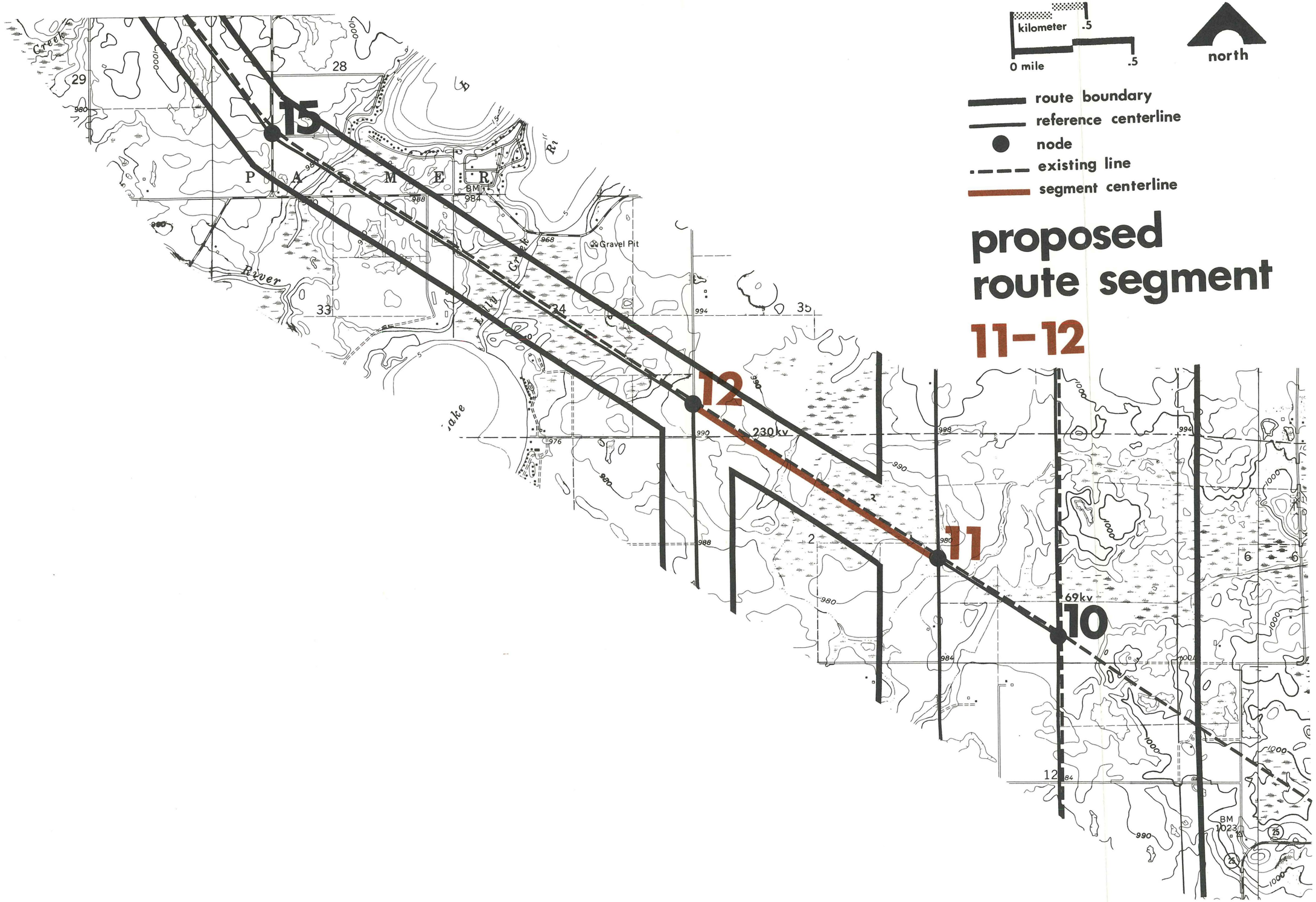
Route segment 11-12 will cross one drainage ditch which is part of the Elk River tributary system. The drainage ditch has been straightened and artifically altered in the past. As such, its potential for recreation and aquatic wildlife management is limited. No areas identified by the FIA as Flood Hazard Zones will be affected.

No recreational, archaeological sites, scientific areas or unique wildlife habitats are known to exist within this route segment.

5.5.5 Route Segment 12-15

Route segment 12-15 is 2.1 miles in length and is located midway between Briggs, Rush and Elk Lakes. The segment extends from County Road 53 to County Road 6. This route segment diagonally crosses 4 agricultural fields and 1 pasture area. Hubbard, Esterville and Salida sandy loams comprise the principal soil types of the route segment. This area has not been classified as prime farmland, however, 1.4 miles of the route segment have soils of high irrigation potential. One center pivot irrigation system exists within the route segment. The transmission line would border the northeastern corner of this irrigated field. In addition, one large turkey farm is located within 1,000 feet of the reference centerline.

The Briggs, Rush and Elk Lake region has experienced a rapid rate of growth and development. Two areas are being subdivided developed for permenant and seasonal housing within the route segment boundaries. The northern most subdivision is bisected by this route segment. Presently no residential structures have been built in this subdivision. In addition, two residential structures are located within 500 feet and 4 residential structures exist between 500 and 1,000 feet of the reference centerline.


kilometer .5
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north
route boundary
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existing line
segment centerline
proposed
route segment
11-12
T5
12
11
10
230kv
69kv
P A S M E R
Gravel Pit
BM
984
BM
1023
River
Creek
Lake

kilometer .5

0 mile .5

north

route boundary

reference centerline

node

existing line

segment centerline

proposed route segment 12–15

15

12

11

10

69 kv

230 kv

P A L M E R

Gravel Pit

River

Creek

Lake

BM 984

BM 1023

Route segment 12-15 will cross one paved and one unpaved roadway. Both of these roadways are identified in the Sherburne Comprehensive Land Use Plan as "Scenic Roadways." Screening of the transmission line crossing can be accomplished with proper landscape plantings; however, the diagonal alignment of the transmisison line accentuates the visibility of the line and makes efficient screening from the roadway more difficult. An additional transportation issue which warrents careful consideration is the impact of the additional transmission line on pontoon aircraft using Lake Briggs. The Minnesota Department of Transportation notes that seaplane operations are permitted on any lake of adequate size. Briggs Lake is of adequate size for seaplane use. Because of the receational use of the lakes, and the large number of seasonal homes on the lake, the attractiveness for seaplane landings on the lakes is enhanced.

The route segment reference centerline will not cross any significant woodlot areas. Several wetlands however, would be affected. A total of approximately .9 mile of wetland crossings would be encountered in this route segment. These wetlands are located adjacent to major recreation and fishing lakes of the region. As such, the estuary-like ecosystems associated with these wetlands are important for food production, breeding and development of the aquatic life of the lakes. These wetlands are additionally important because of the water quality enhancement benefits that they provide the recreational lakes. The wetland vegetation aids in trapping sediments and absorbing nutrients that may be flowing into the lakes. Although an existing transmission line has been constructed through these wetlands, the sensitive wetland lake ecosystem has had an opportunity to partially re-establish itself. The construction activities related to the placement of a new transmission line could adversely affect sediment loads, dissolved oxygen, nutrient cycles and breeding environments of the wetlands in the lake region.

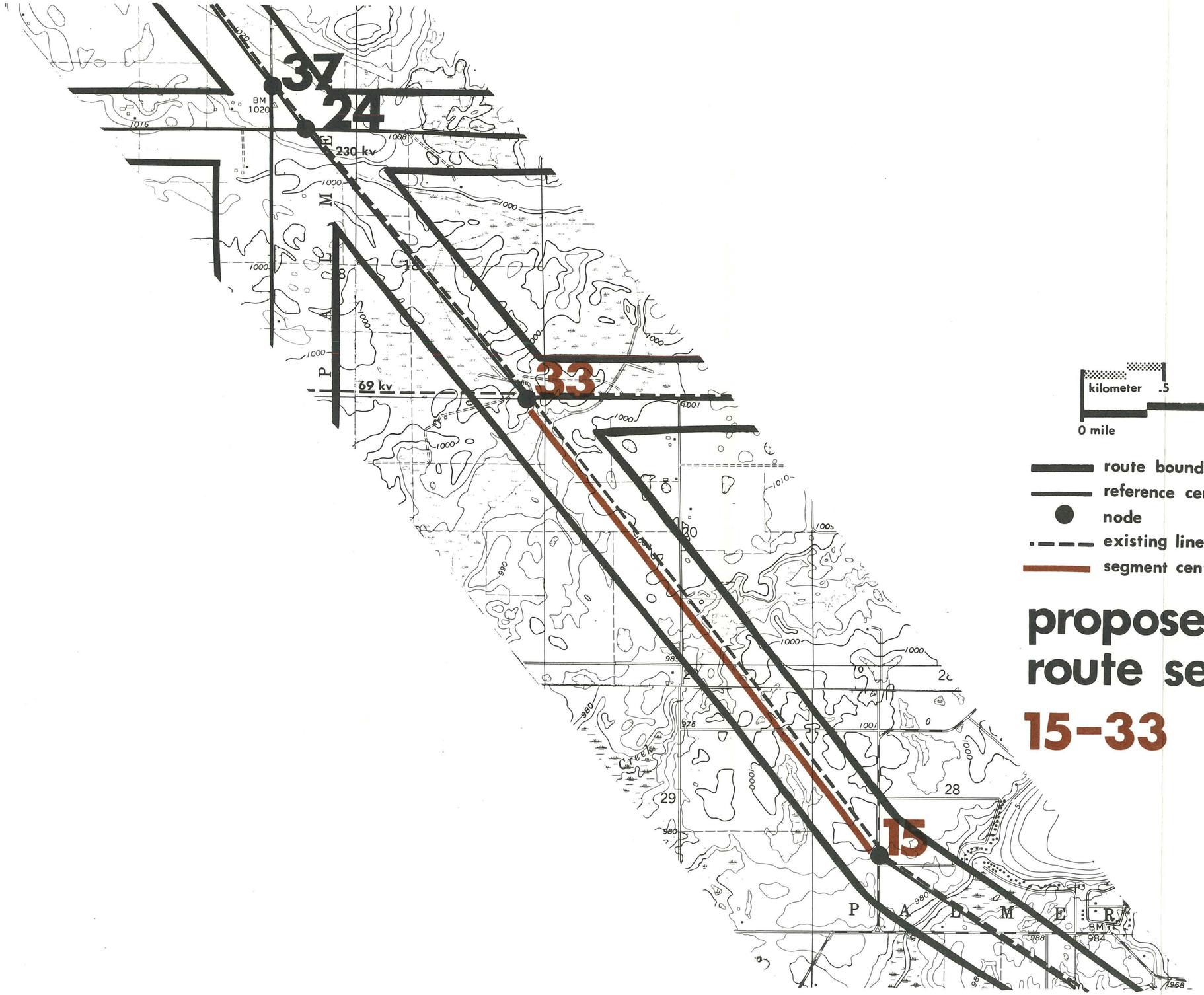
Route segment 12-15 crosses two streams. These waterways are the Briggs Bayou and Lilly Creek. Lilly Creek is a hydrologic connection between Briggs Lake, Rush Lake and Elk Lake. The floodplains associated with Briggs Bayou and Lilly Creek have been identified by the Flood Insurance Administration as Flood Hazard Zones. Of the .9 mile of wetlands crossed by the centerline of this route segment, .8 mile is identified as a Flood Hazard Zone.

One of the principal land use activities occurring within the route segment is related to water recreation. Elk, Rush and Briggs Lakes are extensively used for fishing, boating, and swimming. (See Section 2.15.) The State of Minnesota maintains a public access to Rush Lake in the general vicinity of the route segment. The relatively flat terrain and absence of tall vegetation in the area would permit the 345 kV transmission line to be visible from the public access. In addition to the public recreational activities associated with the lakes, two private recreational facilities exist within the route segment boundaries. One of these facilities (Cottonwood Resort), would be located less than 1,000 feet from the reference centerline. The recreational activities offered at the resort include: fishing, swimming, boating, picknicking and trapshooting. The other private recreational areas is a new lake access and park being incorporated into one of the residential subdivisions. The proposed centerline of the 345 kV transmission line would pass directly over this new park. Although the proposed transmission line will not directly affect any of the above recreational activities, its presence would further diminish the visual attractiveness of the area. The magnitude of the visual impact on the recreational activities would be partially transmission line is already located in the route segment.

An additional feature of scientific and environmental significance exist within the proposed route segment. The Minnesota Historical Society has indicated that "a high correlation between prehistoric archaeological sites and permanent sources of water exist." Several prehistoric archaeological sites have been recorded in the vicinity of Briggs and Elk Lakes, particularly in the regions where the lakes, streams and wetlands coincide. No other recreation facility, archaeological site, scientific area or wildlife habitat is known to exist within the route segment.

5.5.6 Route Segment 15-33

Route segment 15-33 has a total length of approximately 2.3 miles. The reference centerline will parallel the 230 kV transmission line in a northwesterly direction from County Road 6 to the existing Cable/Boyd Lake 69 kV transmission line. The route segment crosses 6 property units which contain 11 agricultural fields and 3 general pasture areas. A total of 1.3 miles of agricultural



proposed route segment 15-33

land will be diagonally crossed by this route segment. Although the route segment parallels an existing transmission line right of way, no property boundaries or other natural features can be followed.

The soils located within the route segment are predominately Salida sands. Some peat, muck and other highly organic materials are also found within the route segment. The soils in the route segment are not classified as prime farmlands, however 1.0 mile of this route does have soils with a high irrigation potential. Presently only one row irrigation system exists in the route segment. The reference centerline, however, does not cross or border this irrigated field.

There are no residential structures, commercial or farm structures within 500 feet of the reference centerline. Three structures do, however, exist within 500 and 1,000 feet of the centerline. In addition, two gravel roads would be crossed by this route segment.

Route segment 15-33 would cross 4 windrows. Although, these windrows would not have to be completely removed, however, an 80 to 150 foot wide area would have to be cleared to accomodate the transmission line right of way. In addition to windrows, approximately .3 mile of evergreen and hardwood woodlots would be crossed. Most of these wooded areas are located along the banks of Rice Creek. These wooded areas may be prone to erosion problems. Approximately .2 mile of wetland areas would also be crossed.

The proposed route centerline crosses Rice Creek and one of its unnamed tributaries. Approximately .1 mile of the route segment is identified by the Flood Insurance Administration as a Flood Hazard Zone.

No recreational facilities, archaeological sites, scientific areas or unique wildlife habitats are known to exist within this route segment.

5.5.7 Route Segment 33-24

Route Segment 33-24 is a 1.2 mile segment extending from the 69 kV Cable/Boyd Lake transmission line to County Highway 3. This route segment parallels the existing 230 kV transmission line right of way across 3 cultivated agricultural fields and 1 pasture area. A total of .4 mile of cultivated fields would be diagonally crossed by this route segment.

The general soil types found within this segment are Zimmerman, Buckhart, and Hubbard sandy loams. Soils in this route segment are not classified as prime farmlands, however,the entire 1.2 mile length of the route segment will cross soils with high irrigation potential. No irrigation systems are located within this route segment.

This route segment has one residential structure located within 500 and 1,000 feet of the reference centerline and would cross one paved roadway.

Although no woodlots or windrows are crossed by this route segment, .3 mile of wetlands will be traversed. Approximately .1 mile of the route segment will cross an area of topographic relief exceeding 6% slope. This area may be susceptible to erosion.

No natural rivers or streams are crossed by the route segment. An unnamed drainage ditch however, would be crossed. This drainage ditch has been straightened and altered in the past and provides no recreational or wildlife management opportunities. There are no FIA designated Flood Hazard Zones in this route segment.

No recreational facilities, archaeological sites, scientific areas or unique wildlife habitats are known to exist within this route segment.

5.5.8 Route Segment 24-37-26

This route segment has a total length of approximately 1.9 miles. The reference centerline of this route segment parallels the existing Monticello-Benton 230 kV transmisison line. Route segment 24-37-26 diagonally crosses 8 property units of which 4 are used as cultivated agricultural fields. The total length of cultivated fields that are diagonally crossed is 1.0 mile.

The soil types encountered within the route segment are Burkhardt, Lino, Emmert and Zimmerman sandy loams. These soil types are not classified as prime farmlands however 1.1 miles of the reference centerline diagonally crosses fields with soils favorable for irrigation. Presently a row irrigation system is located within the route segment boundaries. The reference centerline of this route segment would cross .2 mile of the irrigated field.

37
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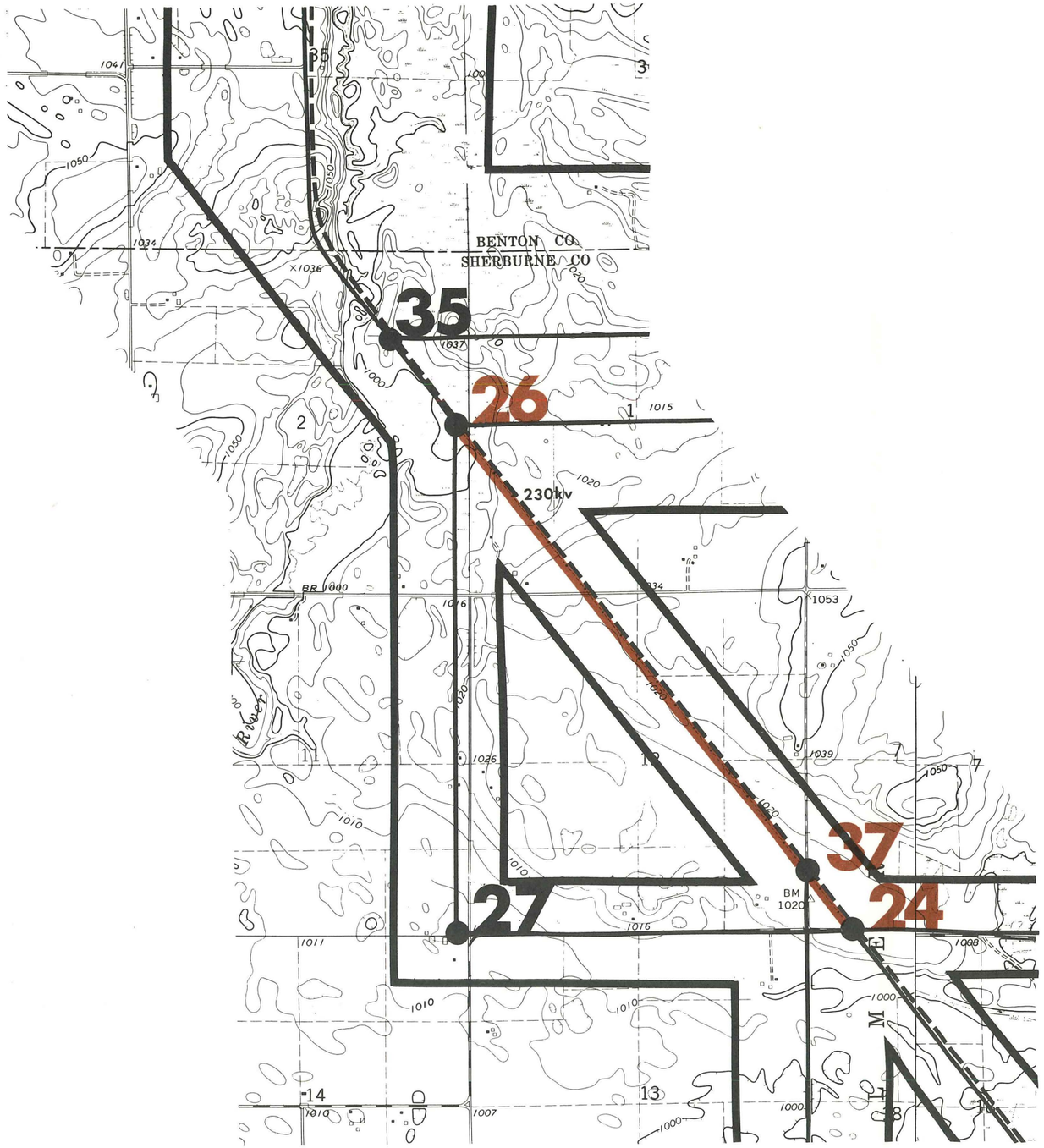


kilometer .5 1

0 mile .5

north

route boundary
reference centerline
node
existing line
segment centerline

proposed route segment

24-37-26

Four rural farm residences are located within 500 to 1,000 feet of the reference centerline. The route segment will cross one local gravel roadway and is about 1 mile from the St. Cloud Airport. (See Section 4.11 for airport impact discussion).

No windrows will be crossed or affected by the transmission line. Approximately 1.0 mile of a woodlot would be crossed necessitating vegetation removal, and a .3 mile length of wetland would be crossed by the reference centerline. No areas of significant slope or severe erosion potential will be crossed by this route segment.

No streams, creeks or FIA Flood Hazard Zones will be crossed.

In a survey of natural areas for The Nature Conservancy, Dr. Max Partch identified a savanna wetland area in the NW 1/4 of the NW 1/4 of Section 12 Palmer Township as having features worthy of preservation. This wildlife area is located within the route segment boundaries but the reference centerline does not cross the wildlife area. No other recreational facilities, archaeological sites, scientific areas or unique wildlife habitats are known to exist in this route segment.

5.5.9 Route Segment 26-35

Route segment 26-35 is a short .3 mile route segment which diagonally crosses 1 property unit. The land use within this route segment is predominantly wetland and Elk River floodplain. The land crossed by this route segment does not appear to be used for cultivated or pasture purpose but 0.2 miles of the soils found in this route segment are classified by the Soil Conservation Service as prime farmland. No irrigation systems exist in the route segment.

No homes or roads are crossed by this route segment. A relatively new rural subdivision however, is located adjacent to the western boundary the route segment. The reference centerline of this route segment is approximately 1,000 feet east of the Elk River. The route segment is about 1 mile from the St. Cloud Airport and the northern limits of the route segment are almost directly perpendicular to the auxiliary Northwest-Southeast runway. Approaches and takeoffs from this runway (runway 5-23) will have to pass over the transmission line. The runway's clear zone and building restriction line do not fall within the route segment boundaries. The proposed 345 kV transmission line will not violate FAA or Minnesota rules or regulations. (See Section 4.11 for more detailed discussion of airport impacts.)

The route segment will cross .2 mile of wetland. No windrows or woodlots will be affected.

The route segment will not cross any rivers or streams, however .2 mile of the segment length will cross wetland and floodplain areas of the Elk River. The entire .2 mile of wetland has been identified by the FIA as Flood Hazard Zone. Vegetation removal, construction, filling and flood proofing should at a minimum, be undertaken in a manner consistent with FIA rules and regulations.

No recreational facilities, archaeological sites, scientific areas or unique wildlife habitats are known to exist in this route segment.

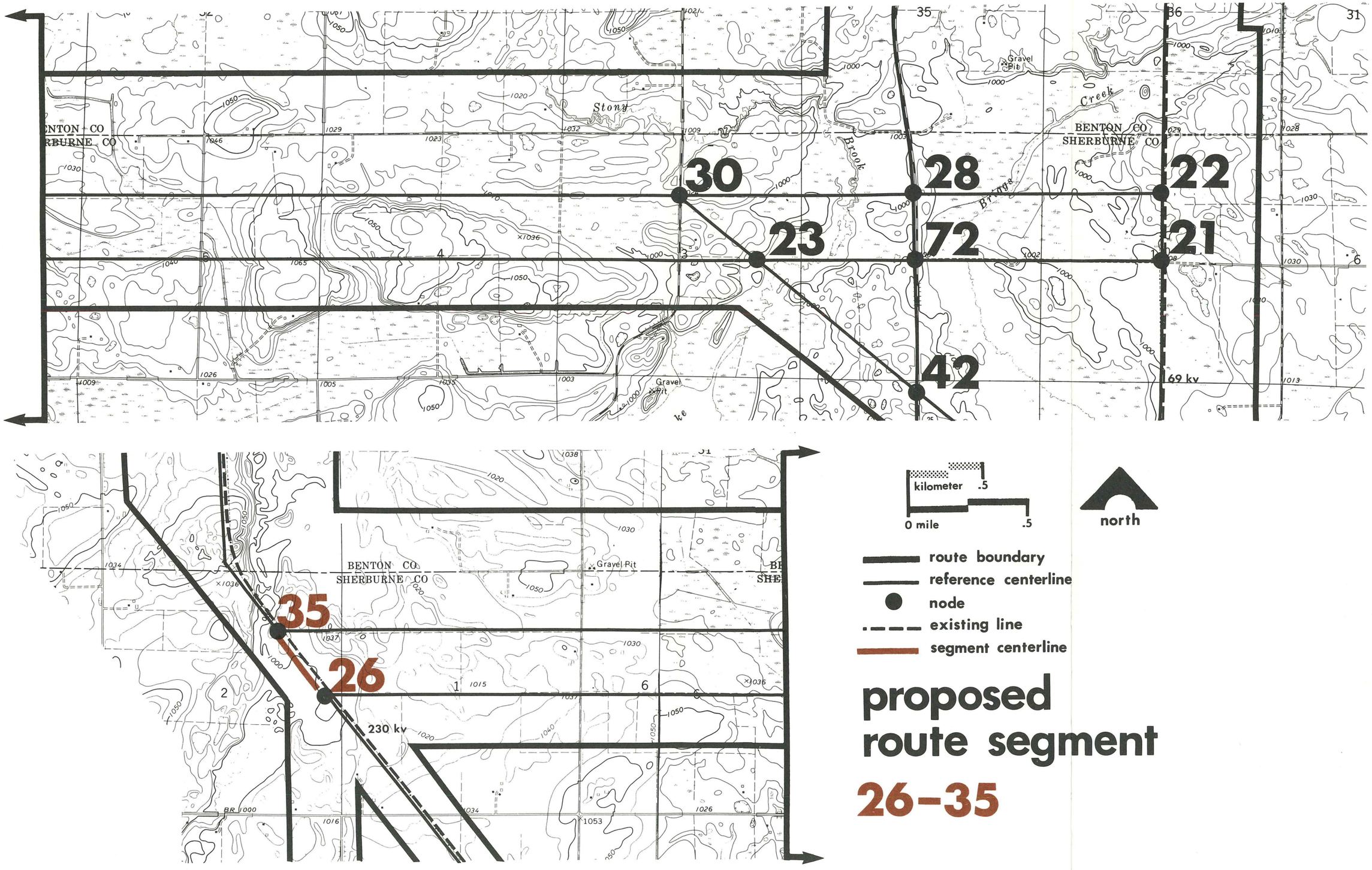
5.5.10 Route Segment 35-40

Route segment 35-40 is common to all but 1 route option (Route D) considered in this report. This route segment is 1.3 miles in length and crosses 3 property boundaries. The route segment centerline parallels the Monticello-Benton County 230 kV transmisison line from the Elk River into the Benton County substation.

Soils crossed by this route segment are Hubbard, Sartell and Chetek sandy loams. The Soil Conservation Service has classified .7 mile of this route segment length as prime farmland. No irrigation systems exist in the route segment.

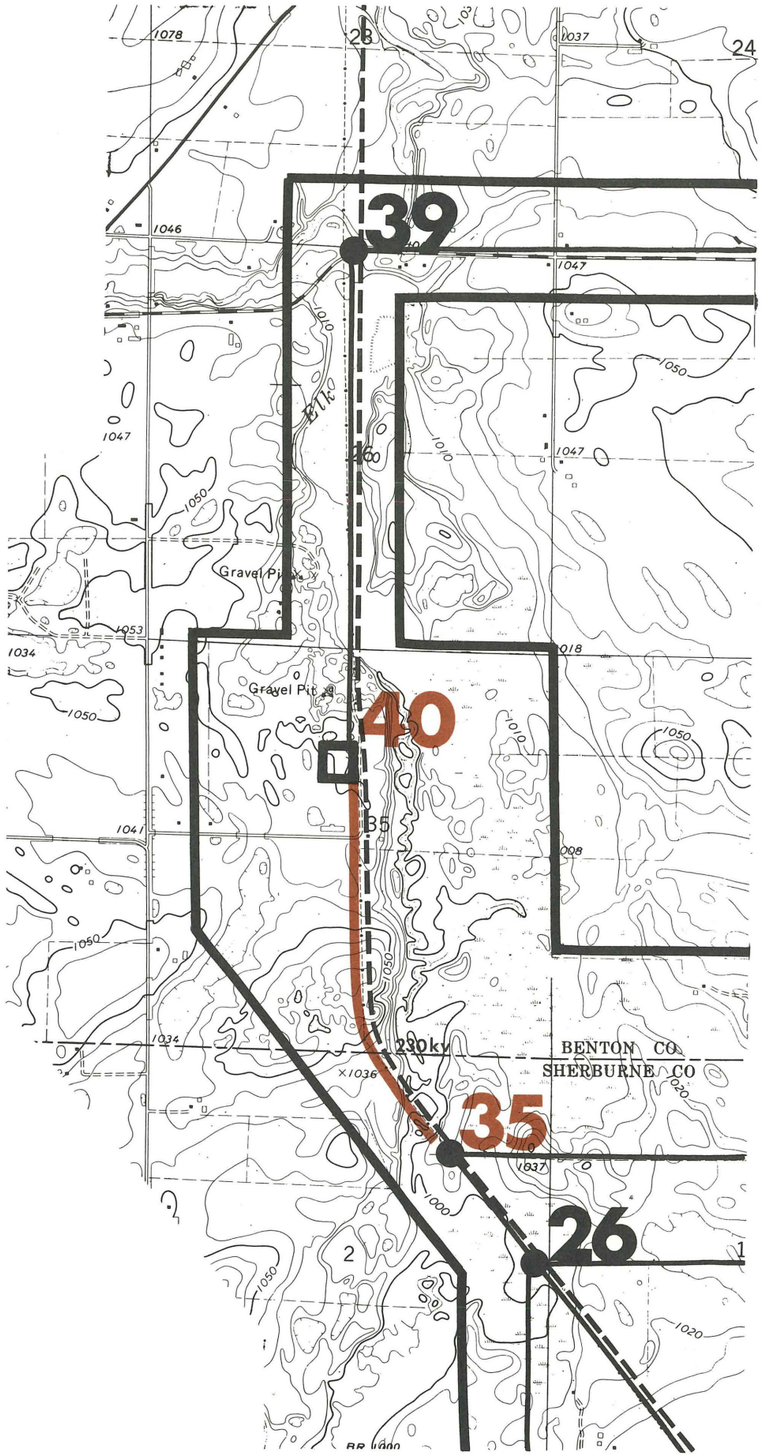
A new rural subdivision is located west of the Elk River. The closest distance beween the subdivision and the reference centerline is approximately 600 feet. The topography of the area and the relatively dense vegetation help to shield the existing 230 kV line from the residents. The addition of a 345 kV line in the vicinity should not have a severe visual impact on the residential subdivision. One farm residence is within 500 feet and 2 non-farm residential structures are within 500 and 1,000 feet of the reference centerline. No roads will be crossed.

Route segment 35-40 will cross 1 windrow and approximately .3 mile of woodlots. Much of the wooded areas are along the banks of the Elk River on slopes which exceed 6% grade. These slope areas are very sensitive to vegetation removal and may experience increased erosion. The vegetation along the Elk River is also important for water temperature and water quality control. Special care and selective cutting along the Elk River banks can reduce the potential impact in this area.



proposed route segment

26–35



kilometer .5

0 mile .5

north

- route boundary
- reference centerline
- node
- existing line
- segment centerline

proposed route segment 35-40

This route segment will cross the Elk River and its floodplain. The FIA has identified .2 mile of the segment length as a Flood Hazard Zone. Construction, filling and flood proofing activities should, at a minimum, meet FIA rules, regulations and standards.

No known recreational facilities, archaeological sites, scientific areas or unique wildlife habitats are known to exist in this route segment. The Elk River, however, is used for fishing and boating and has potential for water recreational uses.

5.5.11 Route Summary

Table 5.3 is a summary of the impacts identified within Route A. All lengths are measured in miles. The land area (acres) of farmland, woodlots, wetlands, etc. that may be impacted by the route will vary depending upon the structure type used and on whether the Monticello-Benton County 230 kV and the Becker-Foley 69 kV transmission line are double circuited. (See Table 3.3 for right of way requirements for the 345 kV line under varying structure type and right of way sharing conditions.)

5.6 ROUTE B

Route B (Nodes 1-5-10-31-19-20-42-23-30-35-40) was submitted by NSP in their application for construction permit. The route parallels an existing 69 kV transmission line north from the Sherco generating plant to County Highway 3. At County Highway 3 the proposed route would leave the Becker-Foley 69 kV line and cross diagonally to a point 1/4 mile south of the Benton-Sherburne County line near County Highway 6. The proposed route would then parallel, in a westerly direction, for a distance of approximately 5 miles, the 1/4 section line. At node 35, the proposed route would intersect the existing 230 kV transmission line and parallel that facility north to the Benton County Substation.

The land uses along the Becker-Foley 69 kV transmission line include residential subdivisions, pasture areas, agricultural land, woodlots, orchards and tree farms. Upon leaving the 69 kV line, the route would require the acquisition of all new right of way as none presently exists in this vicinity. The northern segments of this route encounter rolling morainal topography with numerous woodlots and one trout stream.

The applicant initially recommended to parallel the 69 kV transmission line right of way but during meetings with the Citizens Route Evaluation Committee NSP agreed that double circuiting the 69 kV line would be a more prudent use of land resources. The Citizens Route Evaluation Committee unanimously recommended that the 69

Table 5.4

IMPACT SUMMARY ROUTE B

VARIABLES	ROUTE SEGMENTS										
	1-5	5-10	10-31	31-19	19-20	20-42	42-23	23-30	30-35	35-40	Total
segment length	2.0	4.0	3.7	0.8	0.3	1.3	0.9	0.4	4.5	1.3	19.2
length parallel to HVTL ROW	0	4.0	3.7	0.8	0.3	0	0	0	0	1.3	10.1
diagonal length	0	0.4	0	0	0	1.3	0.9	0.4	0	0	3.0
#property lines crossed	1	8	12	3	2	5	3	1	4	3	42
miles of property lines bordered	0	1.6	1.5	0.8	0.3	0	0	0	3.3	0	7.5
#of fields crossed	0	5	1	0	0	1	0	1	4	1	13
miles of fields crossed	0	0.6	0.2	0	0	0.1	0	0.3	0.5	0.1	1.8
miles of fields bordered	1.6	1.8	1.3	0.3	0.2	0	0	0	2.3	0.6	8.1
pastures crossed	0	0.3	0.3	0	0	0.2	0.1	0	0.2	0.1	1.2
prime farmland crossed	0	0	0	0	0	0	0	0	0.2	0.7	0.9
high irrigation potential	1.3	1.8	3.1	0.5	0.2	1.1	0.8	0.4	2.3	0	11.5
# of center pivots crossed	0	0	0	0	0	0	0	0	0	0	0
# of center pivots bordered	0	1	0	0	0	0	0	0	0	0	1
# of row irrigation crossed	0	0	0	0	0	0	0	0	0	0	0
# of row irrigation bordered	0	0	0	0	0	0	0	0	0	0	0
homes 500' of ROW	0	1	4	0	2	1	0	1	2	1	12
homes 500-1000' of ROW	2	4	2	2	0	1	0	1	4	2	18
business 1000' of ROW	0	0	1	0	0	0	0	0	0	0	1
church/cemetary 1000' of ROW	0	0	0	0	0	0	0	0	0	0	0
#platted areas crossed	0	1	0	0	0	0	0	0	0	0	1
# platted areas bordered	0	1	0	0	0	1	0	0	0	1	3
#paved roads crossed	2	0	1	0	0	1	1	1	0	0	6
# unpaved roads crossed	0	3	1	0	0	0	0	0	2	0	6
#scenic roads crossed	0	0	0	0	0	1	0	0	0	0	1
scenic road bordered	0	0	0	0	0	0	0	0	0	0	0
airport within 1 mile	0	0	0	0	0	0	0	0	0	0	0

IMPACT SUMMARY ROUTE B

VARIABLES	ROUTE SEGMENTS										
	1-5	5-10	10-31	31-19	19-20	20-42	42-23	23-30	30-35	35-40	Total
hwy. ROW bordered	0	0	0	0	0	0	0	0	0	0	0
# of windrows crossed	0	5	0	0	0	0	0	0	0	1	6
# of windrows bordered	0.4	0.3	0.1	0	0	0	0	0	0.1	0	0.9
wood lot crossed	0.1	0.7	0.9	0	0.2	0.5	0.6	0	1.2	0.3	4.5
wetland crossed	0	0.2	0.1	0.1	0	0.1	0.2	0	0.7	0	1.4
tree farms crossed or bordered	0	0	0.7	0.2	0	0	0	0.1	0	0	1.0
steep slopes 6%	0	0.4	0.1	0	0	0.1	0.2	0	0.7	0.3	1.8
# of lakes within 1000' of centerline	0	1	1	0	0	0	0	0	1	0	3
stream crossings	0	1	2	0	0	1	1	0	2	1	8
trout streams	0	0	0	0	0	1	0	0	0	0	1
Flood Hazard Zones	0	0.2	0	0	0	0	0.4	0	0	0.2	0.8
public rec. crossed	0	0	0	0	0	0	0	0	0	0	0
public rec.1000' of ROW	1	0	0	0	0	0	0	0	0	0	1
pvt. rec. crossed	0	0	0	0	0	0	0	0	0	0	0
pvt. rec. 1000' of ROW	0	1	0	0	0	0	0	0	0	0	1
archaeological sites	0	0	0	0	0	0	0	0	0	0	0
wildlife refuges crossed	0	0	0	0	0	0	0	0	0	0	0
scientific/wildlife/vegetation of importance crossed	0	0	0	0	0	0	0	0	0	0	0
scientific/wildlife/vegetation of importance 1000' of centerline	0	0	0	1	0	0	0	0	0	0	1

kV portion of this route should be double circuited. As a worst case situation, however the following route segment analysis will examine the potential impacts of the route as originally proposed in the application. (i.e., the 345 kV line paralleling the 69 kV line.) If the lines are double circuited it is possible that the magnitude of environmental impacts can be reduced.

Route B has the advantage of paralleling or double circuiting the Becker-Foley 69 kV line for much of the route's length. Because of the topography and vegetation surrounding the reference centerline of this route, Route B has the advantage of being screened from roadways and the majority of residents in the study area. The greatest disadvantage of this route is that it will require the development of a new 8.4 mile right of way corridor.

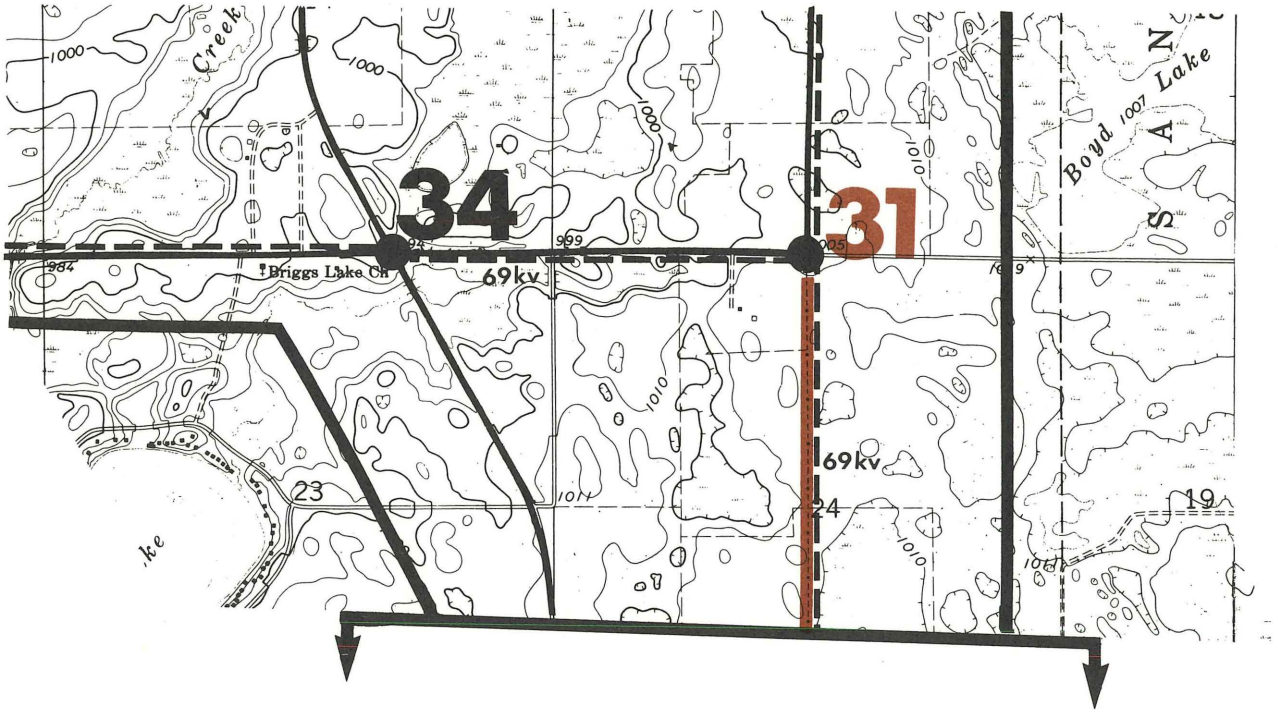
Route B has several common route segments with Route A. These route segments are: 1-5; 5-10; and 35-40. The reader is referred to sections 5.5.1; 5.5.2 and 5.5.10 for detailed discussions of these route segments.

5.6.1 Route Segment 10-31

Route segment 10-31 is a 3.7 mile route segment which parallels the Becker-Foley 69 kV transmission line. The segment crosses and parallels several agricultural fields, pastures, woodlots and tree farms. A total of 12 property units are crossed by this route segment. Approximately 1.3 miles of the segment borders cultivated agricultural fields and .3 mile crosses pasture areas.

The predominate soil types crossed by the reference centerline are Hubbard and Zimmerman sandy loams. These soils are not designated by the Soil Conservation Service as prime farmland, however, 3.1 miles of the segment length have soils with high irrigation potential. Presently, no irrigation system exists within the route segment.

One residential building is crossed by the reference centerline and would have to be removed or relocated. In addition, three other residential structures and one commercial storage building are within 500 feet of the reference centerline. This route segment will cross one paved and one unpaved roadway. Both roadways are rural collector roads and are not major arterials. A small transmission line substation is located at the midway point of the route segment. This substation will not have to be expanded should the 345 kV transmission line be placed within this route segment.



kilometer .5

0 mile .5

north

route boundary

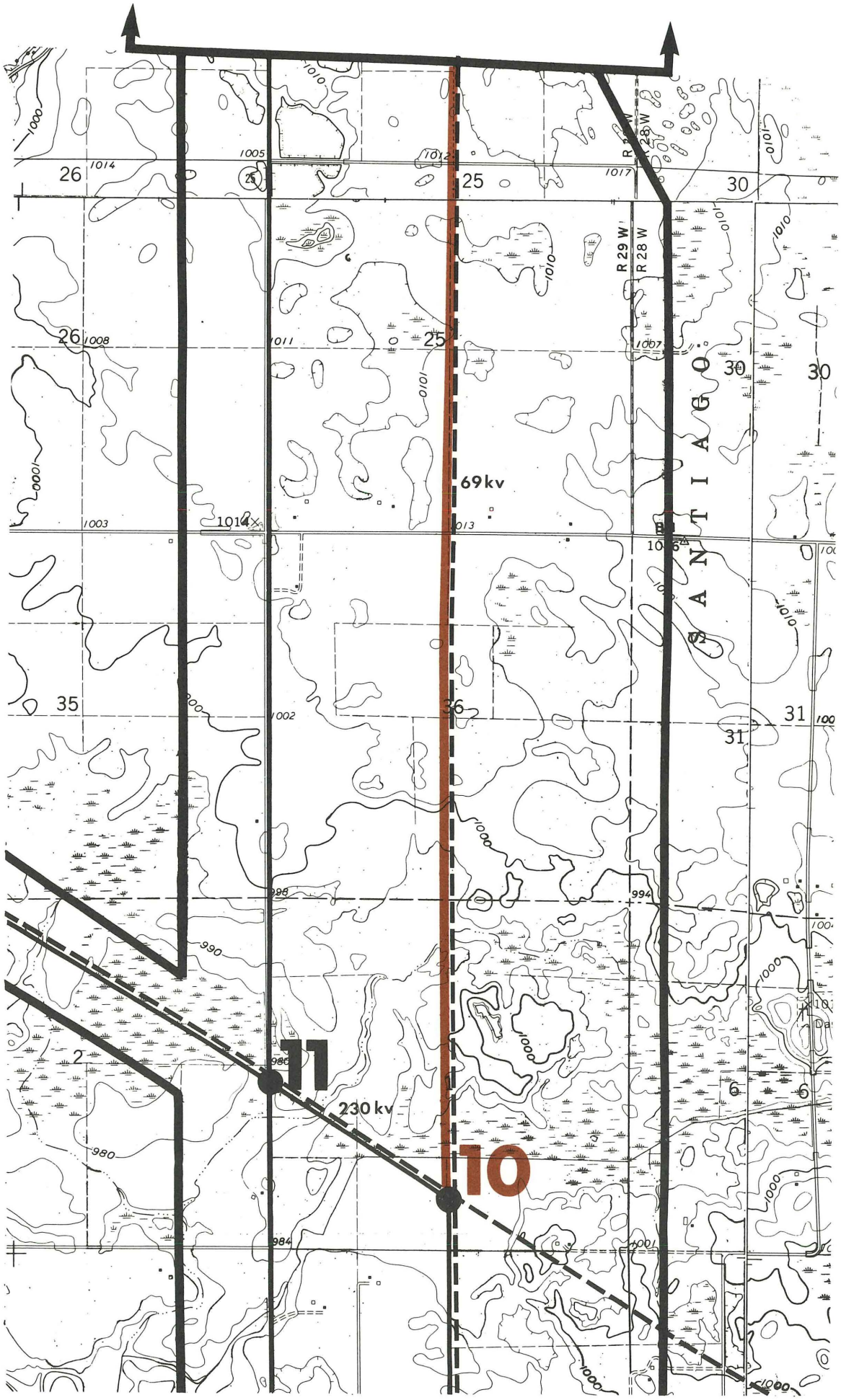
reference centerline

node

existing line

segment centerline

proposed route segment 10-31


69kv
230 kv
11
10
SANTIAGO
R 29 W
R 28 W
26
25
30
35
36
31
2
6

Route segment 10-31 will parallel one windrow for a distance of .1 mile. The segment centerline would also cross .9 mile of woodlots, and parallel .7 mile of tree farms. An area 80 to 150 feet would have to be cleared through the woodlots to accomodate the transmission line right of way. In addition, .1 mile of wetland areas would be crossed. The tree farms paralleled by the centerline are primarily evergreen and Christmas tree plantations. Generally, evergreen plantations are compatible uses with a transmission line right of way.

One of the evergreen plantations, Go-Pher Evergreen located in the SW 1/4 of section 24 Palmer Township, may experience the most severe impact. Depending upon the final alignment of the transmission centerline, Go-Pher Evergreen's office and storage buildings may have to be removed or reloacted. There are no concentrations of steep slopes within the route segment, however, some isolated locations of 6% or greater slopes may be crossed.

The route segment will cross two unnamed tributaries to the Elk River. Both of the drainage areas have been channelized and altered in the past to promote better field drainage. As such the recreational and wildlife management benefits of these waterways are limited. No areas within the route segment have been identified as Flood Hazard Zones by the FIA.

One oak forest located at the northeastern extreme of the route segment has been identified by Dr. Partch for The Nature Conservancy as a priority area for preservation. The reference centerline is located west of this oak forest and should not result in the removal of any of the oak forest. Careful consideration of structure placement and construction activities in this area could help minimize potential impacts to the oak forest. No other recreational facility, archaeological site, scientific area or unique wildlife habitat are known to exist in this route segment.

5.6.2 Route Segment 31-19

Route segment 31-19 is .8 mile in length and crosses 3 property units. Although no agricultural fields or pasture areas are crossed by the reference centerline, .3 mile of cultivated fields will be bordered. The general soil types found in this route segment are Zimmerman and Isanti soils. This segment does not have any areas classified as prime farmland, however, .5 mile of the route passes over soils with high potential for irrigaiton. No irrigation systems presently exist within this segment.

No buildings are crossed by the reference centerline, however, 2 residential structures would be located within 500 and 1,000 feet of the reference centerline. No roadways will be crossed by this route segment.

The vegetation crossed by the reference centerline is a broad mixture of grasslands, fields with scattered decidious trees; evergreens; and wetland vegetation. No areas of steep slope are crossed. There are no stream crossing or Flood Hazard Zones in this route segment.

Within the route segment there is an 80 acre area adjacent to Boyd Lake which Dr. Partch identified for The Nature Conservancy as an upland oak savanna/prairie. This site was ranked by Dr. Partch as a top priority site for preservation. The Minnesota Department of Natural Resources further reports that prarie remnants in this part of the state are scarce and of unique value. The proposed reference centerline is approximately 1/4 mile west of the prairie and should not directly affect the oak savanna/prairie area.

No other recreational facilities, archaeological sites, scientific areas or unique wildlife habitats are known to exist in this route segment.

5.6.3 Route Segment 19-20

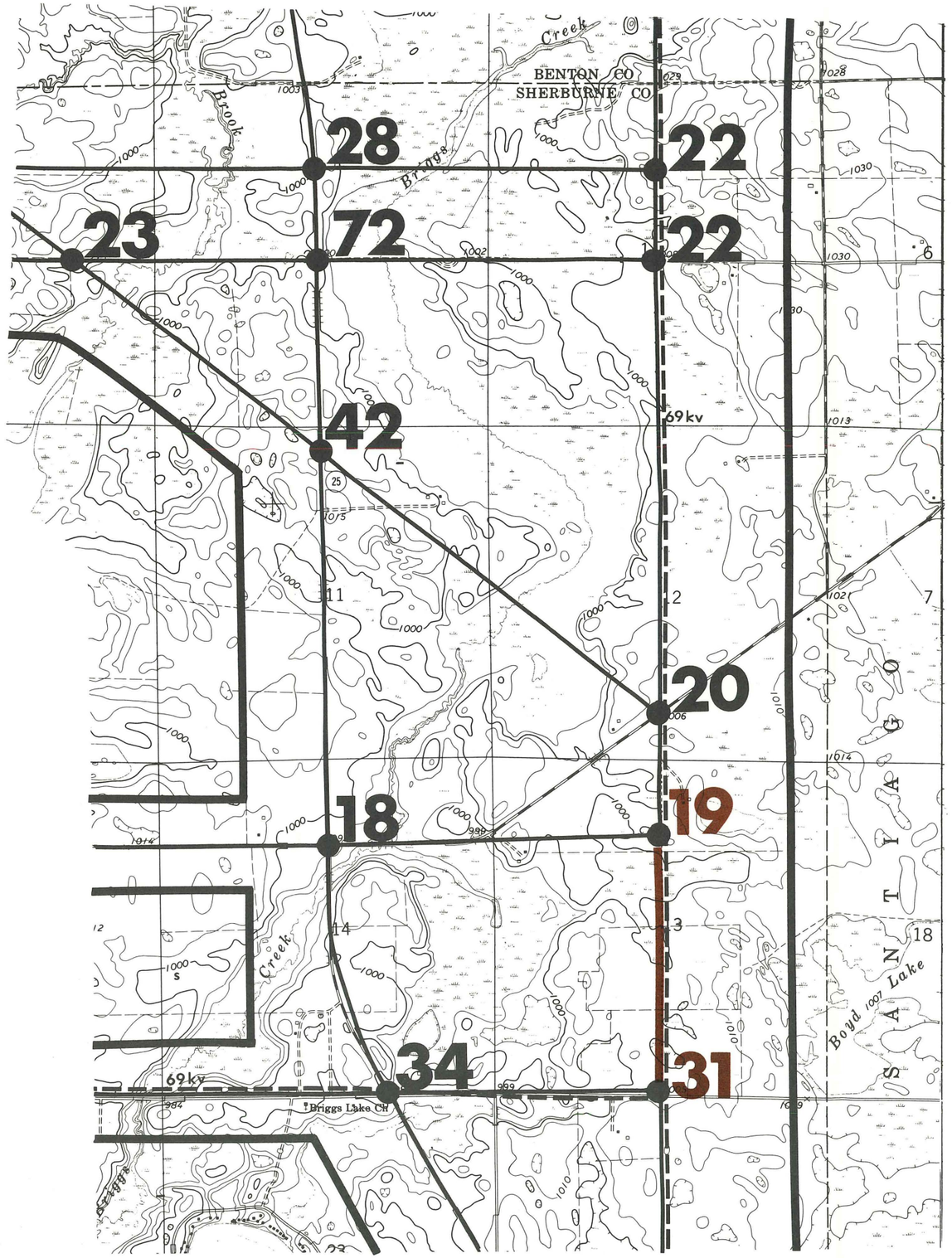
Route segment 19-20 is a short .3 mile segment which extends north from the Cable-Boyd Lake 69 kV line to County Highway 3. The reference centerline crosses two property units and borders one cultivated field.

The soils within this segment are Zimmerman sandy loams. No areas classified as prime farmland are crossed by this route segment, however, .2 mile of soils with high irrigation potential are crossed. There are no irrigation systems in this route segment.

Two residential structures are located within 500 feet of the reference centerline. One dwelling is a single family detached house and one unit is a house trailer. No roadways will be crossed by this segment.

The centerline of this route segment will cross approximately .2 mile of woodlots. A total of 80 to 150 feet wide area may have to be cleared through the wooded area to accomodate the transmission line right of way. There are no concentrations of steep slopes in this route segment.

No streams or other water bodies will be crossed by the reference centerline and no FIA Flood Hazard Zones will be encountered. No known recreational, scientific areas, archaeological sites or unique wildlife habitats are known to exist in this route segment.



kilometer .5

0 mile .5

north

route boundary

reference centerline

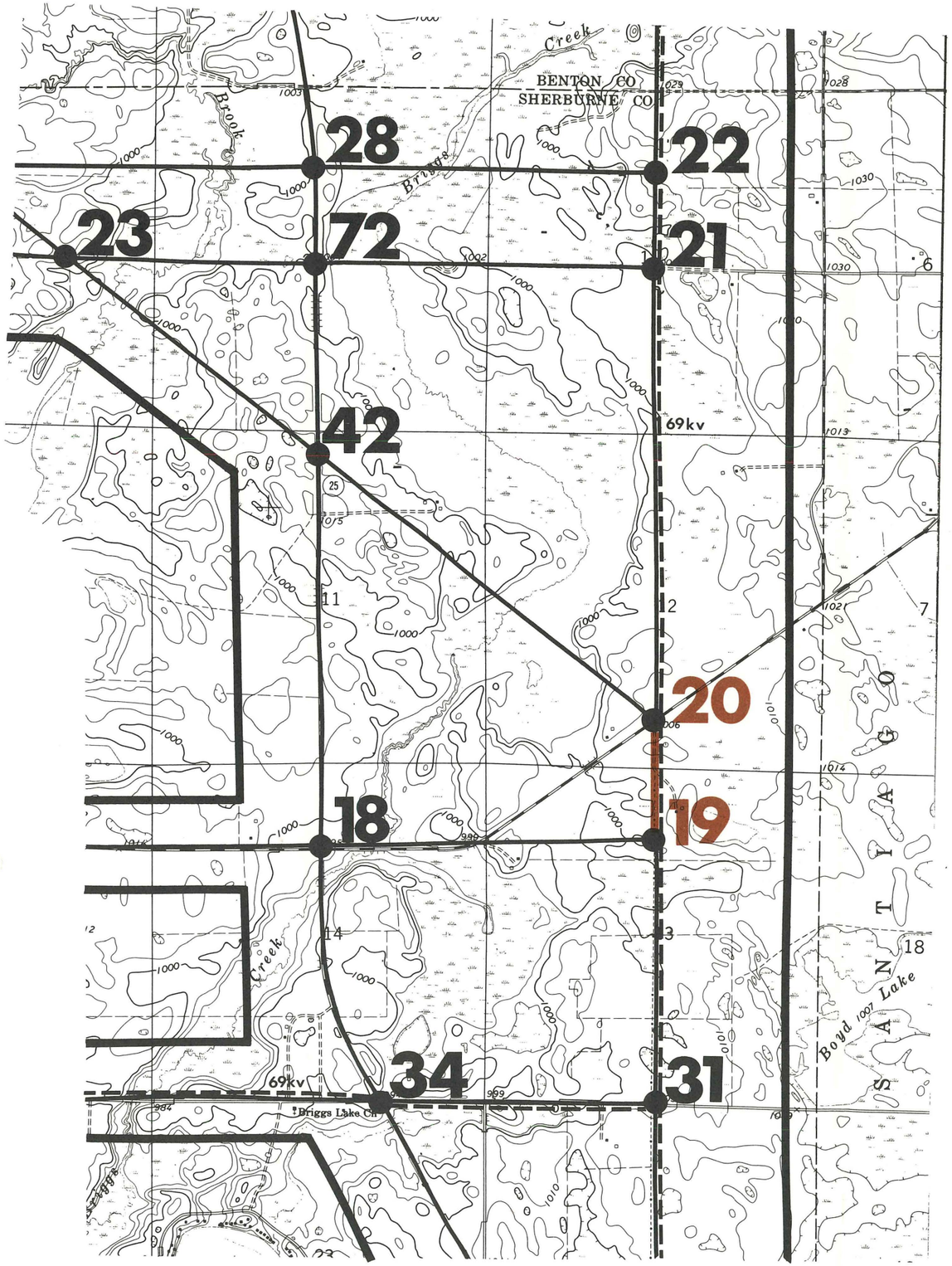
node

existing line

segment centerline

proposed route segment

31–19



kilometer .5

0 mile .5

north

route boundary

reference centerline

node

existing line

segment centerline

proposed route segment

19–20

5.6.4 Route Segment 20-42

Route segment 20-42 is a segment 1.3 miles in length which crosses five property units. This segment diagonally crosses 1 cultivated field and .2 mile of pasture land. Much of the land crossed is wooded floodplain. There is no existing right of way for this route segment to parallel, therefore, a minimum of 24 acres of new right of way would have to be acquired. The soils along this route segment are primarily Hubbard and Zimmerman sandy loams. Some peat and alluvial deposits are also found along the boundaries of Briggs Creek. No soils in this route segment are classified as prime farmland, however, 1.1 miles of the route will cross soils with high irrigation potential. Presently there are no irrigation systems located within the route segment.

Three areas are being developed in the route segment for residential uses. The area located north of node 42 is being sold and developed as 10 acre estates. Another area is Creekwood Estates, which is a recorded subdivision with 14 lots. Only two homes have been constructed in this subdivision thus far. The remaining residential development is located at the corner of Highway 25 and County Road 3. This area is in the preliminary plat stage and has not been formally subdivided. The reference centerline for the 345 kV transmission line will not directly affect these existing or proposed residential development areas. Within the route segment, only 1 existing residential structure is within 500 feet of the centerline. One other residential unit is between 500 and 1,000 feet from the centerline. This route segment will cross one paved roadway which is identified in the Sherburne County Land Use Plan as a scenic roadway.

The vegetation crossed by this route segment consists primarily of hardwood floodplain woodlots and wetlands. A total of approximately .5 mile of woodlot would be diagonally crossed. Much of this wooded area is along the banks of Briggs Creek. A minimum of a 150 foot wide path would have to be cleared through this woodlot to accomodate the transmission line. In addition, .1 mile of wetland area associated with Briggs Creek would also be crossed. The crossing of these wooded areas and wetlands will require careful structure placement, selective tree cutting, and erosion and sediment controls to insure that the crossing will not affect the temperature or water quality of the aquatic environment of the creek. This is important because the Minnesota Outdoor Atlas and the Sherburne County Land Use Plan identify Briggs Creek as a trout stream.

The route segment reference centerline will cross Briggs Creek. Because Briggs Creek is a trout stream, this creek crossing should be excersized with extreme care. No FIA Flood Hazard Zones have been identified in this segment.

Aside from the recreational use of Briggs Creek for trout fishing, no other recreational facilities, archaeological sites, scientific areas or unique wildlife habitats are known to exist in this route segment.

5.6.5 Route Segment 42-23

Route Segment 42-23 is a relatively short .9 mile segment that extends diagonally from Highway 25 to the 1/2 section line of Section 3 Palmer Township. This route segment crosses 3 property units and .1 mile of pasture land. The remaining land crossed by the reference centerline consists of woodlots and Stony Brook floodplain. No cultivated agricultural fields are bordered or crossed by this route segment. There is no existing right of way that this route segment can follow, therefore, a minimum of 16 acres of new right of way would have to be acquired.

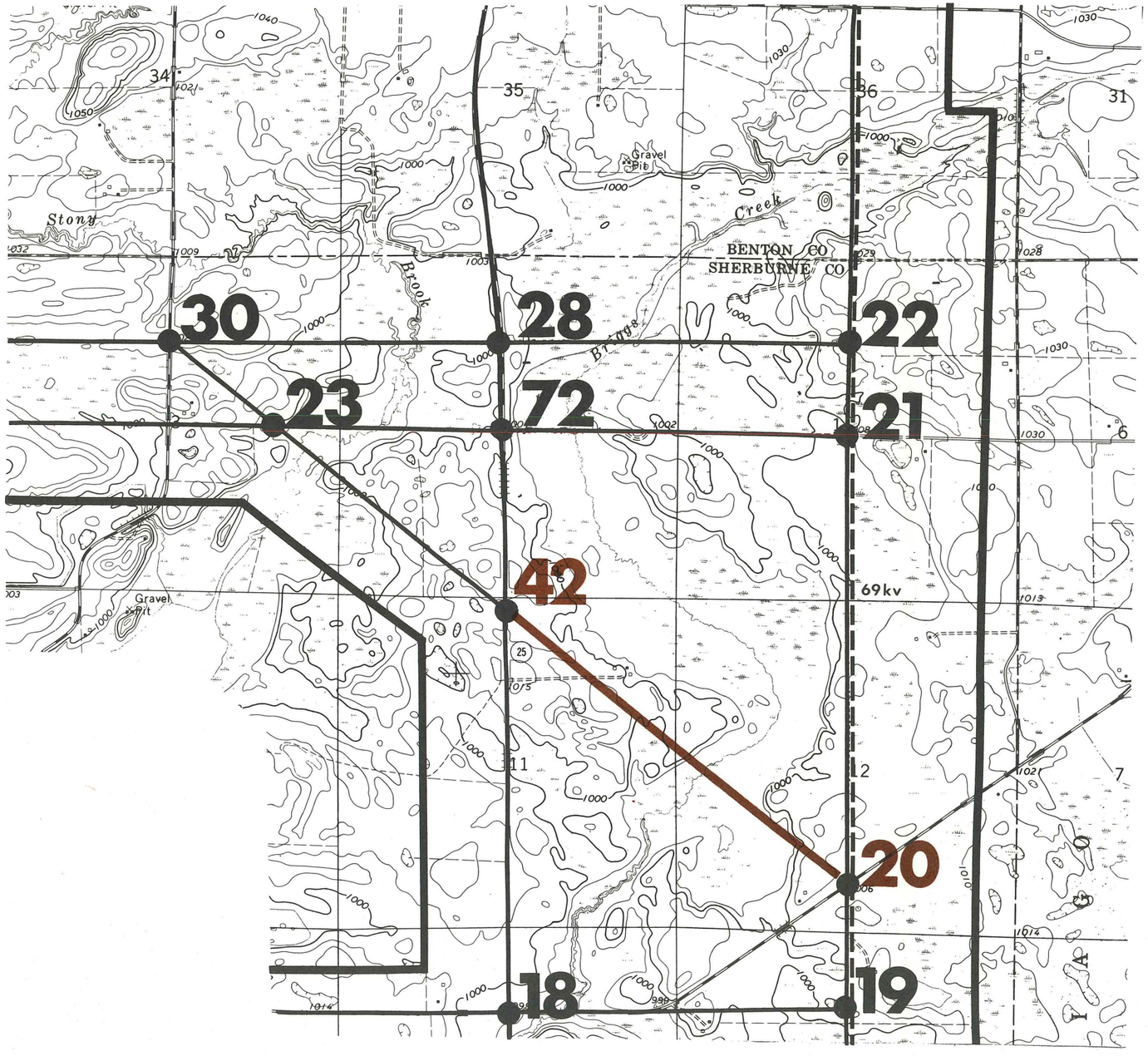
The soil type found in this route segment is Hubbard sandy loams. There are no areas crossed by the reference centerline that have been classified as prime farmland, however, .8 mile of the centerline will cross soils with high irrigation potential. Presently there are no irrigation systems in the route segment.

There are no homes or structures within 1,000 feet of the reference centerline. One paved roadway, Highway 25, will be crossed. This road crossing will require a utility crossing permit from the Minnesota Department of Transportation.

The wooded areas crossed by route segment 42-23 consists of upland hardwoods. A 150 foot wide area would have to be cleared along the path of the centerline to accomodate the transmission line. In addition to the 0.6 mile of woodlots crossed, the route segment will cross approximately 0.2 mile of wetland.

The route segment will necessitate a crossing of Stony Brook and its floodplain area. The FIA has identified .4 mile of this floodplain as a Flood Hazard Zone. Construction, filling and flood proofing should, at a minimum, satisfy the rules and regulations established by the FIA.

There are no known recreational facilities, archaeological sites, scientific areas or unique wildlife habitats in this route segment.



kilometer .5

0 mile .5

north

route boundary

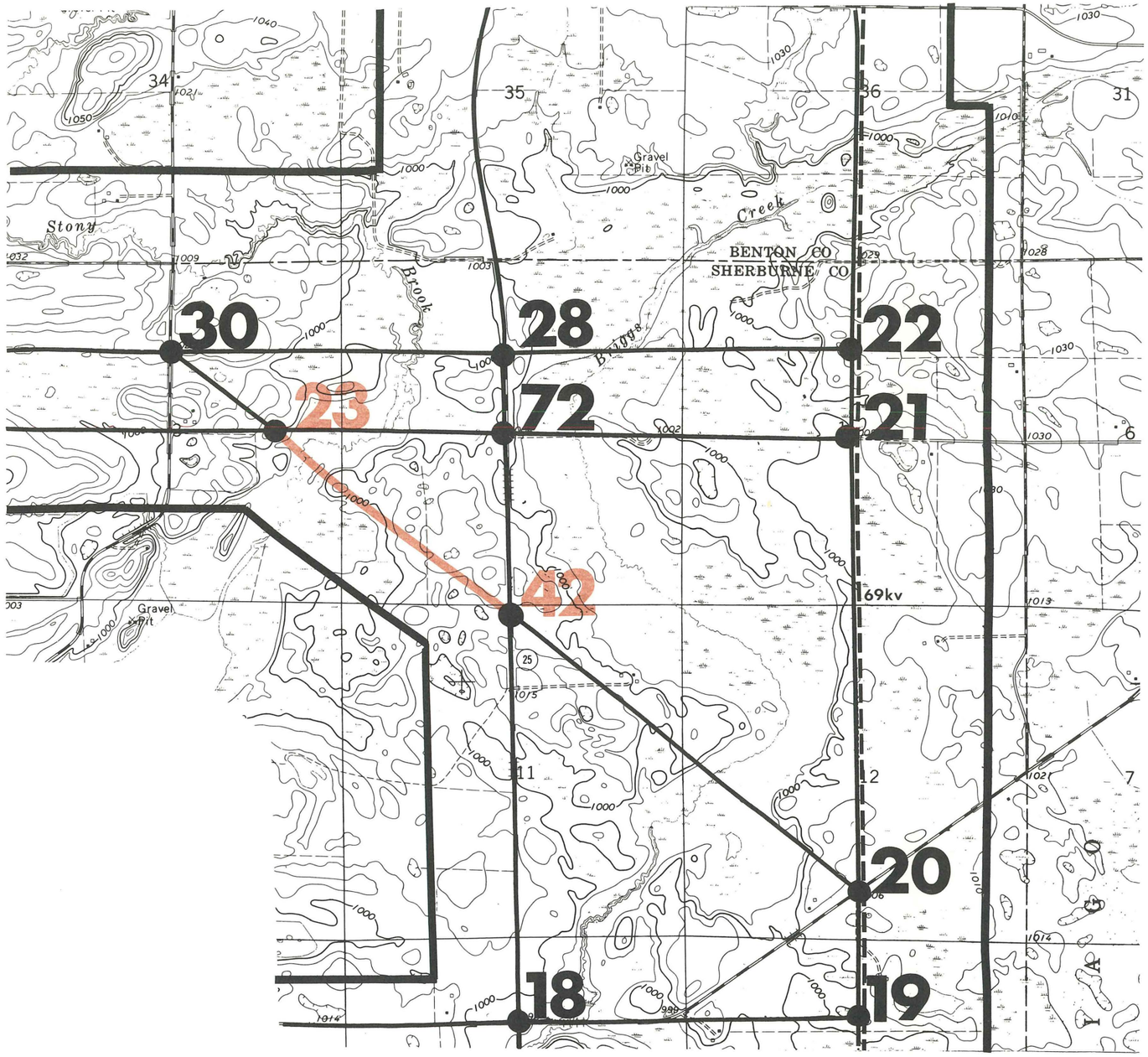
reference centerline

node

existing line

segment centerline

proposed route segment 20–42



kilometer .5

0 mile .5

north

route boundary

reference centerline

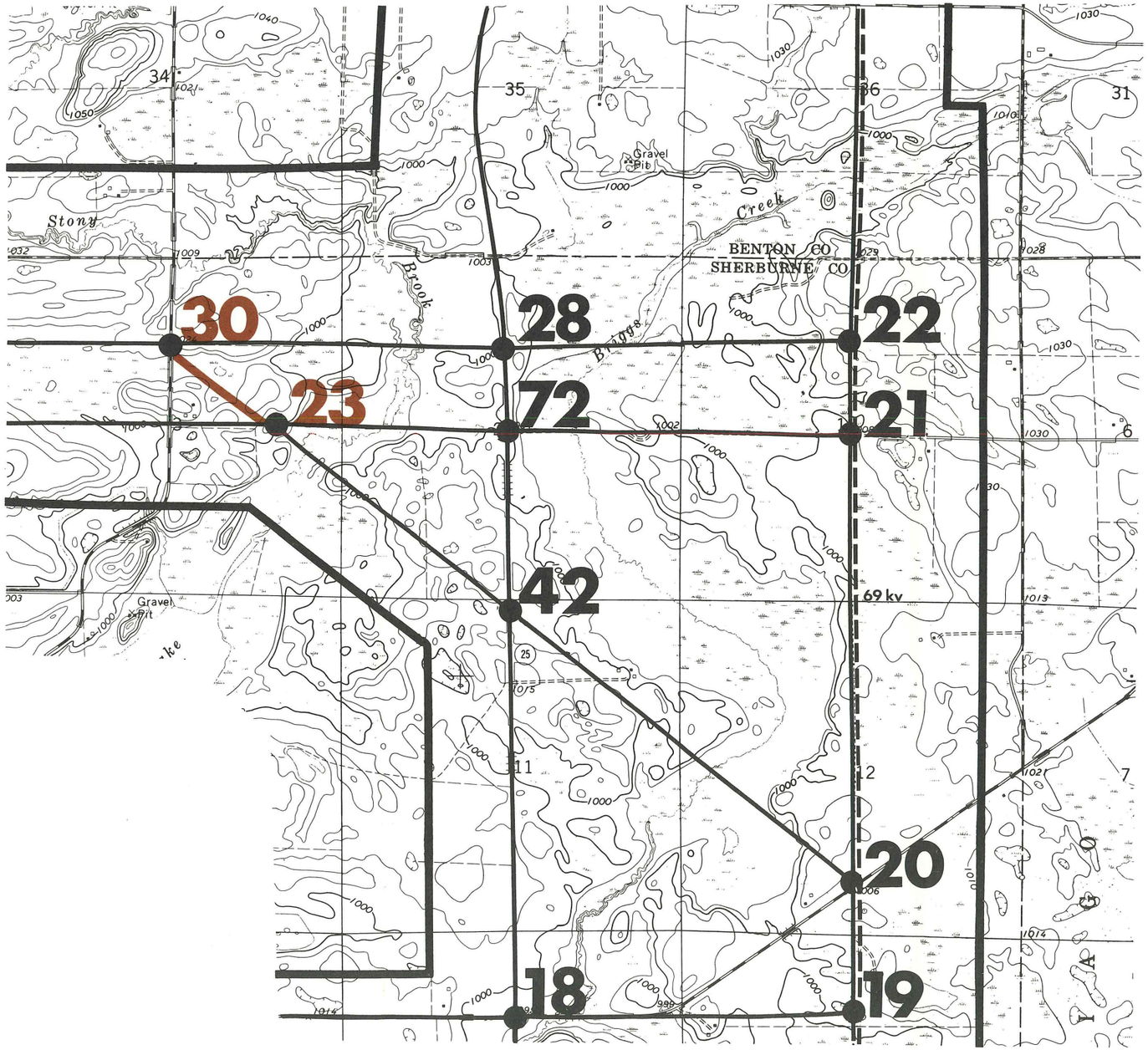
node

existing line

segment centerline

proposed route segment

42–23



kilometer .5

0 mile .5

north

route boundary

reference centerline

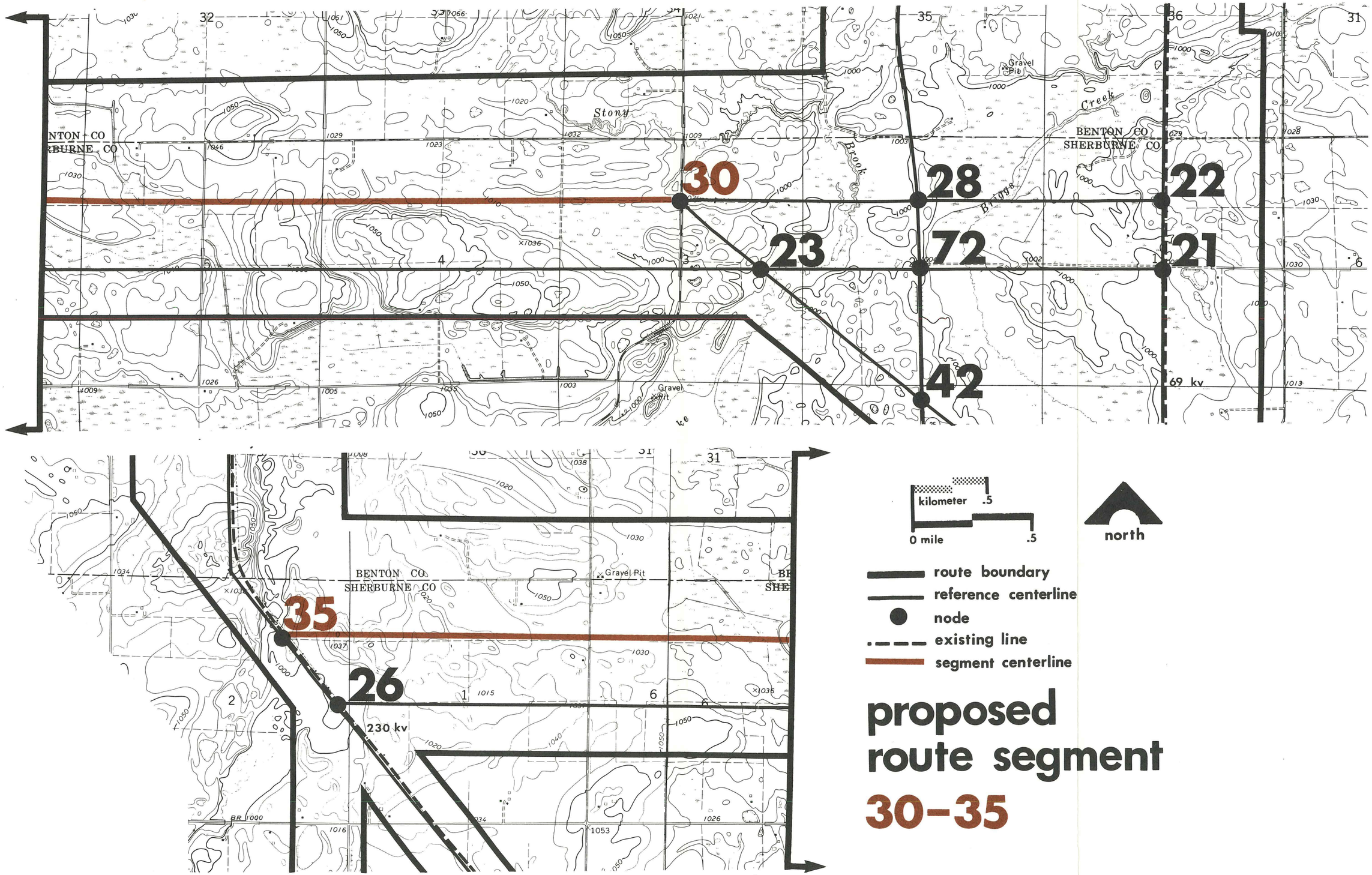
node

existing line

segment centerline

proposed route segment

23–30



proposed route segment 30-35

5.6.6 Route Segment 23-30

Route segment 23-30 is a short .4 mile segment that extends diagonally from the 1/2 section line of Section 3 Palmer Township to the 1/4 section line of Section 3 Plamer Township. The route segment diagonally crosses 1 cultivated field. No existing right of way exists along this route segment so a total of 7 acres of new right of way would have to be acquired.

The soils encountered in this route segment are primarily Zimmerman sands. This route segment does not have prime farmland status, however, the entire route segment length has soils with high irrigation potential. Presently there are no irrigation systems in use in this route segment.

A new single family home is located at node 30 and if the reference centerline is followed, the home would be within the transmission line right of way. As such, the structure would have to be removed or relcoated. One other residential structure is located within 500 and 1,000 feet of the reference centerline. One paved road, County Road 6, would also be crossed.

The route segment does not cross any wooded areas or wetlands. A conifer plantation would be bordered by the reference centerline but should not require any clearing of evergreens.

This route segment does not cross any streams, waterbodies or wetlands. There are no FIA Flood Hazard Zones in the route segment.

There are no known recreational facilities, archaeological sites, scientific areas or wildlife habitats in the route segment.

5.6.7 Route Segment 30-35

Route segment 30-35 is 4.5 miles in length. It extends west from County Road 6 along the 1/4 section line until it intersects the Monticello-Benton County 230 kV transmission line. This route segment crosses 4 property units and parallels property boundary lines for a distance of 3.3 miles. The land crossed by this segment consists of cultivated fields, pasture land, woodlots, and wetlands. Four cultivated fields would be crossed by the reference centerline for a total distance of .5 mile. An additional 2.3 miles of agricultural fields would be bordered. This route segment would necessitate the development of a new right of way. As such approximately 82 acres of land would have to be obtained to accomodate the transmission line in this route segment.

Table 5.5

IMPACT SUMMARY ROUTE C

VARIABLES	ROUTE SEGMENTS								
	1-5	5-6	6- 2	32-36	36-37	37-26	26-35	35-40	Total
segment length	2.0	0.2	1.4	4.1	6.0	1.9	0.3	1.3	17.2
length parallel to HVTL ROW	0	0	0	0	0	1.9	0.3	1.3	3.5
diagonal length	0	0	0	0	0	1.9	0.2	0	2.1
#property lines crossed	1	2	4	21	12	8	1	3	52
miles of property lines bordered	0	0.2	1.3	5.7	3.6	0	0	0	10.8
#of fields crossed	0	0	0	0	0	0	0	1	5
miles of fields crossed	0	0	0	0	0	0	0	0.1	1.1
miles of fields bordered	1.6	0.1	1.3	2.5	4.0	0	0	0.6	10.1
pastures crossed	0	0.1	0	0	0.3	0	0	0.1	0.5
prime farmland crossed	0	0	0	0	0	0	0.2	0.7	0.9
high irrigation potential	1.3	0.2	1.4	3.1	3.6	1.1	0	0	10.7
# of center pivots crossed	0	0	0	0	0	0	0	0	0
# of center pivots bordered	0	0	0	3	2	0	0	0	5
# of row irrigation crossed	0	0	1	0	0	1	1	0	2
# of row irrigation bordered	0	0	0	3	2	0	0	0	5
homes 500' of ROW	0	0	3	40	15	0	0	1	59
homes 500-1000' of ROW	2	1	0	13	2	4	0	2	24
business 1000' of ROW	0	0	1	5	0	0	0	0	6
church/cemetary 1000' of ROW	0	0	0	3	0	0	0	0	3
#platted areas crossed	0	0	0	1	0	0	0	0	1
# platted areas bordered	0	0	0	0	0	0	0	1	1
#paved roads crossed	2	1	1	2	2	0	0	0	8
# unpaved roads crossed	0	0	0	2	4	1	0	0	7
#scenic roads crossed	0	0	0	0	0	0	0	0	0
scenic road bordered	0	0	0	0	0	0	0	0	0
airport within 1 mile	0	0	0	2	0	0	1	0	3

IMPACT SUMMARY ROUTE C

VARIABLES	ROUTE SEGMENTS								
	1-5	5-6	6-32	32-36	36-37	37-26	26-35	35-40	Total
hwy. ROW bordered	0	0	0	1.1	6.0	0	0	0	7.1
# of windrows crossed	0	0	3	4	1	0	0	1	9
# of windrows bordered	0.4	0	0	0.4	0.2	0	0	0	1.0
wood lot crossed	0.1	0	0	0.7	0.1	1.0	0	0.3	2.2
wetland crossed	0	0	0	0.2	0.7	0.3	0.2	0	1.4
tree farms crossed or bordered	0	0	0	0	0	0	0	0	0
steep slopes 6%	0	0	0	0	0	0	0	0.3	0.3
# of lakes within 1000' of centerline	0	0	0	6	0	0	0	0	6
stream crossings	0	0	0	0	2	0	0	1	3
trout streams	0	0	0	0	0	0	0	0	0
Flood Hazard Zones	0	0	0	0	0.2	0	0.2	0.2	0.6
public rec. crossed	0	0	0	0	0	0	0	0	0
public rec. 1000' of ROW	1	0	0	0	0	0	0	0	1
pvt. rec. crossed	0	0	0	0	0	0	0	0	0
pvt. rec. 1000' of ROW	0	0	0	1	0	0	0	0	1
archaeological sites	0	0	0	0	0	0	0	0	0
wildlife refuges crossed	0	0	0	0	0	0	0	0	0
scientific/wildlife/vegetation of importance crossed	0	0	0	0	0	0	0	0	0
scientific/wildlife/vegetation of importance 1000' of centerline	0	0	0	1	0	0	0	0	0

Soils in this route segment are varied, as the segment crosses a glacial, end-moraine. Principal soils found in the segment include: Hubbard, Lino, and Isanti soils. The Soil Conservation Service has classified .2 mile of the route segment as prime farmland. An additional 2.3 miles of the route segment crosses soils with high irrigation potential. Presently no irrigation systems exist in this route segment, however, several property owners in the route segment have indicated that they have plans for installing irrigation equipment.

Two homesites are within 500 feet of the 1/4 section line and 4 additional residential structures are located within 500 and 1,000 feet of the reference centerline. Two unpaved roadways would be crossed by this route segment.

Vegetation in this route segment is dispersed throughout the segment's length. A total of 1.2 miles of woodlots, .7 mile of wetland and several grassland areas would be crossed. In addition, one 0.1 mile long windrow would have to be removed. One area of vegetative cover is of particular importance because it covers a site with steep slopes. Approximately .7 mile of slope greater than 6% grade would be crossed. To minimize severe erosion problems, minimum vegetation removal, and immediate slope stabilization in these areas should be considered.

The route segment will cross two unnamed drainage ditches. These ditches have been channelized and altered to promote field drainage. No FIA Flood Hazard Zones are located in this route segment.

No recreational facilities, archaeological sites, scientific areas or wildlife habitats are known to exist in this route segment.

5.6.8 Route Summary

Table 5.4 summarizes the impacts identified within Route B. All lengths are measured in miles. The land area (acres) of farmland, woodlots, wetlands, etc. impacted by the route will vary depending upon the structure type used and on whether existing transmission lines are double circuited. (See Table 3.3 for right of way requirements.)

5.7 ROUTE C

Route C (Nodes: 1-5-6-32-36-37-26-35-40) was initially proposed by the Minnesota Environmental Quality Board's Power Plant Siting staff. Minnesota State Highway 10 and the Burlington Northern Railroad present an existing right of way corridor. As such, Power Plant Siting staff recommended that the use of this corridor for a high voltage transmission line should be examined. The route, would parallel Minnesota State Highway 10 from the Sherco generating plant to County Road 20. At County Road 20 the route would proceed north, paralleling the roadway until it intersects the Monticello-Benton County 230 kV transmission line. The route then parallels the 230 kV line north to the Benton County substation.

An advantage of Route C is that it parallels existing rights of way for a major portion of the route's length. Disadvantages of the route include potential safety hazards associated with the Clear Lake Airport, and land use problems associated with placing a right of way through the City of Clear Lake. The Minnesota Department of Transportation notes that the right of way on the south side of Highway 10 abuts the railroad and the narrowness of the space between the highway and the railroad could not accomodate additional utility placement. The north side of the highway contains existing local electric distribution lines, buried telephone cables, and water distribution facilities. For purposes of this environmental analysis, it is assumed that the reference centerline will parallel the southern border of the Burlington Northern Railroad right of way.

The following segment analysis identifies the environmental impacts most likely to be encountered. Route segments: 1-5; 37-26; 26-35; and 35-40 are segments common with Route A. These segments are discussed in detail in sections 5.5.1; 5.5.8, 5.5.9 and 5.5.10 respectfully.

5.7.1 Route Segment 5-6

Route segment 5-6 is a short .2 mile segment that parallels Highway 10. The route segment will border .1 mile of cultivated field and .1 mile of pasture land.

The soils in the route segment are all Hubbard sands. These soils are not classified by the Soil Conservation Service as prime farmland. The entire route length of the segment does, however, cross soils with high irrigation potential. Presently no irrigation systems exist within this route segment.

One home is located within 500 and 1,000 feet of the reference right of way. The route segment crosses one paved roadway, County Road 52.

No woodlots, wetlands or windrows will be affected by this route segment. In addition, no streams or water bodies will be crossed by the route segment.

No known recreational facilities, archaeological sites, scientific areas or unique wildlife areas exist within this route segment.

5.7.2 Route Segment 6-32

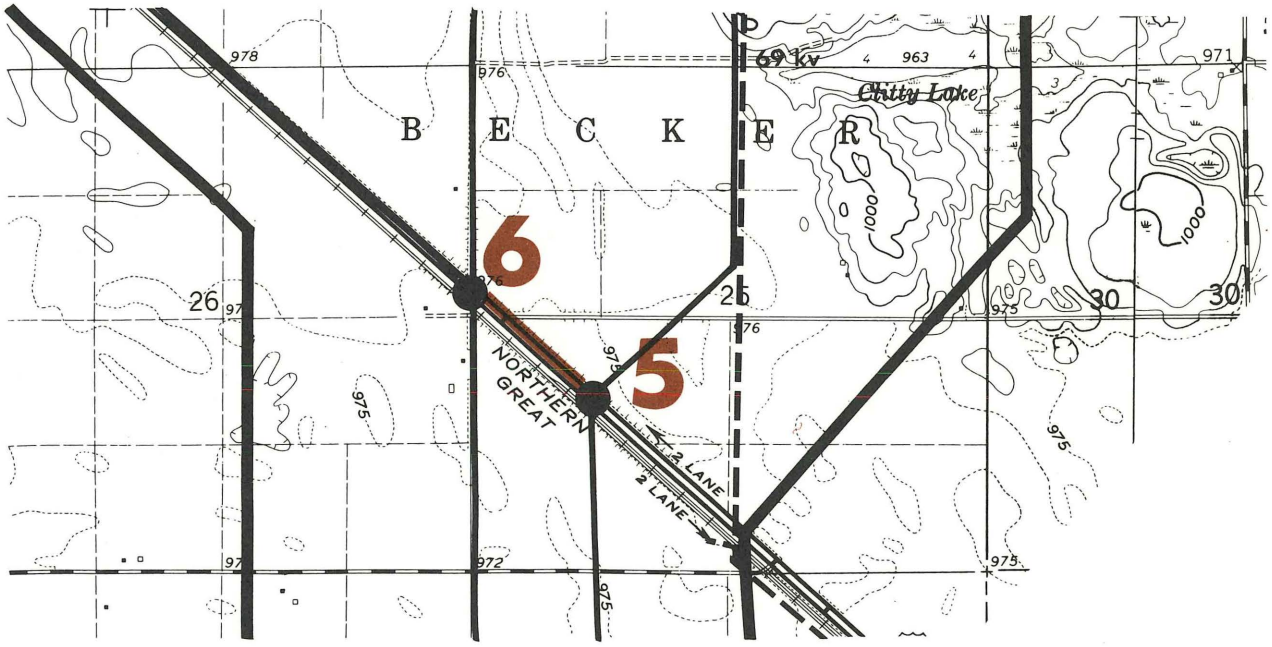
Route segment 6-32 is 1.4 miles in length. The reference centerline parallels the Burlington Northern Railroad and extends from County Road 52 to County Road 53. The land crossed by the transmission line is predominately cultivated agricultural fields. Of the 1.4 mile length of this route segment, 1.3 miles will border cultivated fields.

The soils throughout this route segment are Hubbard sands. No areas classified as prime farmland are present in this route segment, however, the entire 1.4 miles length of the segment crosses areas of high irrigation potential. Presently there is a row irrigated field which is crossed by the reference centerline.

In this route segment, 3 homes are located within 500 feet of the centerline. In addition, a major potato farm storage area consisting of 5 metal buildings would be located in the transmission line right of way. Efficient operation of this potato processing facility is dependent upon its rail access and the proper placement of the buildings. If the transmission line were constructed along the reference centerline, new rail access facilities would have to be constructed. In addition, changes in the operating proceedures of the potato storage facilities and changes in the location of processing equipment in auxiliary buildings not on the proposed right of way might be required. A cement factory, Sherburne Concrete Company, is located on the north side of Highway 10. If the reference centerline remains along the south side of Highway 10, the cement plant should not be affected.

Aside from three windrows that would be crossed by this route segment, no other areas of vegetation would be affected.

This route segment does not cross any water bodies or FIA Flood Hazard Zones.



kilometer .5

0 mile .5

north

route boundary

reference centerline

node

existing line

segment centerline

proposed route segment 5-6

No known recreational facilities, archaeological sites, scientific areas or unique wildlife areas exist in this route segment.

5.7.3 Route Segment 32-36

Route 32-36 has a total length of approximately 4.1 miles. The route segment centerline will parallel the Burlington Northern Railroad right of way from County Road 53, through the City of Clear Lake, to County Road 20. The proposed route would cross 21 property units. Approximately half of these property units are located in the City of Clear Lake. The area crossed by the route segment include rural agricultural fields, residential, commercial and industrial developments. The railroad right of way width through downtown Clear Lake is approximately 150 feet. Homes, warehouses, grain storage elevators and fuel oil storage facilities abut the railroad right of way. A total of 2.5 miles of cultivated agricultural fields will be bordered by the reference centerline.

The soils in the route segment are Hubbard sandy loams. Small pockets of organic peats are located around the drainage ways and lakes. No areas in the route segment have been classified as prime farmland, however 3.1 miles of the route segment will cross areas with high irrigation potential. Presently, several center pivot and row irrigation systems exist in the route segment. The reference centerline will border 3 row irrigated fields and 3 center pivot irrigated fields. Total length of irrigated fields bordered would be approximately 1.9 miles.

A number of homes, businesses and industrial operations would be crossed or located within 1,000 feet of the reference centerline. Approximately 40 residential homes would be within 500 feet of the centerline. In addition a liquid fuel storage facility, a grain elevator, several warehouses and 5 potato farm buildings would be within 500 feet. Thirteen additional homes, two cemetaries, one church, and several small commercial establishments are located between 500 and 1,000 feet of the reference centerline.

This route segment would cross two gravel roads and two State Highways (Minnesota 25 and 10). Both state road crossings would require a utility crossing permit from the Minnesota Department of Transportation.

One privately owned airport and one private landing strip would be affected by this route segment. Leaders Clear Lake Airport is a privately owned landing field located north of Highway 10 and west of County Road 55. The airport consists of a 3000 foot grass runway. The runway is oriented north-south and is located approxi-

mately 760 feet north of the northbound lane of Highway 10. Based upon an approach glide slope of 20:1, the transmission line would pose a serious safety hazard to aircraft. (See Section 4.11 for detailed discussion of airport impacts). The Minnesota Department of Transportaiton suggests that the placement of a transmission line parallel to Highway 10 could seriously jeopardize the licensing status of the Clear Lake Airport.

One private 1,6700 x 40 foot landing strip is located south of Highway 10 and west of County Road 53. The runway is located within 1,000 feet from Highway 10. The construction of a transmission line parallel to Highway 10 would prevent licensing of this private air strip.

One additional transportation related impact is associated with this route segment. The Burlington Northern Railroad would be paralleled for a distance of 4.1 miles. This rail line is actively used for long distance freight traffic. In addition, the rail line is used by AMTRAC for passenger rail service.

Route 32-36 will cross .7 mile of wooded area around Mosford Lake, and parallel about .4 mile of windrows. Placement of the transmission line along the reference centerline would necessitate a 150 foot wide clearing the woods and the removal of the windrow. In addition 4 additional windrows would be diagonally crossed. Only small portions of these windrows would have to be removed. Approximately .2 mile of wetland areas would be crossed by this route segment. Prairie remnants are often found along railroad rights of way. The Minnesota Department of Natural Resources has indicated that prairie remnents in this part of Minnesota are rare. If this route is seleted, care should be taken to avoid any isolated patches of prairie vegetation.

The route segment contains five lakes. If the transmission line parallels and abuts the Burlington Northern Railroad, the reference centerline will not cross any of these water bodies.

North of Highway 10 there is a privately owned camp ground (Lil' Acorn Deer Park). This camp ground, however, is not crossed by the reference centerline. The Minnesota Department of Natural Resources indicates that the series of lakes located in this route segment are used extensively by migratory waterfowl. During the fall of 1976 it was estimated that 4,000 to 5,000 waterfowl populated these lakes. Because these are migratory "rest-stops" there is a concern over waterfowl collisions with the line. No other recreational facilities, archaeological sites, scientific areas or unique wildlife habitats are known to exist in this route segment.

kilometer .5

0 mile .5

north

route boundary

reference centerline

node

existing line

segment centerline

proposed route segment 32-36

36

32

Clear Lake

Clear Lake

St Marcus Cem

Cem

Clearview Sch

Camp Lake

Prairie Lake

Mosford Lake

Lake

Crescent

NORTHERN GREAT

PACIFIC NORTHERN

12

13

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17

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22

23

7

18

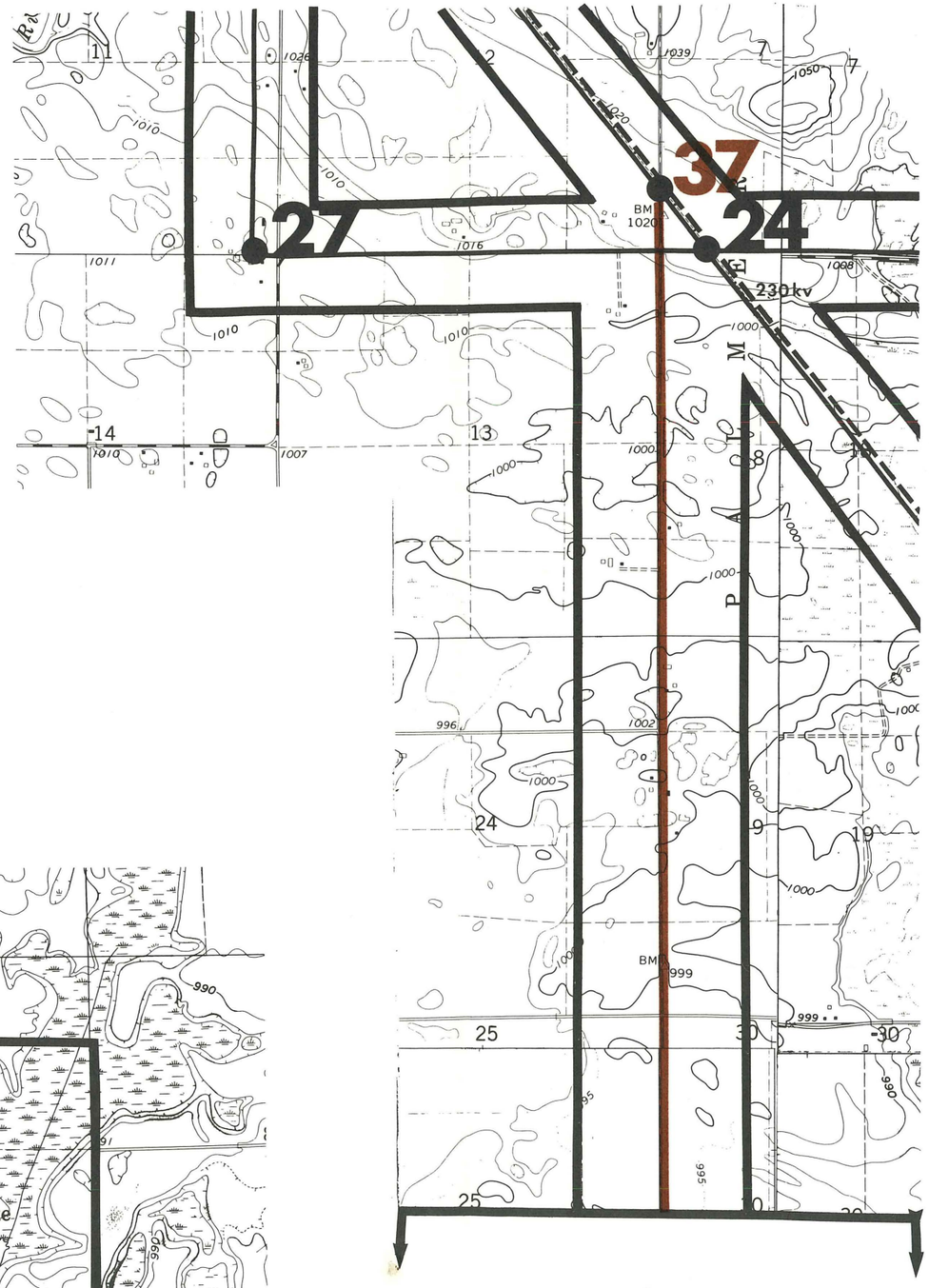
Well

BM 991

10

52

24



kilometer .5

0 mile .5

north

- route boundary
- reference centerline
- node
- existing line
- segment centerline

proposed route segment 36-37

5.7.4 Route Segment 36-37

Route segment 36-37 has a total length of 6.6 miles. The reference centerline would parallel the west side of County Road 20 and extend north from Highway 10 until it intersects with the Monticello-Benton County 230 kV transmisison line. The area crossed by the reference centerline consists primarily of cultivated fields and pasture lands. The route segment would cross 12 property lines, border .4 mile of cultivated fields and .3 mile of pasture lands.

The soils within the route segment are a mixture of Salida, Hubbard and Esterville sands. In addition, small pockets of peat, Isanti and Lino soils are distributed throughout the route. No areas within the route segment are classified as prime farmland, however, 3.6 miles of the route segment will cross land with high irrigation potential. Presently, several center pivot and row irrigation systems are in use within the route segment. Most of the irrigated fields are located in the southern portion of the route segment. A total of two, row irrigation and two, center pivot irrigation systems would be bordered by the reference centerline.

There are 15 homes located within 500 feet of the reference centerline. Depending upon final alignment of the right of way, several of these homes may have to be removed. Two additional homes are located within 500 and 1,000 feet of the reference centerline. Four unpaved and two paved roads would be crossed by the route segment. One of the paved roads, County Road 16, has been identified in the Sherburne County Land Use Plan as a scenic roadway.

Route Segment 36-37 will cross the Elk River and one unnamed drainage ditch. The .2 mile wide flood plain area associated with the Elk River has been identified by the FIA as a Flood Hazard Zone. Construction, filling and flood proofing activities should, at a minimum, meet FIA requirements.

Natural vegetation crossed by the reference centerline is primarily associated with wetlands. A total of .7 mile of wetland area would be crossed. In addition, two windrows would be crossed.

Aside from the recreational uses of the Elk River, no recreational facilities, archaeological sites, scientific areas or unique wildlife habitats are known to exist within this segment.

Table 5.6

IMPACT SUMMARY ROUTE D

VARIABLES	ROUTE SEGMENTS											
	1-5	5-6	6-11	11-34	34-18	18-42	42-72	72-28	28-29	29-39	39-40	Total
segment length	2.0	0.2	3.9	3.5	0.7	1.2	0.8	0.2	2.3	6.0	1.3	22.1
length parallel to HVTL ROW	0	0	0	0	0	0	0	0	0	0	1.3	1.3
diagonal length	0	0	0	0	0	0	0	0	0	0	0	0
#property lines crossed	1	2	11	5	2	5	1	1	7	25	3	63
miles of property lines bordered	0	0.2	3.4	3.5	0.7	1.2	0.8	0.2	2.3	6.0	0.4	18.7
#of fields crossed	0	0	0	0	0	0	0	0	0	0	0	0
miles of fields crossed	0	0	0	0	0	0	0	0	0	0	0	0
miles of fields bordered	1.6	0.1	2.4	2.0	0.3	0.5	0.5	0.2	1.4	3.6	0.6	13.2
pastures crossed	0	0.1	0	0	0	0	0.1	0	0	0.6	0.1	0.9
prime farmland crossed	0	0	0	0	0	0	0	0	0.1	1.4	0	1.5
high irrigation potential	1.3	0.2	2.5	3.1	0.3	1.0	0.7	0.2	0.8	1.7	0.7	12.5
# of center pivots crossed	0	0	0	0	0	0	0	0	0	0	0	0
# of center pivots bordered	0	0	1	3	0	0	0	0	2	0	0	6
# of row irrigation crossed	0	0	0	0	0	0	0	0	0	0	0	0
# of row irrigation bordered	0	0	1	1	0	0	0	0	0	0	0	2
homes 500' of ROW	0	0	15	11	1	1	0	0	7	41	0	76
homes 500-1000' of ROW	2	1	15	8	2	0	0	0	3	6	0	37
business 1000' of ROW	0	0	0	0	0	1	0	0	0	2	0	3
church/cemetary 1000' of ROW	0	0	0	0	0	0	0	0	0	0	0	0
#platted areas crossed	0	0	0	0	0	0	0	0	0	1	0	1
# platted areas bordered	0	0	1	1	0	1	0	0	0	0	0	3
#paved roads crossed	2	1	0	0	1	0	0	0	2	2	0	8
# unpaved roads crossed	0	0	1	2	0	0	0	0	2	4	0	9
#scenic roads crossed	0	0	0	0	1	0	0	0	0	0	0	1
scenic road bordered	0	0	0	0	0	0	0	0	0	0	0	0
airport within 1 mile	0	0	0	0	0	0	0	0	0	0	0	0

IMPACT SUMMARY ROUTE D

VARIABLES	ROUTE SEGMENTS											
	1-5	5-6	6-11	11-34	34-18	18-42	42-72	72-28	28-29	29-39	39-40	Total
hwy. ROW bordered	0	0.2	3.9	3.5	0.7	1.2	0.8	0.2	2.3	6.0	0	18.8
# of windrows crossed	0	0	0	4	0	0	0	0	0	0	0	4
# of windrows bordered	0.4	0	0.4	1.2	0	0	0.8	0.2	0.8	1.9	0	5.7
wood lot crossed	0.1	0	0.9	0.6	0.1	0.3	0	0	0.2	0	0.4	2.6
wetland crossed	0	0	0.2	0.2	0	0	0	0	0.2	0.5	0	1.1
tree farms crossed or bordered	0	0	0	0	0	0.1	0	0	0	0	0	0.1
steep slopes 6%	0	0	0	0	0	0	0	0	0	0.2	0.3	0.5
# of lakes within 1000' of centerline	0	0	0	1	0	0	0	0	0	1	0	2
stream crossings	0	0	3	1	1	0	0	0	1	3	6	15
trout streams	0	0	0	0	1	0	0	0	0	0	0	1
Flood Hazard Zones	0	0	0.1	0	0	0	0	0	0	0.1	1.3	1.5
public rec. crossed	0	0	0	0	0	0	0	0	0	0	0	0
public rec.1000' of ROW	1	0	0	0	0	0	0	0	0	0	1	2
pvt. rec. crossed	0	0	0	0	0	0	0	0	0	0	0	0
pvt. rec. 1000' of ROW	0	0	1	0	0	0	0	0	0	0	0	1
archaeological sites	0	0	0	0	0	0	0	0	0	0	0	0
wildlife refuges crossed	0	0	0	0	0	0	0	0	0	1	0	1
scientific/wildlife/vegetation of importance crossed	0	0	0	0	0	0	0	0	0	0	0	0
scientific/wildlife/vegetation of importance 1000' of centerline	0	0	0	0	0	0	0	1	0	0	0	1

5.7.5 Route Summary

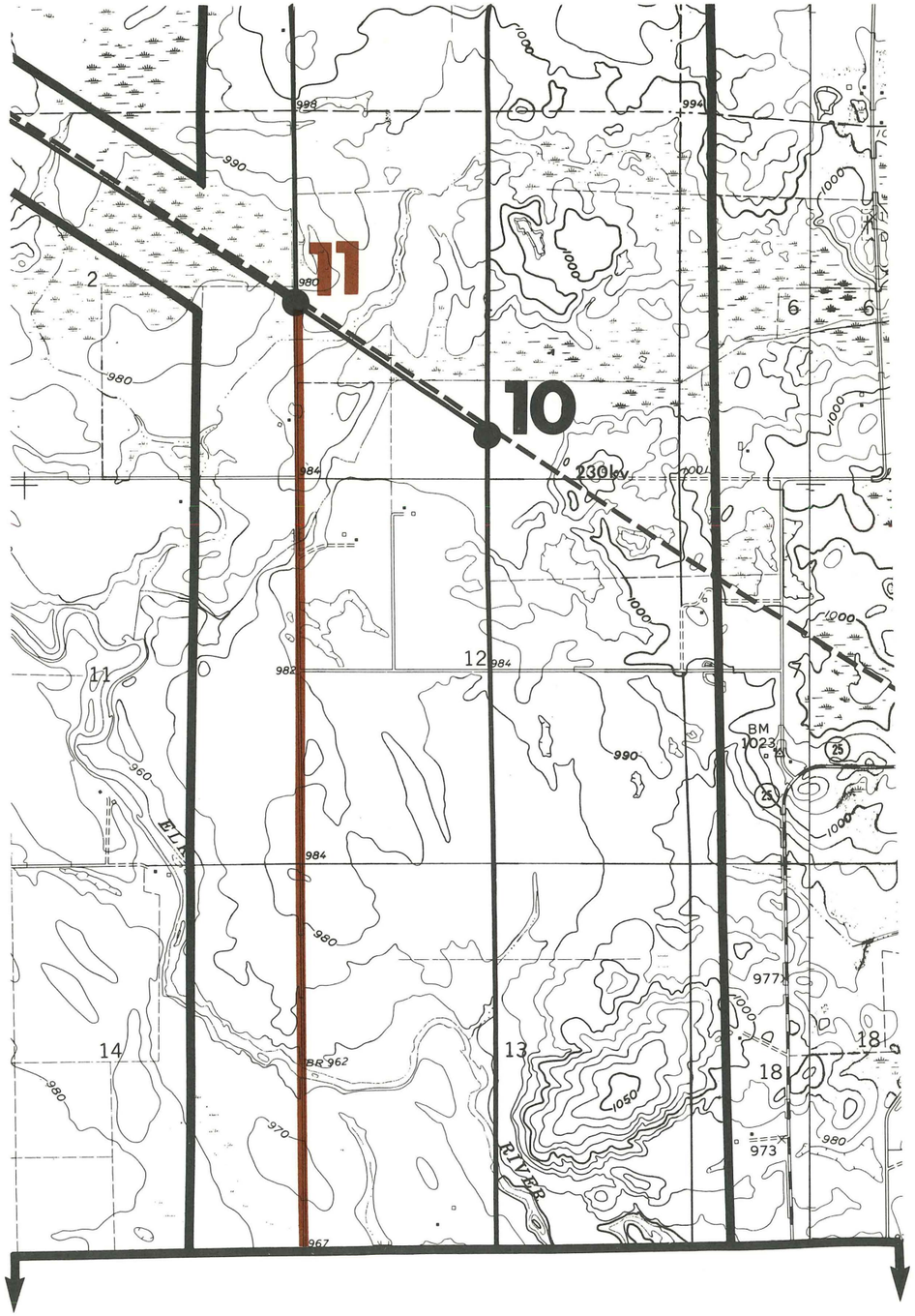
Table 5.5 is a summary of the impacts identified in Route C. All lengths are measured in miles. The land area (acres) of farmland, woodlots, wetlands, etc. impacted by the route will vary depending upon structure type and opportunities for right of way sharing. (See Table 3.3 for right of way requirements.)

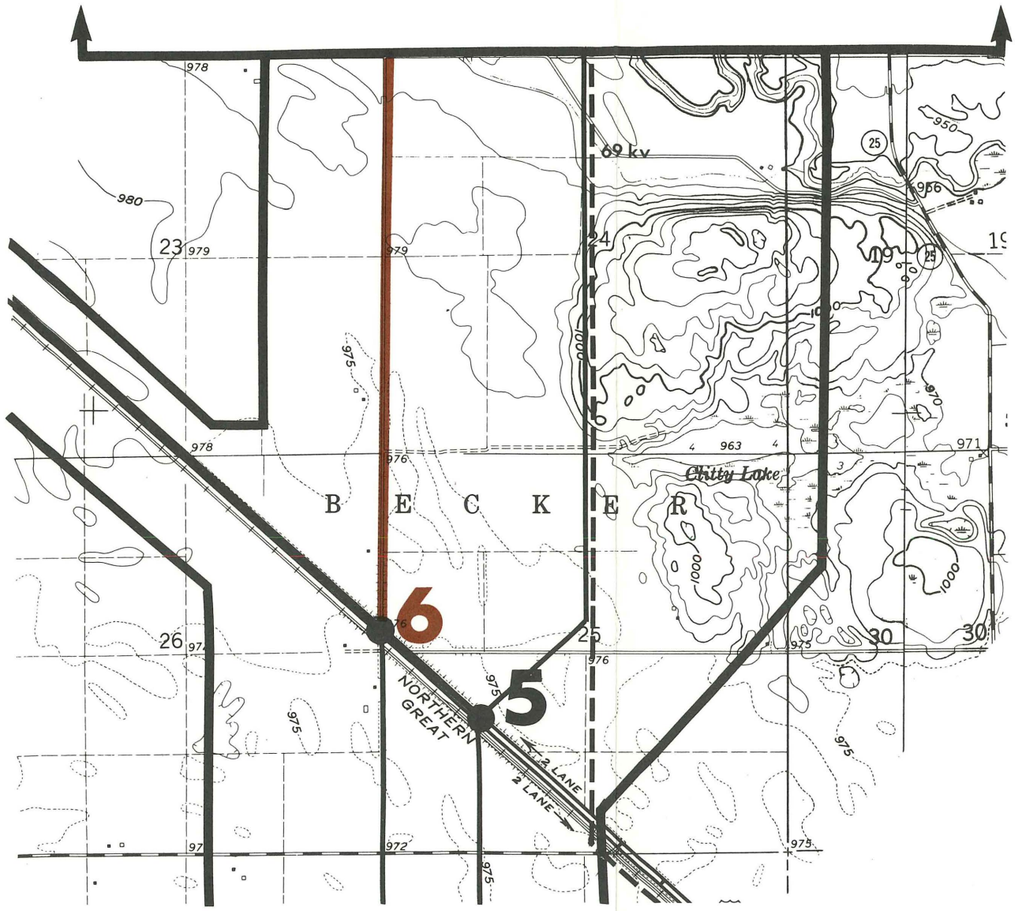
5.8 ROUTE D

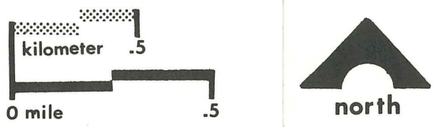
Route D (Nodes: 1-5-6-11-34-18-42-27-28-29-39-40) is one of the routes recommended by the Citizens Route Evaluation Committee. This route was offered as an alternative to using the Becker to Foley 69 kV transmission line right of way. This route also offers a northerly alternative to NSP's original route B proposal. Route D proposes to parallel State Highway 25 north to State Highway 95. At the intersection of these two roadways, route D would follow Highway 95 west until it intersects with an existing 230 kV transmission line. The route would then parallel the 230 kV line south to the Benton County substation. One advantage of this route is that the reference centerline can parallel existing road rights of way for a major portion of the route. The availability for sharing existing road right of way may, however, be limited. The Minnesota Department of Transportation (MNDOT) notes that the Highway 25 right of way is heavily encumbered by inplace utilities including Anoka Electric distribution lines, and multiple telephone cables. MNDOT further notes that some possibility for right of way overhang may exist on the north side of Highway 95, however, such an overhang would require a permit issued by MNDOT. A disadvantage of this route is the number of single family residences that would be affected along the route and the overall length of the route. This is the longest route proposed. The northern access to the substation will also necessitate a minimum of five crossings of the Elk River. This would greatly reduce the river's aesthetic value. The following is a segment by segment analysis of Route D. Route segments 1-5 and 5-6 are common segments to other routes. These segments are discussed in detail in sections 5.5.1 and 5.7.1 respectfully.

5.8.1 Route Segment 6-11

The reference centerline of Route segment 6-11 is 3.9 miles in length and parallels the west side of Highway 25. The route crosses 11 property units and borders 2.4 miles of agricultural fields. A large wetland/floodplain area is located at approximately half way between node 6 and node 11.







route boundary
reference centerline
node
existing line
segment centerline

proposed route segment 6-11

The soils found along the centerline vary. No area in the route segment is classified as prime farmland, however, 2.5 miles of the segment's length are considered to have high irrigation potential. The reference centerline of the route segment will border a row irrigation and a center pivot irrigation system. Both of these irrigated fields are located in the southern portions of the route segment.

One residential subdivision, Wildwood Acres, is located on the east side of Highway 25. A total of 15 homes are located within 500 feet of the reference centerline and another 15 homes are located within 500 and 1,000 feet of the centerline. The route segment crosses 1 unpaved road.

The reference centerline crosses .2 mile of wetland and .9 mile of woodlots. Much of Highway 25 is lined with windrows and approximatley .4 mile of windrows would be within the right of way of the reference centerline. The windrows parallel by the reference centerline may have to be removed.

Route segment 6-11 will cross the Elk River and two unnamed drainage ditches. The .1 mile wide floodplain area of the Elk River has been identified by the FIA as a Flood Hazard Zone. Construction, filling and flood proofing activities should, at a minimum, meet FIA requirements.

Riverwood Campgrounds is located along the Elk River on the east side of Highway 25. The camp will not be crossed or directly affected by the reference centerline. The transmission could, however, result in a negative visual impact on the campground site. No other recreational facilities, archaeological sites, scientific areas or unique wildlife habitats are known to exist in this route segment.

5.8.2 Route Segment 11-34

Route segment 11-34 which is 3.5 miles in length, crosses 5 property lines. Most of the land crossed by this route segment is agricultural land, however, one rural subdivision is located in the vicinity of Julia Lake. No agricultural lands would be crossed however 2.0 miles of fields and .4 mile of pasture land would be bordered.

The soil types found along the path of the reference centerline are predominately Zimmerman and Hubbard sandy loams. No areas of prime farmland have been identified, however, 3.1 miles of the reference centerline would cross soils with high irrigation potential. Several irrigation systems are located within the route segment and the reference centerline would border 3 center pivot irrigation systems and 1.0 mile of a row irrigation system.

This route segment would border for .3 mile, a rural subdivision known as Shady Acres. Several new single family residences have been constructed in this subdivision and several more homes are being planned. Along this route segment, 11 homes are within 500 feet of the reference centerline and 8 homes are within 500 and 1000 feet of the centerline. Two unpaved roadways will be crossed by this route segment.

Most of the land crossed by the reference centerline is agricultural fields, however, .6 miles of woodlots and .2 mile of wetland would also be crossed. A total of 4 windrows would be crossed and approximatley 1.2 miles of windrows abuting Highway 25 would be located within the right of way area. Two conifer plantations are located along the east side of Highway 25 but would not be crossed by the reference centerline.

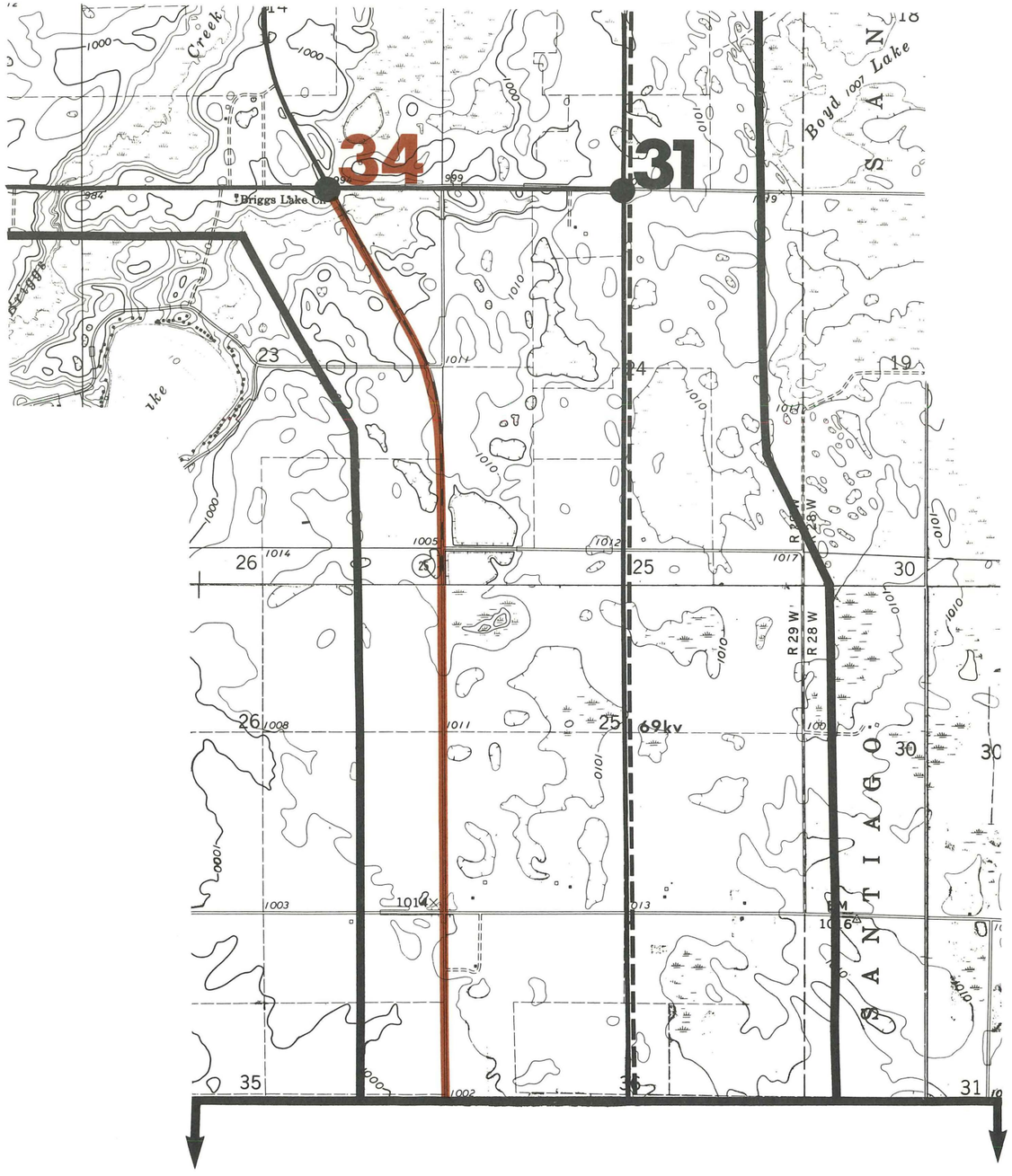
One small unnamed drainage swale would be crossed. This drainage swale flows into Lake Julia. As such, precautions during the construction stages should be exercized near the drainage area so as to minimize sediment or water quality impacts to Julia Lake. This route segment contains no FIA Flood Hazard Zones. No recreational facilities, archaeological sites, scientific areas or unique wildlife habitats are known to exist in this route segment.

5.8.3 Route Segment 34-18

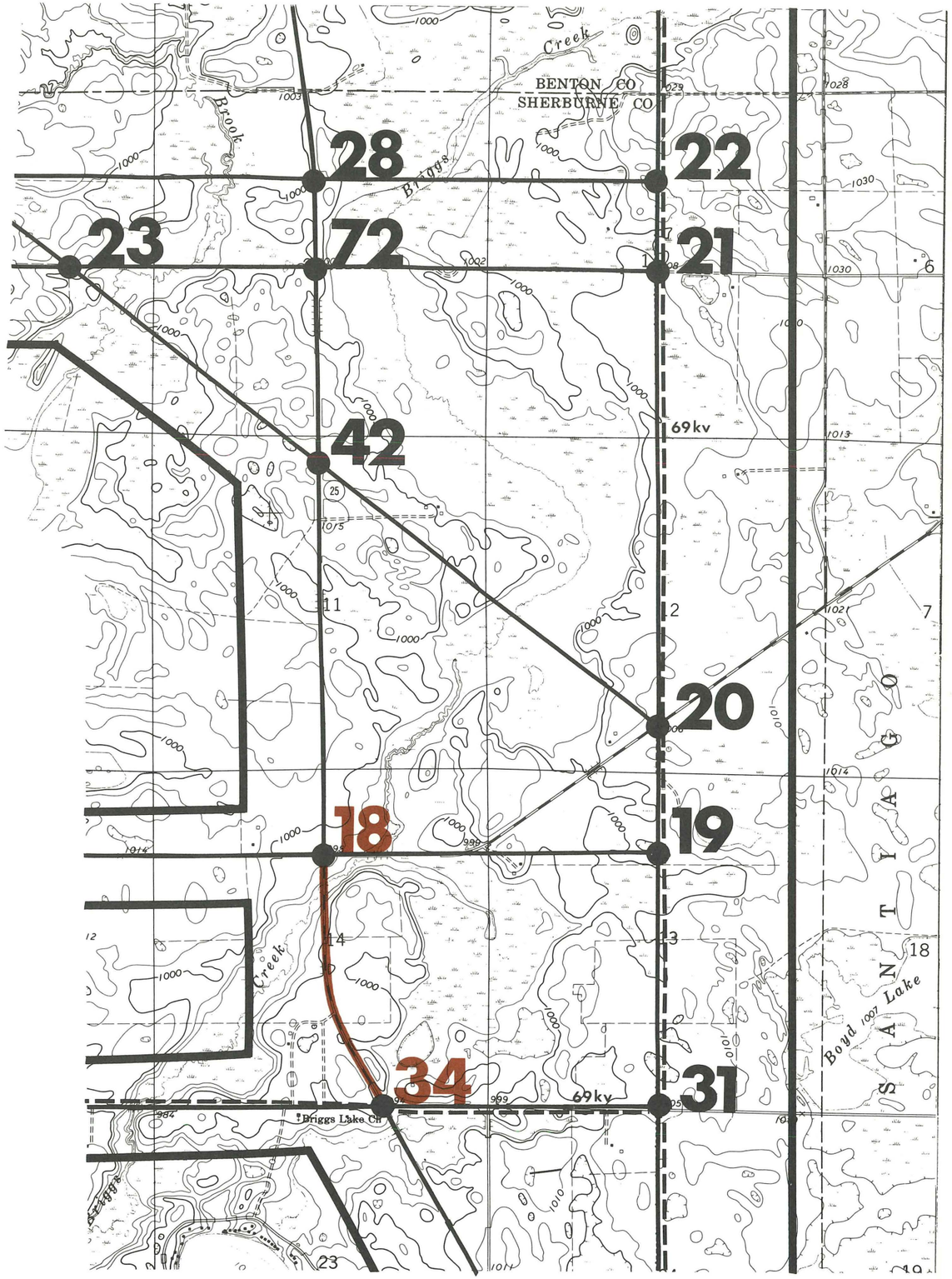
Route segment 34-18 is a .7 mile long route segment which contains woodlots, wetlands and agricultural fields. No cultivated fields are directly crossed, however, a .3 mile length of field would be bordered.

The soils within the route segment are predominately Hubbard and Zimmerman sands. There are no areas classified as prime farmland within the route segment, however, .5 mile of the route will cross soils with high irrigation potential. Presently no irrigation systems are located within this route segment.

Only one residential structure is located within 500 feet of the reference centerline and two additional homesites are located between 500 and 1,000 feet of the centerline. The reference centerline of the route segment will cross one paved road. This roadway, County Road 3, is identified in the Sherburne County Land Use Plan as a scenic roadway.



proposed route segment 11–34


BENTON CO
SHERBURNE CO
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Brook
Briggs
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Briggs Lake Ch
Boyd Lake
Creek
SANTIAGO
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The reference centerline will cross a .1 mile length of woodlot. This wooded area is located along the banks of Briggs Creek. Briggs Creek has been classified as a trout stream and therefore, selective tree removal along the stream banks should be used so as to minimize erosion or water quality impacts that might affect the trout stream. Selective vegetation removal along the Briggs Creek banks is especially important where the centerline crosses slope areas in excess of 6% grade.

Route segment 34-18 crosses Briggs Creek. As noted, this water course has been identified as a trout stream. No FIA Flood Hazard Zones exist in this route segment.

Aside from the trout stream, no other recreational facilities, archaeological sites, scientific areas or unique wildlife habitats are known to exist in the route segment.

5.8.4 Route Segment 18-42

Route segment 18-42 is 1.2 miles in length and the reference centerline will parallel the west side of Highway 25. The land crossed by this route segment is a mixture of agricultural fields, and woodlots. In addition one junkyard and one evergreen plantation are located along the reference centerline. The route segment will cross 5 property units and border .5 mile of cultivated fields.

The soils within the segment are Hubbard soils. The Soil Conservation Service has not classified any areas within the route segment as prime farmland. Approximately 1.0 mile of the route segment length, however, crosses areas of high irrigation potential. Presently no irrigation systems are located in the segment.

One platted subdivision (Creekwood Estates) and one area proposed for subdivision, are located along the eastern frontage of Highway 25. The reference centerline does not affect these residential areas. Only one home is presently located within 500 feet of the centerline. In addition the reference centerline passes over an automobile junkyard.

The route segment crosses .3 mile of woodlots and one evergreen plantation. An area up to 150 feet wide through these wooded areas may have to be cleared to accomodate the transmission line.

No water bodies or areas identified by the FIA as Flood Hazard Zones will be crossed.

No recreational facilities, archaeological sites, scientific areas or unique wildlife habitats are known to exist within this route segment.

5.8.5 Route Segment 42-72

Route segment 42-72 is a .8 mile segment that crosses one property unit. The land crossed consists of a cultivated field and a pasture area. Approximately .8 mile of agricultural fields are bordered by the reference centerline.

Soils in this route segment are Hubbard sands. No areas are classified as prime farmland, however, .7 mile of the route crosses land with high irrigation potention. Presently no irrigation systems are located within the route segment.

There are no homes within 1,000 feet of the reference centerline of this route segment.

The only vegetation potentially affected by the reference centerline is a windrow which parallels Highway 25 for the entire length of the route. This windrow may have to be removed.

The route segment will not cross any water bodies or Flood Hazard Zones.

No known recreational facilities, archaeological sites, scientific areas or unique wildlife habitats exist in this route segment.

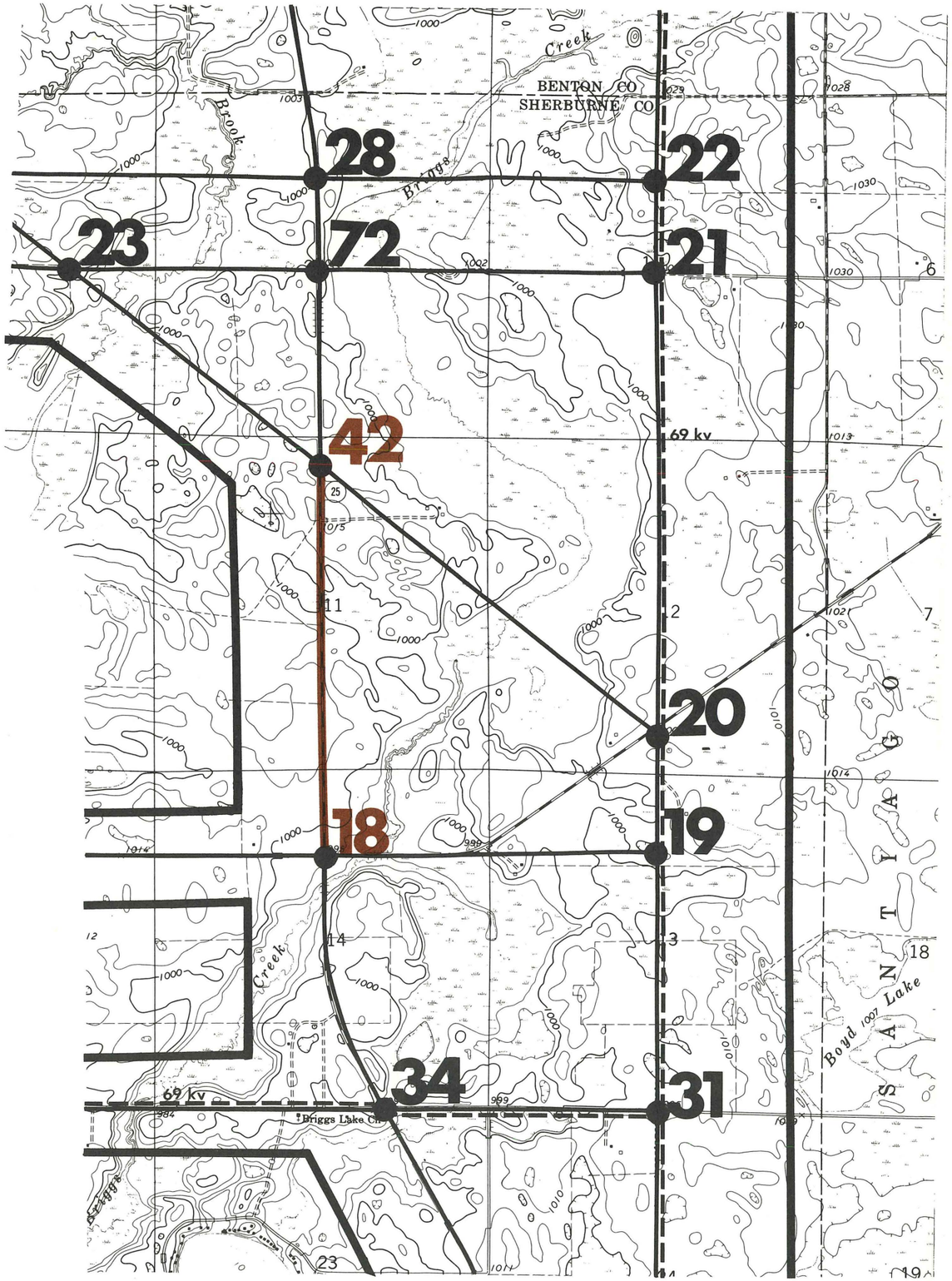
5.8.6 Route Segment 72-28

Route segment 72-28 is a short .2 mile long segment paralleling Highway 25. The route segment crosses 1 property unit presently in use as a cultivated field.

Soils in this route segment are Zimmerman sands and are not classified as prime farmlands. The soils are, however, suitable for irrigation. Presently, no irrigation system exists in the route segment.

The only vegetation affected by the reference centerline is a windrow that parallels Highway 25 for the entire length of the segment. The windrow would most likely be removed to accomodate the transmission line.

No homes, Flood Hazard Zones, recreational facilities, archaeological sites, scientific areas or unique wildlife habitats will be crossed by this reference centerline. A unique wildlife area identified by Dr. Partch for The Nature Conservancy and owned by St. Cloud University, however, is located on the east side of Highway 25. The reference centerline however does not affect this area.



kilometer .5

0 mile .5

north

route boundary

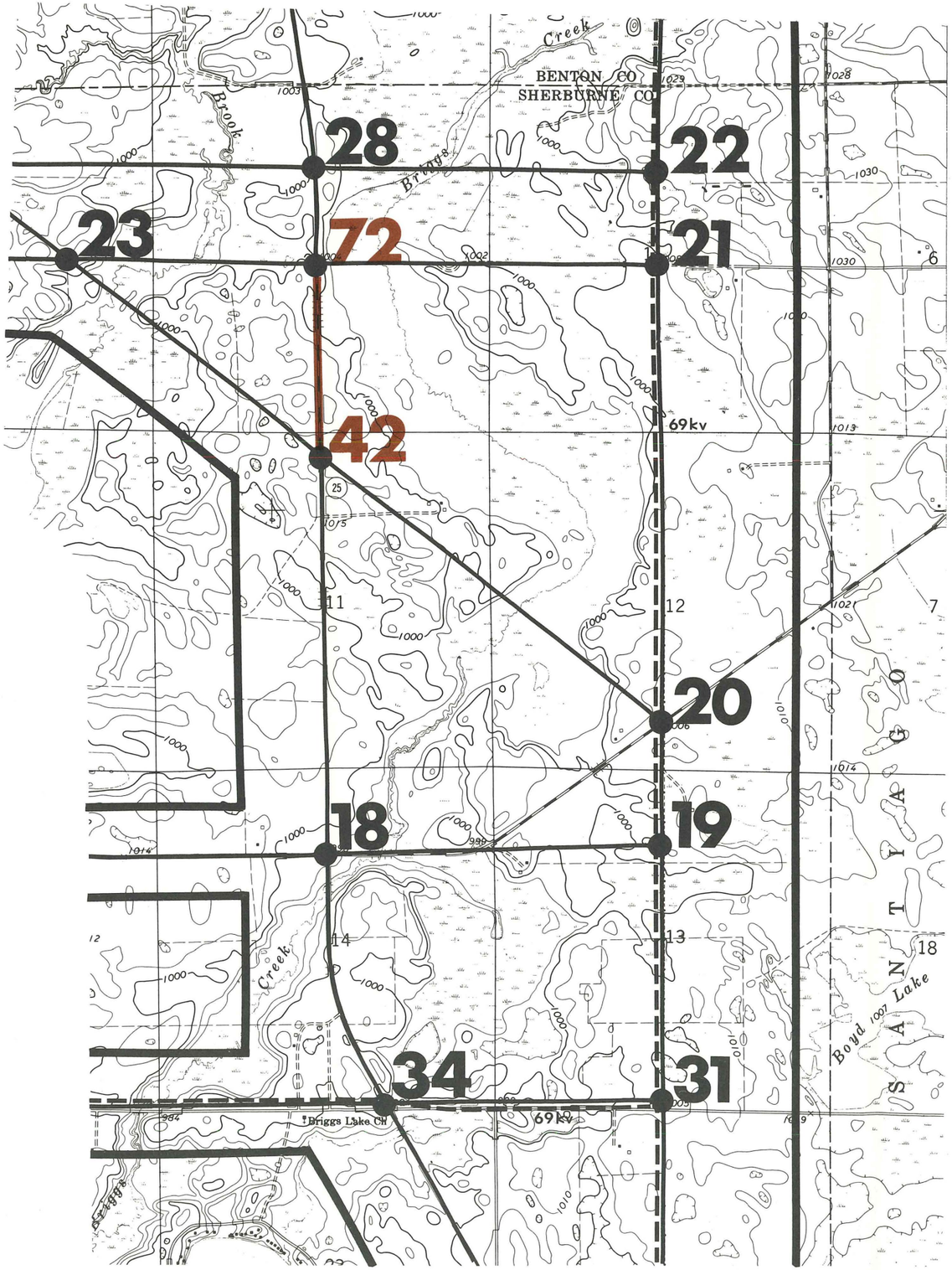
reference centerline

node

existing line

segment centerline

proposed route segment 18-42



kilometer .5

0 mile .5

north

route boundary

reference centerline

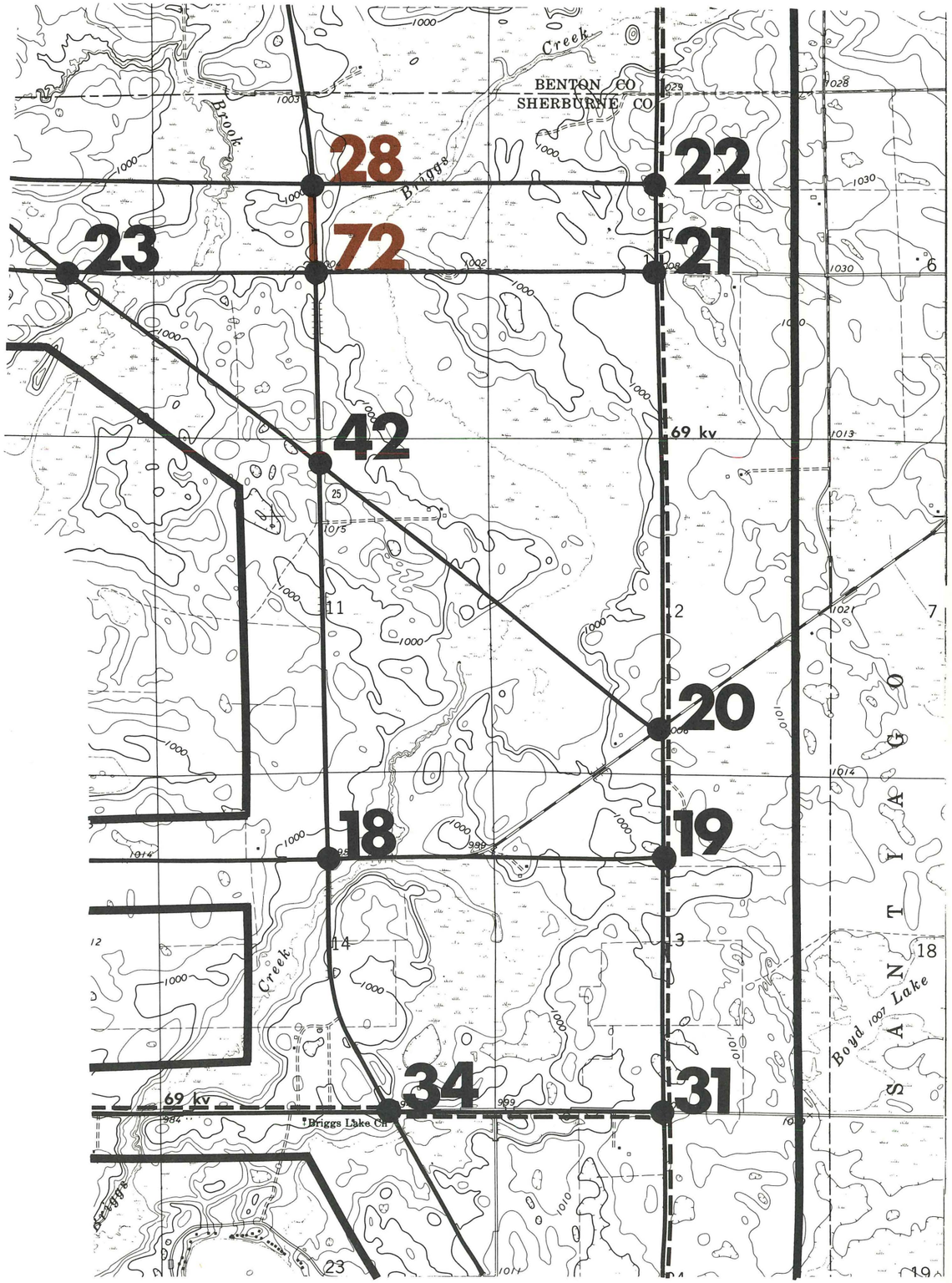
node

existing line

segment centerline

proposed route segment

42-72



kilometer .5

0 mile .5

north

route boundary

reference centerline

node

existing line

segment centerline

proposed route segment

72-28

5.8.7 Route Segment 28-29

Route segment 28-29 is 2.3 miles in length. The reference centerline for this route segment parallels the west side of Highway 25. A total of 7 property units (most of which are cultivated fields) would be crossed. The reference centerline of the route segment borders cultivated agricultural fields for a distance of 1.4 miles.

Soils in this route segment consist of Zimmerman, Hubbard, Sartell, Milaca and Duelm soils. Approximately .1 mile of this route is classified as prime farmland and another .8 mile length has high irrigation potential. Presently 2 row irrigated fields abut Highway 25. The reference centerline would border both of these fields.

Seven single family homes are located within 500 feet of the reference centerline. Most of these homes are located on the east side of Highway 25. Three additional homes are between 500 and 1,000 feet of the reference centerline. This route segment will cross two unpaved and two paved roadways. One of the road crossings (Highway 95), will require a Minnesota Department of Transportation utility crossing permit.

Although most of the route segment consists of agricultural fields, .2 mile of woodlots and .2 mile of wetlands would also be crossed. In addition, approximately .8 mile of windrows abuting Highway 25 would be located in the transmission line right of way.

Although the route segment will cross one unnamed stream, no FIA Flood Hazard Zones have been identified in this route segment.

There are no known recreational facilities, archaeological sites, scientific areas or unique wildlife habitats in this route segment.

5.8.8 Route Segment 29-39

Route 29-39 is a 6.0 mile route segment that parallels the north side of highway 95. The Minnesota Department of Transportation (MNDOT) suggests that some right of way sharing opportunities exist on the north side of Highway 95. Any overhanging of the highway's right of way however will require a permit from MNDOT. This route segment crosses 25 property units, and borders 3.6 miles of cultivated fields and .6 mile of pasture land.

The soil along this route segment is a mixture of Milica, Mora, Hubbard, Ronneby and Duelm soils. Approximately 1.4 miles of the route segment will cross areas classified by the Soil Conversation Service as prime farmland. In addition 1.7 miles of the route segment crosses an area with high irrigation potential.

Presently two center pivot and one row irrigation system are operating in the route segment. These irrigation systems are located on the south side of Highway 95 and should not be affected.

Fourty-one single family homes are located within 500 feet of the segment's reference centerline and an additional 6 homes are located between 500 and 1,000 feet of the centerline. In addition, two businesses would be affected by the route. One business is a building supply company, located north of highway 95 and west of Highway 25. The other business is an agricultural implements supplier, located south of Highway 95. This route segment would cross 6 roadways.

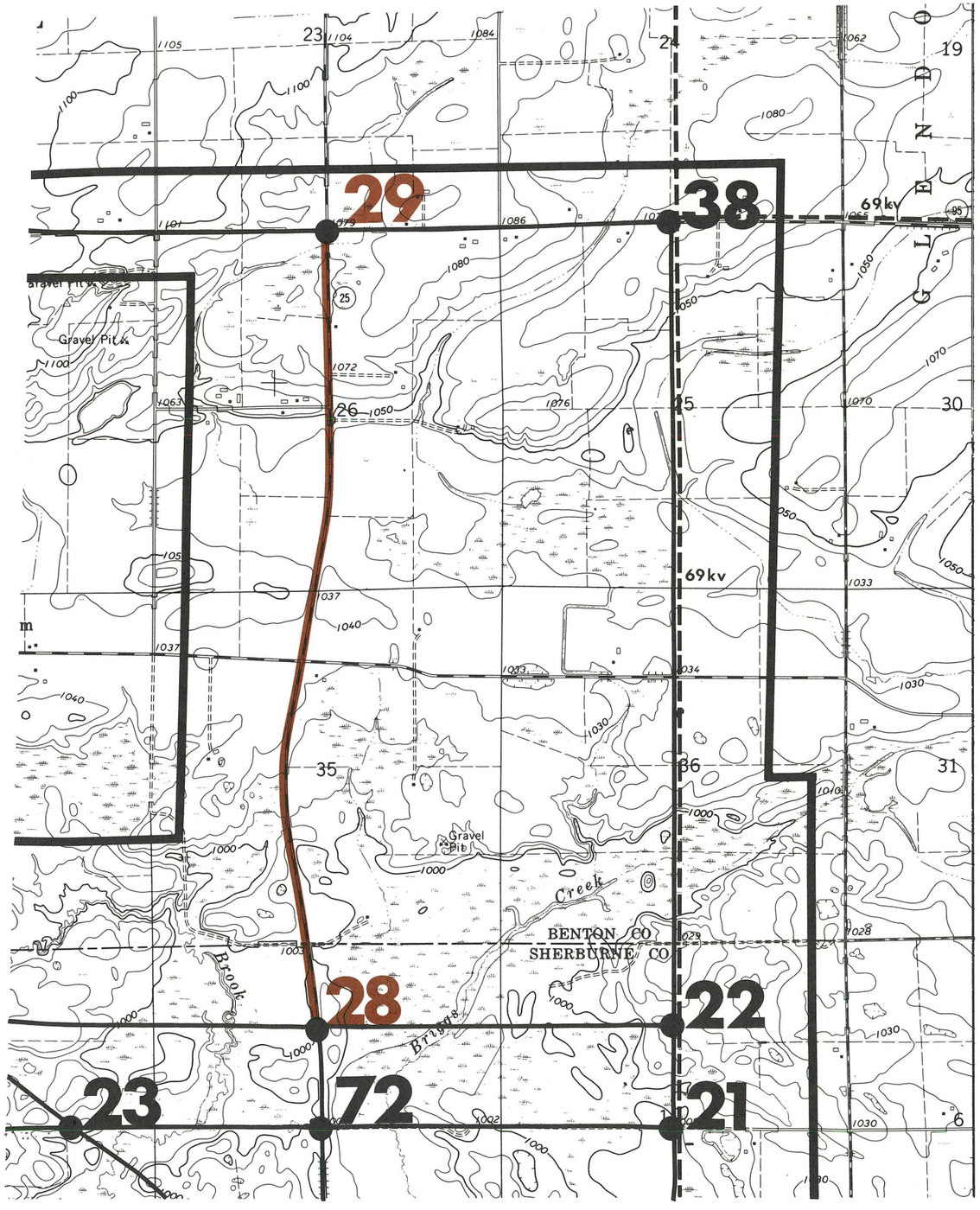
There are several mature windrows that abut the north side of Highway 95. Approximately 1.9 miles of windrows would be paralleled by the reference centerline. In addition, this route segment will cross .5 miles of wetland and floodplain. The rolling topography in the western section of this route sement contains some slopes which may be susceptable to erosion.

The route segment will cross Stony Brook and two unnamed tributaries. The FIA has identified a .1 mile wide floodplain area of Stony Brook as a Flood Hazard Zone. Construction, filling and flood proofing in this area should, at a minimum, meet FIA requirements.

A private wildlife sanctuary known as the Stony Brook Wildlife Management Area would be crossed by the reference centerline for approximately 2 miles. This portion of the Wildlife Management Area contains a residential subdivision and has experienced other manmade impacts in the past. Nevertheless, the transmission line right of way would necessitate obtaining a 14.4 acres easement along the boundary of this Wildlife Management Area. No other recreational facilities, archaeological sites, scientific areas or unique wildlife areas are known to exist in this route segment.

5.8.9 Route Segment 39-40

Route segment 39-40 is a 1.3 miles segment that parallels an existing 230 kv transmission line south to the Benton County substation. The route will cross 3 property lines, .1 mile of agricultural fields and .1 mile of pasture land. An additional .6 mile of cultivated fields will be bordered by the reference centerline.



kilometer .5

0 mile .5

north

route boundary

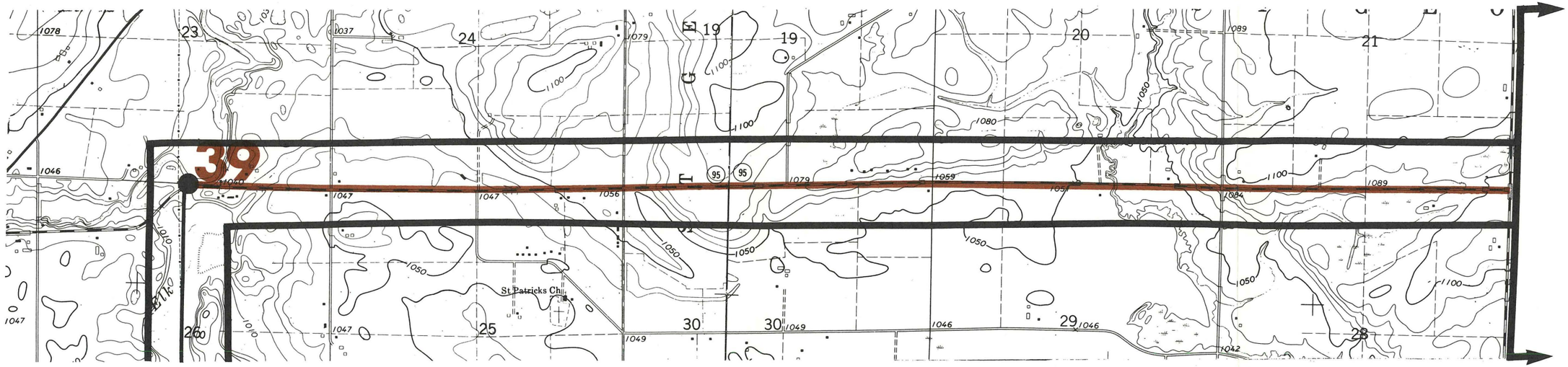
reference centerline

node

existing line

segment centerline

proposed route segment 28–29



kilometer .5

0 mile .5

north

route boundary

reference centerline

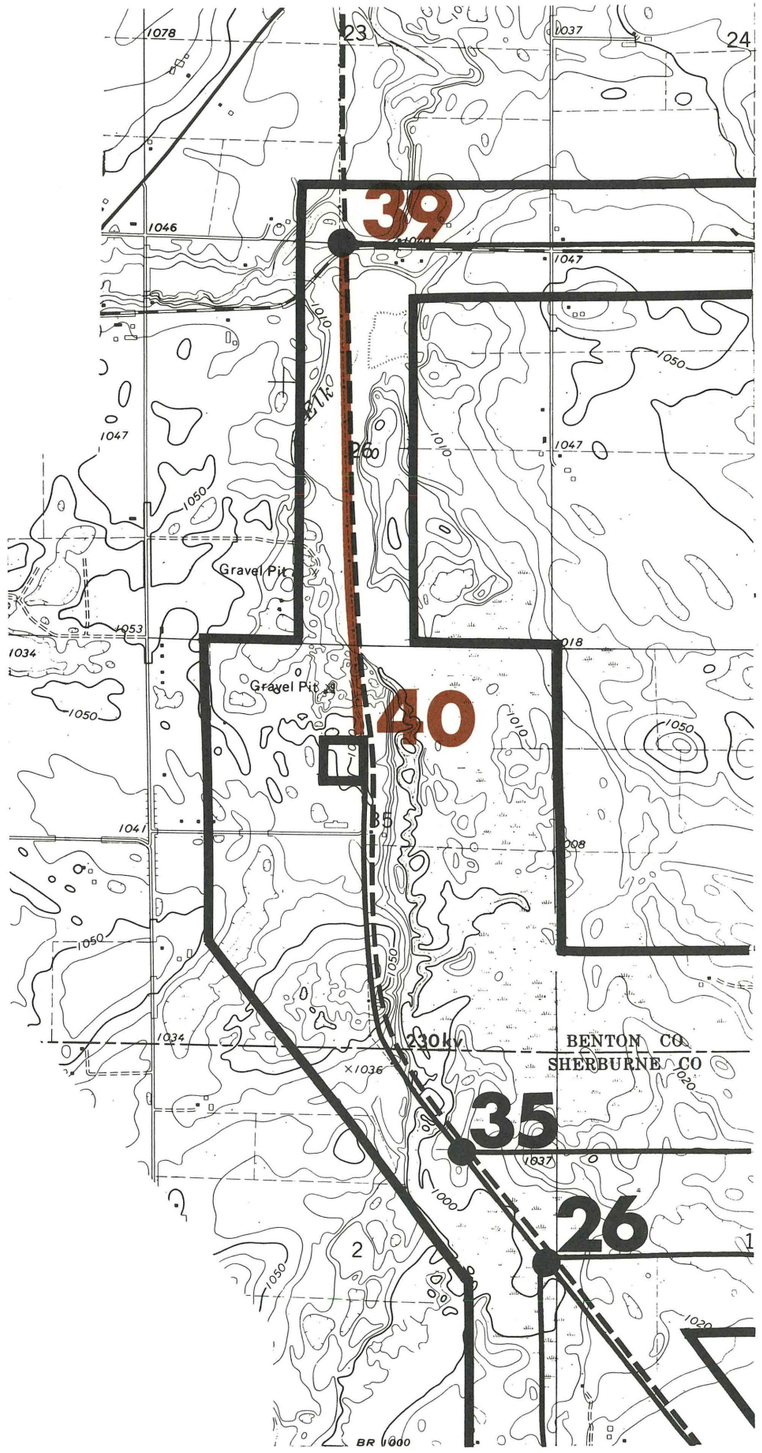
node

existing line

segment centerline

proposed route segment

29–39



kilometer .5

0 mile .5

north

route boundary

reference centerline

node

existing line

segment centerline

proposed route segment

39–40

The soils crossed by this route segment are Hubbard sands. No areas of prime farmland would be crossed, however, .7 mile of the route length crosses soils with high irrigation potential. Presently no irrigation systems are located in this route segment.

If the reference centerline parallels the existing 230 kv line, the Elk River would have to be crossed approximately 6 times. The Minnesota Department of Natural Resources has indicated that this large number of river crossings in a short span of the river is highly undesirable. Most of the reference centerline of this route segment lies within the Elk River floodplain. In fact, the entire 1.3 mile length of the route segment would be located in an area identified by the FIA as a Flood Hazard Zone. All requirements of the FIA should be met.

No homes or roads would be affected by the reference centerline. Two gravel pits, one operational and one dormant, are located west of the existing 230 kv line. These gravel pits would not be affected by the location of the 345 kv transmission line. No recreational facilities, archaeological sites, scientific areas or unique wildlife areas are located in this route segment.

5.8.10 Route Summary

Table 5.6 is a summary of the impacts identified within Route D. All lengths are measured in miles. The land area (acres) of farmland, woodlots, wetlands, etc. impacted by the route will vary depending upon the structure type and right of way sharing opportunities. (See Table 3.3 for right of way requirements.)

5.9 ROUTE SEGMENTS

Several route segments have been proposed by the Citizens Route Evaluation Committee and the MEQB Power Plant Siting staff. These segments provide distinct alternatives to the main routes discussed in sections 5.5 through 5.8.

It should be noted that route segments by themselves, do not constitute a complete route. The route segments are merely elements and modifications of the routes previously discussed. Following the narrative section of each route segment is a summary table of segment impacts. The route segments are listed as a component of a complete route. The impacts directly attributed to the route segment under consideration, are outlined for easy reference.

Table 5.7

IMPACT SUMMARY ROUTE B-1

VARIABLES	ROUTE SEGMENTS									
	1-5	5-10	10-31	31-34	34-33	33-24	24-26	26-35	35-40	Total
segment length	2.0	4.0	3.7	0.8	3.9	1.2	1.9	0.3	1.3	19.1
length parallel to HVTL ROW	0	4.0	3.7	0.8	3.9	1.2	1.9	0.3	1.3	17.1
diagonal length	0	0.4	0	0.1	0	1.2	1.9	0.2	0	3.8
#property lines crossed	1	8	12	6	8	3	8	1	3	50
miles of property lines bordered	0	1.6	1.5	0.8	3.9	0	0	0	0	7.8
#of fields crossed	0	5	1	0	0	3	4	0	1	14
miles of fields crossed	0	0.6	0.2	0	0	0.4	1.0	0	0.1	2.3
miles of fields bordered	1.6	1.8	1.3	0.1	1.9	0.2	0	0	0.6	7.5
pastures crossed	0	0.3	0.3	0	0.2	0.1	0	0	0.1	1.0
prime farmland crossed	0	0	0	0	0	0	0	0.2	0.7	0.9
high irrigation potential	1.3	1.8	3.1	0.2	2.6	1.2	1.1	0	0	11.3
# of center pivots crossed	0	0	0	0	0	0	0	0	0	0
# of center pivots bordered	0	1	0	0	0	0	0	0	0	0
# of row irrigation crossed	0	0	0	0	0	0	1	0	0	1
# of row irrigation bordered	0	0	0	0	0	0	0	0	0	0
homes 500' of ROW	0	1	4	7	5	0	0	0	1	18
homes 500-1000' of ROW	2	4	2	0	4	1	4	0	2	19
business 1000' of ROW	0	0	1	0	0	0	0	0	0	1
church/cemetary 1000' of ROW	0	0	0	0	0	0	0	0	0	0
#platted areas crossed	0	1	0	0	0	0	0	0	0	1
# platted areas bordered	0	1	0	0	0	0	0	0	1	2
#paved roads crossed	2	0	1	1	1	1	0	0	0	6
# unpaved roads crossed	0	3	1	0	1	0	1	0	0	6
#scenic roads crossed	0	0	0	0	1	0	0	0	0	1
scenic road bordered	0	0	0	0	0	0	0	0	0	0
airport within 1 mile	0	0	0	0	0	0	0	1	0	1

IMPACT SUMMARY ROUTE B-1

VARIABLES	ROUTE SEGMENTS									
	1-5	5-10	10-31	31-34	34-33	33-24	24-26	26-35	35-40	Total
hwy. ROW bordered	0	0	0	0.8	2.0	0	0	0	0	2.8
# of windrows crossed	0	5	0	0	2	0	0	0	1	8
# of windrows bordered	0.4	0.3	0.1	0	0.3	0	0	0	0	1.1
wood lot crossed	0.1	0.7	0.9	0.5	1.4	0	1.0	0	0.3	4.9
wetland crossed	0	0.2	0.1	0.1	0.3	0.3	0.3	0.2	0	1.5
tree farms crossed or bordered	0	0	0.7	0	0	0	0	0	0	0.7
steep slopes 6%	0	0.4	0.1	0	0	0.1	0	0	0.3	0.9
# of lakes within 1000' of centerline	0	1	1	0	0	0	0	0	0	2
stream crossings	0	1	2	0	3	1	0	0	1	8
trout streams	0	0	0	0	1	0	0	0	0	1
Flood Hazard Zones	0	0.2	0	0	0.3	0	0	0.2	0.2	0.9
public rec. crossed	0	0	0	0	0	0	0	0	0	0
public rec.1000' of ROW	1	0	0	0	0	0	0	0	0	1
pvt. rec. crossed	0	0	0	0	0	0	0	0	0	0
pvt. rec. 1000' of ROW	0	1	0	0	0	0	0	0	0	1
archaeological sites	0	0	0	0	0	0	0	0	0	0
wildlife refuges crossed	0	0	0	0	0	0	0	0	0	0
scientific/wildlife/vegetation of importance crossed	0	0	0	0	0	0	0	0	0	0
scientific/wildlife/vegetation of importance 1000' of centerline	0	0	0	0	0	0	1	0	0	2

5.9.1 Route Segment B-1

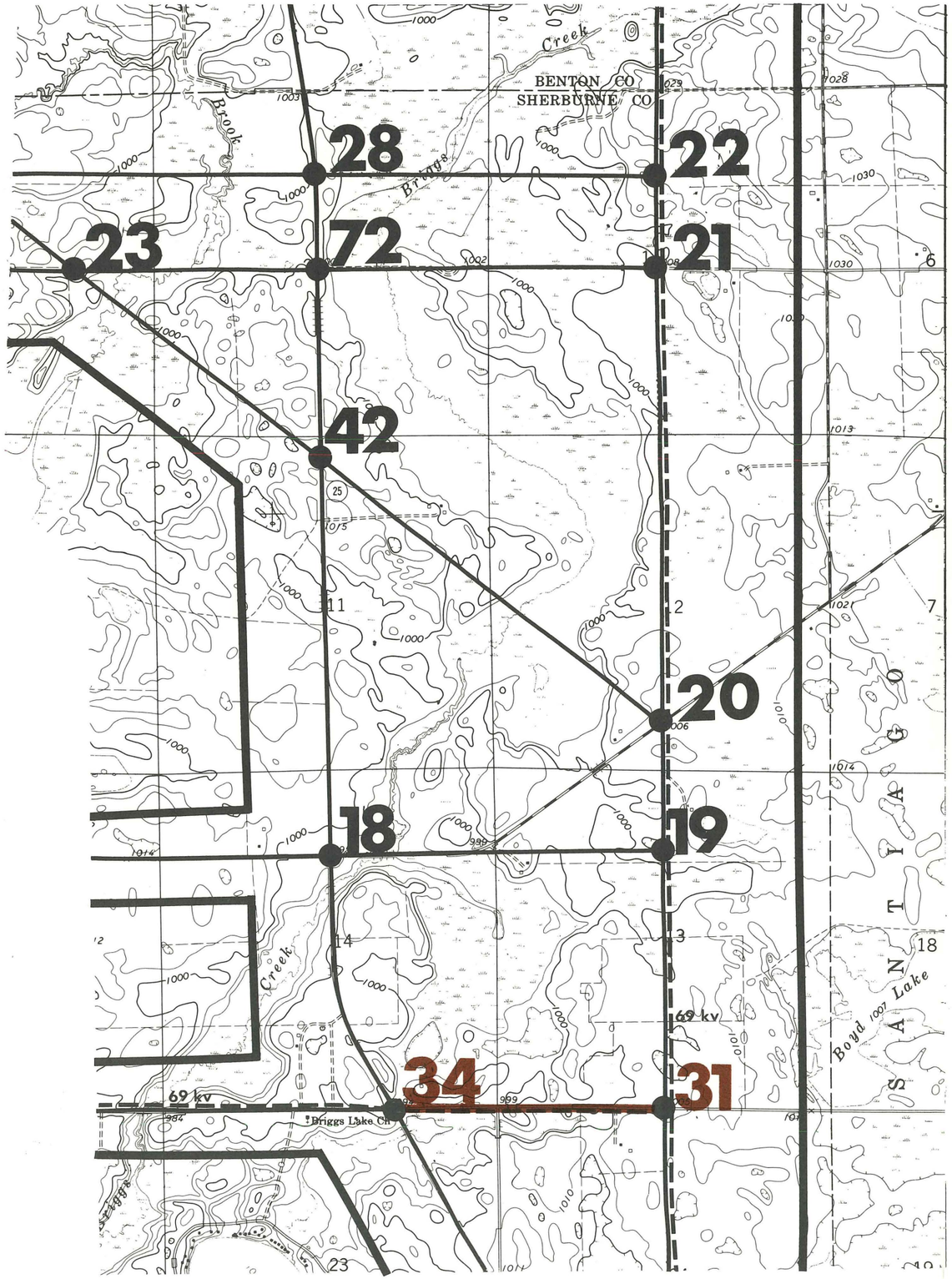
Route segment B-1 consists of nodes 31-34-33. This segment was proposed by the MEQB staff as an east-west link between the Becker-Foley 69 kV transmission line right of way corridor (Route B) and the Monticello-Benton County 230 kV transmission line right of way corridor (Route A). Route segment B-1 would parallel or double circuit the Cable-Boyd Lake 69 kV transmission line that follows County Road 48. Although route segment B-1, is in reality composed of two short segments, (segment 31-34 and segment 34-33) the narrative below is a summary of the total impacts. The individual elements of this route segment are illustrated in Table 5.7.

The total length of Route Segment B-1 is 4.7 miles. This route segment crosses 14 property lines and parallels a road right of way for a distance of 2.8 miles. The land crossed by this route segment is a mixture of residential, woodlots, and agricultural land.

The soils crossed by this route segment are primarily Hubbard and Zimmerman soils. Pockets of organic materials located along river banks and in wetland areas also exist. No prime farmlands have been identified in this route segment, however, 1.4 miles of the segment length is classified as having high irrigation potential. Most of this area with irrigation potential (1.2 miles) is located west of node 34. Presently three, center pivot irrigation systems are located in the route segment. The reference centerline of this segment will border two of these irrigated fields.

Thirteen residential homes would be located within 500 feet of the reference centerline of this route segment. Seven of those homes are located between nodes 31 and 34. The Briggs Lake Gospal Hall, a church, is located within 500 feet of the reference centerline. Four homesites are within 500 and 1,000 feet of the segment centerline. One sand and gravel pit is located at the extreme western edge of this route segment but is not directly affected by the reference centerline.

Route Segment B-1 will cross one unpaved and two paved roadways. One of the paved roads, County Road 6, is identified in the Sherburne County Land Use Plan as a scenic roadway. The other paved roadway, State Highway 25, will require a utility crossing permit from the Minnesota Department of Transportation.



kilometer .5

0 mile .5

north

route boundary

reference centerline

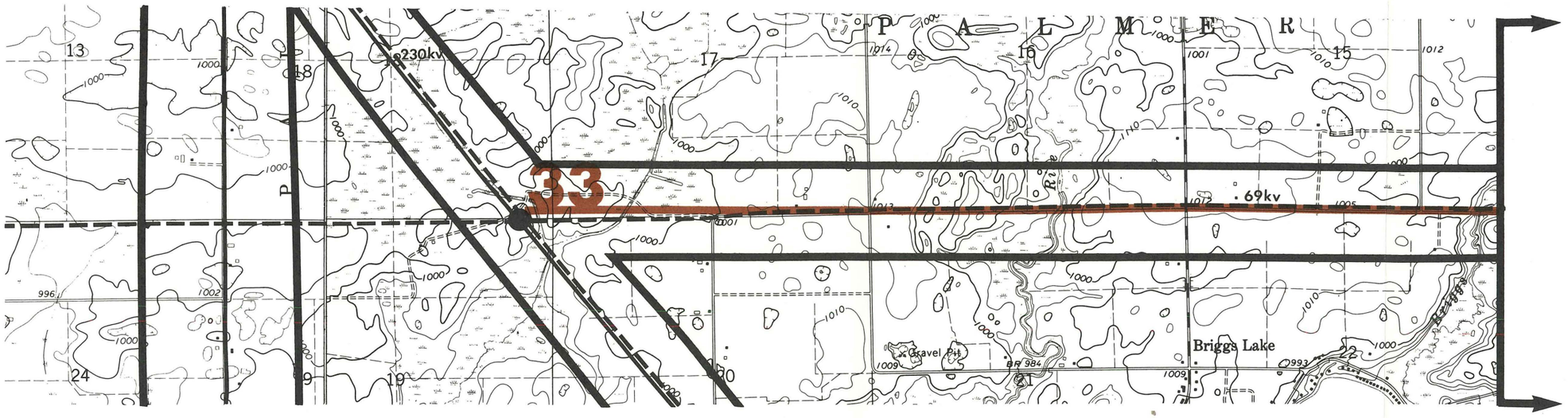
node

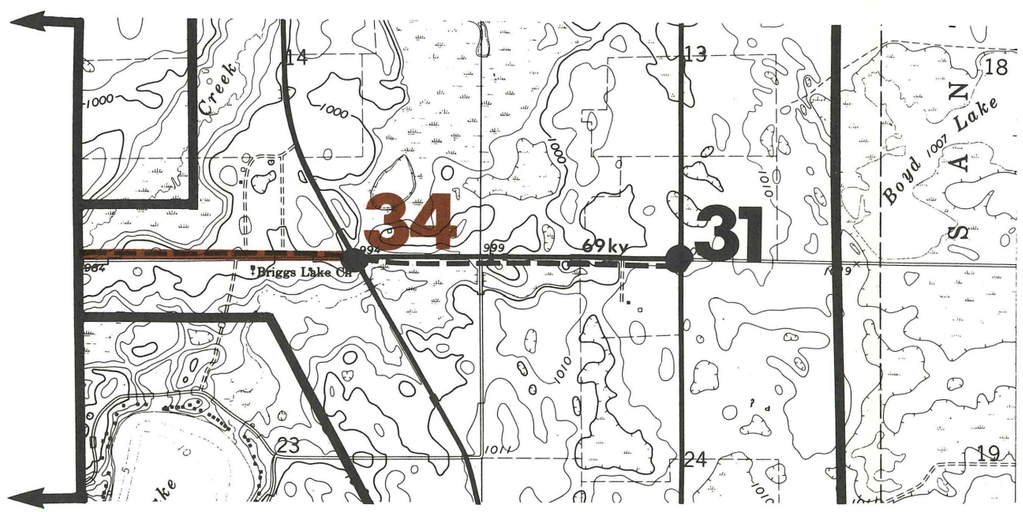
existing line

segment centerline

proposed route segment

31-34





kilometer .5

0 mile .5

north

route boundary

reference centerline

node

existing line

segment centerline

proposed route segment 34-33

Vegetation crossed by the reference centerline includes .4 mile of wetland and 1.9 miles of woodlots. In addition, two windrows would be crossed and one windrow would be paralleled. Most of the natural vegetation of the route segment is located along Rice Creek and Briggs Creek. Vegetation removal associated with the Briggs Creek crossing should be minimized, as Briggs Creek is classified as a trout stream.

This route segment will cross Rice Creek, one of its unnamed tributaries, and Briggs Creek. Of these stream crossings, Briggs Creek warrents careful attention as it has been identified as a trout stream. Approximately .3 mile of the Rice Creek and Briggs Creek floodplains will be crossed by this route segment. These floodplain regions have been identified by the FIA as Flood Hazard Zones. Construction, filling and flood proofing in these areas should, at a minimum, meet FIA requirements.

Aside from the use of Briggs Creek for trout fishing, no other recreational facilities, archaeological sites, scientific areas or unique wildlife habitats are known to exist in this route segment.

A summary of impacts identified within route segment B-1 is illustrated in Table 5.7. The columns that are outlined correspond to the impacts associated with segment B-1. The column identified as total impacts lists the total impacts associated with a complete route of which B-1 is a segment.

5.9.2 Route Segment B-2

Route Segment B-2 (Nodes 19-18-24) is an alternative link between the Becker-Foley 69 kV transmission line (Route B) and the Monticello-Benton County 230 kV transmission line (Route A). The reference centerline of this route segment generally parallels the southern boundaries of County Road 3 from the 69 kV transmission line to the 230 kV line. Total length of this route segment is 5.5 miles. The route segment crosses 14 property units and borders 1.6 miles of cultivated fields.

The soils encountered in this route segment are Hubbard and Zimmerman sands. No areas in the route segment have been identified as prime farmland, however 3.4 miles of the route segment legnth is classified as having high irrigation potential. One center pivot system, located west of node 18, would be bordered by the reference centerline.

Table 5.8

IMPACT SUMMARY ROUTE B-2

VARIABLES	ROUTE SEGMENTS									
	1-5	5-10	10-31	31-19	19-18	18-24	24-26	26-35	35-40	Total
segment length	2.0	4.0	3.7	0.8	1.0	4.5	2.5	0.3	1.3	20.1
length parallel to HVTL ROW	0	4.0	3.7	0.8	0	0	0	0.3	1.3	10.1
diagonal length	0	0.4	0	0	0	0	0	0.2	0	0.6
#property lines crossed	1	8	12	3	2	12	7	1	3	49
miles of property lines bordered	0	1.6	1.5	0.8	0.5	4.1	2.5	0	0	11
#of fields crossed	0	5	1	0	2	0	0	0	1	9
miles of fields crossed	0	0.6	0.2	0	0.2	0	0	0	0.1	1.1
miles of fields bordered	1.6	1.8	1.3	0.3	0	1.6	1.6	0	0.6	8.8
pastures crossed	0	0.3	0.3	0	0	0.2	0	0	0.1	0.9
prime farmland crossed	0	0	0	0	0	0	0	0.2	0.7	0.9
high irrigation potential	1.3	1.8	3.1	0.5	0	3.4	1.1	0	0	11.2
# of center pivots crossed	0	0	0	0	0	0	0	0	0	0
# of center pivots bordered	0	1	0	0	0	1	0	0	0	2
# of row irrigation crossed	0	0	0	0	0	0	0	0	0	1
# of row irrigation bordered	0	0	0	0	0	0	1	0	0	1
homes 500' of ROW	0	1	4	0	2	11	8	0	1	27
homes 500-1000' of ROW	2	4	2	2	0	0	3	0	2	15
business 1000' of ROW	0	0	1	0	0	0	0	0	0	1
church/cemetary 1000' of ROW	0	0	0	0	0	0	0	0	0	0
#platted areas crossed	0	1	0	0	0	0	0	0	0	1
# platted areas bordered	0	1	0	0	0	0	0	0	1	2
#paved roads crossed	2	0	1	0	1	1	0	0	0	5
# unpaved roads crossed	0	3	1	0	0	2	3	0	0	9
#scenic roads crossed	0	0	0	0	0	0	0	0	0	0
scenic road bordered	0	0	0	0	0	1.9	0	0	0	1.9
airport within 1 mile	0	0	0	0	0	0	0	1	0	1

IMPACT SUMMARY B-2

VARIABLES	ROUTE SEGMENTS									
	1-5	5-10	10-31	31-19	19-18	18-24	24-26	26-35	35-40	Total
hwy. ROW bordered	0	0	0	0	0.5	4.5	1.0	0	0	0
# of windrows crossed	0	5	0	0	0	0	0	0	1	6
# of windrows bordered	0.4	0.3	0.1	0	0	0	0	0	0	0.9
wood lot crossed	0.1	0.7	0.9	0	0.8	0.9	1.0	0	0.3	4.5
wetland crossed	0	0.2	0.1	0.1	0.1	1.2	0.3	0.2	0	1.4
tree farms crossed or bordered	0	0	0.7	0.2	0	0	0	0	0	1.0
steep slopes 6%	0	0.4	0.1	0	0	0.1	0	0	0.3	1.8
# of lakes within 1000' of centerline	0	1	1	0	0	1	0	0	0	3
stream crossings	0	1	2	0	1	1	0	0	1	8
trout streams	0	0	0	0	1	0	0	0	0	1
Flood Hazard Zones	0	0.2	0	0	0	0.2	0	0.2	0.2	0.8
public rec. crossed	0	0	0	0	0	0	0	0	0	0
public rec.1000' of ROW	1	0	0	0	0	0	0	0	0	1
pvt. rec. crossed	0	0	0	0	0	0	0	0	0	0
pvt. rec. 1000' of ROW	0	1	0	0	0	0	0	0	0	1
archaeological sites	0	0	0	0	0	0	0	0	0	0
wildlife refuges crossed	0	0	0	0	0	0	0	0	0	0
scientific/wildlife/vegetation of importance crossed	0	0	0	0	0	0	0	0	0	0
scientific/wildlife/vegetation of importance 1000' of centerline	0	0	0	1	0	0	1	0	0	1

Table 5.9

IMPACT SUMMARY ROUTE B-3

VARIABLES	ROUTE SEGMENTS											
	1-5	5-10	10-31	31-19	19-20	20-21	21-22	22-28	28-30	30-35	35-40	Total
segment length	2.0	4.0	3.7	0.8	0.3	1.4	0.3	1.0	1.0	4.5	1.3	20.3
length parallel to HVTL ROW	0	4.0	3.7	0.8	0.3	1.4	0.3	0	0	0	1.3	11.8
diagonal length	0	0.4	0	0	0	0	0	0	0	0	0	0.4
#property lines crossed	1	8	12	3	2	2	1	4	2	4	3	42
miles of property lines bordered	0	1.6	1.5	0.8	0.3	0.8	0	0.7	1.0	3.3	0	10
#of fields crossed	0	5	1	0	0	3	0	1	0	4	1	15
miles of fields crossed	0	0.6	0.2	0	0	0.2	0	0	0	0.5	0.1	1.6
miles of fields bordered	1.6	1.8	1.3	0.3	0.2	0.2	0	0.1	0.3	2.3	0.6	8.7
pastures crossed	0	0.3	0.3	0	0	0	0	0	0	0.2	0.1	0.9
prime farmland crossed	0	0	0	0	0	0	0	0	0	0.2	0.7	0.9
high irrigation potential	1.3	1.8	3.1	0.5	0.2	1.1	0.1	0.7	0.8	2.3	0	11.9
# of center pivots crossed	0	0	0	0	0	0	0	0	0	0	0	0
# of center pivots bordered	0	1	0	0	0	0	0	0	0	0	0	1
# of row irrigation crossed	0	0	0	0	0	0	0	0	0	0	0	0
# of row irrigation bordered	0	0	0	0	0	0	0	0	0	0	0	0
homes 500' of ROW	0	1	4	0	2	0	1	1	1	2	1	13
homes 500-1000' of ROW	2	4	2	2	0	1	0	0	0	4	2	20
business 1000' of ROW	0	0	1	0	0	0	0	0	0	0	0	1
church/cemetary 1000' of ROW	0	0	0	0	0	0	0	0	0	0	0	0
#platted areas crossed	0	1	0	0	0	0	0	0	0	0	0	1
# platted areas bordered	0	1	0	0	0	0	0	0	0	0	1	2
#paved roads crossed	2	0	1	0	0	1	0	0	0	0	0	4
# unpaved roads crossed	0	3	1	0	0	1	0	0	0	2	0	7
#scenic roads crossed	0	0	0	0	0	0	0	0	0	0	0	0
scenic road bordered	0	0	0	0	0	0	0	0	0	0	0	0
airport within 1 mile	0	0	0	0	0	0	0	0	0	0	0	0

IMPACT SUMMARY ROUTE B-3

VARIABLES	ROUTE SEGMENTS											
	1-5	5-10	10-31	31-19	19-20	20-21	21-22	22-28	28-30	30-35	35-40	Total
hwy. ROW bordered	0	0	0	0	0	0	0	0	0	0	0	0
# of windrows crossed	0	5	0	0	0	0	0	0	0	0	1	6
# of windrows bordered	0.4	0.3	0.1	0	0	0	0	0	0	0.1	0	0.9
wood lot crossed	0.1	0.7	0.9	0	0.2	0.8	1.4	0.6	0.1	1.2	0.3	6.3
wetland crossed	0	0.2	0.1	0.1	0	0	0	0.2	0.1	0.7	0	1.4
tree farms crossed or bordered	0	0	0.7	0.2	0	0	0.2	0	0	0	0	1.1
steep slopes 6%	0	0.4	0.1	0	0	0	0	0	0	0.7	0.3	1.5
# of lakes within 1000' of centerline	0	1	1	0	0	0	0	0	0	1	0	3
stream crossings	0	1	2	0	0	0	0	1	1	2	1	8
trout streams	0	0	0	0	0	0	0	1	0	0	0	1
Flood Hazard Zones	0	0.2	0	0	0	0	0	0	0.5	0	0.2	0.9
public rec. crossed	0	0	0	0	0	0	0	0	0	0	0	0
public rec.1000' of ROW	1	0	0	0	0	0	0	0	0	0	0	1
pvt. rec. crossed	0	0	0	0	0	0	0	0	0	0	0	0
pvt. rec. 1000' of ROW	0	1	0	0	0	0	0	0	0	0	0	1
archaeological sites	0	0	0	0	0	0	0	0	0	0	0	0
wildlife refuges crossed	0	0	0	0	0	0	0	0	0	0	0	0
scientific/wildlife/vegetation of importance crossed	0	0	0	0	0	0	0	1	0	0	0	1
scientific/wildlife/vegetation of importance 1000' of centerline	0	0	0	1	0	0	0	1	0	0	0	2

There are 13 residential homes within 500 feet of the reference centerline of this route segment. Most of these homes are located west of node 18. An area under consideration for residential subdivision, is also located just east and north of node 18. The final plat for this area, however, has not been approved.

Route Segment B-2 will parallel County Road 3 for a distance of 5.0 miles. Approximately 1.9 miles of County Road 3 has been identified in the Sherburne County Land Use Plan as a scenic roadway. In addition, two paved and two unpaved roads would be crossed. One of the paved roads, (Highway 25) would require a utility crossing permit from the Minnesota Department of Transportation.

Most of the vegetation crossed by this route segment consists of wetland and woodlot vegetation. Approximately 1.3 miles of wetlands, .4 mile of open water and 1.7 miles of woodlots would be crossed by the reference centerline.

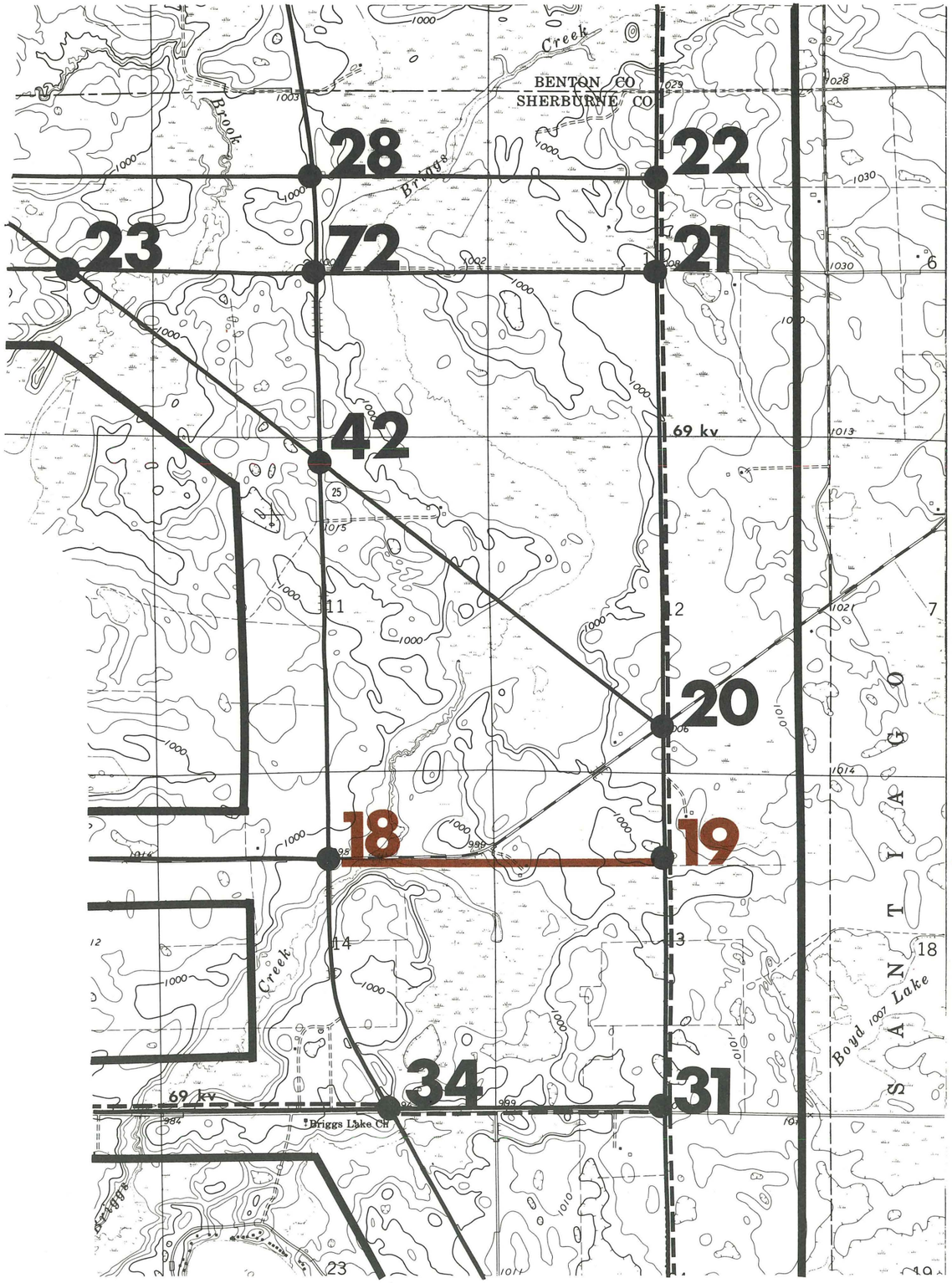
This route segment would necessitate the crossing of Briggs and Rice Creek. Briggs Creek has been identified as a trout stream and therefore, any crossing should be handled with extreme care. Approximately .2 mile of the Rice Creek floodplain has been identified by the FIA as a Flood Hazard Area. Construction, filling and flood proofing in this region should, at a minimum, satisfy FIA regulations.

Aside from trout fishing in Briggs Creek, no known recreational facilities, archaeological sites, scientific areas or unique wildlife habitats exist in this route segment.

A summary of impacts identified within route segment B-2 is illustrated in Table 5.8. The columns outlined correspond to the impacts associated with segment B-2. The "Total Impact" column lists the total impacts potentially encountered in a complete route of which B-2 is a segment.

5.9.3 Route Segment B-3

Route Segment B-3 (Nodes 20-21-22-28-30) was proposed as an alternative to the diagonal crossing from the Becker-Foley 69 kV transmission line to the quarter-section line of Section 3 Palmer Township. The route segment would parallel for 1.7 miles, the existing 69 kV transmission line north from node 20 to a point one-



kilometer .5

0 mile .5

north

route boundary

reference centerline

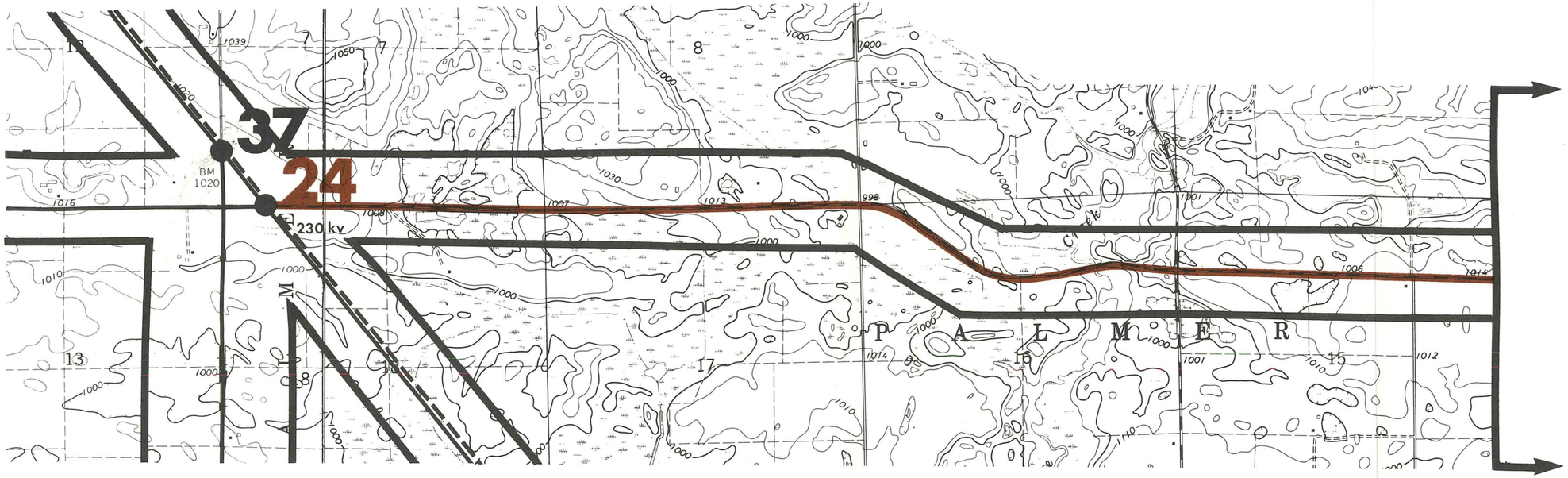
node

existing line

segment centerline

proposed route segment

19–18



kilometer .5

0 mile .5

north

route boundary

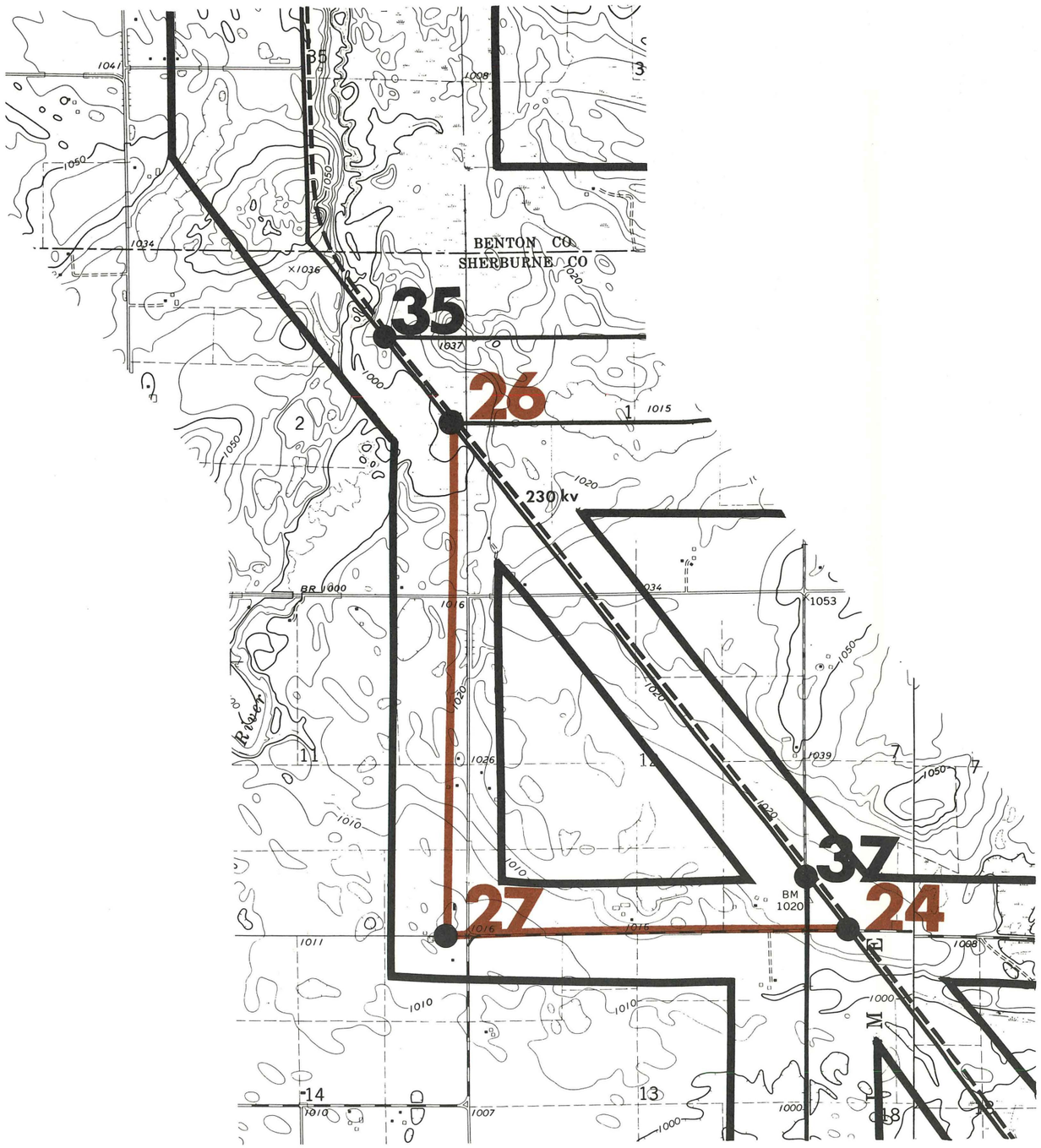
reference centerline

node

existing line

segment centerline

proposed route segment 18-24



kilometer .5

0 mile .5

north

route boundary

reference centerline

node

existing line

segment centerline

proposed route segment 24-27-26

quarter mile south of the Sherburne-Benton County line (Node 22). The route segment then turns due west along the quarter section line until it intersects NSP Route B at node 30. There is no existing right of way from node 22 to node 30. As such 36 acres of new right of way would have to be obtained.

This route segment is 3.7 miles in length and crosses 9 property units. Most of the land crossed is wetland and woodlots, however 4 cultivated fields would also be crossed.

The soils found in this route segment are Zimmerman, Lino and Isanti soils. There are no designated prime farmland areas in this route segment, however, 2.0 miles of the route length will cross land with high irrigation potential. Presently, there are no irrigation systems in the route segment. There are 3 homes within 500 feet of the reference centerline of this and 4 additional homes that are located within 500 and 1,000 feet of the centerline. The route segment will cross one paved road and one unpaved road. The paved road, Highway 25, will require a utility crossing permit from MNDOT. The unpaved road is Township Road 59 and a petition to extend the roadway west and upgrade the road has been presented to the Palmer Township Board. At the time this report was being prepared, no final decision has been made concerning the petitioned request.

Much of the area crossed by this route segment contains woodlot and wetland vegetation. Approximately 2.9 miles of the route segment will cross woodlots and .3 miles will cross wetland areas. Between nodes 21 and 22 there is an evergreen tree farm and nursery stock orchard. The use of herbicides and chemical agents in this area should be minimized so as to reduce potential hazards to the tree farm operation.

This route segment will cross Stony Brook and Briggs Creek. Briggs Creek has been identified as a trout stream and has a broad wetland area on both sides of the creek. Vegetation removal along the banks of Briggs Creek should be carefully managed so as not to adversely affect the creek's aquatic habitat. Approximately .5 mile of the route segment will cross the Stony Brook floodplain. This area has been identified by the FIA as a Flood Hazard Zone. Construction, filling and flood proofing should, at a minimum, meet FIA requirements.

Table 5.10

IMPACT SUMMARY ROUTE B-4

VARIABLES	ROUTE SEGMENTS										
	1-5	5-10	10-31	31-19	19-20	20-42	42-23	23-26	26-35	35-40	Total
segment length	2.0	4.0	3.7	0.8	0.3	1.3	0.9	4.7	0.3	1.3	19.3
length parallel to HVTL ROW	0	4.0	3.7	0.8	0.3	0	0	0	0.3	1.3	10.4
diagonal length	0	0.4	0	0	0	1.3	0.9	0	0.2	0	2.8
#property lines crossed	1	8	12	3	2	5	3	14	1	3	52
miles of property lines bordered	0	1.6	1.5	0.8	0.3	0	0	3.6	0	0	7.8
#of fields crossed	0	5	1	0	0	1	0	5	0	1	13
miles of fields crossed	0	0.6	0.2	0	0	0.1	0	1.0	0	0.1	2.0
miles of fields bordered	1.6	1.8	1.3	0.3	0.2	0	0	1.6	0	0.6	7.4
pastures crossed	0	0.3	0.3	0	0	0.2	0.1	0.5	0	0.1	1.5
prime farmland crossed	0	0	0	0	0	0	0	1.6	0.2	0.7	2.5
high irrigation potential	1.3	1.8	3.1	0.5	0.2	1.1	0.8	2.9	0	0	11.7
# of center pivots crossed	0	0	0	0	0	0	0	0	0	0	0
# of center pivots bordered	0	1	0	0	0	0	0	0	0	0	1
# of row irrigation crossed	0	0	0	0	0	0	0	0	0	0	0
# of row irrigation bordered	0	0	0	0	0	0	0	0	0	0	0
homes 500' of ROW	0	1	4	0	2	1	0	2	0	1	11
homes 500-1000' of ROW	2	4	2	2	0	1	0	2	0	2	15
business 1000' of ROW	0	0	1	0	0	0	0	0	0	0	1
church/cemetary 1000' of ROW	0	0	0	0	0	0	0	0	0	0	0
#platted areas crossed	0	1	0	0	0	0	0	0	0	0	1
# platted areas bordered	0	1	0	0	0	1	0	0	0	0	3
#paved roads crossed	2	0	1	0	0	1	1	0	0	0	5
# unpaved roads crossed	0	3	1	0	0	0	0	1	0	0	5
#scenic roads crossed	0	0	0	0	0	1	0	0	0	0	1
scenic road bordered	0	0	0	0	0	0	0	0	0	0	0
airport within 1 mile	0	0	0	0	0	0	0	0	1	0	1

IMPACT SUMMARY ROUTE B-4

VARIABLES	ROUTE SEGMENTS										
	1-5	5-10	10-31	31-19	19-20	20-42	42-23	23-26	26-35	35-40	Total
hwy. ROW bordered	0	0	0	0	0	0	0	0	0	0	0
# of windrows crossed	0	5	0	0	0	0	0	2	0	1	8
# of windrows bordered	0.4	0.3	0.1	0	0	0	0	0.6	0	0	1.4
wood lot crossed	0.1	0.7	0.9	0	0.2	0.5	0.6	0.4	0	0.3	3.7
wetland crossed	0	0.2	0.1	0.1	0	0.1	0.2	0.8	0.2	0	1.7
tree farms crossed or bordered	0	0	0.7	0.2	0	0	0	0.1	0	0	1.0
steep slopes 6%	0	0.4	0.1	0	0	0.1	0.2	0.7	0	0.3	1.8
# of lakes within 1000' of centerline	0	1	1	0	0	0	0	1	0	0	3
stream crossings	0	1	2	0	0	1	1	2	0	1	8
trout streams	0	0	0	0	0	1	0	0	0	0	1
Flood Hazard Zones	0	0.2	0	0	0	0	0.4	0	0.2	0.2	1.5
public rec. crossed	0	0	0	0	0	0	0	0	0	0	0
public rec.1000' of ROW	1	0	0	0	0	0	0	0	0	0	1
pvt. rec. crossed	0	0	0	0	0	0	0	0	0	0	00
pvt. rec. 1000' of ROW	0	1	0	0	0	0	0	0	0	0	1
archaeological sites	0	0	0	0	0	0	0	0	0	0	0
wildlife refuges crossed	0	0	0	0	0	0	0	0	0	0	0
scientific/wildlife/vegetation of importance crossed	0	0	0	0	0	0	0	0	0	0	0
scientific/wildlife/vegetation of importance 1000' of centerline	0	0	0	1	0	0	0	0	0	0	1

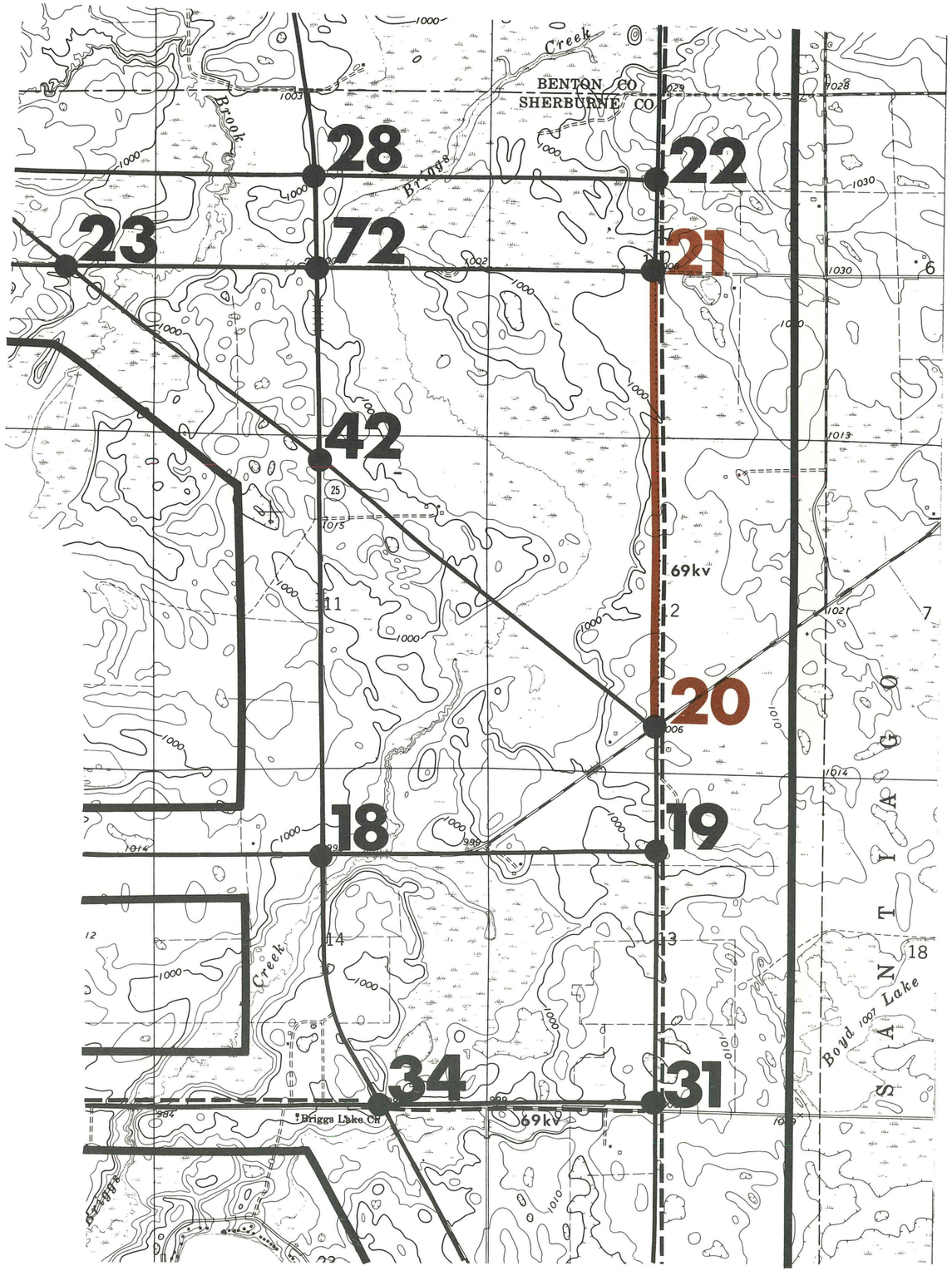
St. Cloud State University owns a 40 acre parcel of land just south of node 28. This area is used as a wildlife reserve and for nature studies. The reference centerline of Route Segment B-3 will parallel the northern boundaries of this nature area. The Minnesota Department of Natural Resources (DNR) also indicates that Sandhill Cranes use wetland habitats immediately to the west and east of the Sherburne National Wildlife Refuge. As such, DNR suggests that the wetlands in the general study area are important wildlife habitats. Construction techniques and construction scheduling in these wetland areas should be coordinated by wildlife specialists to insure minimum disruption in the wetland habitats. No other recreational facilities, archaeological sites, scientific areas or unique wildlife habitats are known to exist in this route segment.

A summary of impacts identified within route segment B-3 is illustrated in Table 5.8. The columns that are outlined correspond to the impacts associated with segment B-3. The "Total Impact" column lists the total impacts potentially encountered in a complete route of which B-3 is a segment.

5.9.4 Route Segments B-4 and B-4'

Route segment B-4 (Nodes 23-26) was proposed as a distinct and different centerline from the centerline proposed by NSP in Route B. Instead of following the quarter section line, route segment B-4 will use the half section line, for transmission line placement. Segment B-4' (Nodes 21-72-23) was proposed as an alternative to the diagonal alignment from nodes 20 to 23 originally proposed by NSP as part of Route B. Route segment B-4 and B-4' do not follow existing right of way corridors. As such these route segments would require the acquisition and creation of approximately 100 acres of entirely new right of way. The narrative below provides a summary of both route segments B-4 and B-4'. The table at the end of this section identifies individual segment impacts.

Route segments B-4 and B-4' have a combined length of 6.4 miles. Most of this route length (4.7 miles) is located west of node 23. The area crossed by this route segment is characterized by rolling topography, wetlands, woodlots and agricultural fields. The reference centerline will cross 21 property units and will parallel existing property boundaries for a distance of 4.8 miles. These route segments will cross 7 cultivated fields. Most of the agricultural fields are located west of node 23.



kilometer .5

0 mile .5

north

route boundary

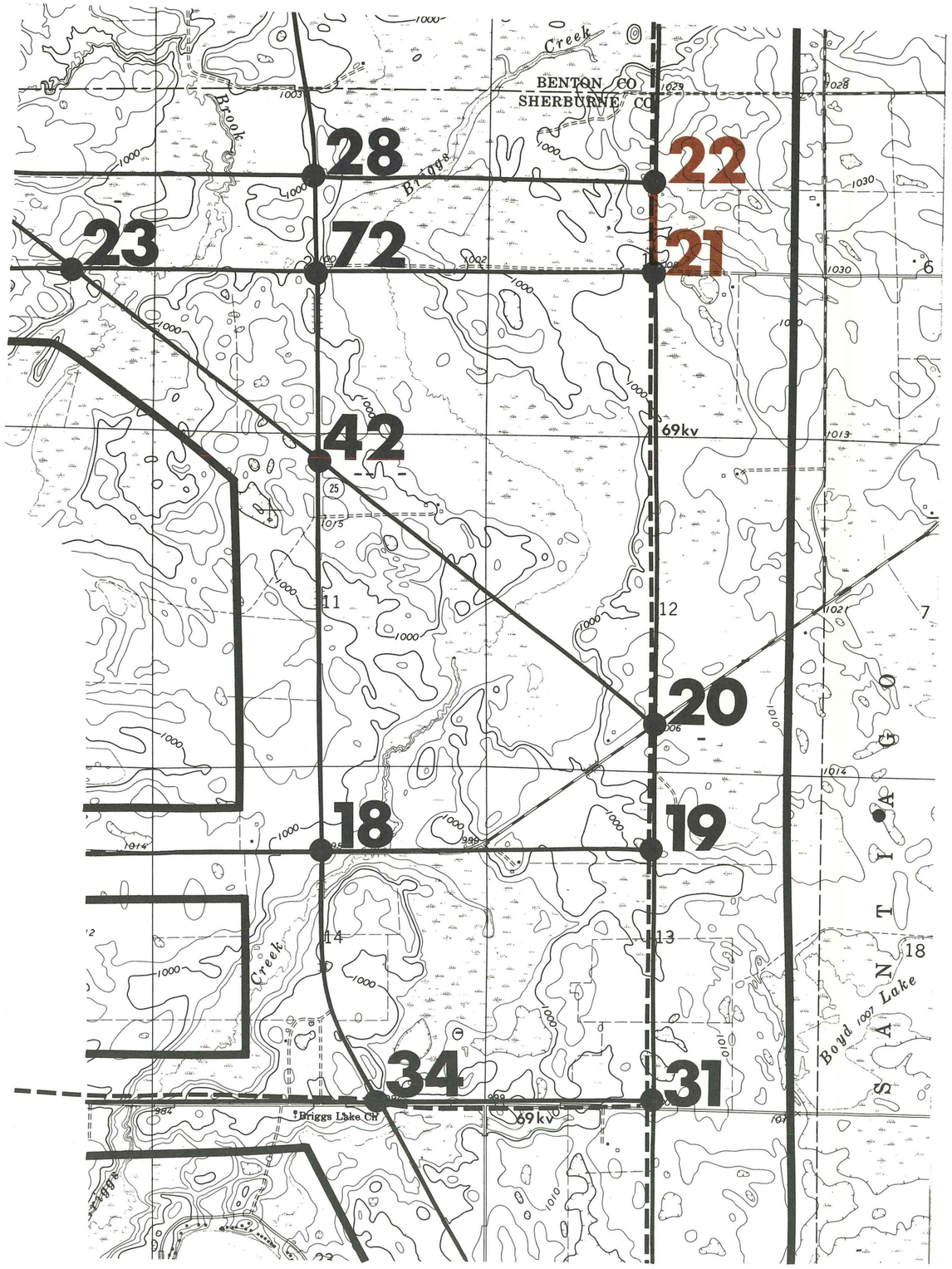
reference centerline

node

existing line

segment centerline

proposed route segment 20-21



kilometer .5

0 mile .5

north

route boundary

reference centerline

node

existing line

segment centerline

proposed route segment

21-22

The soil types crossed by these route segments are a mixture of Zimmerman, Hubbard, Lino, Braham, and Isanti soils. Approximately 1.6 miles of the route segment will cross soils identified as prime farmland. The designated prime farmland is located in the eastern portion of segment B-4. In addition, approximately 4 miles of the route will cross land with high irrigation potential. Presently there are no irrigation systems located within these route segments, however, property owners within the route segment have indicated plans for installing center pivot systems sometime in the future.

There are three homes in these route segments that are less than 500 feet from the reference centerline and two additional homes that are within 500 and 1,000 feet from the centerline. The route segment will cross two paved and one unpaved road. The Highway 25 crossing will receive a utility crossing permit from MNDOT. In addition, Palmer Township has been petitioned to improve, and extend west, Township Road 59. No formal decision on the petitioned request had been made at the time of this EIS preparation. Should the road be extended, there could be a potential conflict between the transmission line right of way and the road alignment. Should this route segment be selected as the final alignment, Northern States Power should coordinate structure placement and transmission line alignment in the vicinity of node 21 with the Palmer Township Board.

The reference centerline of these route segments will cross and parallel approximately .6 mile of windrows. Depending on the exact alignment of the transmission line right of way, the .6 mile of paralleled windrows may have to be removed. In addition, approximately 1.2 miles of woodlots and 1.4 miles of wetland areas would be crossed. The wetland areas east of node 27 may be frequented by Sandhill Cranes and therefore should be disturbed as little as possible during the construction phase. The topography of route segment B-4 (node 23-26) contains some areas of steep slope. Most of the areas are is located in sections 4 and 5 of Palmer Township. The slopes are generally covered with vegetation that helps to prevent soil erosion. Selective vegetation removal and immediate replacement of vegetative cover in these areas can help to minimize erosion potential.

These route segments will cross 4 streams and one small pond. One of the streams crossed if Briggs Creek. This crossing is important because Briggs Creek is classified as a trout stream. The crossing of Briggs Creek should be carefully engineered to avoid impacts on the Creek's aquatic habitat. In addition, approximately .5 mile of the route segment crosses the Stony Brook floodplain. This area has been identified by the FIA as a Flood Hazard Zone.

Table 5.11

IMPACT SUMMARY ROUTE B-4'

VARIABLES	ROUTE SEGMENTS											
	1-5	5-10	10-31	31-19	19-20	20-21	21-72	72-23	23-26	26-35	35-40	Total
segment length	2.0	4.0	3.7	0.8	0.3	1.4	1.0	0.7	4.7	0.3	1.3	20.2
length parallel to HVTL ROW	0	4.0	3.7	0.8	0.3	1.4	0	0	0	0.3	1.3	11.8
diagonal length	0	0.4	0	0	0	0	0	0	0	0	0	0.6
#property lines crossed	1	8	12	3	2	2	4	3	14	1	3	53
miles of property lines bordered	0	1.6	1.5	0.8	0.3	0.8	1.0	0.2	3.6	0	0	9.8
#of fields crossed	0	5	1	0	0	3	1	1	5	0	1	17
miles of fields crossed	0	0.6	0.2	0	0	0.2	0.1	0.1	1.0	0	0.1	2.3
miles of fields bordered	1.6	1.8	1.3	0.3	0.2	0.2	0	0.1	1.6	0	0.6	7.7
pastures crossed	0	0.3	0.3	0	0	0	0	0	0.5	0	0.1	1.2
prime farmland crossed	0	0	0	0	0	0	0	0	1.6	0.2	0.7	2.5
high irrigation potential	1.3	1.8	3.1	0.5	0.2	1.1	0.6	0.5	2.9	0	0	12
# of center pivots crossed	0	0	0	0	0	0	0	0	0	0	0	0
# of center pivots bordered	0	1	0	0	0	0	0	0	0	0	0	1
# of row irrigation crossed	0	0	0	0	0	0	0	0	0	0	0	0
# of row irrigation bordered	0	0	0	0	0	0	0	0	0	0	0	0
homes 500' of ROW	0	1	4	0	2	1	0	0	2	0	1	11
homes 500-1000' of ROW	2	4	2	2	0	1	0	0	2	0	2	15
business 1000' of ROW	0	0	1	0	0	0	0	0	0	0	0	1
church/cemetary 1000' of ROW	0	0	0	0	0	0	0	0	0	0	0	0
#platted areas crossed	0	1	0	0	0	0	0	0	0	0	0	1
# platted areas bordered	0	1	0	0	0	0	0	0	0	0	1	2
#paved roads crossed	2	0	1	0	0	1	1	0	0	0	0	5
# unpaved roads crossed	0	3	1	0	0	0	0	0	1	0	0	5
#scenic roads crossed	0	0	0	0	0	1	0	0	0	0	0	1
scenic road bordered	0	0	0	0	0	0	0	0	0	0	0	0
airport within 1 mile	0	0	0	0	0	0	0	0	0	1	0	1

IMPACT SUMMARY ROUTE B-4'

VARIABLES	ROUTE SEGMENTS											
	1-5	5-10	10-31	31-19	19-20	20-21	21-72	72-23	23-26	26-35	35-40	Total
hwy. ROW bordered	0	0	0	0	0	0	0	0	0	0	0	0
# of windrows crossed	0	5	0	0	0	0	2	0	2	0	1	10
# of windrows bordered	0.4	0.3	0.1	0	0	0	0	0	0.6	0	0	1.4
wood lot crossed	0.1	0.7	0.9	0	0.2	0.8	0.5	0.3	0.4	0	0.3	4.2
wetland crossed	0	0.2	0.1	0.1	0	0	0.3	0.4	0.8	0.2	0	2.1
tree farms crossed or bordered	0	0	0.7	0.2	0	0	0	0	0.1	0	0	1.0
steep slopes 6%	0	0.4	0.1	0	0	0	0.1	0	0.7	0	0.3	1.6
# of lakes within 1000' of centerline	0	1	1	0	0	0	0	0	1	0	0	3
stream crossings	0	1	2	0	0	0	1	1	2	0	1	8
trout streams	0	0	0	0	0	0	1	0	0	0	0	1
Flood Hazard Zones	0	0.2	0	0	0	0	0	0.5	0.5	0.2	0.2	1.6
public rec. crossed	0	0	0	0	0	0	0	0	0	0	0	0
public rec. 1000' of ROW	1	0	0	0	0	0	0	0	0	0	0	1
pvt. rec. crossed	0	0	0	0	0	0	0	0	0	0	0	0
pvt. rec. 1000' of ROW	0	1	0	0	0	0	0	0	0	0	0	1
archaeological sites	0	0	0	0	0	0	0	0	0	0	0	0
wildlife refuges crossed	0	0	0	0	0	0	0	0	0	0	0	0
scientific/wildlife/vegetation of importance crossed	0	0	0	0	0	0	0	0	0	0	0	0
scientific/wildlife/vegetation of importance 1000' of centerline	0	0	0	1	0	0	0	0	0	0	0	1

Table 5.12

IMPACT SUMMARY ROUTE C-1

VARIABLES	ROUTE SEGMENTS										
	1-5	5-6	6-32	32-12	12-15	15-33	33-24	24-26	26-35	35-40	Total
segment length	2.0	0.2	1.4	3.6	2.1	2.3	1.2	1.9	0.3	1.3	16.3
length parallel to HVTL ROW	0	0	0	0	2.1	2.3	1.2	1.9	0.3	1.3	9.1
diagonal length	0	0	0	0	2.1	2.3	1.2	1.9	0.2	0	7.7
#property lines crossed	1	2	4	10	6	6	3	8	1	3	44
miles of property lines bordered	0	0.2	1.3	3.3	0	0	0	0	0	0	4.8
#of fields crossed	0	0	0	3	4	11	3	4	0	1	26
miles of fields crossed	0	0	0	0.4	0.5	1.3	0.4	1.0	0	0.1	3.7
miles of fields bordered	1.6	0.1	1.3	1.9	0	0	0.2	0	0	0.6	5.7
pastures crossed	0	0.1	0	0.1	0.1	0.3	0.1	0	0	0.1	0.8
prime farmland crossed	0	0	0	0	0	0	0	0	0.2	0.7	0.9
high irrigation potential	1.3	0.2	1.4	1.5	1.4	1.0	1.2	1.1	0	0	9.1
# of center pivots crossed	0	0	0	0	0	0	0	0	0	0	0
# of center pivots bordered	0	0	0	6	1	0	0	0	0	0	7
# of row irrigation crossed	0	0	1	0	0	0	0	0	1	0	2
# of row irrigation bordered	0	0	0	1	0	0	0	0	0	0	1
homes 500' of ROW	0	0	3	9	2	0	0	0	0	1	15
homes 500-1000' of ROW	2	1	1	2	4	3	1	4	0	2	20
business 1000' of ROW	0	0	2	0	0	0	0	0	0	0	2
church/cemetary 1000' of ROW	0	0	0	0	0	0	0	0	0	0	0
#platted areas crossed	0	0	0	0	1	0	0	0	0	0	1
# platted areas bordered	0	0	0	1	0	0	0	0	0	1	2
#paved roads crossed	2	1	1	0	1	0	1	0	0	0	6
# unpaved roads crossed	0	0	0	0	1	2	0	1	0	0	4
#scenic roads crossed	0	0	0	0	2	0	0	0	0	0	2
scenic road bordered	0	0	0	3.9	0	0	0	0	0	0	3.9
airport within 1 mile	0	0	0	0	1	0	0	0	1	0	2

IMPACT SUMMARY ROUTE C-1

VARIABLES	ROUTE SEGMENTS										
	1-5	5-6	6-32	32-12	12-15	15-33	33-24	24-26	26-35	35-40	Total
hwy. ROW bordered	0	0	1.4	3.9	0	0	0	0	0	0	5.3
# of windrows crossed	0	0	3	0	0	2	4	0	0	1	10
# of windrows bordered	0.4	0	0	0	0	0	0	0	0	0	0.4
wood lot crossed	0.1	0	0	0.5	0	0.3	0	1.0	0	0.3	2.2
wetland crossed	0	0	0	0.2	0.9	0.2	0.3	0.3	0.2	0	2.2
tree farms crossed or bordered	0	0	0	0	0	0	0	0	0	0	0
steep slopes 6%	0	0	0	0	0	0.1	0.1	0	0	0.3	0.5
# of lakes within 1000' of centerline	0	0	0	0	3	0	0	0	0	0	3
stream crossings	0	0	0	1	2	2	1	0	0	1	7
trout streams	0	0	0	0	0	0	0	0	0	0	0
Flood Hazard Zones	0	0	0	0.3	0.8	0.1	0	0	0.2	0.2	1.6
public rec. crossed	0	0	0	0	0	0	0	0	0	0	0
public rec.1000' of ROW	1	0	0	0	1	0	0	0	0	0	2
pvt. rec. crossed	0	0	0	0	1	0	0	0	0	0	1
pvt. rec. 1000' of ROW	0	0	0	0	2	0	0	0	0	0	2
archaeological sites	0	0	0	0	2	0	0	0	0	0	2
wildlife refuges crossed	0	0	0	0	0	0	0	0	0	0	0
scientific/wildlife/vegetation of importance crossed	0	0	0	0	0	0	0	0	0	0	1
scientific/wildlife/vegetation of importance 1000' of centerline	0	0	0	0	0	0	0	1	0	0	0

St. Cloud State University owns a 40 acre parcel of land located directly north of node 27. This area is used as a wildlife area and for nature study. The reference centerline for these route segments will border the southern limits of the University's property. Aside from the Briggs Creek trout stream status, no other recreational facilities, archaeological sites, scientific areas or unique wildlife habitats are known to exist in these route segments.

Table 5.9 identifies the impacts associated with segments B-4 and B-4'. The columns that are outlined correspond to the impacts associated specifically with segments B-4 and B-4'.

5.9.5 Route Segment C-1

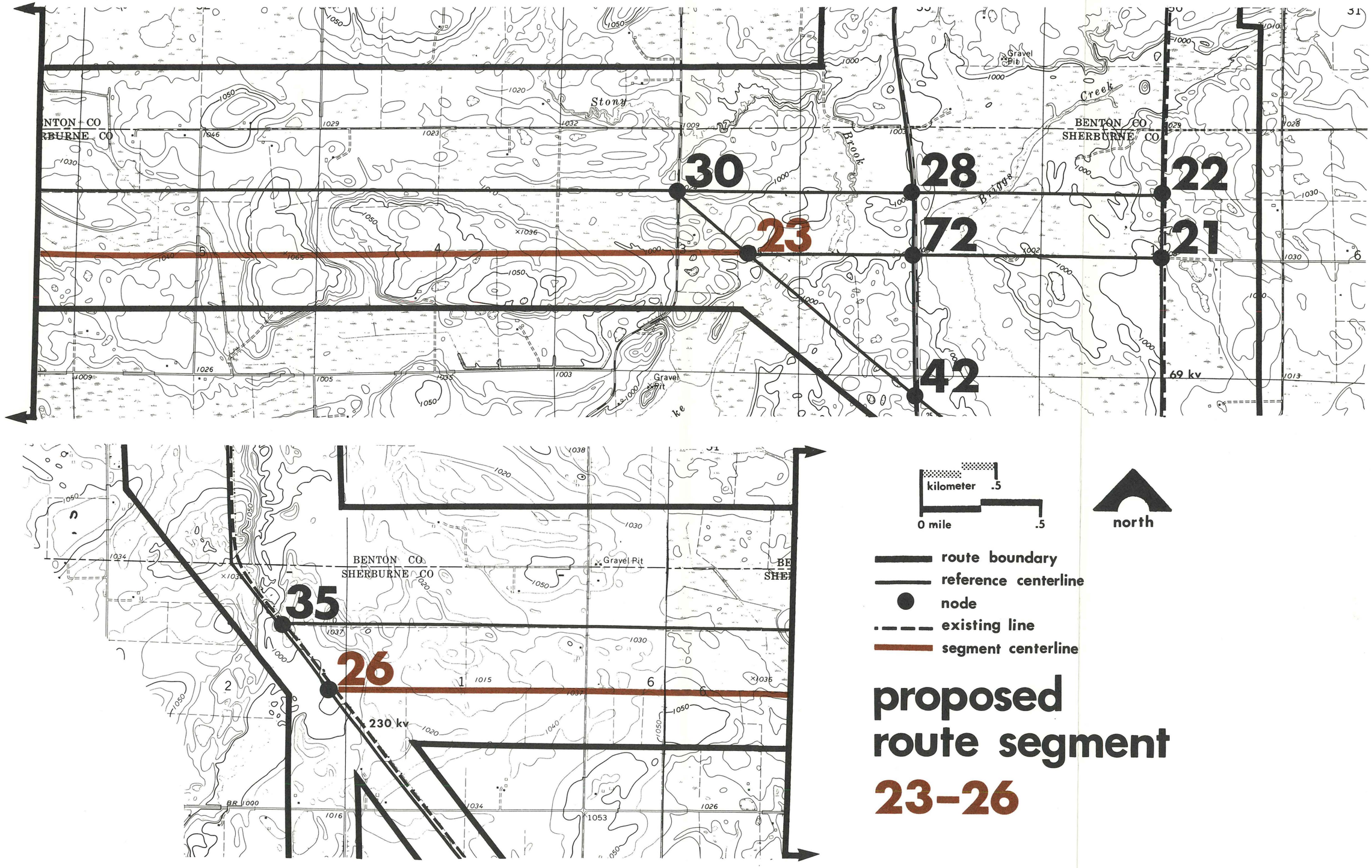
Route segment C-1 (nodes 32-12) is an alternative for interconnecting Highway 10 (Route C) with the Monticello-Benton County 230 kV transmission line (Route A). This route segment has a total length of 3.6 miles and parallels the east side of County Road 53 for 3.4 miles. The reference centerline crosses 10 property units, most of which are used for agricultural activities.

The soils along this route segment are primarily Hubbard and Salida soils. No prime farmland has been identified in this route segment, however, 1.5 miles of the route length will cross soils with high irrigation potential. Presently, 8 center pivot systems and a row irrigation system are in operation within the route segment. The reference centerline will border six of the center pivot systems and cross the row irrigated field.

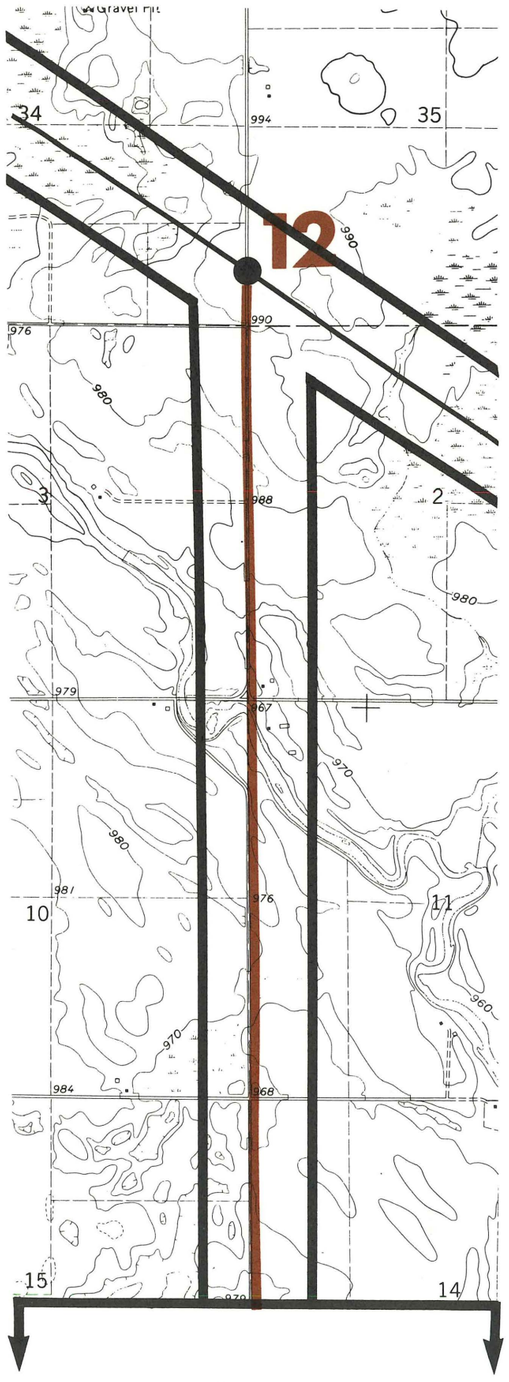
Route segment C-1 contains one rural subdivision known as Prairie Acres. Several new homes have been constructed in this subdivision and several others are being planned for construction in the near future. A total of 9 residential structures and one new storage barn are within 500 feet of the reference centerline. Two additional homes are located within 500 and 1,000 feet of the centerline.

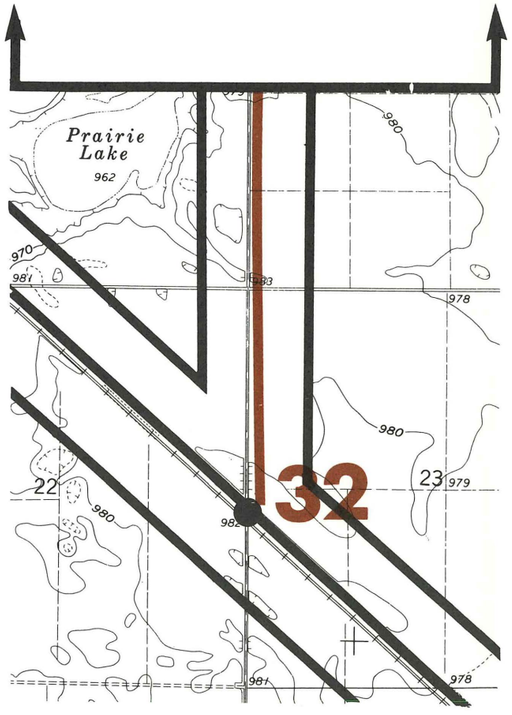
This route segment will parallel 3.4 miles of County Road 53. This roadway has been identified in the Sherburne County Land Use Plan as a scenic roadway. In addition, three unpaved roads will be crossed.

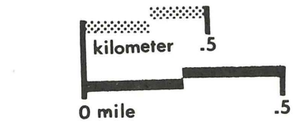
The reference centerline of this route segment will cross approximately .2 mile of wetland and .5 mile of woodlot vegetation. Most of this vegetation is located in the 1.1 mile portion of the route segment north of the Elk River.



proposed route segment 23-26







route boundary
reference centerline
node
existing line
segment centerline

proposed route segment 32-12

The Elk River and .3 mile of the river's floodplain would be crossed by this route segment. The FIA has identified the Elk River's floodplain as a Flood Hazard Zone. Construction, filling and flood proofing in this area should, at a minimum, meet the requirements of the FIA.

No known recreational facilities, archaeological sites, scientific areas or unique wildlife habitats exist in this route segment.

A summary of impacts identified within route segment C-1 is presented in Table 5.10. The columns outlined correspond to the impacts associated with segment C-1. The "Total Impact" column lists the total impacts potentially encountered in a complete route of which B-2 is a segment.

5.9.6 Route Segment D-1

Route segment D-1 (nodes 22-38-29) was presented to the CREC as an alternative to paralleling State Highway 25. This route segment parallels the Becker-Foley 69 kV transmission line north from node 28 to State Highway 95. The route segment then turns due west, paralleling the highway, until it intersects State Highway 25. Total route segment length is 3.3 miles. This route segment will cross 16 property units and 4 cultivated fields. The route segment is characterized by agricultural fields and wetlands.

The soils encountered within this route segment are primarily peat, Sartell, and Chetek soils. Approximately 1.0 mile of this route segment is classified as prime farmland and an additional 1.0 mile crosses areas with high irrigation potential. Presently, there are no irrigation systems in the route segment.

Seven homes are located within 500 feet of the route segment's centerline. All of these homes are located along Highway 95. Two additional homes are located within 500 and 1,000 feet of the reference centerline. This route segment will cross two paved roads and one unpaved road. The Highway 95 crossing will require a utility crossing permit from MNDOT.

Route segment D-1 crosses .5 mile of woodlots and .9 mile of wetland vegetation. No windrows will be affected by the reference centerline. A total of 5 water courses will be crossed by this route segment. Most of these waterways are man-modified field drainage ditches. Briggs Creek, however, has been identified as a trout stream; consequently, selective vegetation removal soil erosion control and stream bank protection should be employed to minimize potential adverse impacts.

Table 5.13

IMPACT SUMMARY ROUTE D-1

VARIABLES	ROUTE SEGMENTS											
	1-5	5-10	10-31	31-19	19-20	20-21	21-22	22-38	38-29	29-39	39-40	Total
segment length	2.0	4.0	3.7	0.8	0.3	1.4	0.3	2.3	1.0	6.0	1.3	23.8
length parallel to HVTL ROW	0	4.0	3.7	0.8	0.3	1.4	0.3	2.3	0	0	1.3	14.8
diagonal length	0	0.4	0	0	0	0	0	0	0	0	0	0.4
#property lines crossed	1	8	12	3	2	2	1	7	3	25	3	70
miles of property lines bordered	0	1.6	1.5	0.8	0.3	0.8	0	1.4	1.0	6.0	0.4	4.8
#of fields crossed	0	5	1	0	0	3	0	1	0	0	0	11
miles of fields crossed	0	0.6	0.2	0	0	0.2	0	0	0	0	0	1.1
miles of fields bordered	1.6	1.8	1.3	0.3	0.2	0.2	0	0.1	0.4	3.6	0.6	10.1
pastures crossed	0	0.3	0.3	0	0	0	0	0	0.1	0.6	0.1	1.4
prime farmland crossed	0	0	0	0	0	0	0	0.5	0.5	1.4	0	2.4
high irrigation potential	1.3	1.8	3.1	0.5	0.2	1.1	0.1	0.9	0.1	1.7	0.7	12.0
# of center pivots crossed	0	0	0	0	0	0	0	0	0	0	0	0
# of center pivots bordered	0	1	0	0	0	0	0	0	0	0	0	1
# of row irrigation crossed	0	0	0	0	0	0	0	0	0	0	0	0
# of row irrigation bordered	0	0	0	0	0	0	0	0	0	0	0	0
homes 500' of ROW	0	1	4	0	2	0	1	0	7	41	0	56
homes 500-1000' of ROW	2	4	2	2	0	1	0	0	2	6	0	19
business 1000' of ROW	0	0	1	0	0	0	0	0	0	2	0	3
church/cemetary 1000' of ROW	0	0	0	0	0	0	0	0	0	0	0	0
#platted areas crossed	0	1	0	0	0	0	0	0	0	1	0	2
# platted areas bordered	0	1	0	0	0	0	0	0	0	0	0	1
#paved roads crossed	2	0	1	0	0	1	0	1	1	2	0	9
# unpaved roads crossed	0	3	1	0	0	1	0	0	0	4	0	8
#scenic roads crossed	0	0	0	0	0	0	0	0	0	0	0	1
scenic road bordered	0	0	0	0	0	0	0	0	0	0	0	0
airport within 1 mile	0	0	0	0	0	0	0	0	0	0	0	0

IMPACT SUMMARY ROUTE D-1

VARIABLES	ROUTE SEGMENTS											
	1-5	5-10	10-31	31-19	19-20	20-21	21-22	22-38	38-29	29-39	39-40	Total
hwy. ROW bordered	0	0	0	0	0	0	0	0	1.0	6.0	0	7.0
# of windrows crossed	0	5	0	0	0	0	0	0	0	0	0	7
# of windrows bordered	0.4	0.3	0.1	0	0	0	0	0	0	1.9	0	2.7
wood lot crossed	0.1	0.7	0.9	0	0.2	0.8	1.4	0.4	0.1	0	0.4	4.1
wetland crossed	0	0.2	0.1	0.1	0	0	0	0.3	0.6	0.5	0	2.1
tree farms crossed or bordered	0	0	0.7	0.2	0	0	0.2	0	0	0	0	0.9
steep slopes 6%	0	0.4	0.1	0	0	0	0	0.3	0	0.2	0.3	1.4
# of lakes within 1000' of centerline	0	1	1	0	0	0	0	0	0	0	0	2
stream crossings	0	1	2	0	0	0	0	3	2	3	6	18
trout streams	0	0	0	0	0	0	0	1	0	0	0	1
Flood Hazard Zones	0	0.2	0	0	0	0	0	0	0	0.1	1.3	1.6
public rec. crossed	0	0	0	0	0	0	0	0	0	0	0	0
public rec.1000' of ROW	1	0	0	0	0	0	0	0	0	0	1	2
pvt. rec. crossed	0	0	0	0	0	0	0	0	0	0	0	0
pvt. rec. 1000' of ROW	0	1	0	0	0	0	0	0	0	0	0	1
archaeological sites	0	0	0	0	0	0	0	0	0	0	0	0
wildlife refuges crossed	0	0	0	0	0	0	0	0	0	1	0	1
scientific/wildlife/vegetation of importance crossed	0	0	0	0	0	0	0	0	0	0	0	0
scientific/wildlife/vegetation of importance 1000' of centerline	0	0	0	1	0	0	0	1	0	0	0	2

In addition to the trout stream which is located in the route segment, the Minnesota Department of Natural Resources notes that Sandhill Cranes often use wetland habitats near the Sherburne National Wildlife Refuge. The broad wetland areas in this route segment are approximately 3.5 miles from the Sherburne Wildlife Refuge boundary. No other recreational facilities, archaeological sites, scientific areas or unique wildlife habitats are known to exist in the route segment.

Table 5-13 summarizes the impacts associated with route segment D-1.

5.10 ROUTE IMPACTS-COMPARATIVE SUMMARY

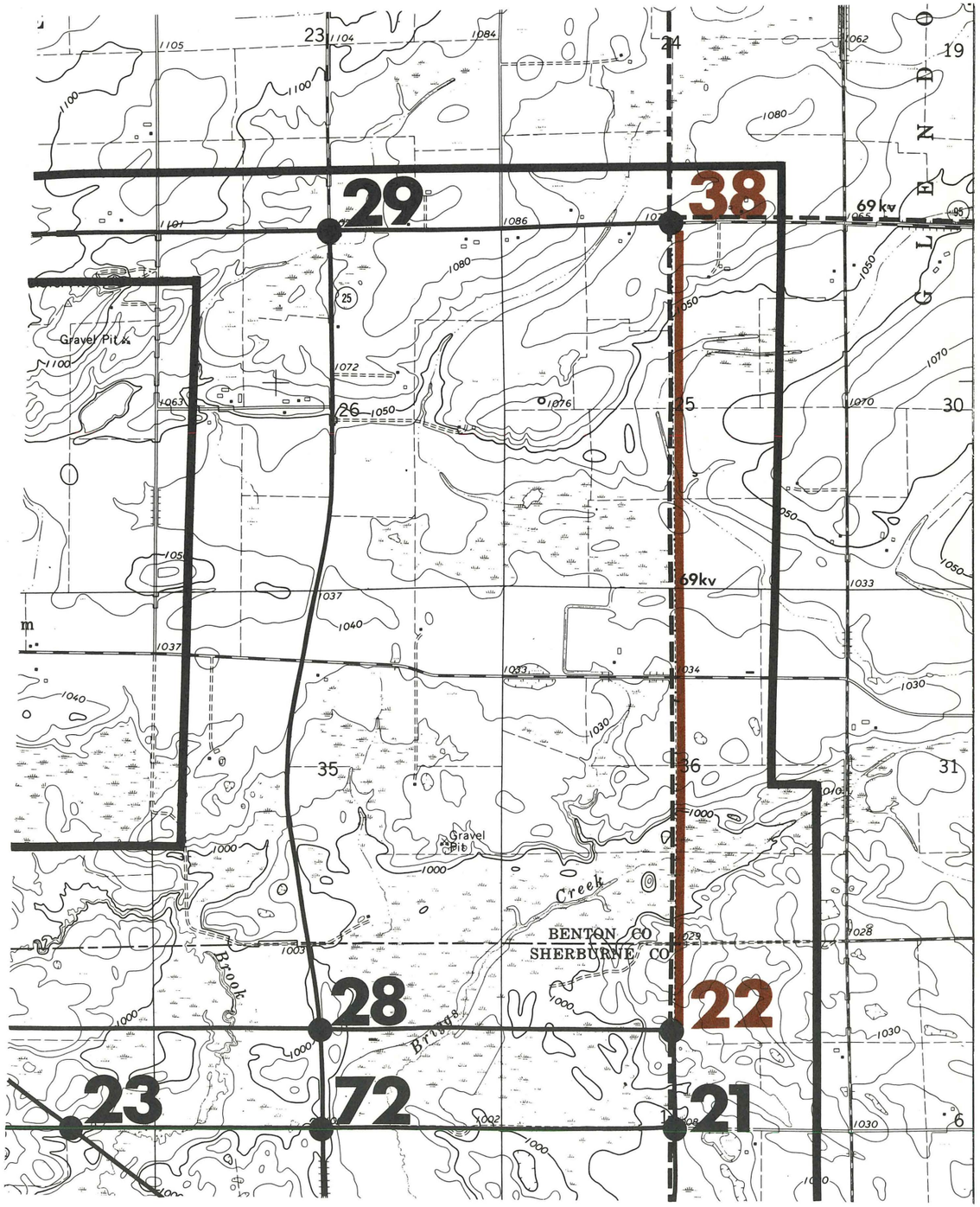
In the previous sections of this chapter, the potential impact of a transmission line on human settlement activities, economic operations, and the natural environment were discussed for each individual route segment. The following text is a comparative summary of the major impacts associated with each of the routing options.

Every routing option imposes a unique set of environmental impacts. Some of the routes impose impacts on human settlement patterns while other routes present constraints for agricultural activities. The selection of a final route for the 345 kV transmission line will require a balancing of all the impacts as well as consideration of appropriate mitigative measures to reduce overall impact levels.

5.10.1 Impact on Existing and Projected Human Settlement Activities

All of the routes and route segments under consideration for the Sherco to Benton County 345 kV transmission line, generate some human settlement impacts. The magnitude of human settlement impacts is greatest where a proposed route passes through population centers, such as Clear Lake or the Briggs Lake region. In addition, high human settlement impacts can be expected where routes encounter large numbers of residential and commercial buildings.

The greatest concentrations of population and development activities are located in the community of Clear Lake and the area surrounding the Briggs-Rush Lake region. Routes A, C, and Route Segment B-1 pass through, or within close proximity to, these population centers. Route C imposes the greatest direct impact on a population center, in that it passes directly through downtown Clear Lake. Construction activities associated with the line would disrupt the daily shopping, transportation, work and living environment of Clear Lake.



kilometer .5

0 mile .5

north

route boundary

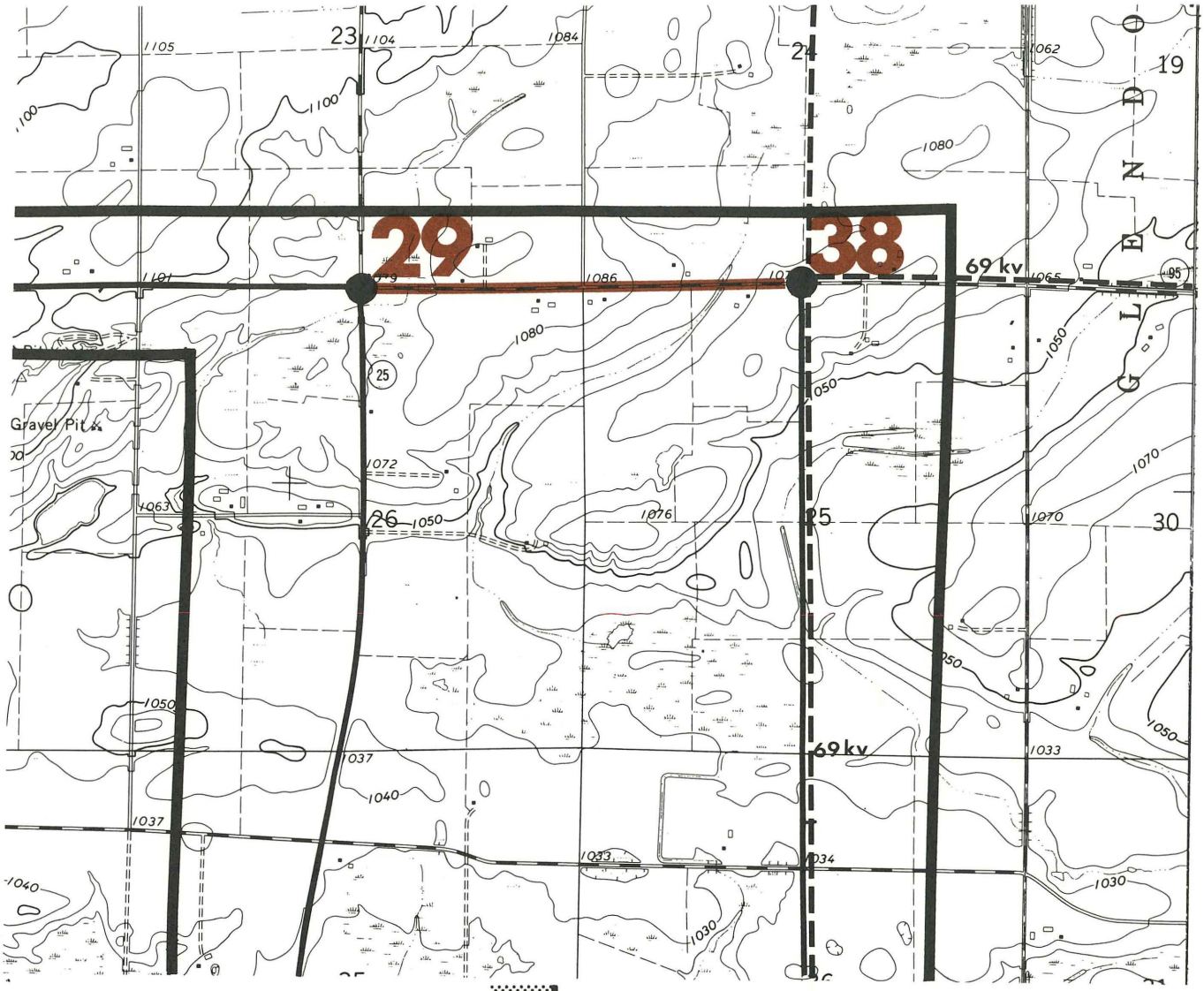
reference centerline

node

existing line

segment centerline

proposed route segment 22-38



proposed route segment

38–29

In addition to population centers, numerous homes and businesses abut State Highways 10, 25 and 95. The reference centerline of Route D, which parallels Highways 25 and 95, will encounter the greatest number of residential structures. (76 homes within 500 feet of the reference centerline.) Route A, although passing near the Briggs Lake resort area, encounters the least number of residential structures (4 homes). However when comparing the total number of homes within 1,000 feet of the reference centerlines, Routes A, B and Routes Segments B-3, B-4, and B-4' are relatively equal in magnitude with regard to impacts on existing homesites.

Several new residential subdivisions have developed in the study area. Most of these platted areas are located along State Highway 25. As such Route D imposes the greatest potential impact on newly develoipig subdivisions. Route A and B bisect Wildwood Acres, however, the proposed transmission line would be located along the back lot lines of homes in this subdivision. The dense tree cover in the vicinity of the subdivision should help to shield the residential area from the visual impact of the transmission line. Route A encounters two additional new residential subdivisions in the Briggs Lake area. The flat terrain and lack of vegetation around Briggs Lake would make a transmission line sited near the lake highly visible in the new residential areas.

The potential impact of the transmission line on the region's transportation system varies widely from route to route. Routes C and D parallel State Highways 10, 25 and 95 for considerable distances. In most instances, however, the reference centerlines indicate transmission line rights of ways which will not infringe upon existing highway rights of ways, but merely parallel them. Unless substantial improvements or relocations of these existing roadways take place, the proposed transmission line should have only minimal effect on the roadways. The Sherburne County Land Use Plan has identified portions of County Road 3, County Road 6, and County 53 as scenic roadways. Route segments C-1 and B2 would parallel these "scenic" roadways. As such, route segments (C-1, B-2) disrupt the visual integrity of these roadways.

The most serious transportation related impacts are associated with the region's air traffic. Route C would affect 3 airfields. Of the three landing areas, the impacts on the Clear Lake Airport would be the most serious. The selection of Route C for the transmission line could jeopardize the operating license of the Clear Lake Airport. Route A and route segment B-1 would place a transmission line within 2,000 feet of landing areas

on Briggs Lake. The construction of a 345 kV transmission line along these routes could pose hazardous conditions for seaplanes in the vicinity, especially during poeriods of limited visibility. The added hazard of a 345 kV transmission line along this route and route segment is partially mitigated by the fact that an existing 230 kV transmisison line is located in Route A and the Cable-Boyd Lake 69 kV line is located along route segment B-1.

With the exception of Route D, all of the routes will enter the Benton County substation from the south. This southern access would place a new transmission line in the general vicinity of the St. Cloud Airport. It would appear, however, that the 345 kV transmission line could be sited in such a manner so as to not interfere with safe operation of aircraft using the St. Cloud Airport. Only route segment 27-26 will conflict with the future building restriction zone and approach zone to the Clear Lake Airport. Nevertheless should any route be selected which uses a southerly approach to the Benton County substation, NSP should coordinate with the City of St. Cloud and the Minnesota Department of Transportation to insure that adequate safety precautions and clearances are maintained.

Mitigating Measures

Careful construction practices, planning and scheduling can help to mitigate the temporary impacts on human settlement activities. In particular, the utility should seek to minimize the disruption caused by construction in areas of concentrated population and commercial activity such as Clear Lake and the Lake Briggs region. In addition residential and commercial areas along Highway 10, Highway 25 and Highway 95 should be protected from construction related impacts.

During the final design and engineering phases of project planning, and in negotiating easements, the utility should seek to minimize the potential adverse effects of the transmission line on existng and propsoed land uses. The utilities should seek to develop a right of way alignment which is consistent and compatible with local development patterns.

5.10.2 Impacts on Economic Activities

Since the economic base of the study area is agriculturally related, impacts of the proposed transmission line on agricultural activities are of considerable concern. Route A poses a severe agricultural impact on the region in that it represents the longest diagonal

crossing of cultivated fields (9.7 miles). In addition Route A crosses more agricultural fields (30) than any other route. Routes C and D have the least potential impact on agricultural fields because they parallel existing roadways.

Many of the agricultural activities in the region rely upon irrigation systems. Routes C, D and route segment C-1 pose the greatest impacts to existing irrigation systems. Routes B, B-3 and B-4 pose the least impact, to irrigated fields.

Soils in the project area are sandy and prone to wind erosion. Crossing and removal of windrows can affect the long term productivity of the region. Routes A, B-4', and C-1 would cross the most windrows while Routes D, D-1 and B-4 would potentially require the greatest number of windrows to be completely removed.

Finally, the study area does not have broad areas of prime agricultural soils. Most of the prime farmland, as defined by the Soil Conservation Service, is scattered in isolated pockets throughout the northern portion of the study area. Route segment B-4, B-4', and Route D would cross the greatest amount of "prime farmland." It should be noted, however, that some of the areas rated as "prime farmland" are not actively cultivated.

Mitigative Measures

Agricultural impacts can occur on any of the proposed routes. The magnitude of impacts may differ, depending upon: the number of fields crossed; the presence of irrigation systems; the type of crops grown; soil types; windrows affected; diagonal crossings verses following property lines; and right of way sharing potentials. Possible mitigative measures include: careful planning of the final location of the right of way and structures; structure type; careful construction scheduling; strict adherence to construction practices which minimize damage to soil, crops or livestock; and the use of appropriate right of way management techniques to reduce problems such as weed growth around the base of transmission line structures.

5.10.3 Impacts on the Natural Environment and Public Lands

All of the proposed transmission line route alternatives will generate some impacts on the natural environment. The impacts can be divided into impacts on recreation areas, impacts on wildlife/vegetation systems; impacts on sensitive landscape features such as steep slopes and floodplains; and impacts on historical or archaeological sites.

5.10.3.1 Impacts on Recreation Areas

The study area has relatively few public recreational areas. The most important sites are located around the Briggs-Elk Lake region. The lake areas provide a variety of camping and water oriented recreational activities. Route A would pose the greatest impact on the recreational activities of the lakes. Although the reference centerline would not directly interfere with daily recreational activities, the transmission line would further detract from the visual environment associated with outdoor recreational activities. The Monticello-Benton County 230 kV transmission line through the lakes region partially diminishes the magnitude of visual impact that a new 345 kV line sited in the same vicinity might impose.

Several private recreatonal facilities are distributed throughout the study area. Route A would impose the greatest impact on private recreation areas as it would cross one private boat launching and beach area; and pass within 1,000 feet of a lake resort and a trap-shooting club. Route C would pass within 1,000 feet of a private campgrounds however, the reference centerline is located on the opposite side of a four lane divided highway. This roadway would provide a buffer between the transmission line and the campgrounds. Routes A, B and D border Riverwoods Campground. The reference centerline does not cross the campground area and the wooded areas around the campground would help to minimize potential visual impacts. Finally, except for Routes A, C, and C-1, all routes cross Briggs Creek. Briggs Creek has been identified as a trout stream and therefore offers unique recreational opportunities. Public access to Briggs Creek, however, is limited as the only access points to the creek are from public roadways. Highway regulations generally restrict fishing activities from roadways.

5.10.3.2 Impacts on Natural Areas and Wildlife Habitats

Due to the extent of farming activities in the study area, relatively few areas remain in a natural state. The areas which do remain are in the form of small scattered stands of woodlots and wetlands. In addition some prairie remnants may exist in areas which have experienced relatively lttle farming or grazing. The woodlot areas are generally found in the eastern and northern sections of the study area. These wooded areas are often located in regions where the topography is not conducive to agricultural uses. Route B and route segments B-1, B-2, and B-3 would cross the greatest number of wooded parcels. Woodlots are also frequently found along stream banks. These wooded areas are of

particular importance because they help to stablilize stream bank erosion, regulate water temperatures, and influence water quality. Route D and segment D-1 cross the greatest number of rivers and streams.

Dr. Max Partch has inventoried and classified the vegetation areas in Benton and Sherburne Counties. He identified several areas as prime candidates for preservation by The Nature Conservancy. The Nature Conservancy however, has no short or long-term plans to acquire or manage any of these sites. Nevertheless, the sites identified by Partch warrent consideration in siting, right of way clearing, and construction. None of the route or route segment reference centerlines cross sites, identified by Partch. Routes A, B, B-3 and B-4' however, would border portions of sites identified by Partch.

Wetlands are highly productive ecosystems. They provide habitats for a wide range of aquatic, bird and terrestrial wildlife species. Route A crosses the largest number of wetland areas. Of particular importance are the wetland areas adjacent to lakes and rivers. These wetlands serve as important spawning and feeding areas for lake and river aquatic life. Route A crosses a wetland area that lies adjacent to Lake Briggs and Elk Lake. All of the other routes cross some wetland regions which are adjacent to, or at the headwaters of, small streams and creeks.

The Minnesota Department of Natural Resources has indicated that three areas of particular value to waterfowl in the region are the lakes southeast of Clear Lake, the Elk Lake Heron Rookery and the wetlands nearest the Sherburne National Wildlife Refuge. The routes and route segments most likely to affect these waterfowl regions are A, B-3, B-4', C, and D-1.

5.10.3.3 Impacts on Historic, Cultural, or Archaeological Sites

There are no known historic or culturally significant sites within the route boundaries of any proposed route alternative. The Minnesota Historical Society notes that several recorded prehistoric archaeological sites are located in the vicinity of Lake Briggs and Elk Lake. The Historical Society further notes that a high correlation exists between close location of rivers, tributaries and marshes, and archaeological sites. Route A passes between Elk Lake and Lake Briggs and requires the largest number of wetland crossings. Although archaeological sites may exist along any of the proposed routes, the greatest potential for archaeological impacts exists for Route A. In any case a detailed archaeological survey of the final route selected should

be conducted prior to transmission line construction, so as to minimize damage or disruption of prehistoric archaeological sites.

Mitigating Measures

Mitigation of potential impacts on natural areas, wildlife habitats, floodplains, wetlands, recreational areas, and archaeological sites can be achieved through careful design engineering and construction of the proposed transmission line. Protection against soil erosion, selective vegetation removal, construction scheduling and structure location can all help to reduce the number and magnitude of impacts. Specific construction practices may be required under the conditions of the construction permit. In addition, individual sites may also be singled out in the permit for special treatment.

5.11 RELIABILITY, COST AND ACCESSIBILITY

The three factors of reliability, cost and accessibility must be considered in response to the requirements of the MEQB "Rules" governing the siting of high voltage transmission lines in Minnesota. These considerations are related to the primary criteria required by the MEQB in evaluating the acceptability of any proposed high voltage transmission line route. These criteria are: minimize adverse human and environmental impact, maximize the efficient use of resources; and ensure continuing electric power system reliability. Reliability is important in the provision of uninterrupted electrical service. Interruption of electrical service can cause economic losses and can disupt functions of important services. The cost of constructing and maintaining a transmission line is important in order to help maintain a reasonable cost of electricity to the consumer. Costs increase in direct proportion to the length of the line. The type of structures used also affects total costs of the project. Accessibility directly affects the efficiency by which the line may be constructed, adequately maintained and repaired. In some areas, access roads may need to be built to the right of way for construction, maintenance and repairs.

5.11.1 Reliability

The issue of reliability has been discussed in detail in Chapter 3. Reliability of service for a proposed transmission line becomes particularly important when a transmission line may be located adjacent to other lines in a transmission system. Where the adjacent

lines serve a similar purpose, common load centers or are designed to supplement or support one another, the physical proximity which results from double circuiting, paralleling or use of common rights of way increases the potential for common outages or faults.

Information supplied by NSP, indicates that paralleling or double circuiting the existing Monticello to Benton County 230 kV transmission line would pose the highest risk to system reliability. The existing 230 kV line and the proposed 345 kV line will both serve as the primary bulk power source for central Minnesota. An outage that would affect both transmission lines would seriously impact the ability of the utility companies to adequately meet peak demands in central Minnesota. The reason for this is that with both the 345 kV and 230 kV lines out of service, there is not an aequate back-up system to redistribute power in sufficient quantities to central Minnesota. From the standpoint of reliability, Route A and route segment C-1 pose the greatest potential impact. Routes utilizing the existing 69 kV systems also pose a reliability problem, but of a lesser magnitude. Should both the 345 kV and 69 kV lines experience a simultaneous outage, the number of customers and geographic region affected is much smaller. (See Chapter 3.)

5.11.2 Cost

The cost of a transmission line is proportional to its length, land uses within the proposed right of way, type of structures used, and constraints which must be successfully overcome. Table 5.14 identifies route lengths and estimated construction costs for each complete route option. Several structure options are listed in the cost chart. The highest cost estimate for the line is $7,705,000 and the lowest estimate is $3,375,000. In general, the costs are higher for double circuiting options than for paralleling or single circuit wood pole options. The applicants have stated a preference for the use of wooden "k" frame structures, however, the MEQB may consider all structure types and their relative impacts in designating a specific structure type(s).

5.11.3 Accessibility

Most of the routes presented are accessible by existing public roads or service roads. Route B and route segments B-3, B-4 and B-4', however, would have limited access for approximately 6-8 miles of the route. These segments tend to be located on field boundaries, quarter section lines and half section lines rather than along existng roads.

TABLE 5-13

ESTIMATED PROJECT COST

Routes	Total Route Length*	Length* with Parallel or Double Circuit Opportunities	Wood k-frame Single Circuit Construction Cost	Single Circuit Steel Pole Construction Cost	Double Circuit Steel Pole Construction Cost
A	16.7	14.7	$3,705,000	$5,135,000	$7,505,000
B	19.2	10.1	$4,110,000	$5,850,000	$6,630,000
C	17.2	3.5	$3,375,000	$5,695,000	$5,695,000
D	22.1	1.3	$4,190,000	$6,215,000	$6,440,000
B-1	19.1	17.1	$4,165,000	$5,830,000	$7,195,000
B-2	20.1	10.1	$4,305,000	$5,970,000	$7,155,000
B-3	20.3	11.8	$4,230,000	$6,075,000	$7,003,000
B-4	19.3	10.4	$3,995,000	$5,935,000	$6,715,000
B-4'	20.2	11.8	$4,375,000	$6,160,000	$7,065,000
C-1	16.3	9.1	$4,175,000	$5,420,000	$6,745,000
D-1	23.8	14.8	$4,215,000	$6,375,000	$7,705,000

*Lengths are measured in miles.

5.12 METHODS OF MINIMIZING IMPACTS

5.12.1 Existing Land Use or Management Plans, and Established Methods of Resource Management

Existing city and county management plans make no specific reference to transmission lines other than recognizing them as essential services. The project and routes have been discussed with local authorities and their comments have been considered in the route and evaluation process.

5.12.2 Use of Existing Right of Way

All complete routes make use of existing rights of way to varying degrees. Table 3.3 summarizes the amount and type of right of way needed under different conditions. As shown, several route alternatives offer potential for paralleling existing rights of way for most of their length. It should be noted, however, that although several routes permit paralleling existing road rights of way, opportunities for sharing existing rights of way may be limited due to existing right of way encumbrances/or projected road improvements.

NSP has indicated that if a route is selected which utilizes portions of the Sherco to Foley 69 kV transmission line, NSP would double circuit the two transmission lines. If the lines are double circuited using steel poles, there is an opportunity to reduce the number of poles from an average of 13 to 18 wooden k frame structures per mile now used for the 69 kV line to an average of 5 to 7 steel pole structures per mile. This is an average reduction of 8 to 11 structures per mile. These are average figures and the number of structures per mile will vary depending upon topographic features and environmental constraints. The opportunity, however, does exist for an overall reduction in the number of structures within an existing right of way. This potential for structure reduction would accrue to all routes using the Becker-Foley 69 kV line corridor.

Route B, and route segments B-3, B-4 and B-4' would all require the establishment of new right of way corridors as portions of these routes do not follow or parallel existing rights of ways. The new right of way requirements along these segments range from 116 to 125 acres.

5.12.3 Natural Division Lines

In most of the route alternatives the reference centerline follows existing property lines or survey lines for a major portion of the route. The 3.0 mile diagonal segment of route B and the 9.7 mile diagonal length of

Table 5-14

Rights of Way Paralleled

	ROUTES										
	A	B	C	D	B-1	B-2	B-3	B-4	B-4'	C-1	D-1
Total route length	16.7	19.2	17.2	22.1	19.1	20.1	20.3	19.3	20.2	16.3	23.8
Transmission line rights of way paralleled	14.7	10.1	3.5	1.3	17.1	10.1	11.8	10.4	11.8	9.1	14.8
Road right of way paralleled	0	0	7.1	18.8	0	6.0	0	0	0	5.3	7.0
Railroad right of way paralleled	0	0	4.6	0	0	0	0	0	0	0	0
Total right of way paralleled	14.7	10.1	15.2	20.1	17.1	16.1	11.8	10.4	11.8	14.6	21.8
% of route paralleling existing right of way	88	53	88	91	90	80	58	54	58	90	92

Route A are major exceptions. In these two cases continuous stretches of transmission line would not follow natural, property or political boundaries.

5.12.4 Alternative Structure Types

In its Application for a Construction Permit, NSP has indicated a preference for wooden "k" frame structures for this project. This preference was based on the relative cost of wooden poles as compared to other structure types. Other structure types examined and under consideration are single shaft poles and double circuit structures. The Citizens Route Evaluation Committee has stated a preference for double circuiting existing transmission lines as much as possible and the use of single shaft poles rather than wooden "k" frame structures.

Tables 3.1 and 3.2 compare the following features of different structure types: number of structures required per mile; foundation requirements; height; land area at base; required guying; and costs per mile. Advantages associated with one structure type for one or several of the above features may be offset by other undesirable characteristics. For example, lattice towers are relatively low in cost, can accommodate longer spans than some other types, and do not require guying. However, they impose a much higher land requirement per tower at base (900-1,000 square feet versus 30-50 square feet for single shaft poles). These advantages and disadvantages must be weighed in order to choose the optimum tower structure type.

5.12.5 Alternative Technologies

Currently, the only practical way of transmitting electric power is by transmission lines. Other methods that have been proposed (e.g., transmission of power by lasers or by microwave) are very inefficient and currently are not technically feasible. Therefore, the only alternative to be considered here will be underground cables.

There are a number of possible underground cable systems. Three types that will not be considered as alternatives are super-conducting, cryogenic, and compressed gas. Both superconducting and cryogenic (supercold) cables are still in the research and development phase and are not yet available for utility use. Compressed gas insulated cables are now only practial for short cable sections in special circumstances. Other systems (solid insulation, high pressure oil-filled pipe-type cables, and low pressure self-contained cables) will be considered in this section.

5.12.5.1 Solid Insulation

Cables with solid plastic insulation ("solid dielectric cable") are commonly used for underground power transmission. They are simple, reliable, and have a relatively low ost when compared to other underground cable systems. However, they are currently available, only for voltages up to about 138 kV. This type of transmission system is considerably more costly than overhead configurations, and would require construction practices which could have significant environmental impacts.

5.12.5.2 High Pressure Oil-Filled Pipe-Type Cables

High pressure oil-filled pipe-type cable (HPOPT) is the cable system most often used for underground transmission lines of 230 kV or larger in the United States. This system has a long history of use and is very reliable. It is also very expensive (five to ten times as expensive as overhead lines).

HPOPT cable is constructed by welding rigid steel pipe sections together in a trench, backfilling the trench, pulling cables insulated with a special paper tape through the pipe, and filling the pipe with a special oil under high pressure. To maintain the high pressure, pumping stations are provided along the cable. To increase the power transfer capability of the cable, a cooling system can be provided to cool the oil at the pumping stations.

5.12.5.3 Low Pressure Oil-Filled Self-Contained Cable

Low pressure oil-filled self-contained cable (LPOF) is used extensively for voltages above 200 kV in Europe and Japan and to some extent in the United States. While being simpler in design and less costly than HPOPT cable, LPOF cable is more susceptible to damage since it lacks steel piping.

LPOF cable is made with an outer oil-tight flexible sheath, oil soaked insulating paper, and a hollow conductor. Oil fills the hollow conductor and, through holes in the conductor, keeps the paper insulation saturated with oil. Oil reservoirs are provided along the cable route to maintain the low pressure on the cable.

This type of cable costs about four to eight times the cost of an overhead system of the same voltage and capacity.

5.12.5.4 Evaluation of Alternatives

The use of underground high voltage cable is often possible. The main question is whether it is practical to do so. Because of the costs involved, underground construction is normally considered only in areas of special concern such as highly scenic locations or densely populated areas.

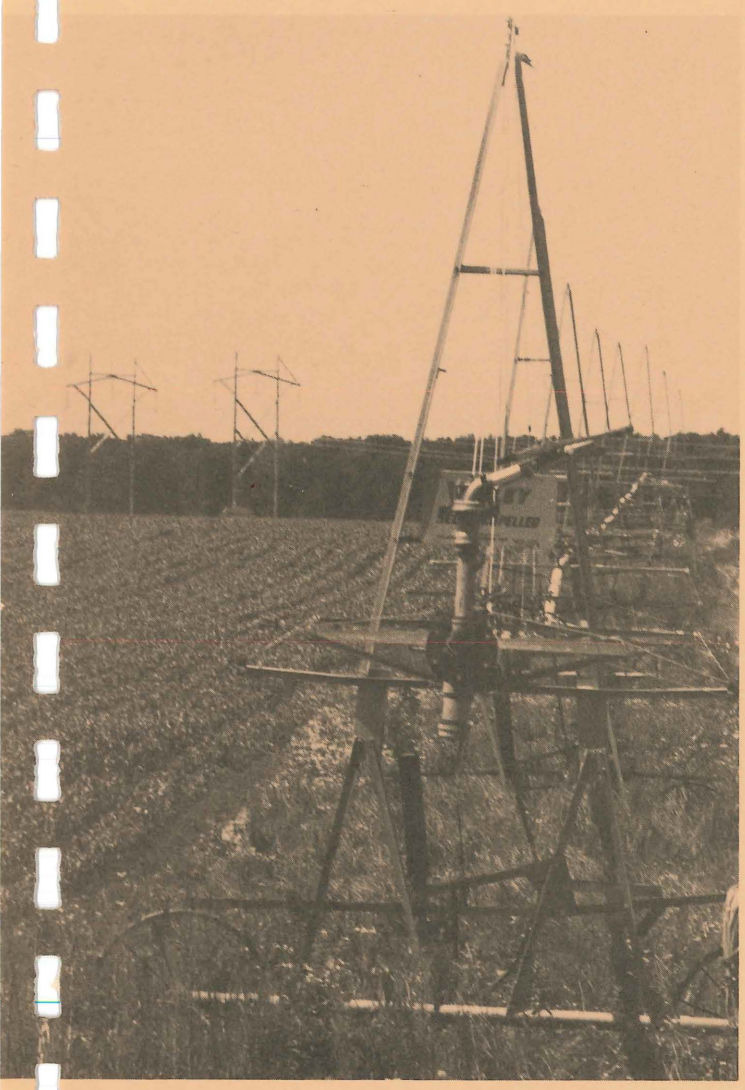
Other potential problems associated with undergrounding high voltage transmission lines are:

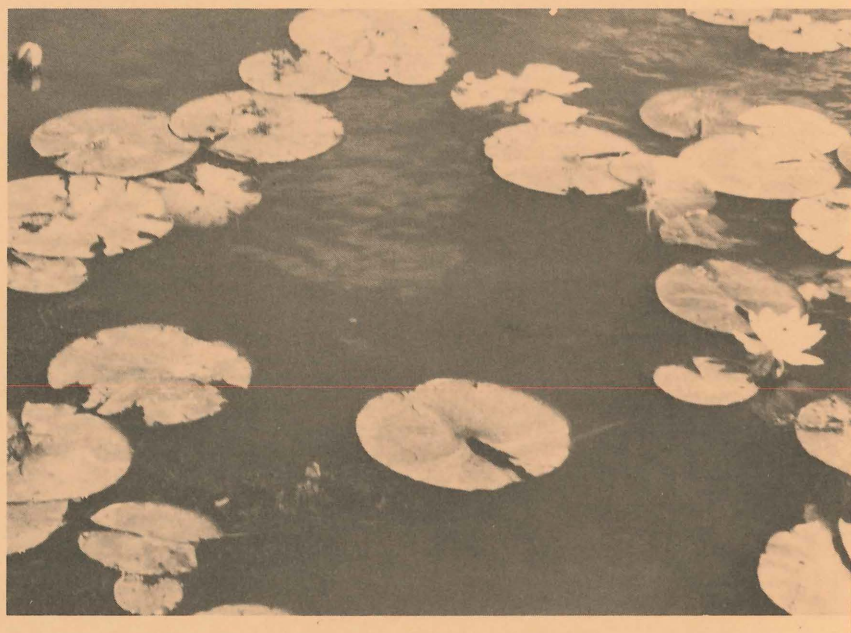
1. Engineering - While an underground system would be less susceptible to weather-related outages, it is sensitive to damage by digging equipment. When damage does occur, it takes much longer to repair than overhead cables.

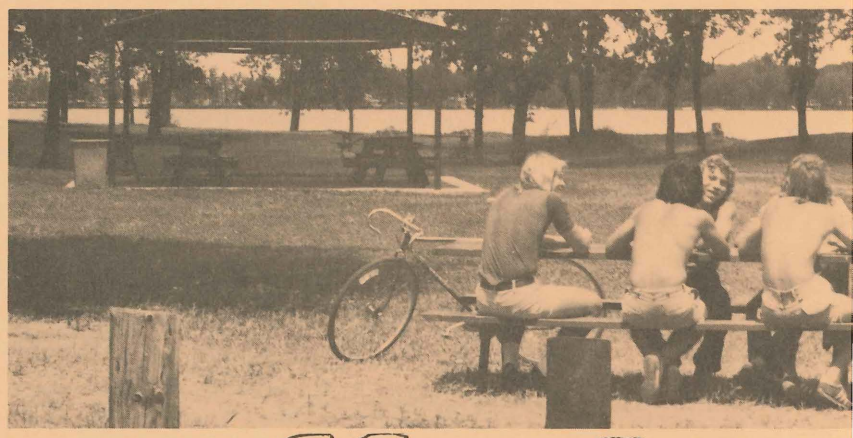
2. Potential adverse environmental effects - The soil would be disturbed by the trenching and special backfill requirements. Vegetation on the right of way would be limited to small shallow rooted species, potentially limiting the ability to restore the right of way to or near its natural state in those instances where the right of way crosses natural areas.

   In the case of line failure, the use of heavy construction equipment on the right of way would be required. Negative impacts on vegetation could also occur because the heating effects of the cable could cause the soil to dry faster than other soil in the area.

3. Agricultural effects - The trenching and backfilling required with underground cable construction constitute a disturbance of the soil which may have negative impacts on soil productivity. Even with careful construction techniques, some soil mixing may be unavoidable. Depending on the type of subsoil and the degree of mixing which occurs, the trenching could potentially affect the fertility and other qualities, e.g., drainage of the disturbed soil. In addition, soil moisture in land above the cable may be deleted as a result of heat dissipation from the cable. This effect could also reduce productivity.







effects

6

6.1 ADVERSE EFFECTS OF THE PROPOSED TRANSMISSION LINE

Construction and operation of the proposed 345 kV transmission line will have some unavoidable adverse effects on the environment. As discussed previously, these impacts can be divided into three major areas of concern. These are agriculture, human settlement, and the natural environment impacts.

Due to the predominance of agricultural land use within the project study area, some adverse effects on farmland and to farm operations will be unavoidable. In general, the following effects can be anticipated.

a. Crop damage will occur within the right of way when construction and maintenance equipment cross planted fields.

b. Compaction of soils will occur where land is traversed by heavy equipment used for line construction and maintenance.

c. Normal surface and subsurface drainage systems may be disrupted by construction activities.

d. Soil erosion and siltation may result where: soil is exposed to the elements; windrows have been cleared as part of right of way management; topsoil is stock piled; construction equipment have created ruts or gullies; or in areas experiencing other soil or vegetation disruptions.

e. Water quality in rivers, streams, lakes and wetlands may be degraded due to increased sedimentation caused by transmission line construction.

f. During the consruction phase of the line some cultivated fields may be crossed and portions of agricultural fields may be used for the assembly and construction of transmission structures. As such, crop damage and interruptions in agricultural activities may occur.

g. Following construction, structures which are located in cultivated fields will remain as permanent obstructions to farming. This may require some changes in equipment handling and alterations in crop patterns.

h. Aerial spraying, dusting or seeding may be more difficult, more costly, and more dangerous.

i. Placement of the HVTL along field edges and property boundaries may influence future plans for consolidation or subdivision of the land for either agricultural or residential uses. It could also affect the economic attractiveness of the property for these uses.

The direct and indirect effects upon human habitation within the study area may include the following:

a. Dwellings and other structures may have to be removed from the right of way. The presence of the transmission line will prevent future construction of buildings within the right of way.

b. In general, the presence of the transmission line creates linear constraints upon future development and consequently potential opportunities for certain land use activities may be altered or lost.

c. The acquisition of an easement for a right of way will transfer certain property rights and may decrease the value of the property.

d. The operation of the high voltage transmission line may create a variety of safety problems. Although these problems may be minimized, they may not be entirely eliminated.

e. The presence of a transmission line could have a negative psychological impact on residents living near the right of way.

f. Historical and archaeological sites may be damaged, especially during construction, unless special care is taken during the siting process. Salvage archaeology may be necessary.

g. Electrical effects from a HVTL may impair the operation of telephone, radio, television and other electronic equipment.

h. A high voltage transmission line can create unavoidable adverse impacts on the visual landscape.

The direct and indirect effects upon the natural environment include the following impacts.

a. Trees and shrubs within the right of way as well as tall trees adjoining the right of way that impose a safety hazard to the operation of the line will be cleared. Tall growing plants will be permanently suppressed within the right of way.

b. Right of way clearing will alter natural habitats and, in some cases, provide easier access for hunters and others participating in outdoor recreation activities.

c. Both plants and animals in the vicinity of the right of way may be affected by the long term use of herbicides.

d. Wetlands, stream banks and other natural features will be altered during the construction period.

e. Water temperature and aquatic habitats may be altered due to the removal of shade vegetation along the banks of water bodies.

f. Construction and maintenance activities may encourage soil erosion and increase stream situation.

g. Birds, especially migrating waterfowl and raptors, may collide with the new tower conductors.

h. Alterations to soil conditions due to topsoil-subsoil mixing, equipment cleaning and compaction may occur.

Although proper design and planning can reduce their impact, these effects, are often unavoidable. Although significant for the entire project, they are a series of relatively small disturbances and may generally occur along the entire length of the right of way. Proper and efficient engineering, construction and maintenance in conjuction with sound routing procedures, should limit these environmental impacts.

6.2 MITIGATIVE MEASURES

The following is a descripton for possible mitigative measures.

6.2.1 DESIGN

a. The alignment should parallel existing rights of way, section lines, quarter-section lines, and property lines to the greatest extent possible.

b. Structures should be located near field boundaries, along roadways, and in the corners of fields when possible to reduce interference with agricultural operations and efficient use of large field equipment.

c. Long tunnel views of the transmission lines can be avoided by preserving or improving existing screening vegetation, employing changes in line alignment at strategic points, or by judiciously landscaping.

d. Existing bridges should be used for stream crossings during construction. Construction near streams should not be performed during high stream flows. Disturbed stream banks will be restored and seeded immediately after construction. When crossing pothole and swamp areas, structures will be placed on well-drained areas, and machinery movements kept to a minimum. Staging and storage sites should be located away from water bodies.

e. Selective clearing should be practiced along stream banks. Undergrowth will be left in order to protect the soils and reduce erosion.

f. Structures should be located so as to minimze disruption of critical environmental features.

g. Structure placement should take into consideration visual impacts that the line may generate.

6.2.2 CONSTRUCTION

a. Trees, shrubs and grass not cleared, should not be damaged during construction.

b. Special sites such as staging areas, tower sites and roadways should be combined to the maximum extent practicable.

c. Timber will be disposed of in accordance with landowners wishes as outlined in the applicant's right of way management policy. Special precautions will be taken in handling and disposing of elm and oak wood particlarly when they are affected by Dutch elm disease or oak wilt.

d. Cross country equipment travel should be avoided whenever possible.

e. The smallest equipment that will effectively perform the job should be used.

f. A thorough and complete clean-up should be conducted daily.

g. Construction should be planned to minimze the adverse effects of soil compaction on agricultural land.

6.2.3 Maintenance

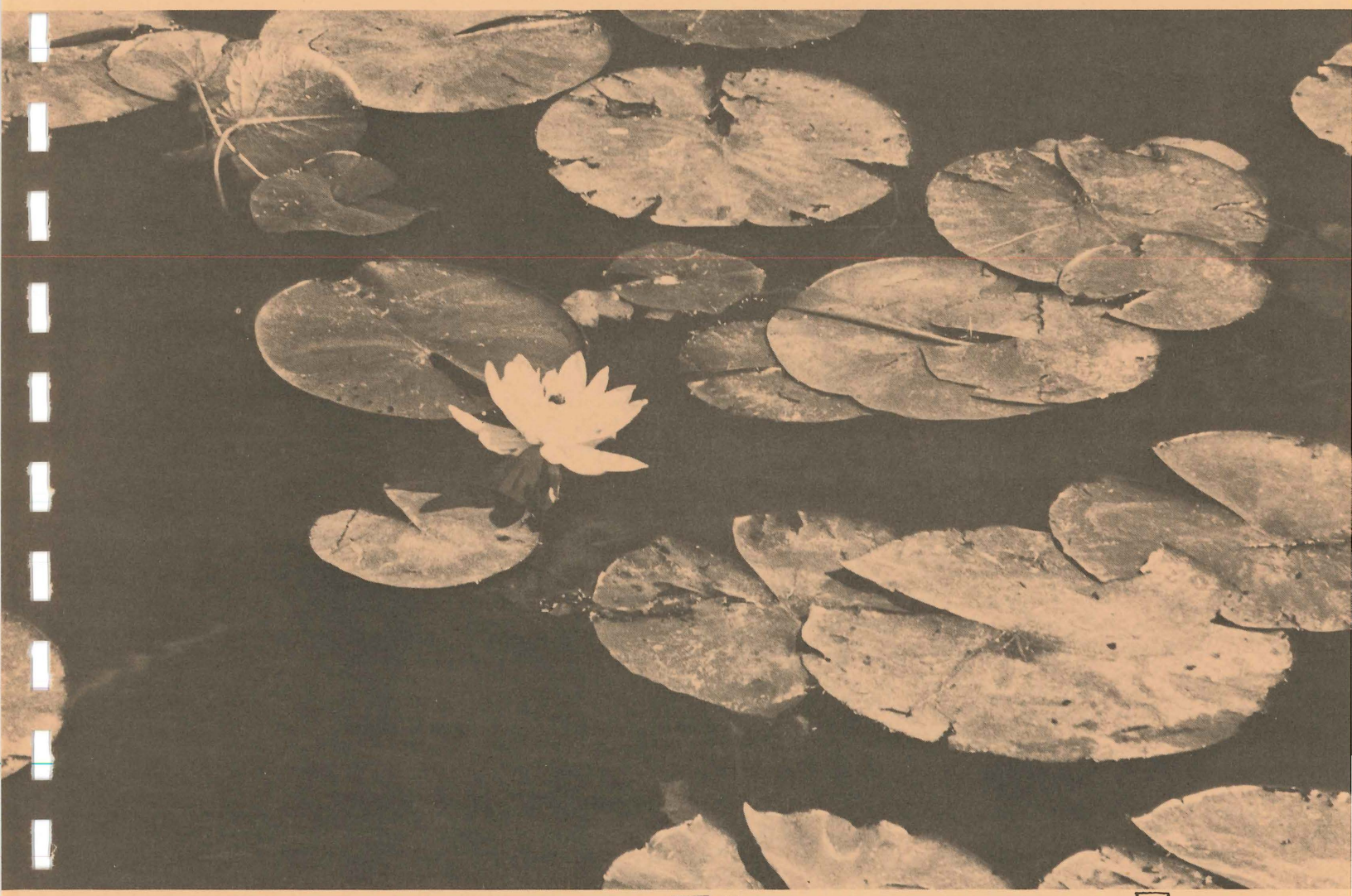
a. Vegetative maintenance should be performed safely and with minimum impact on the environment. Herbicides wll be used only in compliance with government approved regulations and with landowners' knowledge and consent. Where adjacent property owners operate tree farms or apiaries these owners will also be consulted.

b. Low growing native vegetation should be promoted. Any grasses and shrubs introduced should be compatible with existing plant communities, wildlife and livestock.

c. Environmental damage or inadequate restoration should be inspected by NSP and rectified.

d. Maintenance should be performed with minimal impact on crops, fields and agricultural operations.

e. Elm trees affected by Dutch elm disease may be encountered on the right of way selected. All elm wood, whether diseased or not, will be removed in accordance with standards established by the Minnesota Department of Agriculture.



commitments 7

CHAPTER 7

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Construction and operation of the proposed transmission facilities will require the utilization of land, labor and material resources. These resources will be committed for varying periods of time, and most will be recovered after the useful life of the transmission facilities. The utilization of sound engineering and construction practices will minimize resource requirements.

Irreversible commitments include the labor, gas and other energy used in construction and maintenance of the line and any brush or timber burned in clearing the right of way. Some of the timber may be sold on the commercial market to the wood products industry or used by the land owners. Generally, all materials used for construction may be recycled with certain exceptions, such as concrete footings.

Where this transmission line does not use an existing right of way, a new right of way of no more than 150 feet wide will be acquired. Although the basic land use may not change appreciably in the right of way, certain land use practices must be modified. In non-forested areas, the only actual commitment of land on the right of way itself occurs directly beneath structure footings and for guy wires, should they be required. In agricultural lands, certain field operations may have to be modified.

In forested areas, the commitment of land for transmission facilities represents a comparatively permanent use of that land. All tall growing vegetative species within the right of way and all danger trees will be removed and prevented from re-establishing themselves through the applicants right of way management program, this is necessary for maintaining required clearance and safety standards of the line. Clearing and vegetation management, either by mechanical or herbicidal means, will result in an irreversible change in vegetation patterns and fauna relationships along the right of way until the line is abandoned.

The applicants have indicated that the abandonment of the right of way does not seem likely in the foreseeable future. If the line is abandoned, all structures will be removed and the right of way restored in a manner consistent with the existing land uses.

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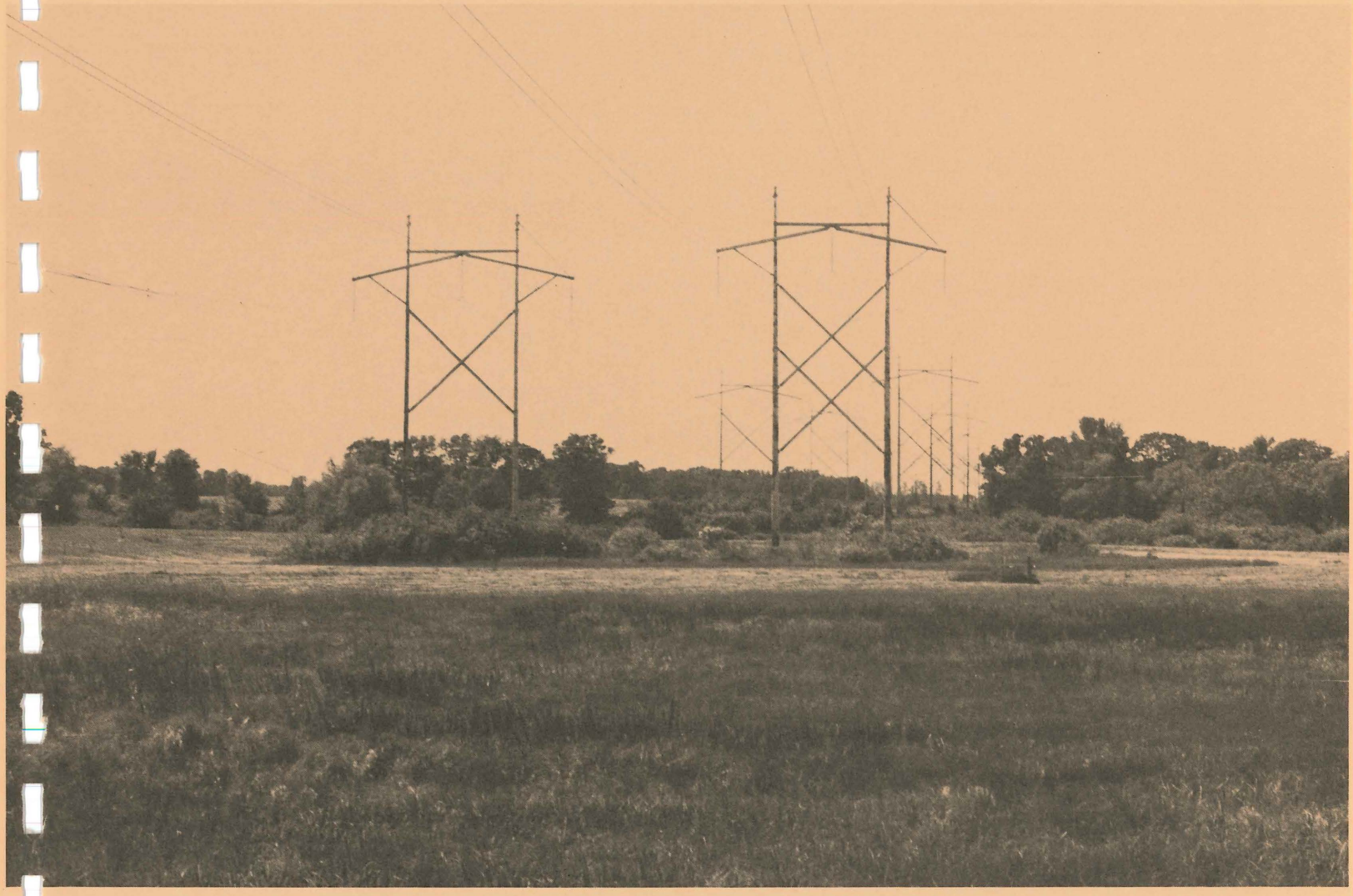

usage

CHAPTER 8

SHORT AND LONG TERM USE OF THE ENVIRONMENT

The project's short term consequences include the disruption of land use and land cover during the construction process and the adjustment period for the natural landscape, e.g., shifts in wildlife habitats immediately after the construction of the line. Other disruptions include: land cleared of vegetation for the line, the existence and maintenance of access roads, the maintenance of rights of way; cutting of trees; brush burning; and the general nuisances of construction activities such as dust, noise and fumes. Although temporary, these activities may disturb nearby residents and wildlife.

The expected average useful life of a 345 kV transmission line is between 40 and 50 years. Experience indicates that, in most cases, transmission rights of way and corridors are the areas most likely to be upgraded to higher capacities in response to energy demands and technological advancements. Since the locations of generating facilities and load centers are not expected to shift significantly, the 345 kV right of way will likely continue to be the best available route for transmitting electricity in the area. Therefore, the 345 kV right of way represents a long term use of the environment.

The most significant long term impact on the environment and productivity to this 345 kV transmission line and associated facilities is its general contribution to the electrical power distribution system and its ability to provide an adequate and relaible power supply.

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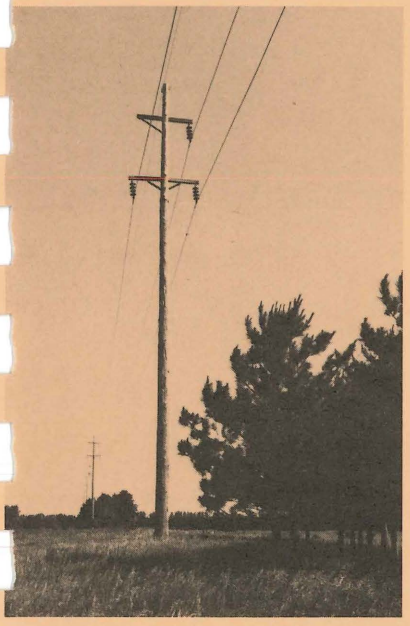
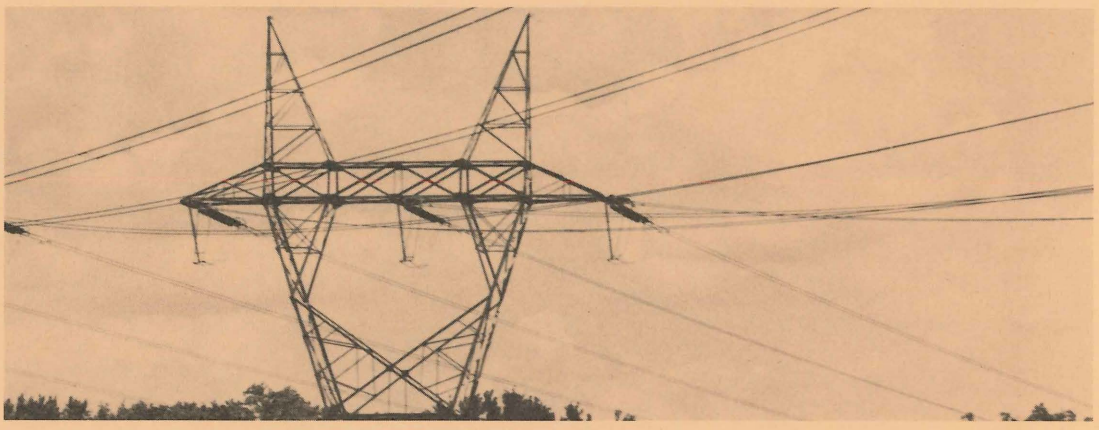
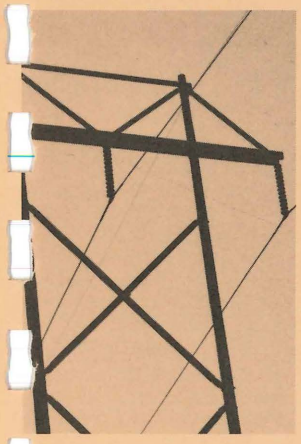






alternatives

CHAPTER 9

ALTERNATIVES TO THE PROPOSED ACTION

9.1 ADDITIONAL ROUTES

The routes and route segments covered in this report include all of the prudent and feasible routing alternatives in the study area. While it is conceivable that other routes could be developed, it is not likely that any additional routes would have physical characteristics or advantages which would be significantly different from those routes under consideration.

9.2 CERTIFICATE OF NEED

Prior to the siting and construction of large energy generating and transmission facilities, Minnesota Statutes, Chapter 116H requires that the Director of the Minnesota Energy Agency review and approve the need for such facilities. With regard to transmission lines, Minn. Stat. § 116H.02, subd. 5(b) (1978), defines a large energy facility as:

> Any high voltage transmission line with a capacity of 200 kilovolts or more and with more than 50 miles of its length in Minnesota; or any high voltage transmission line with a capacity of 300 kilovolts or more with more than 25 miles of its length in Minnesota. . . .

Since the Sherburne-Benton County 345 kV line is less than 25 miles long, this project by itself does not require a Certificate of Need from the Director of the Minnesota Energy Agency.

However, the Director of the Minnesota Energy Agency conducted an inquiry on April 30, 1979 in order to determine whether the close relationship between the recently approved Benton County - Milaca 230 kV line and the proposed Sherburne - Benton County 345 kV line justified their being considered one line for the purpose of Certificate of Need requirements. The question arose because these two lines have the following similar features:

a. both lines are the products of coordination and planning by NSP, CPA and UPA;

b. both lines are scheduled to be completed in the early 1980s;

c. both lines tie into the Benton County substaion and require expansion of that facility;

d. UPA, which would own the Benton County-Milaca line, also would share ownership of the Sherburne-Benton County line with NSP, and CPA; and

e. The Benton County-Milaca line will use power delivered to the Benton County Substation in part by the Sherburne-Benton County transmission line.

After reviewing hearing testimony and other materials submitted by the utilities, the Director of the Minnesota Energy Agency declared on June 1, 1979 that a Certificate of Need was not required. Despite the similarity of carrying capacities, common ownership and in-service dates, the major function of the 345 kV line is to serve as an interconnection between the metropolitan systems of the Twin Cities and northern Minnesota. The 345 kV line will also serve NSP and CPA needs in the St. Cloud area. In contrast, the Benton County-Milaca 230 line will meet local demands within UPA's service area.

9.3 SYSTEM ALTERNATIVES

9.3.1 Transmission Line to Alternative Terminal Points

Alternate terminal points for the proposed 345 kV line have been considered. The southern endpoint at Sherburne County Substation is the northern limit of the existing Twin Cities 345 kV system. Any other location would require a considerably longer line and/or a new substation, resulting in a much higher cost than the facilities proposed.

The Benton County Substation is the proposed northern endpoint. Currently this facility serves area loads, via 115 kV lines into St. Cloud and west to central Minnesota. In addition it is interconnected with northern Minnestoa by a 230 kV line. Any northern endpoint for the 345 kV line other than the Benton County substation would require construction of a new 345-230-115 kV substation. A new 345-230-115 kV substation (not including a 345/230 kV transformer, 345 kV breakers, and terminal) would require an investment in 1981 of about $2.3 million. These additional costs result from duplication of equipment which is already present at the Benton County site.

A sizable investment would also be necessary because transmission from an alternate northern terminal to the Benton County substation would still be necessary. Expansion of the existing Benton County substation is less costly than other alternatives.

9.3.2 Direct Current Transmission

Direct current (dc) transmission has limitations. Although dc transmission lines are less expensive to build than comparable alternating current (ac) lines, they must be used over long distances (100 miles or greater) in order for the construction cost savings to offset the expense of the additional terminal equipment costs. In addition a dc transmission line needs special equipment to make it compatible with ac systems. With the short lengths of the proposed transmission line alternatives, no economic savings would be realized; consequently the use of a dc transmission line is not considered to be a feasible alternative.

9.3.3 Power Generation

An alternative to the transmission of electricity to the Benton County substation via a HVTL, is the installation of generating facilities that produce bulk power equivalent to that which would be supplied by the proposed 345 kV transmission line. In their application, NSP notes that there is a possibility of adding more oil-fired combustion turbine generation at the Granite City generator. It was determined by the applicants, however, that this alternative is not economically feasible because of the high oil costs. In addition, any oil-fired additions to the Granite City generators would require a Certificate of Need from the Minnesota Energy Agency. If new oil-fired combustion turbines were constructed, there is the possibility that additional transmission lines might still be required as an outlet for the generating station. Finally, new generating facilities may produce adverse air and water quality impacts, additional solid waste disposal requirements and other environmental impacts which may be greater than those associated with transmission lines.

9.3.4 Upgrading of Existing Lines

The alternative of rebuilding the existing MonticelloSt. Cloud 115 kV line to a higher capacity 115 kV line would achieve a small improvement in transmission capacity for this area. Upgrading the 115 kV line, however, only defers the Sherburne-Benton County 345 kV project for a couple of years. This alternative would require an investment in 1981 of about $900,000 to reconductor the 115 line and an expense in 1981 of about $100,000 for temporary 230 kV substation facilities needed at Monticello.

Converting the existing Monticello-St. Cloud 115 kV line to 230 kV is also only a temporary solution because the Sherburne-Benton County 345 kV project would most likely still be required by the mid 1980's. This would require an investment in 1981 of about $2.1 million to rebuild the 115 line and an expense in 1981 of about $235,000 for temporary 230 kV substation facilities needed at Monticello and St. Cloud until the Sherco-Benton 345 kV line is built.

These alternatives do not appear to be cost effective or meet long range energy needs of the service area.

9.4 PROJECT NEED/NO ACTION

9.4.1 Reliability

Loss of the 230 kV Monticello-Benton County line would pose the most serious threat to system reliability since it is the major bulk power source for central Minnesota. At the present time, the oil-fired generators at Granite City are operated when demand is high. This ensures that sufficient capability is available to serve loads in central Minnesota while still providing adequate reserve for interconnections with northern Minnesota. During the early 1980's, NSP notes that there will not be sufficient transmission capability available during peak demand periods if the 230 kV line is out of service. NSP further suggests that the problem of continued load growth in central and northern Minnesota will increase the risk of insufficient transmission capability and the expense of operating the Granite City generators.

The Sherco-Benton 345 kV line was planned in order to restore sufficient capacity in the transmission system in order to maintain the present level of electrical service reliability in future years.

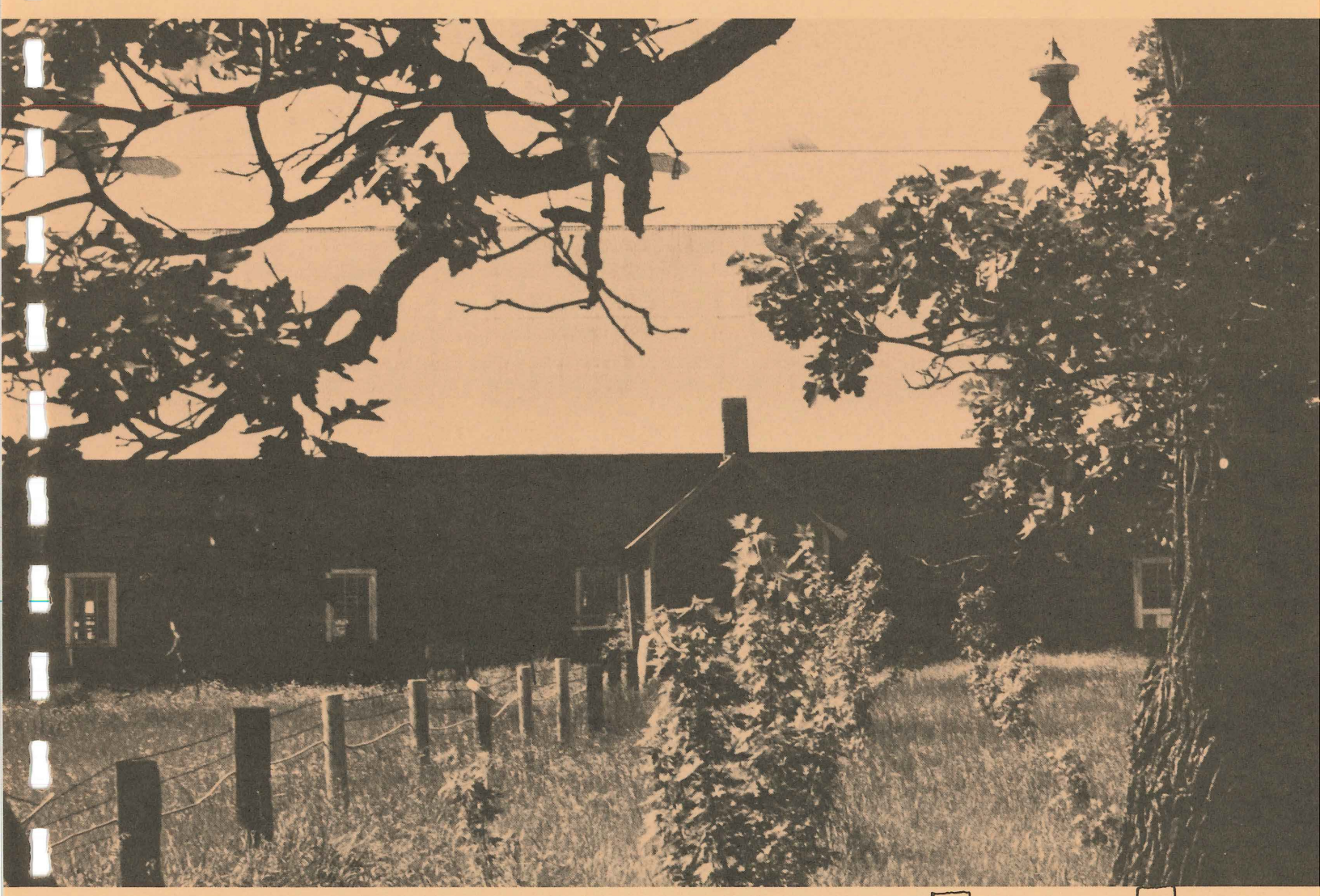
9.4.2 Capacity

If the 230 kV Monticello-Benton County line is out of service, an overload on the 115 kV Monticello-St. Cloud line could range up to 120-125 percent of its thermal capacity when power is being transferred to northern Minnesota. Any other set of conditions that would remove an equal amount of transmission capacity from service would have the same effect. Bringing the Granite City generators on-line would only reduce this overload to approximaely 110 percent. Future load growth will cause more severe overloads to occur. Ultimately, the Granite City generators will not be able to reduce the overloads on the 115 kV line, when the 230 kV line is out of service.

In their application, NSP states that the Monticello-St. Cloud 115 kV line, in case of an emergency, can be loaded beyond its thermal capacity (approximately 120 percent) for a limited time. However, once the line has been loaded beyond its thermal capacity for four cumulative hours, it has lost its emergency capability forever.

Should both the Monticello-Benton County 230 kV line and the Monticello-St. Cloud 115 kV line be out of service at the same time, the only measure that could be taken to restore service would be to start up the Granite City generators. The generators, however, would not be able to supply more than 15 percent of the winter peak customer demand. In addition, starting up the Granite City generators to restore limited service would take about 2 hours. The time to restore service to the remainder of the service area would depend on the nature of the outage. For example, if failure is only due to an equipment malfunction, servce may be restored the same day. If, however, there is damage to the structures on the 230 kV line, it could be weeks before all facilities are operating and local service restored.

10



controls

CHAPTER 10

FEDERAL CONTROLS AND REGULATIONS

10.1 INTRODUCTION

The proposed 345 kV transmission line is subject to a number of Federal laws and regulatons, in addition to those enforced by the State of Minnesota. Failure to comply with any of these laws and regulations could result in the delay, modification, or ultimate cancellation of the project.

10.2 APPLICABLE FEDERAL LAWS

Cooperative Power Association and United Power Association are REA cooperatives. These utilities have applied to REA for a loan guarantee to facilitate financing their portion of the proposed 345 kV transmission line project. Subsequently, REA was designated the lead Federal agency for the purpose of coordinating compliance with the National Environmental Policy Act of 1969 (NEPA). The United States Army Corps of Engineers requires permits under Section 404 of the Federal Water Pollution Control Act of 1974 whenever wetlands are filled. The transmission line must meet height limitations for structures near airports established by the Federal Aviation Administration and the Minnesota Department of Transportation. In addition, safety markers may be required on conductors located in the vicinity of airports.

Federal regulations (Title 23, part 645.206 (e)) presently prohibits transmission lines on or overhanging freeway rights of way. Transmission lines may cross freeways but structures generally are not allowed within the right of way of controlled access roads.

10.3 EXECUTIVE ORDERS

10.3.1 National Historic Preservation Act and Executive Order 11593

The National Historic Preservation Act of 1966, Executive Order 11593: "Protection and Enhancement of the Cultural Environment," and other related Acts are implemented by 36 CFR 800, "Procedures for the Protection of Historic and Cultural Properties."

To insure the protection of historic and cultural properties, surveys must be conducted to locate, identify, and assess the cultural resources that might exist in those areas that would be affected by the proposed project. In accordance with 36 CFR 800, the surveys incude a review of previously known site locations recorded in the National Register of Hisotric Places and on file at the Minnesota Historical Society, a study of historical documents relating to the affected counties and a field survey of the proposed route centerline.

10.3.2 Executive Order 11990: Protection of Wetlands

Executive Order 11990: "Protection of Wetlands" directs each federal agency to ". . . take action to minimize the destruction, loss of degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for: (a) providing federally undertaken, financed, or assisted construction and improvements; and (b) conducting Federal activities and programs affecting land use, including, but not limited to, water and related land resource planning, regulating, and licensing activities."

Specifically, the direction is to be carried out in furtherance of Section 101(b)(3) of the National Environmental Policy Act of 1969 and, to the extent possible, is to follow the implementation procedures of the Council on Environmental Quality and the Water Resources Council.

CPA and UPA have incorporated the guidance of the Council on Environmental Quality and the Water Resources Council in its planing activities and is coordinating closely with both state and Federal agencies whose responsiblities are to manage wetland resources.

10.3.3 Executive Order 11988: Floodplain Management

Executive Order 11988: "Floodplain Mangement," directs that each Federal agency . . . "shall take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural beneficial values served by floodplains in carrying out its responsilibities for: (a) providing federally undertaken, financed, or assisted construction and improvements; and (b) conducting Federal activities and programs affecting land use, including but not limtied to water and related land resources planning, regulating, and licensing activities."

To implement this directive, the agency must, before taking action, determine whether the proposed action will occur in a floodplain. If the agency determines or proposes to conduct, support, or allow an action to be located in a floodplain, the agency shall evaluate the action, and consider alternatives that can be employed to avoid adverse effects and incompatible development in the floodplains.

10.3.4 Secretary's Memorandum No. 1827 Revised: Statement on Land Use Policy

The Secretary's Memorandum No. 1827 Revised: "Statement on Land Use Policy" expresses concern for the continued loss of lands well suited to the production of food, forage, fiber, and timber, and the degradation of the environment resulting from those losses. Consequently, major consideration must be given to important farm, range and forest lands, and the long-range need to retain the productive capability of agriculture and forestry.

The Secretary's Memorandum sets policy requiring that Department of Agriculture personnel carefully explore land use alternatives which would minimize impacts on important farm, range, and forest lands, and where possible, avoid land use decisions which commit important farmlands to non-farmland and non-range land uses.

10.4 OTHER REGULATIONS

10.4.1 Endangered Species Act

Under Section 7 of the Endangered Species Act, the United States Fish and Wildlife Service (FWS) requires that an examination of critical natural habitats within the study area be carried out in order to determine whether or not any species protected under the Endangered Species Act of 1973 would be harmed. In addition, the FWS will review the proposed project with regard to any potential adverse impacts on other wildlife in the area.

10.4.2 Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act requires that the U.S. Fish and Wildlife Service and the state wildlife agency participate in the review of permit applications for activities that would modify any body of water. These agencies have been informed of the proposed project and follow-up contacts will be made as permitting activities are pursued.

10.4.3 Wild and Scenic Rivers Act

The Wild and Scenic Rivers Act establishes the policy of the United States that certain rivers of the nation, which "...posses outstanding remarkable scenic, recreational, geologic, fish and wildlife, historic, cultural, or other similar values, shall be preserved in free-flowing conditions, and that they and their immediate environments shall be protected for the benefit of future generations."

In the process of evaluating alternative routes for the 345 kV transmission line the above rules, regulations, and executive orders have been considered in this report.

11

responsibilities

CHAPTER 11

MULTI-STATE RESPONSIBILITIES

The proposed 345 kV Sherburne-Benton County transmission line will not cross any state or international boundaries. In addition, although NSP, CPA, and UPA transmission systems cross state boundaries, the electricity transmitted on this line will be used entirely within the applicant's service area in Minnesota.

appendix

APPENDIX A

INDIVIDUALS AND AGENCIES CONTACTED

U.S. Congress

Senator Rudy Boschwitz	Washington, D.C.
Senator David Durenburger	Washington, D.C.
Representative Richard Nolan	Washington, D.C.

U.S. Department of Agriculture, Forest Service

Dale O. Vandenburg	Broomall, PA

U.S. Department of Agriculture, Soil Conservation Service

William Harju	Elk River, MN

U.S. Department of Agriculture, Stabilization and Conservation

Delores Blocker	Elk River, Mn
Andrew Smelter	Foley, MN

U.S. Army Corps of Engineers

Dave Parsons	St. Paul, MN

U.S. Environmental Protection Agency

Barbara Taylor	Chicago, Il

U.S. Department of Housing and Urban Development, Federal Emergency Management Agency

Frank Finch	Chicago, Il

U.S. Department of the Interior, Fish and Wildlife Service

Richard Berry	St. Paul, MN
Nancy Walters	St. Paul, MN

U.S. Department of the Interior, Geologic Survey

William Menard	Reston, VA

U.S. Department of the Interior, Heritage Conservation and Recreation Service

Frank Jones	Ann Arbor, MI

Minnesota State Legislators

Senator Robert G. Dunn	Princeton, MN
Senator Jack Kleinbaum	St. Cloud, MN
Representative Robert McEachern	St. Michael, MN
Representative James Pehler	St. Cloud, MN

Minnesota Department of Agriculture

Dave McGinnis	St. Paul, MN

Minnesota Energy Agency

Karen Cole	St. Paul, MN
Richard Wallen	St. Paul, MN

Minnesota Department of Health

Laura Oatman	Minneapolis, MN

Minnesota Department of Natural Resources

Tom Balcom	St. Paul, MN
C. R. Burrows	St. Paul, MN
John Stein	St. Paul, MN

Minnesota Department of Transportation

Rodger Bush	St. Cloud, MN
Randy Halvorson	St. Paul, MN
J. Kreidewers	St. Paul, MN
Corrine Sando	St. Paul, MN
Dick Thiessen	St. Paul, MN

Minnesota Pollution Control Agency

Janet Cain	Roseville, MN

Minnesota Historical Society

Russell Fridley	St. Paul, MN

Minnesota Department of Public Safety

Ed Herman	St. Paul, MN

Central Minnesota Regional Development Commission

Jerry Johnson	St. Cloud, MN
Ralph Thompson	Belgrade, MN
Otto Schmid	St. Cloud, MN

County and Township Officials

Benton County Association of Township Officers	Milaca, MN
Lyle Smith, Chairman, Sherburne County Board	Big Lake, MN
LeRoy Pauley, Haven Township Board	Clear Lake, MN
Joe Ruhoff, Minden Township Board	Sauk Rapids, MN
Cecil Peterson, Palmer Township Board	Elk River, MN
Harvey Alfords, Sherburn Zoning Admn.	Elk River, MN
Richard Gronau, Benton County Historical Society	Sauk Rapids, MN
Greg Guzy, Sherburne County Historical Society	Becker, MN

Municipal Officials

Thomas L. Boelz	Clear Lake, MN
Jan Peterson, City Attorney	St. Cloud, MN
St. Cloud Municipal Airport Advisory Board	St. Cloud, MN
Ray Georges	Becker, MN

Other Agencies and Organizations

Jim Alders, Northern States Power	Minneapolis, MN
Carl Backes, Benton County Farmers Union	Sauk Rapids, MN
Geoff Barnard, The Nature Conservancy	Minneapolis, MN
Larry Downing, Sierra Club	Minneapolis, MN
Norm Ecklund, Northern States Power	St. Cloud, MN
Emil Hipsag, Sherburn County Farmers Union	Elk River, MN
Toni Harvatin, The Nature Conservancy	Minneapolis, MN
William Kiffmier, East Central Minnesota Irrigators Association	Clear Lake, MN
Neil Larson, Elk River Enterprises, Inc.	Elk River, MN
Burton Olson, Benton County Agricultural Society	
Malcolm Olson, Citizens Against Power Plant Pollution	Becker, MN
Dr. J. Peck, St. Cloud Area Environmental Council	
Randy Peterson, Go-Pher Evergreen	Clear Lake, MN
E. L. Phillips, Burlington Northern Railroad,	St. Paul, MN
Edward Pikarski, St. Cloud Community Wildlife Club	St. Cloud, MN
J. Sivenson, Sherburne County Rural Telephone Company	Big Lake, MN
Richard Thorson, Clear Lake Sportsman Club	Clear Lake, Mn
W. G. Woods, Northwestern Bell Telephone	Minneapolis, MN