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DRAFT ADDENDUM

DRAFT ENVIRONMENTAL IMPACT STATEMENT

MINNESOTA PORTION OF A CRUDE OIL PIPELINE FROM WOOD RIVER, ILLINOIS TO PINE BEND, MINNESOTA

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TO

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CRUDE OIL PIPELINE FROM
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January, 1978

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STATE OF MINNESOTA

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INTRODUCTION

INTRODUCTION

Northern Pipe Line Company of Delaware, Inc. plans to construct approximately 100 miles of 24-inch diameter pipeline through southeastern Minnesota. The pipeline will carry crude oil and connect refineries in Pine Bend and St. Paul Park, Minnesota, to crude oil supplies available in the vicinity of Wood River, Ilinois.

This document has been prepared in accordance with the requirements of the Minnesota Environmental Quality Board's Rules and Regulations for Environmental Impact Statements (Minn. Reg. MEQC 21-36), pursuant to the Environmental Policy Act of 1973.

In addition, this document will provide an information and planning document for use by Northern Pipe Line Company, area communities and public interest groups, regional development agencies, state and federal agencies, and concerned citizens. An explanation of Landowners' Rights is included as Appendix H.

Where data or discussions are of a general nature, or don't differ from the previous analysis, they have been referenced as "See page ___ of the Draft Environmental Impact Statement". Specific data and analysis for new sites are presented in this Addendum.

This Addendum has been prepared as a result of major changes in the proposed route. The former proposed route was found to traverse an area where there was a potential for groundwater contamination in the event of an oil spill. This potential was due to the shallow depth of bedrock aquifers under portions of the route, and also to the proximity of sinkholes. These conditions could possibly allow oil from a spill to enter the bedrock aquifers. These

aquifers transmit fluids through solution cavities and joints resulting in rapid movement in unpredictable directions. This in turn would prevent containment and clean-up measures from being effective in these areas.

Extensive studies conducted by the pipeline company and the State Agencies during the Fall of 1977 indicated that the pipeline should be routed in areas having a minimum of 50 feet of glacial till to protect the bedrock aquifers from contamination. Utilizing this criterion, several routes were evaluated. The Minnesota Geological Survey provided a map which delineated areas where 50 feet of soil overlies bedrock, and the final routes were selected to maintain the 50 feet of soil above bedrock wherever possible.

In the vicinity of Northfield, two alternate routes are evaluated. The West Alternate was at first believed to avoid bedrock which may be shallower than 50 feet deep. This was based on a map prepared by the Minnesota Geological Survey over two years ago. For the analyses in this document, the map was updated with new data. The update is included as Figure 6. The update indicates that shallow bedrock will be encountered as far south as Faribault, and that no route could totally avoid the problem. An area to the east of Northfield is indicated on the update as containing a lesser amount of shallow bedrock than the West Alternate. A route proposed through the area is included in this document and is designated as the East Alternate. It should be noted that these Alternates are concerned only with traversing the shallow bedrock and locating an acceptable crossing of the Cannon River. For over 80% of the total project length, only one route is proposed.

During the preparation of this document, several meetings were held to evaluate proposed routes. Representatives from the Minnesota Department of Natural Resources,

Minnesota Pollution Control Agency, Minnesota Department of Health, Minnesota Department of Agriculture, Minnesota Department of Transportation, Minnesota Energy Agency, Minnesota State Planning Agency, Minnesota Geological Survey, and Northern Pipe Line Company of Delaware, Inc., were present at some or all of these meetings. The meetings resulted in the selection of the East Alternate as the more environmentally sound route, and the following special precautions to be taken in the shallow bedrock area:

1. 25% of the pipeline will be x-rayed for welding defects (as opposed to 10% required by Federal Department of Transportation Regulations).

2. Extra valves will be installed in this area with gate valves on the upstream side of the crossings of the Cannon River and the four channels of Chub Creek, and check valves on the downstream sides of each of those crossings.

3. A regular program of hydrostatic testing will be followed throughout the life of the pipeline to detect future weak points or potential leaks.

1. PROJECT DESCRIPTION

1. PROJECT DESCRIPTION

1.1 SUMMARY STATEMENT

Northern Pipe Line Company of Delaware, Inc. proposes to construct approximately 100 miles of 24-inch diameter pipeline through southeastern Minnesota, which will connect refineries in Pine Bend and St. Paul Park, Minnesota, to crude oil supplies available in the vicinity of Wood River, Illinois. Two alternate routes are proposed for a portion of the project in the vicinity of Northfield. Cost of the project is estimated at $150 million.

This project has been initiated due to planned reductions in crude oil exports from Canada that will result in a total cut-off of Canadian crude oil in 1981. The supplies to be tapped by this pipeline are available in central Illinois by way of connections to other existing crude oil pipelines and include North African and Venezuelan crude.

1.2 STATEMENT OF PURPOSE

1.2.1 Uses of the Proposed Pipeline

See page 2 of the Draft Environmental Impact Statement.

1.2.2 Need for the Proposed Project

See pages 2 to 5 of the Draft Environmental Impact Statement.

1.3 LOCATION OF PROPOSED PIPELINE

1.3.1 Proposed Route

The proposed pipeline will enter Minnesota at Section 32, T.101N. R.14W., LeRoy Township, Mower County, Minnesota, and it will terminate at Koch Industries' Pine Bend Terminal, Section 24, T.115N. R.19W., in Rosemount, Minnesota. Two routes are proposed in the vicinity of Northfield (Figure 1 and Appendix G). The route will pass through the following townships, in order, from north to south:

Dakota County

Both Alternates:

Rosemount

Empire

East Alternate:

Castle Rock

Waterford

West Alternate:

Castle Rock

Waterford

Greenvale

Rice County

East Alternate:

Northfield

Wheeling

West Alternate:

Bridgewater

Cannon City

Wheeling

Both Alternates:

Richland

Steele County

Merton

Dodge County

Ellington

Claremont

Wasioja

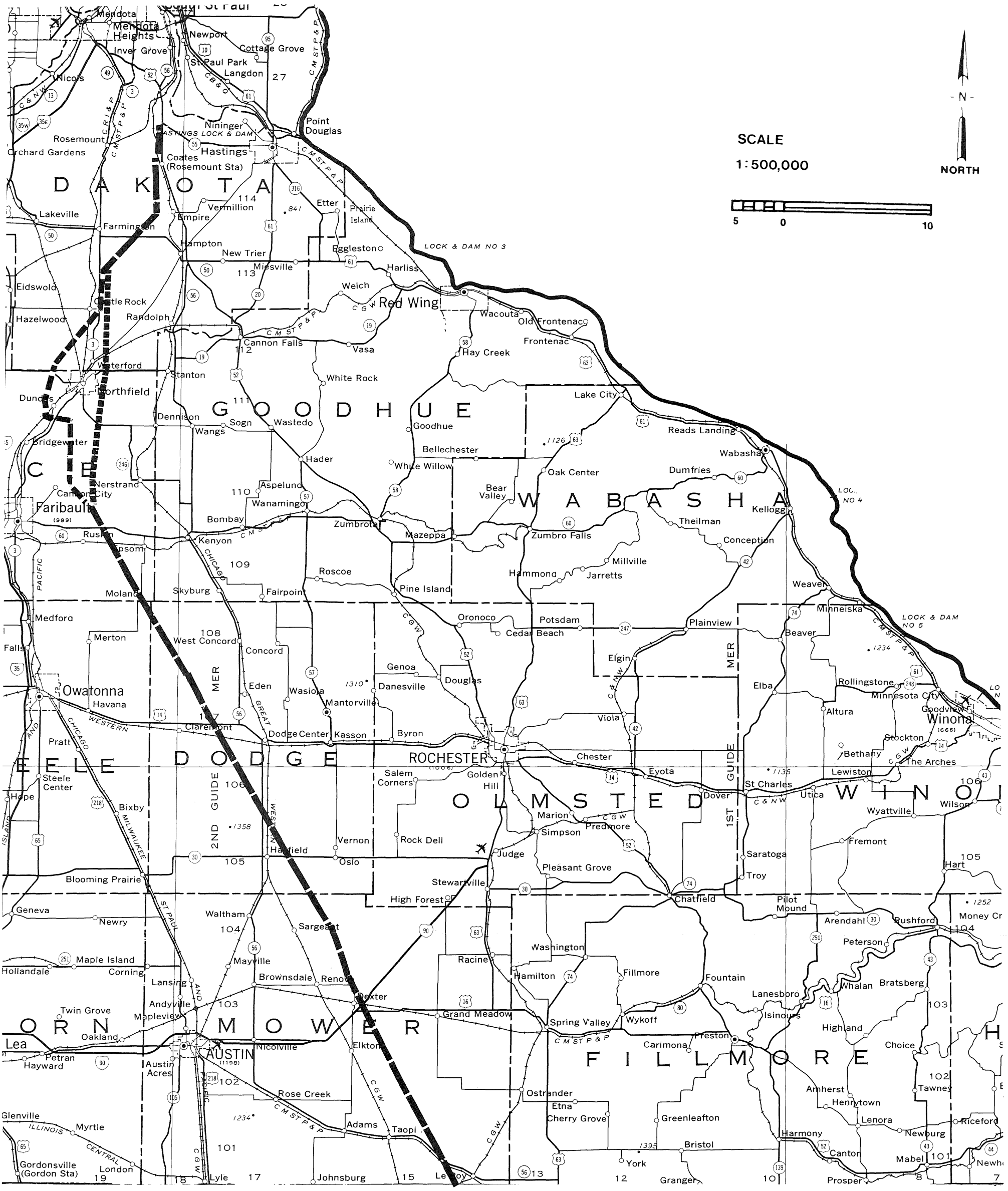
Ashland

Hayfield

Vernon

FIGURE 1

PROJECT LOCATION



NORTHERN PIPE LINE CO.

OF DELAWARE INC.

Mower County

Sargeant
Dexter
Grand Meadow
Clayton
Lodi
LeRoy

1.3.2 Pipeline Crossings

County	Pipeline Owner	Size (In.)	1/4	Sec.
Dakota	Northern Natural Gas	16	SE	29 T.115N. R.19W.
	Northern Natural Gas	24	NE	13 T.114N. R.19W.
	Northern Natural Gas	30	NE	13 T.114N. R.19W.
	Williams Pipeline	8	NE	2 T.113N. R.19W.
	Northern Natural Gas	12	Center	6 T.112N. R.19W.
Dodge	Northern Natural Gas	6	SE	33 T.108N. R.18W.
	Northern Natural Gas	12	NE	25 T.107N. R.18W.
	Northern Natural Gas	10	NE	25 T.107N. R.18W.
Mower	Northern Natural Gas	16	SW	4 T.104N. R.16W.

1.4 LAND REQUIREMENTS

1.4.1 Right-Of-Way

The proposed right-of-way width for this project is 50 feet, or approximately 6 acres per mile of pipeline. The entire right-of-way acreage in Minnesota would be about 598 acres for the East Alternate, and 621 acres for the West Alternate.

1.4.2 Easement Fees

See page 7 of the Draft Environmental Impact Statement.

1.4.3 Future Facilities

A pump station may be constructed in southern Minnesota in the future as a related facility. The total number of pump stations required for Case I (see pages 8 to 9 of the Draft Environmental Impact Statement) does not include a pump station in Minnesota; however, if the volume demands increase as projected (Case II), a pump station in Minnesota would be required by 1982. This station would utilize approximately 5 acres and would be located so as to have road access and adequate electric power. The pump station would occupy a space of about 500 feet by 400 feet, and would be surrounded by a chain-link fence. The facility would probably consist of three unmanned, remote control, electrically-driven centrifugal pumps; several above-ground valves, an electric substation, a small structure to house controls and switch gears, and a parking lot. Since a pump station is not a part of the present proposed project, no formal design has been done, and no further assessment of impacts is possible at this time.

No additional land requirements are proejcted for the Cottage Grove or Pine Bend Terminals to accommodate this project.

1.5 PROPOSED FACILITIES

See page 8 of the Draft Environmental Impact Statement.

1.6 CONSTRUCTION PROCEDURES

See pages 9 to 16 of the Draft Environmental Impact Statement.

1.7 OPERATION AND MAINTENANCE

See page 16 of the Draft Environmental Impact Statement.

1.8 EMERGENCY PROCEDURES

Information derived from the report entitled "Northern Pipe Line Company of Delaware, Inc. Oil Conservation Alert Procedure" is attached as Appendix A.

1.9 QUALITY CONTROL AND SAFETY DESIGN

1.9.1 Construction Techniques

The pipe used for this pipeline is constructed from sheet steel which is rolled on a press into a pipe form, then welded together along a longitudinal seam. The welding is of the double submerged arc type which provides maximum protection against oxidation of the weld. This results in a very high strength weld. This pipe is inspected at the factory, and faulty pipe is rejected. Pipe sections are welded together in the field. These welds are also of the double submerged arc type. On the average, 25% of the welds are x-rayed over the entire length of the pipe. This includes x-raying 100% of stream crossings, road and railroad crossings, tie-ins, and 10% of cross-country welds. The x-ray procedure is an industry standard and was first instituted to ensure that welders employed by the industry would remain conscientious. This minimizes faulty welds which require the pipe to be excavated and repaired after installation. The Federal Department of Transportation standard was adopted after the industry had already instituted this procedure.

The pipe will be coated with an anti-corrosion coating. This will probably be a PVC plastic-like material. The pipe will be double wrapped with the overlapping seams of each layer of wrap offset. The pipe will be tested with a Holiday detector which detects defects, breaks, or holes in the coating. The total coating thickness will be at least

25 mils. The pipe will be wrapped on-site to prevent damage to the coating due to excess handling. The backfill will be inspected to remove all rocks and foreign material that could damage the pipe or its coating during the backfill process.

The pipe will be tested for integrity after construction is complete using a hydrostatic pressure test. In this test, a volume of water is pumped into a sealed-off section of pipe and placed under pressure. The pressure is increased to 90% of the yield pressure of the pipe. The pressure is then held for a specified time to detect any leaks. Since the pipeline will operate at 72% of yield strength, the test is in excess of anticipated pressures in the pipe. Any pipe found to contain leaks in this process are repaired or replaced and the entire section is retested.

1.9.2 Design/Operation

Design

Relief valves are planned at the Pine Bend Terminal of the pipeline to ensure that any pressure surges within the section between Pine Bend and the closest pump station will not exceed 10% to 20% of the operating pressure at that point. A pressure above this level will automatically be vented into a storage tank at the Pine Bend Terminal. Extra gate valves and check valves above the number usually planned for a pipeline of this nature have been specified in order to safeguard the area of shallow bedrock in southern Dakota County. These valves will minimize the amount of oil that could leave the pipe due to a leak in that area. The pipe for this project has been specified above industry standards. The industry standard is to choose a wall thickness which is 1/100 of the diameter of

the pipe. For a 24-inch diameter pipe, this means a 0.24-inch wall thickness. The pipe for this project has been specified at one thickness higher than this, or 0.281 inch wall thickness.

Operation

During operation, the pipe will be under cathodic protection. This is a process whereby an electric potential is placed on the pipe to render it negative with respect to the surrounding soil to prevent generation of electric currents between the soil and the pipe which could result in corrosion. The system is put into operation shortly after the pipe has been completed. Periodic measurements of the electric potential in both the soil and the pipe are made to ensure that the charge placed on the pipe is the correct one. This procedure provides a high degree of protection against corrosion.

Corrosion inhibitors are not planned at this time to be placed in the oil stream, because the crude oil which will be pumped will vary in chemical composition and other parameters. The nature of an inhibitor would have to be determined on a specific basis. Some corrosion problems in crude oil transportation lines are due to water collecting in the pipe. This is minimized by very strict requirements on how much water can be in the crude oil that is transported by the pipe. Also, the nature of the crude causes turbulent flow so that the water does not have the opportunity to settle out of the flow stream and collect in low points of the pipe. A problem could possibly arise in cases where parrafin-containing trapped water may collect against the steel of the pipe. This is corrected by the use of a cleaning tool called a pig. The pig is a scraper device which scrapes the paraffin off of the inside walls of the pipe.

Every two to three years, an exposure test is conducted.

In this test, a section of the pipe is cut out and inspected for corrosion. If corrosion is found, the appropriate corrosion inhibitors are injected into the stream on an on-going basis.

1.9.3 Leak Detection Systems

The amount of oil lost to the environment in the case of a spill depends upon a number of variables. These will be described in the following summary of the pipeline company's emergency procedure.

An extremely small leak may not be noticed immediately, but if a substantial amount of oil were being lost over a period of time, it would be detected by the gauges which measure the volumes of oil being sent through the line. A complete "over-short", or comparison of volumes in and out of the line, will be taken every two hours.

A break in the line, such as a rupture or split seam, would register as a pressure drop at the monitoring terminal, which is manned 24 hours a day, 7 days a week. The time it would take for the pipeline pumps to be shut down has been calculated by the Company as follows:

> "The leak detection capability of a pipeline supervisory control and surveillance system, typical of the one that will be employed on the Wood River to Pine Bend pipeline at the maximum Case II volume of 210,000 BPD (9211 BPH) is on the order of 154 barrels. This quantity is based upon a 10-minute short-term sampling time and an assumed 10 percent detection capability, e.g., (9211 BPH x 10 min. x 0.10)/60 Min./Hr. = 154 barrels. Assuming an additional 1 minute of operator evaluation and reaction time, an additional spill volume of some 154 barrels would result; e.g., 9211 BPH x 1 min./60 min./hr. = 154 barrels. This would result in a worst-case spill (assuming a completely severed pipeline) of only 308 barrels until the pipeline is shut down."

A smaller hole would, of course, lose less oil. It should be emphasized that this is only the quantity lost until

the "upstream" pumps are turned off. The "downstream" suction pumps would be kept on to draw down the oil quantity and pressure. A pilot would then be put into the air to determine the exact location of the spill within 100 or so miles between pumping stations, if the spill has not been located already. Company staff, police, or fire department personnel on the ground are then notified and the shut-off valve "upstream" of the spill is then closed. Manual shut-off valves are located approximately every 15 miles. The time between detection and the closing of the nearest shut-off valve could range up to several hours.

At this time a great deal of oil could be lost, or very little depending on the size of the break and position of the break in relation to the topography. If the break is at a low point in the topography, it is likely that most of the oil from the leak up-system to the top of the next ridge or high point will spill. If the break occurs at a high point, probably very little oil would be lost.

Automatic shut-off valves controlled electronically from a central point could, in many cases, cut the amount of oil lost because the valve could be almost immediately shut. If the break occurs far "downstream" from the valve, however, the presence of any kind of shut-off valve could be virtually worthless, depending on topographic relationships. Accidental closing of automatic valves during pipeline operation can over-pressure the pipe and cause leaks.

2. DESCRIPTION OF THE EXISTING ENVIRONMENT

2. DESCRIPTION OF THE EXISTING ENVIRONMENT

2.1 LAND USE

2.1.1 General

The crude oil pipeline proposed for construction from the Pine Bend Terminal in Rosemount, Minnesota, to the Minnesota-Iowa border would traverse portions of the following Minnesota counties: Dakota, Rice, Dodge, Steele, and Mower.

The land use along the proposed pipeline is predominantly agricultural. Approximately 96% of both the East and West Alternates is cropland, including about 4% which appears to be highway right-of-way which is farmed. Approximately 3.3% of the East Alternate and 2.8% of the West Alternate is pasture or agriculture/open land. Forested areas make up slightly less than 1% of either route. Most of the forested area occurs near streams and rivers.

The total route miles by land use and the total acreages for the proposed 50-foot right-of-way and the 3-foot wide trench are presented in Table 1. Land use per township for the respective route alternatives is presented in Table 2.

Table 1

LAND USE OF PROPOSED RIGHT-OF-WAY

	PREFERRED			ALTERNATE		
		Acreage			Acreage	
	Miles	50' ROW	3' Trench	Miles	50' ROW	3' Trench
Cultivated*	95.40	572.4	34.6	99.60	597.6	36.2
Pasture & Open	3.37	20.2	1.2	2.86	17.2	1.0
Forest	0.96	5.8	**	1.02	6.1	**
TOTAL	99.73	598.4	35.8	103.48	620.9	37.2

*Including portions of road and highway right-of-way which appear to be cultivated.
**Not applicable.

Table 2

MILES OF LAND USE ALONG PROPOSED ROUTE

County/Township	Miles		
	Cultivated	Pasture and Open	Forest
Dakota County			
Both Alternates:			
Rosemount	2.48	0.22	0.66
Empire	5.89	0.55	0
Castle Rock	3.03	0.32	0.03
East Alternate:			
Castle Rock	2.91	0.11	0.15
Waterford	4.34	0.38	0.19
West Alternate:			
Castle Rock	4.00	0	0.03
Waterford	1.28	0.06	0
Greenvale	4.54	0.54	0
Rice County			
East Alternate:			
Northfield	6.52	0.45	0.11
Wheeling	4.33	0.42	0
West Alternate:			
Bridgewater	7.08	0.09	0.45
Cannon City	2.75	0.13	0.03
Wheeling	2.91	0.03	0
Both Alternates:			
Wheeling	1.09	0	0
Richland	6.78	0.18	0
Steele County			
Merton	2.16	0	0.06
Dodge County			
Ellington	4.79	0.08	0
Claremont	6.80	0.17	0
Wasioja	0.63	0	0
Ashland	6.53	0.09	0.27
Hayfield	4.81	0	0
Vernon	2.27	0	0
Mower County			
Sargeant	6.47	0.06	0.01
Dexter	2.46	0	0
Grand Meadow	4.64	0	0
Clayton	6.80	0.01	0
Lodi	3.08	0.06	0.08
LeRoy	6.33	0.27	0
TOTALS*			
East Alternate	99.14	3.37	0.96
West Alternate	99.60	2.86	1.02

*Total includes a cumulative total of approximately 4 miles of highway right-of-way which appears to be cultivated.

With the exception of approximately 9 miles of public right-of-way along roads and highways, the route passes through land which is privately owned.

2.1.2 Communities and Residential Areas

The proposed pipeline does not traverse any incorporated areas or population centers along its route until it reaches the terminus at Pine Bend, which is in the incorporated city of Rosemount. The proposed pipeline will, however, be routed near several communities. The following is a list of communities within three miles of the route:

County	Community	Population
Dakota	Rosemount	4,047
	Coates	212
	Hampton	369
	Castle Rock	120
	Waterford	100
Rice	Dundas	460
	Northfield	10,235
	Cannon City	120
Steele	None	--
Dodge	Claremont	520
	Dodge Center	1,603
	Hayfield	939
Mower	Sargeant	85
	Dexter	252
	Elkton	134
	Taopi	59
	LeRoy	870

The closest community is Dundas in northern Rice County which is located approximately 0.25 miles east of the West Alternate. Dexter, in Mower County, is located approximately 0.5 miles west of the route. All other

TABLE 3
LAND USE BY TOWNSHIP

County/Township	Farm Acreage			Percent of Township Land in Farms		
	Total Farm Acres	Number of Farms	Average Acres per Farm	Harvested Percent	Total Percent	Non-Farm Percent
Dakota County						
Both						
Rosemount	11,231	60	187	33	54	46
Empire	15,880	52	305	64	70	30
East Alternate						
Castle Rock	17,193	83	207	57	74	26
Waterford	8,526	32	266	82	90	10
West Alternate						
Castle Rock	(Same as above.)			(Same as above.)		
Waterford	(Same as above.)			(Same as above.)		
Greenvale	19,454	92	211	74	82	18
Rice County						
East Alternate						
Northfield	24,605	95	259	71	94	6
Wheeling	19,571	89	220	69	89	11
West Alternate						
Bridgewater	20,625	107	193	62	85	15
Cannon City	17,483	92	190	64	89	11
Wheeling	(Same as above.)			(Same as above.)		
Both						
Richland	16,709	76	220	59	73	27
Steele County						
Merton	22,425	84	267	87	97	3
Dodge County						
Ellington	18,217	72	253	65	78	22
Claremont	21,179	63	336	91	94	6
Wasioja	19,757	100	198	67	87	13
Ashland	22,117	62	357	90	95	5
Hayfield	21,314	77	277	87	92	8
Vernon	18,789	88	214	58	81	19
Mower County						
Sargeant	18,700	58	322	60	83	17
Dexter	19,347	68	285	73	84	16
Grand Meadow	19,830	58	342	71	87	13
Clayton	15,654	48	326	56	68	32
Lodi	15,710	59	266	57	69	31
Le Roy	17,717	66	288	56	76	23

Source: Minnesota Crop and Livestock Reporting Service and Minnesota Analysis Planning System

TABLE 4
ACRES OF CROPS HARVESTED IN 1974 BY TOWNSHIP

County/Township	Corn, Grain or Silage	Soy Beans	Oats	Barley	Wheat	Potatoes	Peas	Sweet Corn	Hay	Others	Total Acres Harvested
Dakota County											
Both											
Rosemount	2,388	1,614	880	0	209	7	196	193	1,445	70	7,032
Empire	5,712	2,607	878	0	1,341	106	680	69	1,571	0	14,535
East Alternate											
Castle Rock	5,381	3,417	1,351	0	1,173	5	262	9	1,473	209	13,280
Waterford	3,175	1,313	434	0	1,848	4	195	78	600	45	7,692
West Alternate											
Castle Rock		(Same as above.)									
Waterford		(Same as above.)									
Greenvale	5,494	4,075	947	16	1,099	0	0	98	2,113	0	13,842
Rice County											
East Alternate											
Northfield	9,532	4,450	1,363	10	583	0	131	92	2,393	0	18,554
Wheeling	7,413	3,290	1,311	0	387	0	95	38	2,466	29	15,154
West Alternate											
Bridgewater	7,635	3,576	973	23	729	0	0	0	2,260	0	15,059
Cannon City	6,313	2,828	917	0	602	0	20	110	1,591	120	12,501
Wheeling		(Same as above.)									
Both											
Richland	6,968	3,012	1,012	12	394	0	50	60	1,818	95	13,421
Steele County											
Merton	9,295	6,374	1,193	0	713	250	110	326	1,794	0	20,055
Dodge County											
Ellington	6,759	4,751	1,251	0	437	0	155	275	1,543	0	15,171
Claremont	9,311	5,439	1,227	0	403	0	206	587	2,138	0	19,311
Wasioja	7,397	3,725	1,372	40	92	0	35	82	2,414	0	15,157
Ashland	10,105	7,988	1,086	0	150	0	58	287	1,320	0	21,144
Hayfield	7,596	8,417	1,059	0	347	0	60	140	1,121	0	19,861
Vernon	5,435	4,316	1,409	10	255	0	207	403	1,428	0	13,463
Mower County											
Sargeant	6,355	5,120	505	0	25	35	168	490	873	0	13,571
Dexter	7,136	7,462	1,041	0	85	0	40	180	846	0	16,790
Grand Meadow	6,728	7,768	1,018	0	230	0	50	240	166	0	16,200
Clayton	6,283	5,114	1,034	0	80	0	0	0	712	0	13,223
Lodi	6,124	3,783	1,507	0	0	0	0	0	1,589	0	13,003
Le Roy	5,682	4,020	1,311	0	0	0	0	0	1,818	0	12,831

Source: Minnesota Crop and Livestock Reporting Service.

communities and residential areas are located at least one mile from the route.

2.1.3 Agriculture

The dominant land use of southeastern Minnesota is agriculture. Along the approximately 100-mile route, about 96% of the land is cultivated. Table 3 shows the farm versus the non-farm use of the land on a township basis.

Table 4 indicates the acreage of various crops harvested in 1974 by township. Corn is the most important crop by acreage followed by soy beans and hay, respectively.

2.1.4 Forest Use

The greatest amount of forested land is located along the West Alternate which has slightly more than one mile (6.1 acres) of forested area. Most of the forested area is in scattered tracts near stream and river crossings. As was indicated in Table 2, the largest single area of forest is located in Bridgewater Township of Rice County. The closest major forested area to the route is the Nerstrand Woods State Park, which is located approximately 0.25 miles east of the East Alternate in Wheeling Township of Rice County.

2.1.5 Other Land Uses

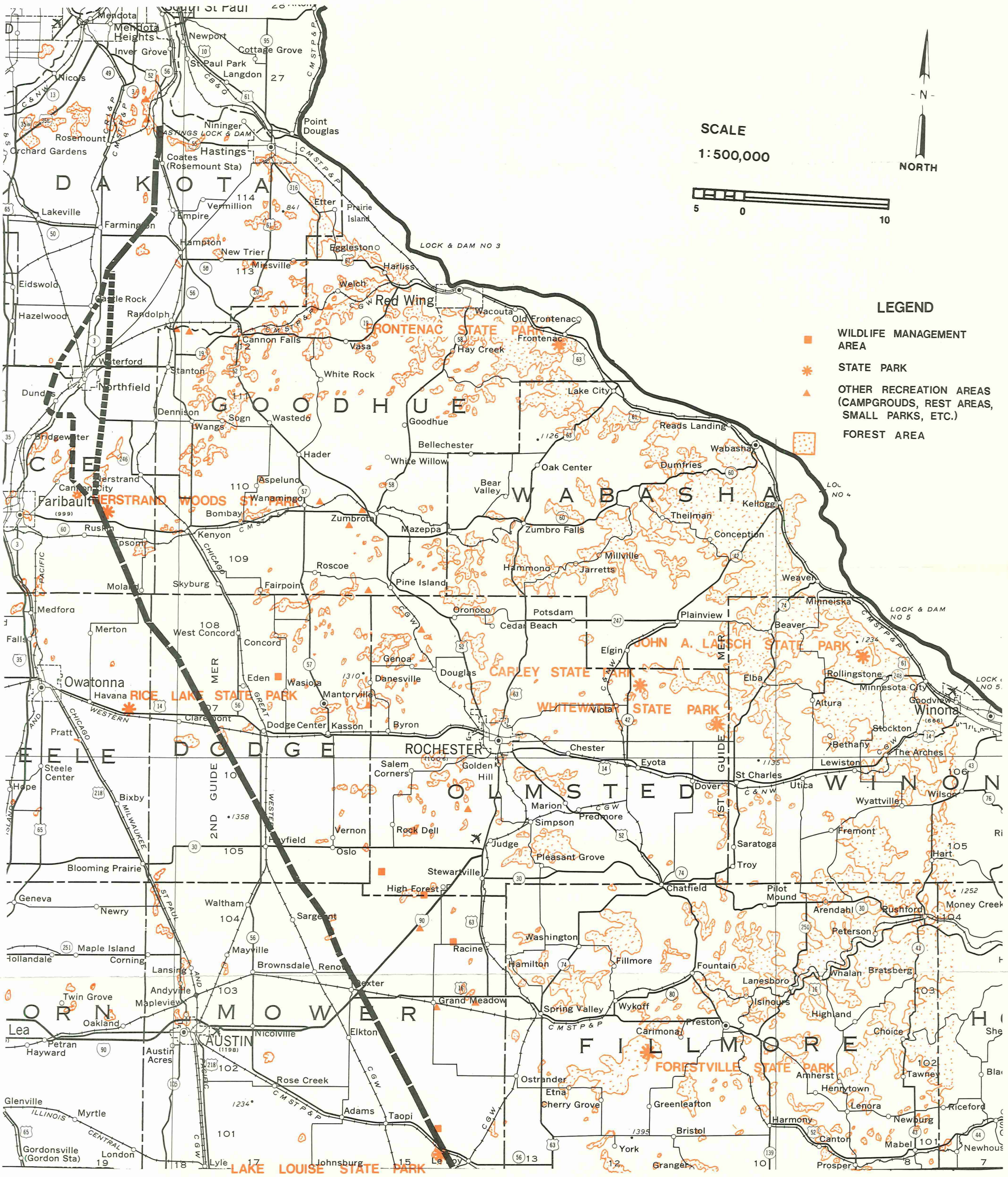
The proposed pipeline will intersect 9 railroads, 8 electrical transmission corridors, 9 pipelines, and 117 roads and highways, the vast majority of which are graveled township roads.

2.1.6 Other Significant Resources

The land along the proposed pipeline route has been subjected to intensive cultivation and other forms of manipulation. As a result, there are few natural, undisturbed

FIGURE 2

LAND USE


SCALE
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5 0 10
N
NORTH
LEGEND
WILDLIFE MANAGEMENT AREA
STATE PARK
OTHER RECREATION AREAS (CAMPGROUDS, REST AREAS, SMALL PARKS, ETC.)
FOREST AREA
DAKOTA
GOODHUE
WABASHA
CEDAR
DODGE
OLMSTED
WINONA
ROCHESTER
FILLMORE
MOWER
AUSTIN
Red Wing
Hastings
Faribault
Owatonna
Northfield
Lake City
Wabasha
Winona
Rochester
Austin
Mendota
Mendota Heights
Inver Grove
Newport
Cottage Grove
St Paul Park
Langdon
Nininger
Point Douglas
Rosemount
Orchard Gardens
Coates (Rosemount Sta)
Vermillion
Empire
Etter
Prairie Island
Lakeville
Farmington
Hampton
New Trier
Miesville
Eggleston
Harliss
Welch
Eidswold
Castle Rock
Hazelwood
Randolph
Cannon Falls
Vasa
Hay Creek
Frontenac
Old Frontenac
Wacouta
Waterford
Stanton
White Rock
Dundas
Dennison
Sogn
Wastedo
Wangs
Goodhue
Reads Landing
Bridgewater
Hader
Bellechester
White Willow
Oak Center
Dumfries
Bear Valley
Kellogg
Theilman
Conception
Zumbro Falls
Mazeppa
Zumbrota
Bombay
Ruskin
Kenyon
Millville
Hammond
Jarretts
Roscoe
Pine Island
Skyburg
Fairpoint
Molandt
Medford
Merton
West Concord
Concord
Oronoco
Potsdam
Cedar Beach
Plainview
Weaver
Minneiska
Beaver
Elgin
Genoa
Douglas
Danesville
Eden
Wasioja
Mantorville
Havana
Elba
Rollingstone
Minnesota City
Goodview
Altura
Viola
Claremont
Dodge Center
Kasson
Byron
Pratt
Steele Center
Hope
Chester
Eyota
Salem Corners
Golden Hill
Lewiston
Stockton
Bethany
The Arches
St Charles
Dover
Utica
Wilson
Wyattville
Marion
Predmore
Simpson
Rock Dell
Vernon
Judge
Saratoga
Fremont
Hart
Pleasant Grove
Troy
Chatfield
Pilot Mound
Arendahl
Rushford
Money Creek
Peterson
Blooming Prairie
Geneva
Newry
Waltham
Sargeant
High Forest
Stewartville
Oslo
Hollandale
Maple Island
Corning
Mayville
Brownsdale
Racine
Washington
Hamilton
Fillmore
Fountain
Whalan
Bratsberg
Lanesboro
Isinours
Highland
Twin Grove
Andyville
Mapleview
Grand Meadow
Spring Valley
Wykoff
Preston
Carimona
Choice
Oakland
Lea
Petran
Hayward
Austin Acres
Nicolville
Elkton
Rose Creek
Ostrander
Etna
Cherry Grove
Greenleafton
Harmony
Bristol
York
Granger
Prosper
Canton
Amherst
Henrytown
Lenora
Newburg
Mabel
Tawney
Riceford
Newhouse
Glenville
Myrtle
Gordonsville (Gordon Sta)
London
Lyle
Johnsburg
Adams
Taopi
Le Roy
Nicols
Inver Grove
Cottage Grove
Langdon
Point Douglas
Hastings
Rosemount
Orchard Gardens
Lakeville
Farmington
Empire
Vermillion
Etter
Prairie Island
Hampton
New Trier
Miesville
Eggleston
Harliss
Welch
Red Wing
Wacouta
Old Frontenac
Frontenac
Hay Creek
Vasa
Cannon Falls
Waterford
Stanton
White Rock
Northfield
Dundas
Dennison
Sogn
Wastedo
Wangs
Goodhue
Reads Landing
Bridgewater
Hader
Bellechester
White Willow
Oak Center
Dumfries
Wabasha
Bear Valley
Kellogg
Theilman
Conception
Zumbro Falls
Mazeppa
Zumbrota
Faribault
Cannon City
Bombay
Ruskin
Kenyon
Millville
Hammond
Jarretts
Roscoe
Pine Island
Skyburg
Fairpoint
Molandt
Medford
Merton
West Concord
Concord
Oronoco
Potsdam
Cedar Beach
Plainview
Weaver
Minneiska
Beaver
Elgin
Genoa
Douglas
Danesville
Eden
Wasioja
Mantorville
Owatonna
Havana
Elba
Rollingstone
Minnesota City
Goodview
Winona

areas remaining. The proposed route does not come within one mile of any wildlife management area. With the exception of the Cannon River crossing, the floodplains of most of the rivers are pastures and cultivated fields which come right to the river banks.

The East Alternate route passes 0.5 miles to the east of the Carleton College State Game Refuge in the southern part of Dakota County near the Rice County line. In Claremont Township of Dodge County, the route traverses a 1.5-mile length of the Claremont Game Refuge. Both are statutory refuges as designated by the State with all property remaining in private hands.

The West Alternate route crosses the Cannon River approximately one mile north (downstream) of the Rice County Cannon River Wilderness Area. None of the streams or creeks along the proposed route are designated as trout streams. However, Spring Brook is known to contain trout about a mile downstream of the crossing.

2.1.7 Land Use of Possible Pump Station Site

A specific site has not as yet been selected for the pump station. It is anticipated that at some point in the future, one 5-acre, non-forested site will be selected at some point along the proposed route for a pump station.

2.2 SURFACE WATERS

2.2.1 Location

Ten stream crossings are proposed on the East Alternate, and thirteen on the West Alternate (see Figure 3).

DAKOTA COUNTY

Vermillion River	T.114N. R.19W. Sec. 24
East Alternate	
Chub Creek	T.112N. R.19W. Sec. 16
Cannon River	T.112N. R.19W. Sec. 21

West Alternate

Chub Creek	T.112N. R.20W. Sec. 12

RICE COUNTY

East Alternate

None

West Alternate

Heath Creek	T.112N. R.20W. Sec. 33
Spring Brook	T.111N. R.20W. Sec. 4
Cannon River	T.111N. R.20W. Sec. 22
Prairie Creek	T.110N. R.20W. Sec. 11

Both Routes

North Fork of Zumbro River,	
Crossing 1	T.109N. R.19W. Sec. 22
Crossing 2	T.109N. R.19W. Sec. 16

DODGE COUNTY

South Branch of Middle Fork of Zumbro River	T.107N. R.18W. Sec. 10
Dodge Center Creek	T.106N. R.17W. Sec. 6

MOWER COUNTY

North Branch of Root River	T.104N. R.16W. Sec. 4
Upper Iowa River	
Crossing 1	T.101N. R.15W. Sec. 12
Crossing 2	T.101N. R.14W. Sec. 19

No lakes, marshes, or wetlands are crossed by the proposed routes.

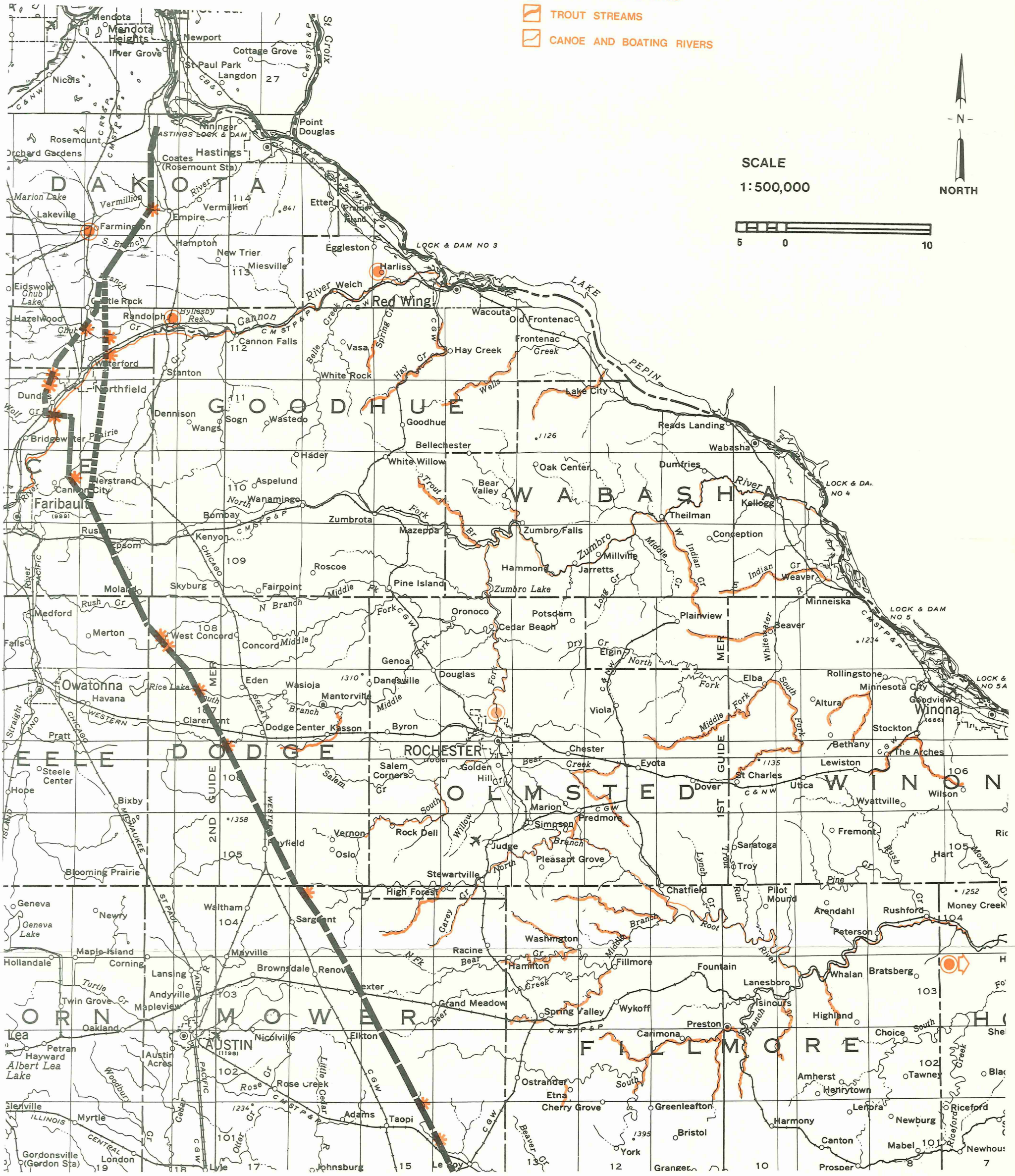
2.2.2 Physical Description

Vermillion River

At the proposed crossing, the Vermillion River is about

FIGURE 3

SURFACE WATERS



NORTHERN PIPE LINE CO.

OF DELAWARE INC.

25 feet wide and about 1 foot deep. The average summer flow is about 14 cfs. The bottom is sand and gravel. Banks are about 3 to 4 feet high and stand vertically. Soils along the banks appear to be a silty sand.

Vegetation along the Vermillion consists of willow thickets on the north bank which range from about 20 to 100 feet in width. On the south side, vegetation is entirely pasture and crops. The floodplain along the river is about 500 feet wide.

Air photos of the proposed crossing are includes in Appendix B. A summary of river characteristics is included in Table 6.

East Alternate

Chub Creek

At the proposed point of crossing, the creek is about 15 to 20 feet in width. Depth and flow were not measured due to ice cover. For the same reason, the bottom was not examined. The banks stand about 3 feet high on the north side and about 10 feet high on the south side. In both cases, the banks stand near vertical. Soil appears to be a sandy clay.

Vegetation on the north bank consists of a stand of box elders with a few willows. On the south side, the banks are open field and pasture. The floodplain appears to be about 500 feet wide.

An air photo of the proposed crossing is included in Appendix B. A summary of river characteristics is included in Table 6.

Cannon River

At the proposed crossing, the width of the river is 88 feet and the depth is 3 feet. Average flow is about

240 cfs. The banks are approximately 6 feet high on the north side and stand vertically. No bedrock outcrops are apparent on this side. On the south side, a 12 to 15-foot vertical bank includes a 6-foot cliff of exposed limestone bedrock. The soils appear to be a sandy clay with some organics.

Vegetation includes silver maple, box elder, a few willows, occasional aspen, american elm, and raspberries, in a band about 1,000 feet wide on the north side of the river. The south side has about a 10 to 20-foot wide tree and brush line. The floodplain is about 1,000 feet wide. The Cannon River is designated by the Minnesota DNR as a canoe and boating route and is considered a fairly good bass fishing stream.

Air photos of the proposed crossing are included in Appendix B. A summary of river characteristics is included in Table 6.

West Alternate

Chub Creek

At the crossing point, Chub Creek is approximately 10 feet wide and less than 1 foot deep. The bottom appears to be sandy. The banks are about 2 to 3 feet high on both the north and south sides and stand vertically. Soils appear to be an organic sandy clay.

Vegetation consists of a narrow band of trees bordered by open fields on both the north and south banks. The floodplain is 0 to 10 feed wide.

Air photos of the proposed crossing are included in Appendix B. A summary of river characteristics is included in Table 6.

Cannon River

At this crossing, the Cannon River is about 50 to 75 feet wide. Both banks are about 10 feet high. The floodplain is about 3,000 feet wide. On the east, the floodplain abuts steep bluffs which include bedrock cliffs 50 feet or more in height. On the west, the topography rises more gently for about 50 to 60 feet of relief.

The banks are covered with a moderately dense growth of trees and some lowland shrubs. Cultivated fields extend up to the banks on the east side. On the west bank, an open field and Highway 3 are located.

Air photos of the proposed crossing are included in Appendix B. A summary of the river characteristics is included in Table 6.

Heath Creek

At the proposed crossing, Heath Creek is about 15 to 25 feet wide. Depth is about 1 to 2 feet. Flow was not measured because of ice cover, nor were bottom characteristics observed. The banks on the north are about 3 to 4 feet high and are very steep. On the south, they appear to be 1 to 2 feet high and are also steep.

Vegetation on the north consists of a 10-foot band of trees consisting mostly of red oak, basswood, and box elder, with a few white oak. On the south, there is a 100-foot wide thicket of trees of the same type. The floodplain is about 100 feet wide.

Air photos of the proposed crossing are included in Appendix B. A summary of river characteristics is included in Table 6.

Spring Brook

Spring Brook is 3 to 5 feet wide at the crossing. Banks are 3 to 5 feet high, and no floodplain is apparent. The brook was frozen at the time of inspection.

Fields on both sides are cultivated to the banks. Trout are known to spawn in the stream about a mile downstream from the crossing point.

Air photos of the proposed crossing are included in Appendix B. A summary of river characteristics is included in Table 6.

Prairie Creek

At the crossing point, Prairie Creek is 5 to 10 feet wide with banks 2 to 5 feet high. From the banks, the land slopes upward at about 45° providing 50 to 100 feet of relief. The floodplain appears to be 100 to 200 feet wide.

On the east, the slope of the hill is cultivated, with pasture along the cree. On the west, the slopes are in pasture.

Air photos of the proposed crossing are included in Appendix B. A summary of river characteristics is included in Table 6.

Both Alternates

North Fork of the Zumbro River - North Crossing

At the proposed crossing, the river is 15 to 20 feet wide. Depth was not measured due to ice. Average flow is 13 cfs. Banks are about 6 to 8 feet high and from 60° to vertical in slope on both sides of the river. Soils appear to be sandy clay with some organics.

Vegetation consists of one large box elder, one large willow, and mesic pasture. The floodplain is about 500 feet wide.

Air photos of the proposed crossing are included in Appendix B. A summary of river characteristics is included in Table 6.

North Fork of the Zumbro River - South Crossing

At the proposed crossing point, the river is about 10 feet wide and depth is about 9 inches. Average flow is 13 cfs. Banks are about 6 to 8 feet high on both the north and south sides and stand at about a 45° slope. Soils are sandy clay with some organics. The bottom appears to be sandy and cobbly.

Vegetation is primarily mesic pasture and weeds, ranging to low pasture and weeds. The floodplain is about 70 feet wide.

Air photos of the proposed crossing are included in Appendix B. A summary of river characteristics is included in Table 6.

South Branch of the Middle Fork of the Zumbro River

At the proposed crossing, the river is about 15 to 20 feet wide, and depth is about 1-1/2 feet. Average flow is about 9 cfs. The bottom appears to be sand and gravel. Banks on both sides are 6 to 8 feet high and stand vertically.

The land is farmed up to the river banks on both sides, while the banks themselves are weed-covered. The floodplain is about 300 feet wide.

Air photos of the proposed crossing are included in Appendix B. A summary of river characteristics is included in Table 6.

Dodge Center Creek

At the proposed crossing, the creek is about 25 to 30 feet wide. Depth and bottom characteristics were not observed due to ice cover. Average flow is 26 cfs. Banks are about 6 to 8 feet high and stand 60 degrees to vertical. Soil is sandy clay.

Vegetation is mesic to low. On the north bank are found soft maple, ash, elm, willow, and some white oak. On the south are elm, willow, and a few oaks. The floodplain is 1,000 to 2,000 feet wide.

Air photos of the proposed crossing are included in Appendix B. A summary of river characteristics is included in Table 6.

North Branch of the Root River

At the proposed crossing, the width of the river is 10 to 15 feet. Depth and bottom characteristics were not measured due to ice. Average flow is 1.4 cfs. Banks are 6 to 8 feet high and stand at about a 60° slope. Soil appears to be a clayey sand.

Vegetation is mostly mesic upland weeds. The north bank has a 30 to 50-foot wide weed strip between the river and cropland. On the south bank, there is a 30-foot wide weedy strip abutting the cropland. This portion of the river appears to be maintained as a part of a county ditch system. There is no apparent floodplain.

Air photos of the proposed crossing are included in Appendix B. A summary of river characteristics is included in Table 6.

Upper Iowa River - North Crossing

At this crossing, the river is about 10 feet wide. Depth and bottom characteristics were not measured due to

ice. Average flow is 8 cfs. The banks are about 2 feet high and stand vertically on both north and south sides. On the north side above the bank is about a 30° slope providing a total of about 10 to 15 feet of relief. On the south, there is a relatively flat floodplain about 150 feet wide.

Vegetation consists of moist to mesic pasture, with scattered white oaks. There are crops located above the floodplain on the south and above the fill on the north. West of the crossing, there is a stand of red and white oak.

Air photos of the proposed crossing are included in Appendix B. A summary of river characteristics is included in Table 6.

Upper Iowa River - South Crossing

At this point, the river is about 5 to 20 feet wide and 6 to 9 inches in depth. Average flow is about 14 cfs. The bottom appears to be pebbly. Soils appear to be an organic sandy clay, and banks which are 3 to 5 feet high on both sides stand near vertical.

Vegetation consists primarily of mesic pasture and crops. The floodplain appears to vary from 0 to 200 feet on either side of the river, depending on the nature of the meanders.

Air photos of the proposed crossing are included in Appendix B. A summary of river characteristics is included in Table 6.

2.2.3 Water Quality

Water quality in the Vermillion, Cannon, Zumbro, and Root Rivers is monitored by the Minnesota Pollution Control Agency. The locations of the monitoring sites are presented in Figure 3. Although the sites are not near the pipeline

TABLE 5
ESTIMATED WATERSHED DISCHARGE DATA
(All Data Expressed as Cubic Feet/Second (cfs))

River Crossings and U.S.G.S. Data	Period of Record	Extremes: Period of Record Max.	Extremes: Period of Record Min.	Extremes: 1976 Max.	Extremes: 1976 Min.	Means - 1976: June	Means - 1976: July	Means - 1976: Aug.	Means - 1976: Sept.	Average Discharge Period of Record
Vermillion River near Empire	5/42 - 6/45 9/69 - Present	2,030	8.4	664	12	25.5	16.9	14.3	14.6	-
Vermillion River Crossing	*	1,624	6.7	531	9.6	20.4	13.5	11.4	11.7	-
Chub Creek Crossing	*	502	2	164	3	6.3	4.2	3.5	3.6	-
Heath Creek Crossing	*	500	2	163	3	6.3	4.2	3.5	3.6	-
Spring Brook Crossing	*	17	0	6	0.1	0.2	0.1	0.1	0.1	-
Cannon River Basin, Straight River near Faribault	10/65 - Present	5,990	11	535	11	45.8	26.5	16.2	16.0	242
Cannon River Crossing	*	15,830	29	1,400	29	121.0	70.0	43.0	42.0	640
Prairie Creek Crossing	*	118	0.5	38	1	1.5	1.0	0.8	0.9	-
South Fork Zumbro River near Rochester	1/52 - Present	19,600	8.4	5,200	34	71.0	63.9	46.4	38.0	150
North Fork Zumbro River Crossings (2)	*	1,745	1	463	3	6.0	5.6	4.1	3.4	13
South Branch Mid-Fork Zumbro River	*	1,128	0.5	300	2	4.1	3.7	2.7	2.2	8.6
Dodge Center Creek	*	3,390	1.5	900	6	12.3	11.1	8.0	6.6	26
Root River near Lansboro	2/10 - 11/10 2/11 - 9/14 7/15 - 9/17 8/40 - Present	22,100	29	14,100	96	168	132	119	104	335

TABLE 5 (Cont.)
ESTIMATED WATERSHED DISCHARGE DATA
(All Data Expressed as Cubic Feet/Second (cfs))

River Crossings and U.S.G.S. Data	Period of Record	Extremes				Means - 1976				Average Discharge Period of Record
		Period of Record		1976						
		Max.	Min.	Max.	Min.	June	July	Aug.	Sept.	
North Branch Roof River Crossing	*	71	0	29	0.3	0.6	0.4	0.3	0.3	1.4
Iowa River Basin	5/09 - 9/14									
Cedar River near Austin	10/44 - Present	9,530	0	3,910	36	76.4	47.3	44.1	41.9	188
Upper Iowa River Crossings (2)	*									
1		425	0	175	1.6	3.4	2.1	2.0	1.9	8.4
2		692	0	284	2.6	5.5	3.4	3.2	3.0	13.7

*No data. Discharges are estimated by proportional watershed areas using the recorded USGS data included in the table.

Sources: U.S. Geological Survey, Water Data Report Mn 76-1
Water Resources Data for Minnesota, Water Year 1976.
U.S. Department of Agriculture, Soil Conservation Service,
Minnesota Watershed Inventory.

TABLE 6

SELECTED DATA ON PROPOSED RIVER AND STREAM CROSSINGS

River Crossings	Location	December, 1977 Width (feet)	December, 1977 Depth (inches)	Discharge cfs Overall Average	Discharge cfs Avg. Summer 1976	Gradient Feet/mi.	Bottom	Banks	Floodplain* (feet)
Vermillion River	T.114N. R.19W. Sec. 24	25	10 1/2	-	14.3	5.7	Sand/Gravel	3-4 ft., Vert.	500
East Alternate									
Chub Creek	T.112N. R.17W. Sec. 16	15-20	-	-	2.8	3.5	-	3-10 ft.,Vert.	500
Cannon River	R.112N. R.19W. Sec. 21	88	36	242	25.8	4	Cobbly	6-15 ft.,Vert. (includes 6 ft. bedrock cliff)	1,000
West Alternate									
Chub Creek	T.112N. R.20W. Sec. 12	10	<12	-	2.8	7.7	Sandy	2-3 ft.,Vert.	10
Heath Creek	T.112N. R.20W. Sec. 33	15-25	12-24	-	2.8	6.9	-	1-4 ft.,Steep	100
Spring Brook	T.111N. R.20W. Sec. 14	3-5	-	-	0.1	-	-	3-5 feet	0
Cannon River	T.111N. R.20W. Sec. 22	100	36	242	25.8	4		100-150 ft. (includes 50 ft. bedrock cliff)	3,000
Prairie Creek	T.110N. R.20W. Sec. 11	5-10	-	-	1.0	-	-	5-10 w/mod.-Steep Slope above	100-200
Both									
North Fork, Zumbro River Crossing 1	T.109N. R.19W. Sec. 16	15-20	-	13	4.8	9.1	-	6-8 ft.,Steep	500
Crossing 2	T.109N. R.19W. Sec. 22	10	9	13	4.8	16.7	Cobbly/Sand	6-8 ft.,Mod.Slope	70
South Branch, Middle Fork Zumbro River	T.107N. R.18W. Sec. 10	15-20	18	8.6	3.2	5.2	Sand/Gravel	6-8 ft.,Vert.	300
Dodge Center Cr.	T.106N. R.17W. Sec. 6	25-30	-	26	9.5	3.5	-	6-8 ft.,Steep to Vert.	1,000-2,000
North Branch Root River	T.104N. R.16W. Sec. 4	10-15	-	1.4	0.4	13.9	-	6-8 Ft.,Vert.	0
Upper Iowa River Crossing 1	T.101N. R.15W. Sec. 12	10	-	8.4	2.4	5.1	-	2 feet, Vert.	150
Crossing 2	T.101N. R.14W. Sec. 19	5-20	6-9	13.7	3.8	7.4	Pebbly	3-5 ft.,Vert.	200

*Estimated from topographic maps, aerial photos, and field observations.

route, these are the only data available and give an indication of the water quality in these rivers. Table 8 of the Draft Environmental Impact Statement (page 40) summarizes these data. The data are from a STORET retrieval in November of 1976.

2.3 SOILS AND TOPOGRAPHY

2.3.1 General

Figure 4 is a map of geomorphic regions of southeastern Minnesota, as defined in the Minnesota Soil Atlas (2). The proposed pipeline route has been overlayed. The route lies in eight geomorphic regions: Mississippi Valley Outwash (#29), Cannon Valley Outwash (#30), Kenyon-Taopi Plain (#38), Harmony-Plainview Uplands (#39), Hayfield-Owatonna Moraine (#35c), Emmons-Faribault Moraine (#35b), Northfield-Myrtle Moraine (#36), and Claremont-Lyle Plain (#37). Descriptions of these areas are included below. See page 43 of the Draft Environmental Impact Statement for an explanation of map codes.

Mississippi Valley Outwash (#29)

See page 48 of the Draft Environmental Impact Statement.

Cannon Valley Outwash (#30)

See page 48 of the Draft Environmental Impact Statement.

Kenyon-Taopi Plain (#38)

See page 48 of the Draft Environmental Impact Statement.

Harmony-Plainview Uplands (#39)

See page 48 of the Draft Environmental Impact Statement.

Emmons-Faribault Moraine (#35b)

The Emmons-Faribault Moraine consists of irregular ground, end and terminal moraines, and ice disintegration features of loamy texture. The dominant landform is a complex

GEOMORPHIC AREAS

Boundaries

29. Mississippi Valley Outwash
30. Cannon Valley Outwash
31. Cedar Valley Outwash
32. Minnesota Valley Outwash
33. Lonsdale-Lerdal Till Region, Clayey, Rolling
34. Waconia-Waseca Moraine, Loamy, Rolling

35a Prior Lake Moraine, Irregular, Strongly Rolling

35b Emmons-Faribault Moraine, Irregular, Rolling

35c Hayward-Owatonna Moraine, Irregular Gently Rolling

36. Northfield-Myrtle Moraine, Silty, Gently Rolling
37. Claremont-Lyle, Plain, Silty, Level
38. Kenyon-Taopi Plain, Silty, Undulating
39. Harmony-Plainview Uplands, Silty, Gently Rolling
40. Red Wing-La Crescent Uplands, Steep
41. Rochester Drift Plain
42. Wells-Rush River Ground Moraine, Clayey, Level
43. Arlington-Matowan Ground Moraine, Loamy, Undulating
44. Blue Earth-Garden City Ground Moraine, Silty, Rolling
45. Twin Cities Formation, Loamy, Rolling
46. Minnesota Lake Plain, Clayey

KEY TO LETTERS

S — Sandy

L — Loamy or silty

C — Clayey

R — Bedrock

W — Well drained

P — Poorly drained

D — Dark colored surfaces

L — Light colored surfaces

SOIL LANDSCAPE UNITS

SSWD — Sandy over sandy, well drained, dark colored soils

SSWL — Sandy over sandy, well drained, light colored soils

SLWD — Loamy over sandy, well drained, dark colored soils

Loamy over sandy, well drained, light colored soils

SLPD — Loamy over sandy, poorly drained, dark colored soils

Loamy over sandy, poorly drained, light colored soils

LSWL — Sandy over loamy, well drained, light colored soils

LLWD — Deep silty or loamy, well drained, dark colored soils

LLPD — Deep silty or loamy, poorly drained, dark colored soils

Deep silty or loamy, well drained, light colored soils

Deep silty or loamy, poorly drained, light colored soils

LCWD — Clayey over loamy, well drained, dark colored soils

LCPD — Clayey over loamy, poorly drained, dark colored soils

LCWL — Clayey over loamy, well drained, light colored soils

RSWD — Sandy over rock, well drained, dark colored soils

Silty or loamy over rock, well drained, dark colored soils

Silty or loamy over rock, well drained, light colored soils

Silty or loamy over rock, poorly drained, dark colored soils

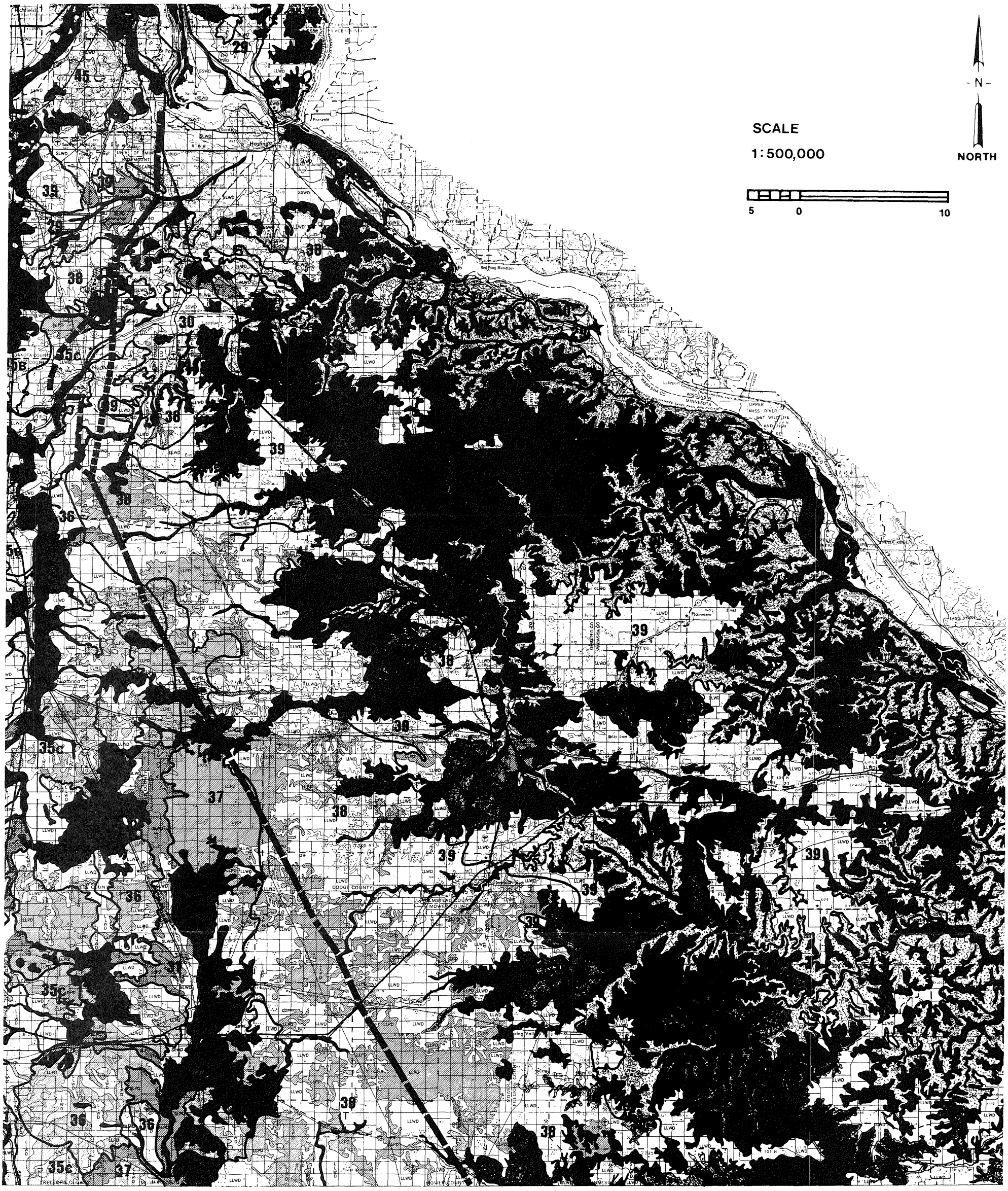
SSR — Steep-stony-rocky land

Organic soils

Alluvial soils undifferentiated

FIGURE 4

SOILS



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of knolls that rise irregularly above a lower level. The knolls seemingly are irregularly placed on an underlying slope. The underlying slope controls the drainage and the knolls ascend and descend with changes within this slope.

The dominant relief is 10 to 30 feet above the knoll base in the rolling areas. Contour lines have a very erratic pattern.

The lower level can normally be drained except for deeply inset depressions. The depressions and dead lakes are filled with peat. The water table on knolls is more than 10 feet deep. The water table on the lower level ranges from above the surface to about 6 feet deep.

Hayward-Owatonna Moraine (#35c)

The Hayward-Owatonna Moraine consists of irregular ground, end and terminal moraines, and ice disintegration features of loamy texture. The dominant landform is a complex of knolls that rise irregularly above a lower level. The knolls are irregularly emplaced on an underlying slope which controls the drainage.

The dominant relief is 5 to 15 feet above the knoll base in the gently rolling areas. Contour patterns tend to be very erratic.

The lower level can normally be drained except for deeply inset depressions. The depressions and old lakebeds are filled with peat. The water table on knolls is more than 10 feet deep. The water table on the lower level ranges from above the surface to about 6 feet deep.

The soil parent material is predominantly a loamy calcareous till, but modified drift in the form of silts and clay occurs in small scattered areas. Outwash valley trains, kames, and eskers are commonly associated features.

Northfield-Myrtle Moraine (36)

The Northfield-Myrtle Moraine consists of a gently rolling silt-mantled end moraine. The dominant landform is a complex of knolls irregularly emplaced on a regional slope. Slope irregularity has been subdued by a silt mantle. Closed depressions are common. Contour patterns are very erratic.

The water table on knolls is more than 10 feet deep while on the lower levels, it ranges from 1 to 6 feet deep. Old lakebeds and depressions are filled with peat.

Claremont-Lyle Plain (37)

The Claremont-Lyle Plain consists of a nearly level silt mantled till plain. The topography is very gently undulating to nearly level, with the few high areas rising 5 to 15 feet above the plain.

The water table in this region range from 0 to 6 feet deep varying seasonally. No lakes occur in this geomorphic region. Some small depressions have a thin layer of peat or muck, but are not large enough to be mapped.

2.3.2 Soil Surveys

Appendix C includes copies of the County Soil Surveys with the proposed route overlain. Capability Unit Classifications appear on the map keys for each county in Appendix C.

TABLE 7. SELECTED FEATURES OF SOIL LANDSCAPE UNITS WITHIN THE EMMONS-FARIBAULT MORAINE, IRREGULAR, ROLLING (35B) GEOMORPHIC REGION

Soil Landscape Unit*	Percent Geomorphic Region	Landscape Position	Most Common Texture and Thickness (Ft)		Moisture Relationships		Approximate Fertility in Rooting Zone			Major Soil Series
			Rooting Zone	Substratum	Inches of Avail. Water to 5 Feet	Drainage Class	ph	P	K	
LLWD	59	Gently rolling to rolling upland	Loam to clay loam (4)	Loam to clay loam (4+)	8-12	Well drained	6.1 - 7.3	Low	Med	Nicollet Clarion Lester LeSueur
LLWL	22	Rolling upland	Sandy loam to loam (4)	Sandy loam to loam (4+)	4-12	Well drained	5.1 - 6.5	Med	Med	Hayden
LLPD	6	Depressional to gently sloping upland	Loam to clay loam (4)	Loam to clay loam (4+)	8-12	Poorly drained	6.6 - 7.3	Low	Low to Med	Glencoe Webster
P	3	Low lying depressions	Peat (1-3)	Peat (3+)	12+	Very poorly drained	5.1 - 7.3	Low	Low	Unnamed
A	2	Nearly level stream bottoms	Loam or silt loam (2-4)	Loam or silt loam (4+)	4-12	Well to poorly drained	5.6 - 7.8	Var	Var	Huntsville Colo Comfrey
RLWD	1	Structural bench nearly level to rolling	Loam (2-4)	Limestone or sandstone bedrock (4+)	4-8	Well drained	5.6 - 7.3	High	Med	Rockton Copas
M	1	Low lying depressions	Peat or mineral soil	Peat or mineral soil	1-4 ft on surface	Marshy				
SSWD	Trace	Rolling upland	Loamy sand or thin sandy loam (1-3)	Sand and gravel (3-20+)	<4	Well drained	5.6 - 7.3	Low	Low to Med	Esterville Lakeville
SLWD	Trace	Nearly level terraces	Loam or silt loam (2-3)	Sand and gravel (3-20+)	4-8	Well drained	5.1 - 7.3	Low to Med	Low	Waukegan Kasota
Water	6									

*Harms, G. F., et al, Minnesota Soil Atlas, St. Paul Sheet, Agricultural Experiment Station, University of Minnesota, 1973.

TABLE 8. SELECTED FEATURES OF SOIL LANDSCAPE UNITS WITHIN THE HAYWARD-OWATONNA MORAINE, IRREGULAR, ROLLING (35C) GEOMORPHIC REGION

Soil Landscape Unit*	Percent Geomorphic Region	Landscape Position	Most Common Texture and Thickness (Ft)		Moisture Relationships		Approximate Fertility in Rooting Zone			Major Soil Series
			Rooting Zone	Substratum	Inches of Avail. Water to 5 Feet	Drainage Class	ph	P	K	
LLWD	50	Rolling upland	Loam to clay loam (4)	Loam to clay loam (4+)	8-12	Well drained	6.1 - 7.3	Low	Med	Nicollet Clarion Lester LeSueur
LLPD	40	Depressional to gently sloping upland	Loam to clay loam (4)	Loam to clay loam (4+)	8-12	Poorly drained	6.6 - 7.3	Low	Low to Med	Glencoe Webster
P	3	Low lying depressions	Peat (1-3)	Peat (3+)	12+	Very poorly drained	5.1 - 7.3	Low	Low	Unnamed
A	2	Nearly level stream bottoms	Loam or silt loam (2-4)	Loam or silt loam (4+)	4-12	Well to poorly drained	5.6 - 7.3	Var	Var	Huntsville Colo Comfrey
LCPD	2	Depressional upland	Silty clay loam (4)	Loam to clay loam (4+)	8-12	Poorly drained	6.1 - 6.5	Low Med	Med	Cordova
LLWL	1	Rolling upland	Sandy loam to loam (4)	Sandy loam to loam (4+)	4-12	Well drained	5.1 - 6.5	Med	Med	Hayden
LCWD	1	Rolling upland	Silty clay loam (3-4)	Clay loam to loam (4+)	8-12	Well drained	5.6 - 6.5	Med	Med	Guckeen
M	1	Low lying depressions	Peat or mineral soil	Peat or mineral soil	1-4 ft on surface	marshy				

*Ibid.

TABLE 9 . SELECTED FEATURES OF SOIL LANDSCAPE UNITS WITHIN THE NORTHFIELD-MYRTLE MORAINE, SILTY, GENTLY ROLLING (36) GEOMORPHIC REGION

Soil Landscape Unit*	Percent Geomorphic Region	Landscape Position	Most Common Texture and Thickness (Ft)		Moisture Relationships		Approximate Fertility in Rooting Zone			Major Soil Series
			Rooting Zone	Substratum	Inches of Avail. Water to 5 Feet	Drainage Class	ph	P	K	
LLWD	48	Gently rolling upland	Silt loam (2-4)	Loam to clay loam (4+)	8-12	Well drained	6.1 - 6.5	Low to Med	Med	Merton Moland
LLPD	36	Depressional to gently sloping upland	Silt loam to silty clay loam (2-4)	Loam to clay loam (4+)	8-12	Poorly drained	6.1 - 7.3	Low	Low to Med	Glencoe Maxfield
LLWL	9	Gently rolling upland	Silt loam (2-4)	Loam to clay loam (4+)	8-12	Well drained	5.1 - 6.5	Med	Med	Hayden
P	4	Low lying depressions	Peat (1-3)	Peat (3+)	12+	Very poorly drained	5.1 - 7.3	Low	Low	Unnamed
SLPD	1	Nearly level outwash plain	Loam,silt loam or silty clay loam (2-3)	Sand and gravel (3-20+)	4-8	Poorly drained	6.1 - 7.8	Low	Low	Talcot Biscay Kato
A	1	Nearly level stream bottoms & low terraces	Loam or silt loam (2-4)	Loam or silt loam (4+)	4-12	Well to poorly drained	5.6 - 7.8	Var	Var	Huntsville Colo
SLWL	1	Nearly level to gently rolling outwash pl.	Sandy loam, loam or silt loam (2-3)	Sand and gravel (3-20+)	4-8	Well drained	4.5 - 6.5	High	Med to High	Tell Bixby
SLWD	Trace	Nearly level terraces	Silt loam (2-3)	Sand and gravel (3-20+)	4-8	Well drained	5.1 - 7.3	Low to Med	Low	Waukegan Wadena
LLPL	Trace	Nearly level to undulating upland	Silt loam or loam (2-3)	Loam (4+)	8-12	Poorly drained	5.1 - 6.5	Low to Med	Med	Skyberg Sargeant
M	Trace	Low lying depressions	Peat or mineral soil	Peat or mineral soil	1-4 ft on surface	Marshy				

*Ibid.

TABLE 10. SELECTED FEATURES OF SOIL LANDSCAPE UNITS WITHIN THE CLAREMONT-LYLE PLAIN, SILTY, LEVEL (37) GEOMORPHIC REGION

Soil Landscape Unit*	Percent Geomorphic Region	Landscape Position	Most Common Texture and Thickness (Ft)		Moisture Relationships		Approximate Fertility in Rooting Zone			Major Soil Series
			Rooting Zone	Substratum	Inches of Avail. Water to 5 Feet	Drainage Class	ph	P	K	
LLPD	49	Nearly level to depressional upland	Silt loam or loam (2-4)	Loam (4+)	8-12	Poorly drained	5.6 - 7.3	Low	Med	Floyd Clyde
LLPL	33	Nearly level to undulating upland	Silt loam or loam (2-4)	Loam (4+)	8-12	Poorly drained	5.1 - 6.5	Low to Med	Med	Skyberg Sargeant
LLWD	11	Gently sloping upland	Silt loam or loam (2-4)	Loam (4+)	8-12	Well drained	5.1 - 6.5	Low to High	Low to Med	Ostrander Racine Kenyon
SLPD	3	Nearly level outwash plain	Loam,silt loam or silty clay loam (2-3)	Sand and gravel (3-20+)	4-8	Poorly drained	6.1 - 7.8	Low	Low	Talcot Biscay Kato
A	1	Nearly level stream bottoms & low terraces	Loam or silt loam (2-4)	Loam or silt loam (4+)	4-12	Well to poorly drained	5.6 - 7.8	Var	Var	Huntsville Colo
SLWD	1	Nearly level terraces	Silt loam (2-3)	Sand and gravel (3-20+)	4-8	Well drained	5.1 - 7.3	Low to Med	Low	Waukegan Wadena Dakota
LLWL	1	Gently sloping upland	Silt loam or loam (2-4)	Loam (4+)	8-12	Well drained	5.1 - 7.3	Low to High	Med	Renova Kasson
RLPD	1	Depressional upland	Silt loam (2-4)	Limestone or sandstone bedrock (4+)	4-8	Poorly drained	7.4 - 7.8	Low	Med	Faxon

*Ibid.

Selected Features of Soil Landscape Units Within the Mississippi Valley Outwash (#29) Geomorphic Region

Selected Features of Soil Landscape Units Within the Cannon Valley Outwash (#30) Geomorphic Region

Selected Features of Soil Landscape Units Within the Kenyon-Taopi Plain (#38) Geomorphic Region

Selected Features of Soil Landscape Units Within the Harmony-Plainview Uplands (#39) Geomorphic Region

See Tables 10-13, pages 44 to 46 of the Draft Environmental Impact Statement.

2.4 GEOLOGY/GROUNDWATER

2.4.1 Bedrock Geology

Figure 5 is a map of bedrock geology in southeastern Minnesota. A description of each formation is included in Table 18 of the Draft Environmental Impact Statement, page 55. Based on a map updated with data from the Minnesota Geological Survey, 95% of the East Alternate lies in an area where bedrock is covered by 50 feet or more of glacial till or outwash, while 90% of the West Alternate lies in this region (Figure 6).

2.4.2 Surficial Geology

Figure 7 is a map of the surficial geology of southeastern Minnesota. The route lies in outwash sand and gravel in central and southern Dakota County and in drift of the Des Moines Lobe or of the Kansan Stage throughout most of the remainder of the route. Some terrace deposits of sand and gravel are encountered at the North Branch of the Zumbro River, and dolomite cliffs (Prairie du Chien Group) are encountered along the Cannon River.

2.4.3 Groundwater

See page 56 of the Draft Environmental Impact Statement.

EXPLANATION

MESOZOIC — CRETACEOUS

Kw

Windrow Formation
(*Sand, clay, and local ferruginous regolith. In part may be Tertiary in age*)

MESOZOIC — CRETACEOUS / PALEOZOIC — DEVONIAN

Dsr

Shell Rock Limestone
(*Limestone and shaly limestone; presence in Minnesota is uncertain*)

Dcv

Cedar Valley Formation
(*Dolomite, shaly dolomite, and dolomitic limestone*)

PALEOZOIC — ORDOVICIAN

Omd

Maquoketa and Dubuque Formations
(*Shale and limestone*)

Og

Galena Formation
(*Dolomite and limestone*)

Decorah Shale
(*Shale and minor limestone*)

Platteville and Glenwood Formations
(*Platteville, dolomite and limestone; Glenwood, shale*)

Osp

St. Peter Sandstone
(*Sandstone and minor siltstone; uncomformably overlies Prairie du Chien Formation*)

Opc

Prairie du Chien Formation
(*Shakopee Dolomite, New Richmond Sandstone, and Oneota Dolomite*)

PALEOZOIC — CAMBRIAN

Csc

St. Croixian Group
(*Jordan Sandstone, St. Lawrence Formation, Franconia Sandstone, and Dresbach Formation*)

PRE-CAMBRIAN — KEWEENAWAN

Unnamed formation
(*Red feldspathic sandstone with interbedded shale; possibly equivalent to the Fond du Lac Formation of east-central Minnesota*)

Contact

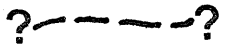
U
D

Fault
(*U, upthrown side; D, downthrown side*)

LEGEND

50 FT ISOPACHOUS
(DEPTH TO BEDROCK) LINE

DASHED WHERE
APPROXIMATE OR INFERRED



QUESTION MARKS INDICATE
INSUFFICIENT DATA
FOR INTERPRETATION

FIGURE 5

BEDROCK GEOLOGY

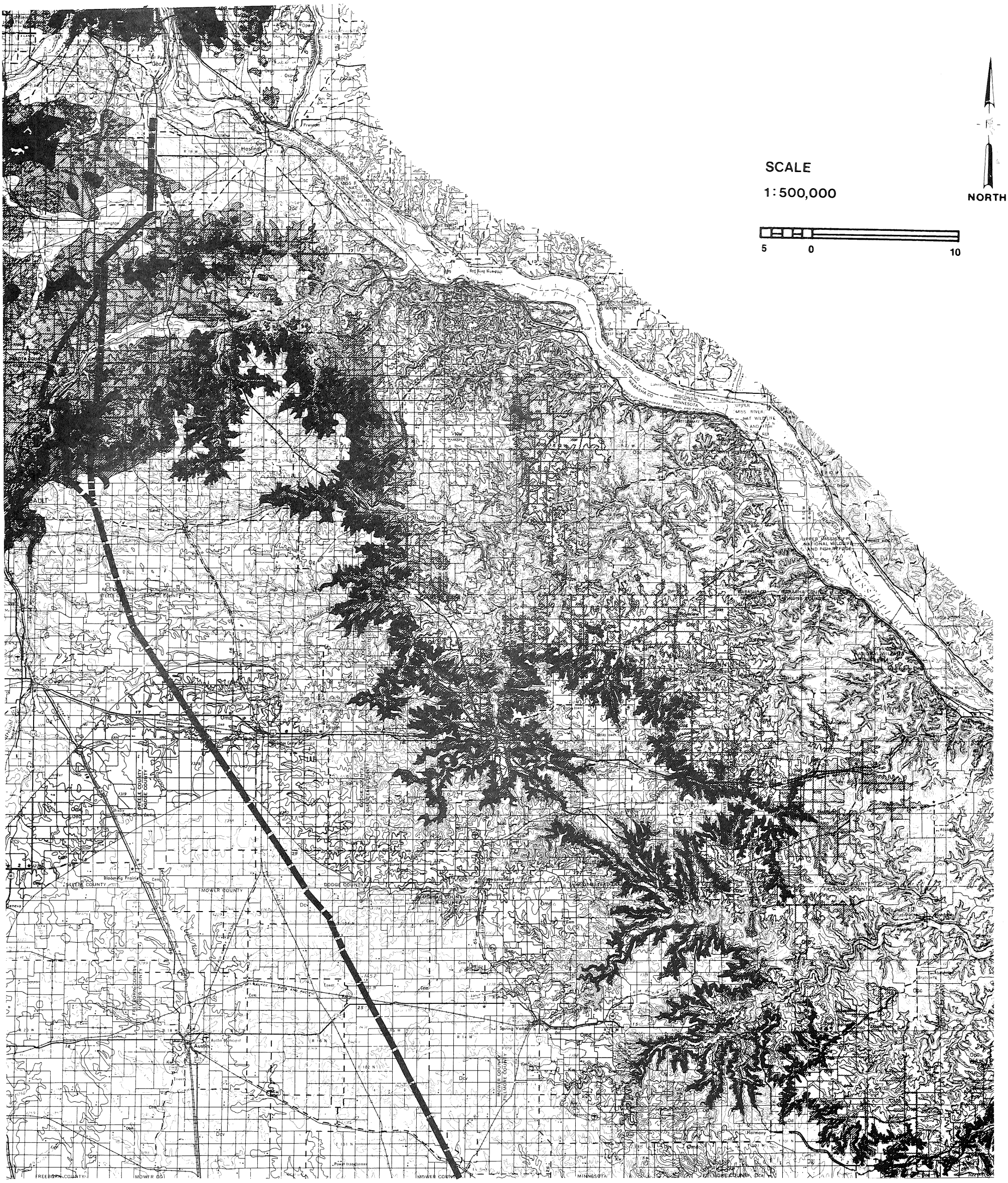


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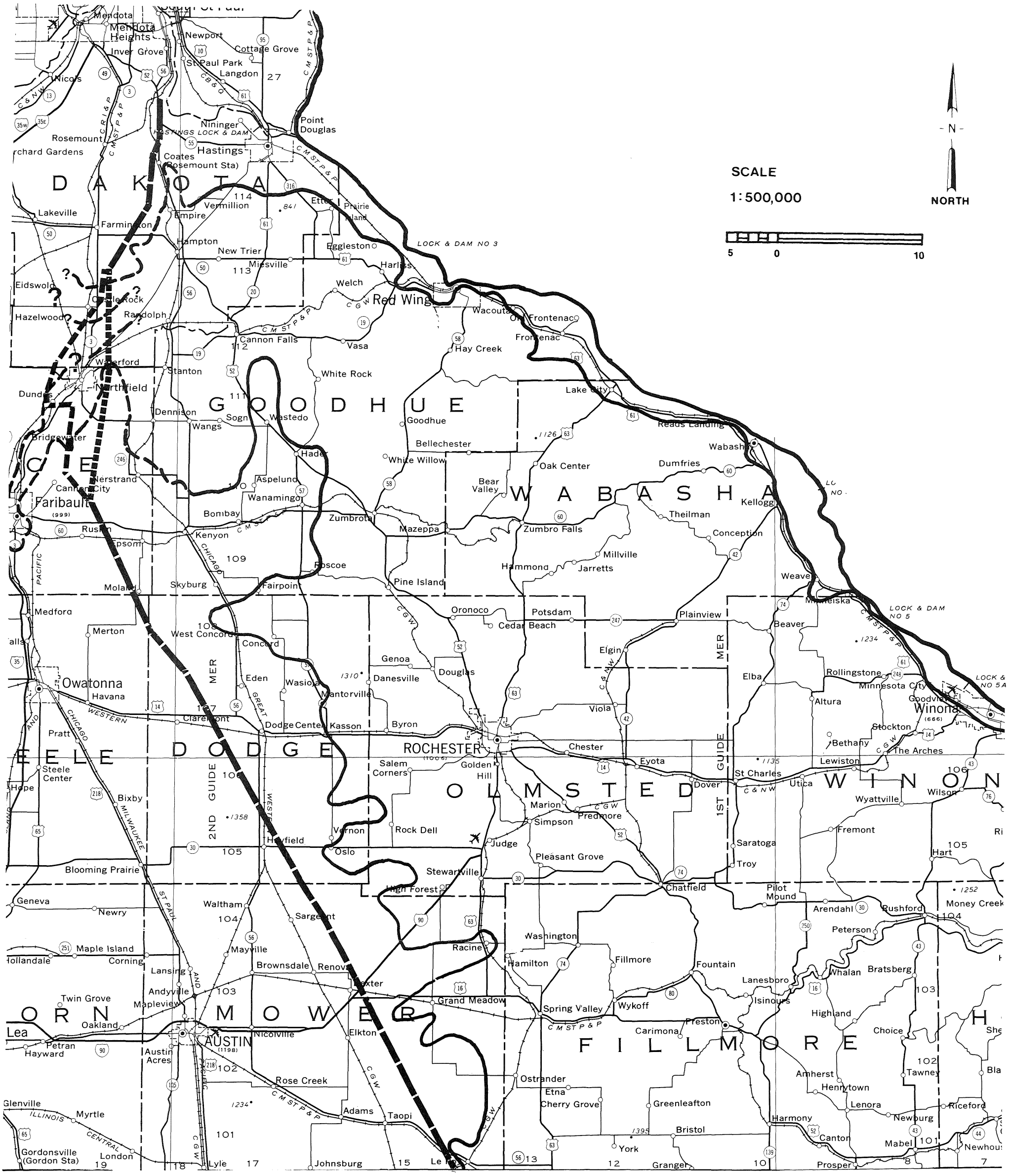
FIGURE 6

DEPTH TO BEDROCK



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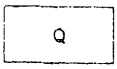
EXPLANATION

Recent

Swamp deposits

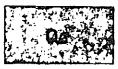
(*Peat and muck; also includes some marshy tracts with little or no peat or muck and in part now artificially drained*)



Alluvium

(*Includes some peat and muck and some bare or nearly bare rock on Mississippi and Minnesota River bottomlands.*)

Pleistocene — Wisconsin stage — Late Wisconsin



Dune sand

(*Fine wind-blown sand; includes much land on which there are no wind-blown deposits*)

Terminal moraines of the Keewatin ice

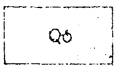
(*Includes those of the Des Moines lobe and of the Grantsburg sublobe and recessional morainal deposits. Composed of young gray drift and includes, in places, older moraines of red drift mantled with gray drift; moraines deposited in lakes, cross-lined. K, Kames, isolated gravel hills*)

Ground moraines of the Keewatin ice

(*Includes the Des Moines lobe and the Grantsburg sublobe, composed of young gray drift. Approximate outer limit of the gray drift deposited by the Keewatin ice of the Wisconsin stage indicated by line of crosses*)

Terminal moraines of the Superior lobe of the Labrador ice

(*Composed of young reddish drift*)



Outwash sand and gravel

(*Associated with formation of moraines of Keewatin, Patrician, and Superior glaciers*)

(*Continued at right*)

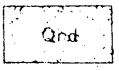
QUATERNARY

CONTINUED

Pleistocene — Wisconsin stage — Middle Wisconsin

Moraines of Patrician red drift, overlapped by thin gray drift

(*The result of the Patrician moraines having been overridden, but not destroyed, by the Keewatin ice of the Wisconsin stage*)



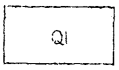
Red glacial drift

(*Mostly ground moraine; includes that deposited by the Patrician ice sheet and the Superior lobe of the Labrador ice*)

Terminal moraines of the Patrician ice sheet

(*Composed of young red till containing few limestone pebbles*)

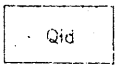
Pleistocene — Peorian interglacial stage



Loess

(*Fine buff silt loam, mainly wind-blown dust*)

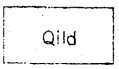
Iowan stage



Iowan drift

(*Gray drift of Keewatin ice sheet in southwestern Minnesota, correlated with Iowan drift of northeastern Iowa*)

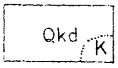
Illinoian stage



Illinoian drift

(*Old red drift of the Patrician ice sheet, tentatively referred to the Illinoian stage of glaciation*)

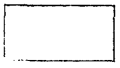
Kansan stage



Kansan drift

(*Old gray drift of the Keewatin ice sheet, partly overlain by Iowan drift in southeastern Minnesota. Kames, indicated by letter (K), are regarded by Leverett as probably Iowan*)

QUATERNARY

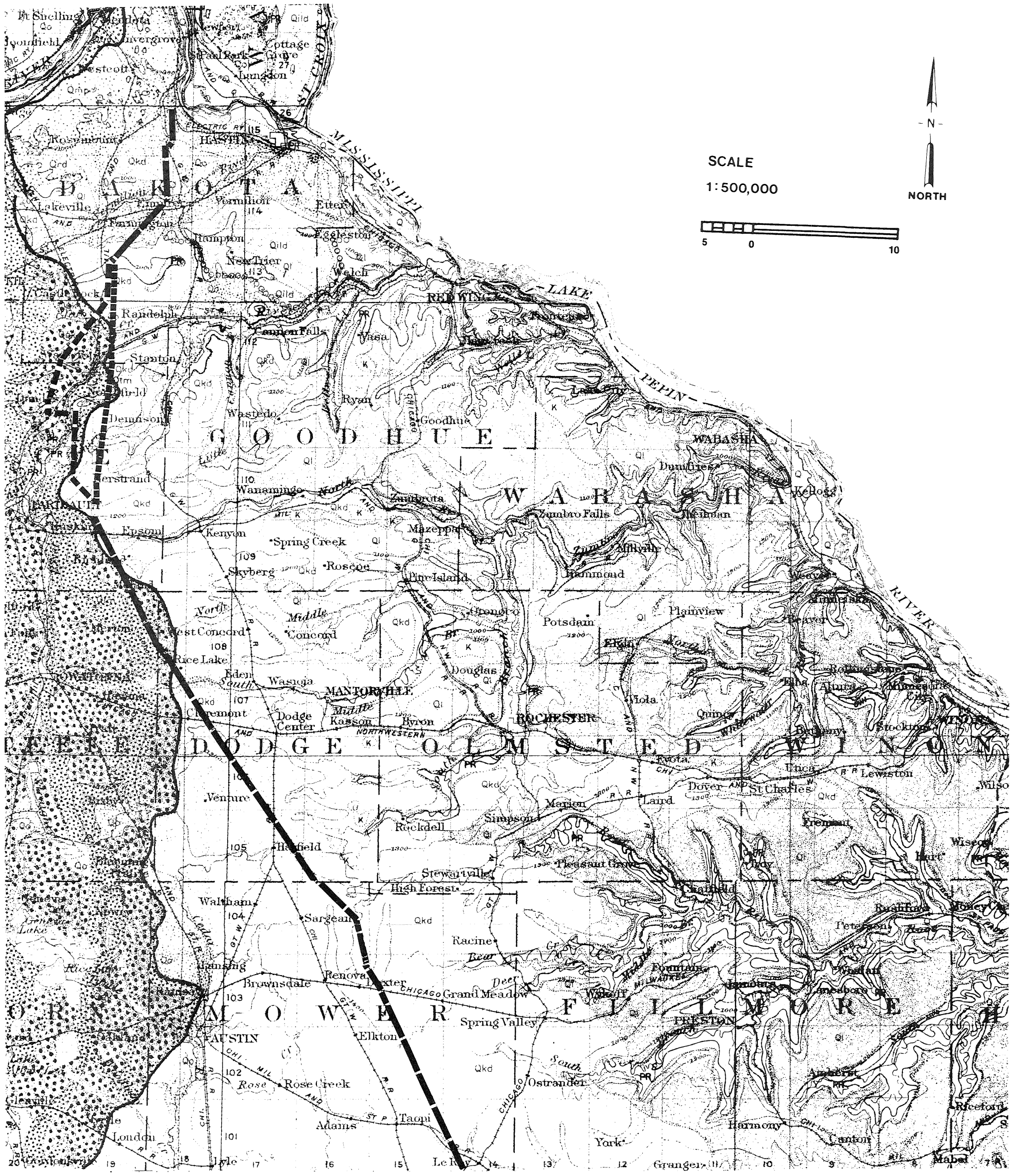


Rock outcrops

(*Tracts where bedrock is bare or but thinly or partly covered. Paleozoic rocks (PR). Pre-Cambrian rocks (R) not completely mapped*)

FIGURE 7

SURFICIAL GEOLOGY



NORTHERN PIPE LINE CO.

OF DELAWARE INC.

2.5 BIOLOGICAL ENVIRONMENT

2.5.1 Vegetation

The natural vegetation of the region, as it existed before settlement, and as would be found in totally undisturbed locations, must be discussed briefly in order to gain a perspective of the existing vegetative patterns (4). The proposed pipeline route runs along the border zone, or ecotone, between the hardwood forests to the east and the prairie to the west. Forests occupy protected areas such as valley slopes and river bottoms, as well as some upland sites. Most of the upland in the vicinity of the pipeline route once consisted of what is known as oak savannah - scattered groves of oaks (mostly burr oak), oak-aspen thickets, and isolated trees growing on the open prairie.

The true hardwood forests (Big Woods) are found to the east of the pipeline route. They consist of various mixtures of oaks (mostly burr, white and red), sugar maples, basswood, hickory, elm, ash, and walnut, depending on the site characteristics. On drier upland sites, as mentioned above, oaks predominate, with black oaks preferring the driest sites, and burr, white, and red oaks being found on a wide range of sites. Protected slopes and well-drained fertile soils are dominated by sugar maples and these are the classic maple-basswood forests. Common species include basswood, white and red oak, slippery elm, hickory, and ironwood (5).

Bottomland forests along river valleys and floodplains contain several different combinations of species. On pioneering sites along sand bars, mud flats, and other open places of recent soil disturbance near the water's edge, the usual forest is dominated by black willow and cottonwood. On open sites near the upland edge of the wet ground,

white oak or birch are the usual dominants. As both of these types mature, they are invaded by silver maple and american elm. Green ash is often found in these communities and black walnut on the moist, but not wet, sites.

At the present time, approximately 99 percent of the proposed pipeline route consists of open upland (see Land Use Section), most of which is used for agriculture and grazing, with small, unmanaged areas remaining along fence rows, various right-of-ways, forest edges, and on steep slopes. Vegetation in these areas include alfalfa, clover, grasses, pigweed, ragweed, goldenrod, and other common weed species. No known tracts of native prairie exist in the vicinity of the proposed route.

Only about 1 percent of the proposed route is actually forested; for, as mentioned above, most of the forested areas in southeastern Minnesota lie to the east (Figure 2). Upland wooded areas consist primarily of oak and oak/aspen thickets, generally found in areas where the terrain precludes cultivation, especially along the hills leading down to the various rivers and streams. Windbreaks planted around farmsteads are numerous and may consist of a variety of species, including some not native to the area such as red pines, spruces, etc.

Limited areas near the edges of woods consist of open brush, predominantly vegetated by hazel, dogwood, wolfberry, sumac, and blackberries. Some scattered small clumps of young aspen, oaks, and other species are also present.

Southeastern Minnesota is naturally well-drained and there are not very many natural wetland areas or lakes. The few wetlands that existed in the western portion of this region have been drained for agriculture and grazing. Thus, wetland and aquatic types of vegetation play a small role in

the ecosystems found in the region of the proposed route. Along the streams, there are islands and bars supporting aquatic vegetation, and occasional depressions that resemble small swamps exist in uncultivated areas near streams. The types of vegetation found here include rushes, cattails, sedges, needle grass and reed grass.

2.5.2 Wildlife

See pages 61 to 62 of the Draft Environmental Impact Statement.

Waterfowl

Southeastern Minnesota (except for the Mississippi River Valley) is not a highly productive waterfowl area, because of the naturally well-drained landscape and the resultant lack of lakes in the area. Southwestern Dakota, Dodge, and Mower Counties are considered regions of low waterfowl value (7). Rice and Steele Counties have a slightly higher waterfowl value. The seasonally flooded areas along river courses provide limited waterfowl habitat. None of the streams crossed, except for the Cannon River, have well-established floodplains in the vicinity of the proposed pipeline crossings. Virtually all of the upland depressions (Type II wetland area) and shallow meadow marshes (Type III) have been drained for agricultural purposes, thus reducing what limited waterfowl habitat may have existed in this part of southeastern Minnesota. Some Type IV wetlands still occur. There are two designated wildlife areas within three miles of the pipeline route.

In Claremont Township of Dodge County, the proposed route traverses approximately 1.5 miles of the Claremont Game Refuge, which is a statutory refuge, with all land held in private ownership.

Only three species of ducks have nesting ranges that include southeastern Minnesota (east of Rice, Steele, and Freeborn Counties). These are the blue-winged teal, the most important breeding duck in Minnesota (represents nearly half the breeding populations in Minnesota), the mallard, and the woodduck, both of which are important breeding ducks in Minnesota (8,9). In southeastern Minnesota, the woodduck is the most common waterfowl, preferring slow rivers, bottomlands, and ponds. The woodduck nests in cavities of large trees such as willows, cottonwoods, and oaks. The mallard inhabits waters of many kinds, and its only demands are waters with shallow areas, suitable nesting sites, and sufficient food. The blue-winged teal nests adjacent to marshes of which there are very few in this part of southeastern Minnesota. Several species of migrants may be encountered in southeastern Minnesota, but the great numbers of ducks that migrate through the Upper Midwest each year usually travel to the east or west of this part of southeastern Minnesota because of the lack of suitable ponds, lakes, and wetlands in the area.

Upland Game Birds

See page 63 of the Draft Environmental Impact Statement.

Other Birds

See page 64 of the Draft Environmental Impact Statement.

2.5.3 Fishery Resources

From a recreational viewpoint, one of the more important species of fish in the region of the proposed pipeline route is the smallmouth bass. However, of the rivers crossed by the proposed pipeline, only the Cannon River is considered to have fair bass habitat. Bass are not as particular as trout in their habitat requirements, but they do not do well in slow, silty, warm streams and rivers, nor in very small streams

with gravelly or coarse bottoms. A high pool/riffle ratio is also important. They tolerate warmer water than trout (70-80°F), and can also tolerate the moderately fertile waters that result from agricultural activities and human encroachment.

None of the streams have known trout populations or habitat suitable for trout at the proposed crossing points. Most of the good trout habitat is found in smaller tributaries of the various branches of the Root River, generally lying to the east of the proposed route. These streams have swift flow and are better shaded than the more easterly streams. Trout are reported to spawn in Spring Brook about one mile downstream of the crossing.

Most of the streams have an assortment of suckers, minnows (includes dace, chubs, and shiners), darters, muddlers, and sticklebacks.

Included is a list of rivers crossed and selected notes on the fishery resources of each.

AVAILABLE INFORMATION
FISHERY RESOURCES - BY INDIVIDUAL RIVER

Vermillion River

- poor bottom conditions for fish reproduction
- minnow-sucker stream

Chub Creek

- warm, poor shading
- poor game fish habitat

Heath Creek

- some shading
- shallow, no game fish

Spring Brook

- trout spawn about one mile downstream of the crossing

Cannon River

- warm, some pollution problems
- good bass habitat, especially downstream

North Fork Zumbro River

- warm
- only suckers-darters, some bass far downstream

South Branch Middle Fork Zumbro River

- warm
- no game fish at crossing, excellent bass fishing far downstream

Dodge Center Creek

- no available fisheries data

Root River, North Branch

- - drainage ditch at crossing, no game fish
- far downstream is excellent smallmouth bass fishing

Upper Iowa River

- some pools, but generally shallow
- no available fisheries data

2.5.4 Rare, Unique, or Endangered Species

See page 66 of the Draft Environmental Impact Statement.

2.6 SOCIO-ECONOMIC ENVIRONMENT

2.6.1 Population

Growth rates have varied and will continue to vary in the counties traversed by, and the communities within 2 miles of, the proposed pipeline route. Table 11, containing past, present, and projected population figures, documents the differing rates of growth. While Dodge and Mower Counties can expect stable population conditions, Rice and Steele Counties can expect continued modest population increases. Dakota County, on the other hand, as a result of urban influences, has and will continue to experience the most rapid growth.

Table 12 shows the density of population in the unincorporated areas of the townships through which the proposed pipeline passes. Those townships with closest proximity to urban areas (Rosemount, Empire, and Castle Rock Townships - Metropolitan Area; Waterford, Bridgewater, and Cannon City Townships - Northfield and Faribault) have the highest population and thus, the highest densities.

2.6.2 Economics

Income and economic base characteristics also vary among the counties traversed by the proposed pipeline. Tables 13 and 14 illustrate these variations. As indicated on the tables, Dodge County is the most dependent on agriculture (26.8%) and has the lowest median income. As noted above, Dodge County is also not growing in population. The reverse is true in Dakota County, which has a very low reliance on agriculture (2.2%), has a median income higher than that found in the state as a whole, and a high growth rate.

2.6.3 Transportation

The proposed pipeline route will cross portions of the rail, highway, pipeline, cable, and electrical transmission network. Appendix E lists all the designated federal, state, and county roads under which the pipe will be laid. The pipeline will also cross numerous nondesignated county and township/municipal roads, as illustrated on the maps in Appendix G.

The following rail lines intersect the proposed pipeline route:

COUNTY	RAIL LINE	LOCATION
Dakota	Chicago Northwestern	S.36, R.19W, T.115N
	Minneapolis, Northfield, & Southern	S.13, R.20W, T.112
	Chicago, Milwaukee, St. Paul & Pacific	S.6, R.19W, T.112

TABLE 11
INDUSTRY EMPLOYMENT DISTRIBUTIONS, PERSONS 16 YEARS OLD AND OVER, 1970

	1940	1950	1960	1970	1976	1980	1990	2000
Dakota County	39,660	49,019	78,303	139,808	184,113	199,300	273,250	328,900
Coates	NA	NA	202	212	214	250	250	250
Rice County	32,160	36,235	38,988	41,582	43,200	44,700	47,600	50,200
Northfield	4,533	7,487	8,707	10,235	12,500	NA	NA	NA
Dundas	456	469	488	460	NA	NA	NA	NA
Steele County	19,749	21,155	25,029	26,931	29,100	29,000	31,200	31,900
Dodge County	12,931	12,624	13,259	13,037	13,700	13,200	13,600	13,400
Claremont	398	426	466	520	NA	NA	NA	NA
Dodge Center	1,029	1,151	1,441	1,603	NA	NA	NA	NA
Hayfield	742	805	889	939	NA	NA	NA	NA
Mower County	36,113	42,277	48,498	43,783	43,200	44,100	45,000	43,100
Sargeant	138	121	113	85	NA	NA	NA	NA
Dexter	303	316	313	252	NA	NA	NA	NA
Elkton	117	141	147	134	NA	NA	NA	NA
Taopi	151	118	92	59	NA	NA	NA	NA
Leroy	752	959	971	870	NA	NA	NA	NA

Sources: 1940-1970 - All areas, U.S. Census
1976-2000 - Rice, Steele, Dodge, and Mower Counties, Minnesota State Demographer
1976-2000 - Dakota County and Coates, Metropolitan Council
1976 - Northfield, Northfield Planning Office

TABLE 12
RURAL POPULATION DENSITIES, 1970

County	Township	Population/Square Mile
Dakota	Rosemount	99.2
	Empire	41.6
	Castle Rock	34.5
	Greenvale	20.8
	Waterford	35.9
Rice	Bridgewater	35.0
	Cannon City	34.3
	Wheeling	15.2
	Richland	15.6
	Northfield	16.4
Dodge	Ellington	13.0
	Claremont	14.1
	Wasioja	23.6
	Ashland	11.3
	Hayfield	12.6
	Vernon	16.1
Steele	Merton	13.2
Mower	Sargeant	11.5
	Dexter	12.0
	Grand Meadow	13.7
	Clayton	7.6
	Lodi	11.5
	Le Roy	12.5

Source: Extrapolated from 1970 U.S. Census

TABLE 13

INDUSTRY OF EMPLOYED PERSONS, 16 YEARS OLD AND OVER, 1970

	Dakota County		Rice County		Dodge County		Steele County		Mower County		State of Minnesota	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Agriculture	1,179	2.2	1,487	9.6	1,331	26.8	1,592	14.5	1,607	9.9	111,030	7.6
Mining	27	-	12	-	5	0.1	48	0.4	10	0.1	14,008	0.9
Construction	3,507	6.6	902	5.8	289	5.8	590	5.4	657	4.1	82,759	5.7
Manufacturing	14,569	27.3	2,450	15.8	818	16.5	3,069	28.0	5,409	33.5	309,222	21.1
Trans/Comm/Util	5,043	9.4	543	3.5	161	3.2	451	4.1	597	3.7	96,004	6.6
Wholesale/Retail	10,927	20.5	2,821	18.2	870	17.5	1,877	17.1	3,065	18.9	322,579	22.0
F.I.R.E.	3,084	5.8	405	2.6	155	3.1	781	7.1	495	3.1	67,977	4.6
Service	9,852	18.5	5,501	35.4	897	18.1	1,712	15.6	2,889	17.9	309,870	21.2
Govt/Public	5,167	9.7	1,402	9.0	434	8.8	848	7.7	1,415	8.8	150,824	10.3
TOTAL	53,355	100.0	15,523	99.9	4,960	99.9	10,968	99.9	16,144	100.0	1,464,273	100.0

Source: 1970 U.S. Census

TABLE 14

INCOME CHARACTERISTICS BY COUNTY, 1970

	Dakota County	Rice County	Dodge County	Steele County	Mower County	State of Minnesota
Median Income	$12,120	$9,486	$8,146	$9,302	$9,834	$9,931
Percentage of All Families Earning More Than $15,000	30.4%	16.5%	9.7%	14.9%	17.7%	20.3%
Percentage of All Families with Incomes Below Poverty Level	3.5%	7.4%	11.8%	7.6%	8.6%	8.2%

Source: 1970 U.S. Census

Rice	Chicago Northwestern	S.28, R.20W, T.111N
	Chicago, Milwaukee, St. Paul & Pacific	S.21, R.20W, T.111N
	Chicago, Milwaukee, St. Paul & Pacific	S.9, R.19W, T.109N
Dodge	Chicago Northwestern	S.36, R.18W, T.107N
Mower	Chicago, Milwaukee, St. Paul & Pacific	S.19, R.15W, T.103N
	Chicago, Milwaukee, St. Paul & Pacific	S.19, R.14W, T.101N

As listed in the Project Description, the proposed line will cross 9 existing gas or oil pipelines. The majority of the existing lines carry gas and are owned by the Northern Natural Gas Company.

2.6.4 Taxation

See pages 72-73 of the Draft Environmental Impact Statement.

The 1976 mill levies and the total assessed valuation of taxable properties in the study area counties are as follows:

COUNTY	MILL LEVY	TOTAL ASSESSED VALUE
Dakota	19.44	$ 633,257,627
Rice	27.19	100,877,689
Dodge	25.93	46,628,397
Steele	22.67	86,645,932
Mower	25.70	138,438,210

Source: County Auditor's Offices

2.6.5 Services

See the general discussion on services on page 73 in the Draft Environmental Statement.

TABLE 15

HEALTH CARE MANPOWER AND FACILITIES

County	Primary Physicians	Physicians/ Population Ratio	Hospitals	Beds	Beds/ Population
Dakota	39	1:4,054	Divine Redeemer, South St. Paul	130	1:665
			Regina Memorial, Hastings	100	
			Sanford, Farmington	47	
			Total	277	
Rice	18	1:2,356	Northfield City Hospital, Northfield	46	1:290
			Rice County District Hospital, Faribault	103	
			Total	149	
Dodge	3	1:4,387	---	---	---
Steele	15	1:1,815	Owatonna City Hospital, Owatonna	101	1:288
Mower	22	1:2,000	St. Olaf Hospital, Austin	147	1:294

Sources: Minnesota Department of Health
Region 10 Development Commission

1. Health Care - Table 15 inventories primary physicians* and general hospital beds in the study area counties. As noted in the Draft EIS, the maximum safe physician to population ratio, as recognized by the Minnesota Health Department, is 1:5,000. All of the study area counties are within this standard. (Refer to the discussion on Emergency Facilities found on page 75 of the Draft Environmental Impact Statement.)

2. Police Protection - The County Sheriff's Department in each of the study area counties provides law enforcement services to the unincorporated portions of their counties, as well as to those municipalities contracting for police protection. Municipalities not under contract with the Sheriff, maintain their own police departments.

3. Fire Protection - The unincorporated communities and rural areas along the proposed route maintain contractual agreements with townships and municipalities to provide fire protection.

2.6.6 Archaeological/Historical Sites

The Minnesota Historical Society is preparing an evaluation of the proposed project.

2.7 AIR QUALITY AND NOISE

2.7.1 Air Quality

Mower, Dodge, Steele, and Rice Counties lie in Air Quality Control Region 128, while Dakota County lies in Air Quality Control Region 131. For a discussion of the "Priority Classifications" of these regions, see pages 77 to 78 of the Draft Environmental Impact Statement.

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*General Practitioner, Internal Medicine, Pediatrics, Ob-Gyn.

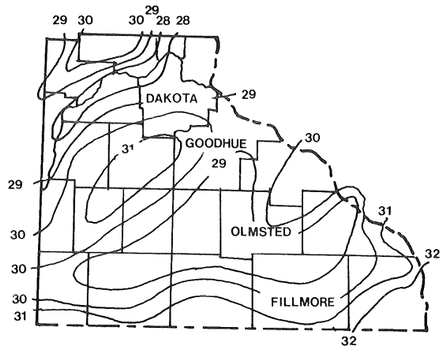
2.7.2 Noise

See page 79 of the Draft Environmental Impact Statement.

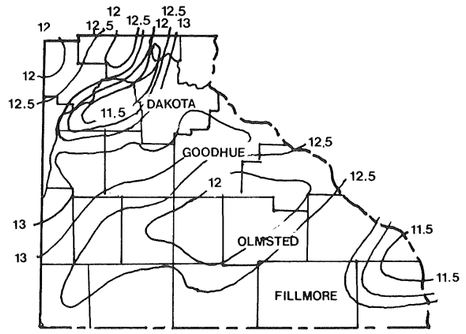
2.8 CLIMATE

See pages 79 to 80 of the Draft Environmental Impact Statement.

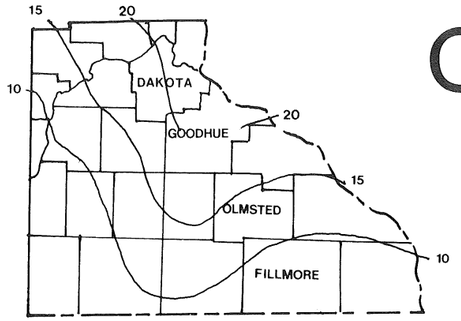
NORTHERN PIPE LINE CO.
OF DELAWARE INC.



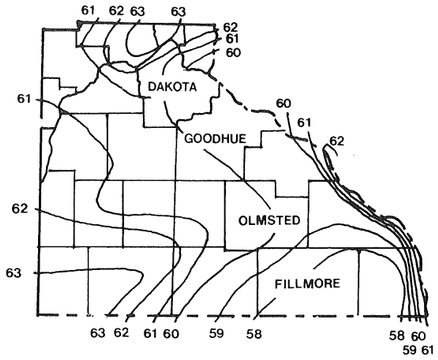
Annual normal precipitation in inches.



Summer normal precipitation in inches.



Average number of days per year when snow cover is more than 12 inches.



Average daily minimum temperature during July.

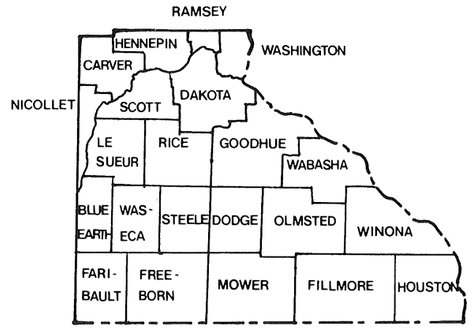
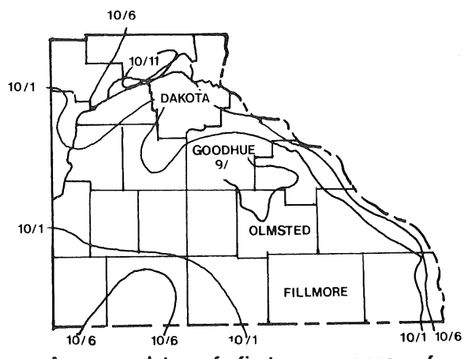
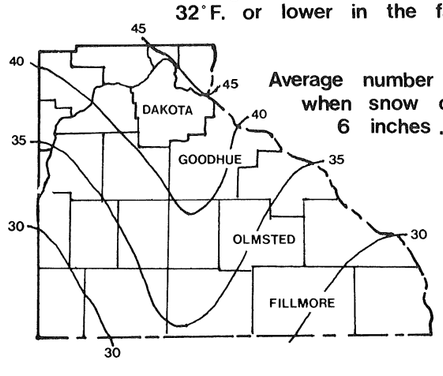


FIGURE 8

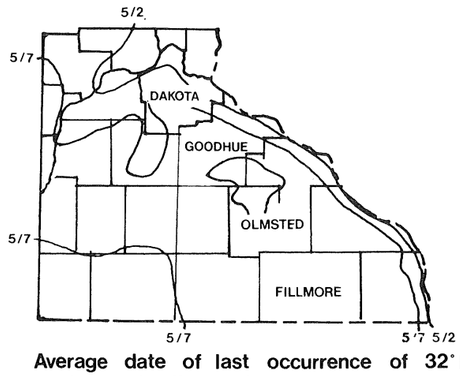
CLIMATE SUMMARY



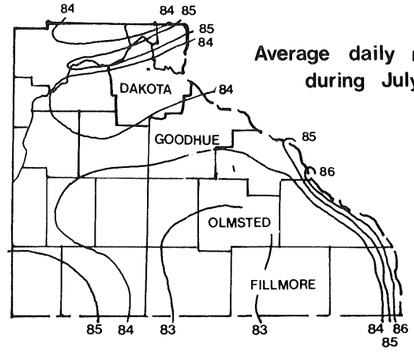
Average date of first occurrence of 32°F. or lower in the fall.



Average number of days per year when snow cover is more than 6 inches.



Average date of last occurrence of 32°F. or lower in the spring.



Average daily maximum temperature during July

ADAPTED FROM MINNESOTA SOIL ATLAS (ST. PAUL SHEET) EARL L. KUEHNAST

3. ENVIRONMENTAL IMPACTS

3. ENVIRONMENTAL IMPACTS

3.1 CONSTRUCTION

3.1.1 Land Use

The major land use impacts during the construction phase will be the effects on agriculture; loss of crops, soil compaction, and possibly soil dilution. During the construction period, the use of the land on the 50-foot right-of-way will be limited to construction-related activities by Northern Pipe Line Company, and one season's crop loss will be incurred. The construction procedure may result in reduced productivity over the 3-foot wide pipeline trench for a period of time because of the mixing of sub-soils with overlying topsoil. The owner/tenant has the right to specify topsoil stockpiling (double ditching) as part of the easement agreement (see Appendix H, Landowners' Rights). Proper drainage of fields having drain tiles will not be disturbed, since the drain tiles, when cut, will be carefully repaired (see details under 3.1.3, Soils). The trench will be fenced or covered where necessary to protect grazing animals.

Construction at all major roads, most minor roads, and railroads will utilize a tunneling technique rather than open trenching. This will eliminate the need for major road or rail line closures, thereby eliminating the traffic delays and inconveniences that would otherwise occur.

The proposed route does not go through any residential areas, nor does it pass within 300 feet of any residence.

The Cannon River is designated as a canoe and boating route. Except for a few days during the actual construction across the river, canoeists will experience no inconveniences. Even during the trenching process, canoes will be able to

pass around the crane. Furthermore, during weekends, when the river is most heavily used for canoeing, there will not be any construction activity.

3.1.2 Surface Waters

See page 83 of the Draft Environmental Impact Statement.

The East Alternate requires 10 river and stream crossings. The West Alternate requires 13 river and stream crossings.

On the East Alternate, the Cannon River crossing includes 6 to 15 feet of bedrock cliffs and 25 feet of relief. On the West Alternate, the crossing includes 50 to 100 feet of bedrock cliffs and 150 feet of relief.

3.1.3 Soils and Topography

See pages 83 to 85 of the Draft Environmental Impact Statement.

Agriculture

The East Alternate includes 95.40 miles of cultivated soil. The West Alternate includes 99.60 miles of cultivated soil. Approximately 53% of the East Alternate parallels land lines, which offers the opportunity to avoid tile along portions of this length. Approximately 21% of the West Alternate parallels land lines.

Soil Mixing

Although Northern Pipe Line Company does not propose to separate topsoil and subsoil (double ditching) along the entire route, the landowner/tenant may require this action as part of the easement agreement (see Appendix H, Landowners' Rights).

Drain Tile

A large portion of southern Minnesota is extensively drain-tiled. In trenching across tiled fields, the tile lines will be cut. Every effort will be made to reinstall tile lines properly; however, the tile repair may become misaligned, which would impair the operation of the tile system. Misalignment is usually due to settlement of the backfill underlying the tile repair.

The following construction technique is proposed to prevent misalignment. A steel channel will be used to establish the grade along which the repair will be made over the pipeline. A second channel will be welded along the bottom of the first to act as a stiffener and to prevent sagging. The channels will be constructed of ASTM A-36 steel. Each end of the channel will rest on a transverse support channel of the same material. The support channel will, in turn, rest on a foundation of either concrete blocks or poured sackrete. This foundation will be constructed at least two feet into undisturbed soil on each bank to provide a solid footing for each foundation to prevent settling of the entire assembly. The steel assembly will be coated with ENDCOR 750 primer and 772 topcoat to prevent rust and corrosion. The fill between the pipeline and the tile crossing assembly will be of compacted granular material and will be a minimum of one foot thick. The tile repair will be laid across the top channel.

Figure 9 is an engineering drawing of the proposed assembly. The details described above are shown schematically. This technique will minimize impairment of tile operation due to repair misalignment.

3.1.4 Geology/Groundwater

Geology

There will be no impacts upon the geology itself. The geology influenced the selection of the route in that 50 feet of glacial till over bedrock was desired to minimize possible pollution of groundwater in the event of a spill. This is discussed in more detail in Section 3.2.4, Operation/ Geology.

Sinkholes

The pipeline has been routed through areas which have more than 50 feet of soil over the bedrock for the majority of the route (the only significant exception is the Cannon River crossing) and avoid all known sinkholes. Sinkholes are discussed in greater detail in Section 3.2.4, Operation/ Geology.

Groundwater

See page 86 of the Draft Environmental Impact Statement.

3.1.5 Biological Environment

Vegetation

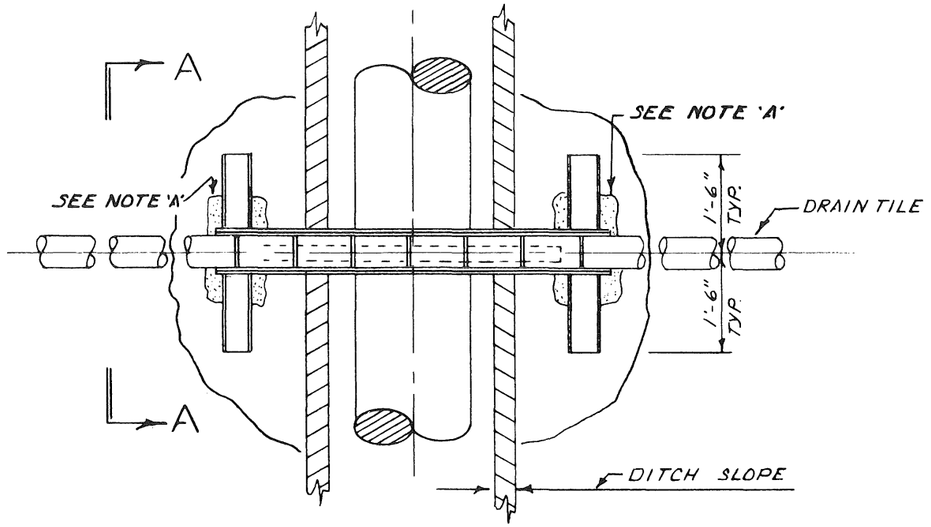
See pages 86 to 87 of the Draft Environmental Impact Statement. The East Alternate traverses 0.96 miles of forested land. The West Alternate traverses 1.02 miles of forested land.

Wildlife

See pages 87 to 88 of the Draft Environmental Impact Statement.

Rare, Unique, or Endangered Species

It is unlikely that habitat suitable for trout lillies, wood turtles, or bobwhite will be encroached upon.



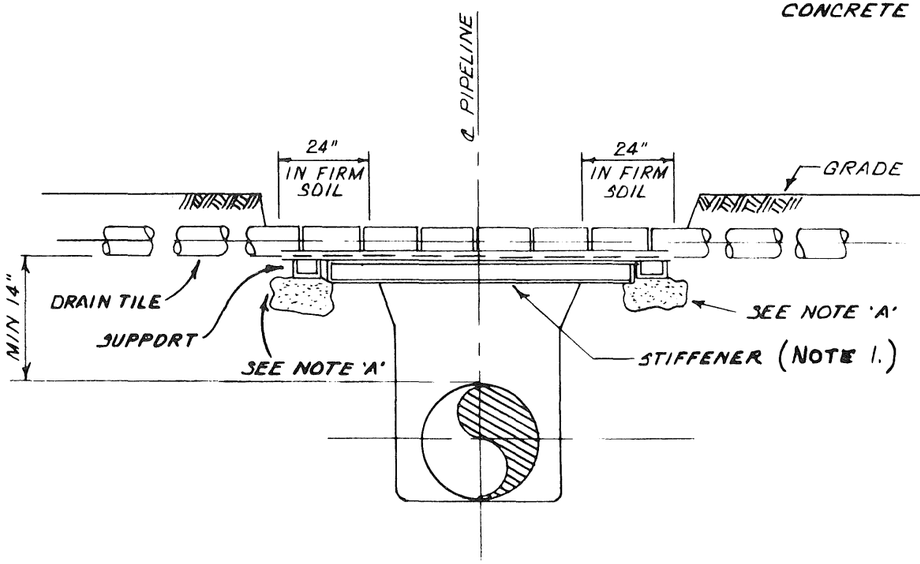
PLAN

NOTE 'A': SAKRETE OR PRECAST CONCRETE BLOCK

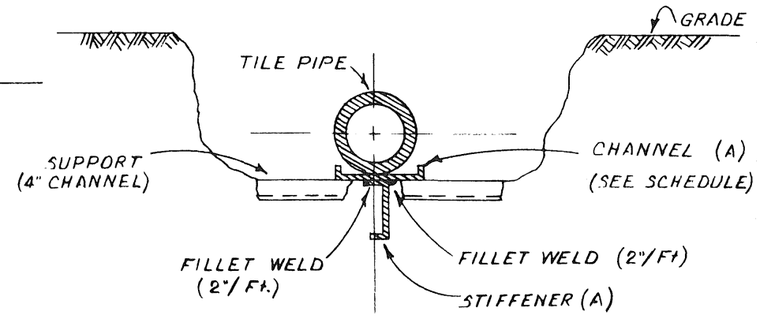
CHANNEL SCHEDULE		
TILE (O.D.)	CHANNEL WIDTH	
	A	B
3"	5 x 6.7 #/Ft.	4 x 5.4 #/Ft.
4"	5 x 6.7 #/Ft.	4 x 5.4 #/Ft.
6"	6 x 8.2 #/Ft.	4 x 5.4 #/Ft.
8"	8 x 11.5 #/Ft.	4 x 5.4 #/Ft.
10"	8 x 11.5 #/Ft.	4 x 5.4 #/Ft.

GENERAL NOTES

1. STIFFENERS REQUIRED ANY TIME SPAN EXCEEDS 4' IN LENGTH.
2. MINIMUM ANGLE OF TILE CROSSING WITH RESPECT TO PIPELINE 60°
3. DESIGN DATA: DEPTH OF COVER OVER DRAIN - 2'-6" MAX.
   DISTANCE BETWEEN BEARING POINTS - 8'-0" MAX.
4. COMPLETED ASSEMBLY TO BE COATED WITH ENDCOR 750 PRIMER AND 772 TOP COAT.
5. CHANNELS TO BE PROVIDED IN ACCORDANCE WITH AISC PROVISIONS FOR ASTM A-36 STEEL.
6. FILL IN THE REGION BETWEEN THE PIPELINE AND THE TILE CROSSING FOR A DISTANCE 5' EACH WAY FROM THE ℄ OF THE TILE CROSSING WITH THROUGHLY COMPACTED GRANULAR MATERIAL.



PROFILE



SECTION A-A

NORTHERN PIPE LINE COMPANY
OF DELAWARE

TYPICAL DRAIN TILE CROSSING

DATE: 9-8-77	DRAWING NO. B-	REV. 9-15-77
SCALE: NONE		
DESIGNED BY:	SHEET ____ OF ____	
DRAWN BY: ME		

3.1.6 Socio-Economic Environment

Population

Since contractors have not as yet been selected for this project, the forecasting of population impacts from construction is a somewhat speculative undertaking. However, based on Northern Pipe Line Company's estimates and experience, the following assumptions have been made:

- The Minnesota portion of the line would likely be constructed as a part of a single "spread".
- A work force of up to 250 will be required.
- The prime contractor could be a non-Minnesota firm.
- Approximately 75% of the pipeline work force (188) workers could be non-Minnesotans and would constitute a population influx.
- Approximately 50% (94) of the immigrating workers could be accompanied by an average of 2.5 dependents (235) for a possible total immigration of some 423 people (188 workers + 235 dependents = 423 total immigrants).
- The pipeline work force would be broken into about 10 crews. The construction population would therefore be comprised of groups ranging in size from approximately 25-65 people.
- Duration of construction in Minnesota will be approximately two to three months, with the estimated stay of any immigrant worker at a given location in the study area being approximately one month.
- For the most part, immigrant workers would likely utilize self-contained mobile housing units. In some cases, motel accommodations would be utilized.

Based on these assumptions, it would appear that the impact on population from construction will be short-term, on

a relatively small scale. In all probability, the larger communities (excluding those in the Twin City Metropolitan Area) along the proposed route (Northfield, Faribault, Dodge Center) will serve as the short-term places of residence for inmigrant workers and their dependents.

Economics

The proposed pipeline will have direct and indirect economic impacts on the study area during the preconstruction and construction phases. The first input to local economics will arise from the purchase by Northern Pipe Line Company of construction and use easements along the 50-foot right-of-way. The price of these easements will be determined on an individual basis through negotiations with each landowner. Therefore, the degree to which local economies will benefit cannot be determined at this time.

A second direct input to local economies will arise from payroll dollars spent by the project work force. It is estimated by Northern Pipe Line Company that average wages could amount to approximately $480/foot of pipe, or $2,534,000 for 100 miles of pipeline in Minnesota. Assuming a work force of 250 workers, these figures represent $10,138 average total wages paid to each worker during the project in Minnesota. Crews are expected to be in the state for two to three months, working six-day weeks, at ten hours per day.

It has been estimated that a local (Minnesota) laborer or an immigrant worker with dependents will expend approximately 70% of take-home pay on locally derived goods and services, while the inmigrant without dependents will expend roughly 35%.

Other direct economic impacts will result from payment for right-of-way and damages to property owners and rental fees paid by the contractor for temporary storage space.

A portion of the money directly introduced into the local economy (easement fees, payroll, damage compensation, and rentals) will be recirculated by the local merchants who provided the initial goods and services, at a rate approximately equal to that characteristic of non-resident workers with dependents (70%). This "ripple" effect amounts to an indirect economic impact of the project's construction phase.

There will be a small economic impact associated with yield reductions resultant from topsoil disturbances, particularly in those portions of Dakota County with 3 feet or less of loam overlying sand (see Figure 4 in the Soils Section). Based on a trench width of 3 feet, it is estimated that less than 37.5 acres of productive land will be affected. Impact to a lesser degree is anticipated along the rest of the route as well. The degree to which crop yields will be influenced cannot be predicted. However, any reductions in yields will diminish over time. The duration of yield reduction cannot be forecasted, and will be governed by soil type, climate, farming practices, and restoration activities. Possible soils compaction in the right-of-way, caused by construction activities, may also affect yields, but the number of determinant variables involved makes impact projection impossible. Compensation for these losses will be negotiated between the landowner/tenant and the company before construction begins.

It should be noted that, on its Clearbrook line, (construction in 1973), Minnesota Pipe Line Company (a sister company of Northern Pipe Line Company) has not received any complaints of economic loss due to yield reductions beyond those negotiated during damage settlements.

Discussions with the county assessor from each county indicate that the pipeline will have no impact on either the market or assessed value of land, as long as the land maintains its current use designation. For instance, agricultural land values will not be affected. Should development opportunities become available, however, the potential value of the land within or near the right-of-way might be reduced somewhat, because of pipeline right-of-way development restrictions.

Transportation

The East Alternate includes two highways and one railroad crossing. The West Alternate includes three highways and three railroad crossings. (These are in addition to the crossings where only one route is proposed.) As discussed in Section 1.6, Construction Procedure, construction at all major roads, most minor roads, and railways will utilize a boring technique rather than open trenching. This will eliminate the need for major road or rail line closures, thereby forestalling the traffic delays and inconveniences that would otherwise occur.

Permits will be obtained from the rail companies and a rail company representative will be present for any rail line borings.

As a result of agreements with local governments, some minor township gravel roads may temporarily be closed to permit trenching. Road closures would be brief (usually two days or less) and alternate routes would be identified.

Crossings of existing oil and gas pipelines will be accompanied by passing over or under them depending upon depth. The Northern Pipe Line Company's line will, in any event, maintain a minimum cover of 3 feet. Crossing of existing pipelines will be coordinated with the pipeline owners.

Inasmuch as the proposed pipeline will intersect rather than parallel major electrical transmission lines, no safety hazards or corrosive impacts are anticipated.

Taxation

The proposed project will not affect the system of taxation employed in Minnesota, but rather will marginally increase revenues generated by that system. During the construction phase, the state will benefit from the taxation of wages earned in the state by both resident and non-resident workers, who will be subject to the same withholding and refund policies. The state will also tax the purchase of all materials used on the project, whether purchased in or out of Minnesota, at a rate of 4% of sales price. The state will further benefit from the 4% tax on the sale of all non-exempt tangible personal property to workers and their dependents.

Services

The availability and adequacy of services varies from county to county. The influx of construction workers and their dependents could temporarily place some additional service burden on the affected areas, but not to the extent of requiring additional services.

Historical/Archaeological Sites

At this time, the Minnesota Historical Society is evaluating the route for historical and archaeological sites. In their response to the previous route (Appendix H of the Draft Environmental Impact Statement), they requested that an archaeological survey be conducted within 1,000 feet of any permanent body of water. It is anticipated that this request will also be made for the proposed route.

3.1.7 Air Quality and Noise

See pages 92 to 93 of the Draft Environmental Impact Statement.

3.1.8 Climate

There will be no impacts upon the climate.

3.2 OPERATION AND MAINTENANCE

3.2.1 Land Use

The land use of the approximately six acres per mile of right-of-way will be restricted to non-permanent type uses such as fence lines, access roads, and cultivation. Such restrictions do not represent a significant land use impact. Regrowth of large trees along the right-of-way will be discouraged; thus a maximum of 6.1 acres of forest land. would be permanently removed. Intensive land use areas, such as residential areas, have been avoided for several reasons, including the cost of compensation and the sacrifice of those uses. However, future growth is anticipated along the Northfield-Faribault corridor which is traversed by the West Alternate. Minimal growth is anticipated along the East Alternate.

3.2.2 Surface Waters

See page 93 of the Draft Environmental Impact Statement.

3.2.3 Soils and Topography

See pages 94 to 95 of the Draft Environmental Impact Statement.

3.2.4 Geology/Groundwater

Geology

See page 95 of the Draft Environmental Impact Statement.

Groundwater

The only operation-related phenomenon which may affect groundwater is an oil spill. The degree to which the spill affects the environment depends upon how much oil is spilled, how permeable the soils or rocks are, whether or not there is frost on the ground, whether the spill ponds or runs, vegetative cover, and how much time elapses between the start of the spill and clean-up operations.

In order to minimize potential impacts to groundwater, a route was selected which provides a minimum of 50 feet of soil above the bedrock over most of the route (see Figure 6). This provides for several things: 1) A very long period of time before the oil has moved through the soil and encountered bedrock. 2) A "blotter capacity" which will absorb a large quantity of oil. There are attractive forces including adhesion, capillarity, and suction between the soil particles and the oil, which binds a film of oil to the soil particles. Thus, for every foot of soil penetrated, a certain amount of the spilled oil is rendered immobile. The MPCA has estimated that approximately 1,000 barrels of oil spilled over 1,000 square feet of area will be contained within 50 feet of glacial till. This is a major spill and has a relatively low probability of occurrence. Thus, the soil affords a very high degree of protection to the bedrock. 3) The solution channels and sinkholes, known as "Karst" features, are not likely to appear as surface phenomena through 50 feet of soil, so no open channels to the bedrock are anticipated to develop.

In southern Dakota County, the East Alternate traverses about 5 miles of shallow bedrock. This occurs in two strips separated by an area of deeper bedrock (Figure 6). Three special measures are planned to minimize the hazards in this region:

1. A minimum of 25% of the length of pipe through this region will be x-rayed.
2. Extra gate valves and check valves will be installed to minimize the amount of oil which could leave the pipeline through a leak.
3. A program of regular hydrostatic testing will be instituted to periodically check the pipe for weak points.

These measures are intended to minimize the chances of a leak occurring in this region, and the extra valves are intended to minimize the amount of oil which could drain out of any particular leak. The valves will be located with consideration given to the topography and to which direction oil will drain due to gravity.

The West Alternate traverses about 11 miles of shallow bedrock (Figure 6). The special measures described above for the East Alternate also applies to the West.

The Cedar Valley, Maquoketa, Dubuque, Galena, Platteville, and Prairie De Chien aquifers consist of fractured limestone and dolomite. A pollutant which enters the aquifer may be transmitted through the aquifer at a high rate of speed and along an unpredictable path. While this does not necessarily mean that a regional water quality problem would develop (since there generally appears to be a channelization of flow to a specific discharge point, such as a spring or creek), the unpredictability of the channelization pattern makes it difficult or impossible to contain the spill locally by conventional methods, such as installing and pumping wells down gradient of the spill.

There are three mechanisms by which the oil may reach the aquifer; 1) after overland flow, it may percolate through the soil under the influence of gravity; 2) it may migrate through the soil in the trench under the influence of both gravity and pipeline pressure, and 3) it may encounter bedrock directly by overland flow to sinkholes and outcrops.

In the first case, the severity of the problem is controlled by how thick the soil cover is and how fast the oil will move through the soil. This in turn is controlled by the viscosity and density of the oil in question, and by the permeability (either primary or secondary) of the soil. While these factors are difficult to quantify on a site specific basis, it is clear that there is a period of time during which the oil moves through the soil before encountering bedrock. The depth of unconsolidated material present along the proposed route should give sufficient time for removal of the ponded oil before oil would reach the bedrock aquifer.

In the second case, additional factors affect the problem. If a pinhole leak occurs, the oil leaves the pipeline under pressure. The leak acts as a point source of pressure, and the oil forms a spherical body which grows in size with time. Also, gravity acts on the oil. The net result of the pressure and gravity vectors is that the oil sphere appears to grow in size and sink through the soil at the same time. The pressure vector is larger than the gravity vector, so the oil eventually reaches the surface because the body "grows" faster than it "falls". Another factor is the nature of the soil. In addition to the permeability factors described above, the shear strength and density of the soil is important. In this second case, the oil is under pressure from the pipeline. As the oil front migrates upward and nears the ground surface, the soil will

shear and provide a relatively open path to the surface. This occurs when the pressure at the oil front exceeds the confining pressure due to the weight of soil above the front and the shear strength of that zone of soil. At that time, virtually all oil movement is along the shear zone and a pond forms rapidly at the surface. The depth of unconsolidated materials present along most of the proposed route should be sufficient to contain the growing oil sphere until it can reach the surface and pond.

In the third case, oil may flow overland from the spill and follow a natural drainage pattern to a sinkhole or rock outcrop. A sinkhole is caused by the collapse of the ceiling of a channel or cave in the bedrock, which leaves a depression in the ground surface and in many cases, provides an open conduit to the underlying bedrock. The collapse is the result of the removal of support due to dissolution of the rock by groundwater. If spilled oil drains into a sinkhole, the oil could enter the bedrock through the sinkhole. Although site specific details cannot be predicted, there is a time period during which the soil is flowing overland from the leak to the sinkhole. This period is affected by the viscosity of the oil, the atmospheric temperature, topography, vegetative cover, or other ground cover. The present route has been selected to avoid known sinkholes.

Outcrops may be affected in the same manner as sinkholes. The outcrops along the proposed route occur at the Cannon River Crossings. Department of Transportation regulations specify extra heavy wall pipe and 100% x-rays of welds at all river crossings. This results in river crossings being the least probable location for a spill. In all other ways, an outcrop will be affected as in the discussion of sinkholes.

The above discussion describes the reasons for the concern about the bedrock and for the attempt to maintain 50 feet of soil above the bedrock. Within the soil itself, however, sand and gravel deposits are aquifers. In some cases, the water table in surficial sand and gravel may be quite shallow. A spill which reaches these deposits may locally contaminate the groundwater. In the case of a granular aquifer such as this, vertical movement of the oil is obstructed by the water table due to the lighter density of the oil. The oil then moves along the surface of the water table in the direction of the groundwater gradient. This gradient can be determined and the direction of oil movement predicted by the installation and use of piezometers after the spill. The oil can then be recovered from the soil by the use of vacuum or suction recovery methods.

The East Alternate traverses about 14.3 miles of outwash sands and gravels. The West Alternate traverses about 12.5 miles. The extra valves described above are intended to minimize the amount of oil which is spilled.

A fraction of the crude oil components are soluble in water. It is possible that some of these could be leached by infiltrating precipitation or dissolved by contact with the water table. If the concentrations of these components in the groundwater exceed state standards, a recovery well may be installed which will create a gradient to the well and permit the polluted water to be pumped out of the aquifer and treated or disposed. The necessity, locations, size, and duration of this operation will be evaluated by the Minnesota Pollution Control Agency.

3.2.5 Biological Environment

See pages 95 to 96 of the Draft Environmental Impact Statement.

3.2.6 Socio-Economic Environment

Population

Population impacts as a result of operation of the line will be negligible, as Northern Pipe Line Company has, at this point, no plans for establishing new line maintenance centers along the proposed route, or hiring new employees to serve the new line.

Economics

No direct or indirect economic impacts are expected in the study area as a result of pipeline operation. However, as addressed earlier in this report, the pipeline will improve the petroleum supply situation in the Uppder Midwest, and thereby assist in the stabilization of petroleum-related product prices.

Taxation

During the operation of the pipeline, the counties, incorporated areas, school and special districts in which the line is situated, will apply their mill levies to the pipeline's assessed value (43% of its market value as determined annually by the Minnesota Department of Revenues).

Services

Service needs during future pipeline operation will be very limited, especially since no additional employees are planned and none of those presently employed will be located in the construction area.

3.2.7 Air Quality and Noise

See page 97 of the Draft Environmental Impact Statement.

3.2.8 Climate

There will be no impacts upon the climate.

3.3 IMPACT SUMMARY AND COMPARISON

The following table compares the major impacts of the two alternates. More detailed analyses may be found in Chapter 3, Environmental Impacts.

Table 16

IMPACT COMPARISONS

	East Alternate	West Alternate
Land Use		
Overall Length	99.73 miles	103.48 miles
Cultivated	95.40 miles	99.60 miles
Pasture	3.37 miles	2.86 miles
Forest	0.96 miles	1.02 miles
Future Use	Little future growth anticipated	Much future growth anticipated
Surface Waters	10 major crossings: Cannon River crossing, banks low, bedrock cliffs 6-15 ft high, straight, well-armored channel	13 major crossings: Cannon River crossing, banks steep, bedrock cliffs 50-100 ft high, downstream of island meaning possible erosion problems
Soils	95.40 miles of cultivated soil, fewer diagonal crossings of tiled fields	99.60 miles of cultivated soil, greater diagonal crossings of tiled fields
Geology	Approximately 14.3 miles of outwash traversed; approximately 5 miles of shallow bedrock traversed	Approximately 12.5 miles of outwash traversed; approximately 11 miles of shallow bedrock traversed
Groundwater	Approximately 14.3 miles of outwash traversed, approximately 5 miles of shallow bedrock traversed	Approximately 12.5 miles of outwash traversed; approximately 11 miles of shallow bedrock traversed

Table 16 (Continued)

Biology	0.96 miles of forest No trout known near crossings, bass fishing on Cannon River	1.02 miles of forest Trout spawning area 1 mile downstream of Spring Brook crossing, bass fishing on Cannon River
Socio-Economics	Two major highway crossings, one railroad crossing	Three major highway crossings, three railroad crossings

Other impacts similar for both Alternates

From these analyses, it is clear that the East Alternate causes the lesser environmental impacts, and therefore is the recommended route.

4. IMPACT MITIGATION

4. IMPACT MITIGATION

4.1 LAND USE

See page 98 of the Draft Environmental Impact Statement.

4.2 SURFACE WATERS

See page 98 of the Draft Environmental Impact Statement.

4.3 SOILS AND TOPOGRAPHY

See pages 98 to 99 of the Draft Environmental Impact Statement.

4.4 GEOLOGY/GROUNDWATER

4.4.1 Geology

See page 99 of the Draft Environmental Impact Statement.

4.4.2 Groundwater

The route selection process has minimized the chances for significant impacts upon groundwater. The criterion of a 50-foot minimum thickness of soil over bedrock wherever possible should prevent oil from reaching the solution channel aquifers. In the area where the 50-foot thickness could not be achieved, three special measures will be taken:

1. A minimum of 25% of the length of the pipeline in this region will be x-rayed.
2. Extra gate valves and check valves will be installed in this area to minimize the amount of oil which could drain through a leak due to gravity.
3. A program of periodic hydrostatic pressure tests will be instituted to detect weak points in the pipe in the future.

These measures are intended to minimize the chances of major leaks occurring in the area.

Emergency procedures in case of a spill are detailed in Appendix A. If oil reaches the groundwater in granular soils, it may be recovered by vacuum methods. This involves a well which is pumped by vacuum and has a tank truck cut into the vacuum line between the pump and the well. Additional wells may be used to induce a local gradient to the vacuum well. Oil and water collected in the truck can be placed in a storage tank and the oil separated from the water. This method has been used successfully on the West Coast.

4.5 BIOLOGICAL ENVIRONMENT

See pages 99 to 100 of the Draft Environmental Impact Statement.

4.6 SOCIO-ECONOMIC ENVIRONMENT

See pages 100 to 101 of the Draft Environmental Impact Statement.

4.7 AIR QUALITY AND NOISE

See page 101 of the Draft Environmental Impact Statement.

5. ALTERNATIVES

5. ALTERNATIVES

5.1 TRANSPORTATION

See pages 102 to 103 of the Draft Environmental Impact Statement.

5.2 SITES AND LOCATIONS

5.2.1 Proposed Route

The East and West Alternate routes were selected from several potential routes. The first route to be proposed in October, 1976, was found to cross a large area with the potential for groundwater contamination. After extensive evaluations by the Company and the State agencies, an area was defined where the potential for groundwater pollution in the event of a spill would be minimized. Subsequent route options attempted to stay within this area. It soon became apparent that the Cannon River crossing would have to lie in an area of shallow bedrock, but the rest of the route could be located in an area which had a thickness of 50 feet or more of soil above the bedrock. This eliminated a potential route just west of Cannon Falls. Near Northfield, a route had been proposed which crossed the Rice County Wilderness Park. More detailed evaluations of that route revealed that the park was environmentally and bureaucratically a poor location for a pipeline. The portion of that route which crossed the park was relocated and is now the West Alternate. The East Alternate was selected after analyses of the most up-to-date geological data available indicated that less shallow bedrock would be encountered along that route than along the West Alternate. Note that the differences in the two routes are concerned only with the Cannon River crossing. For 80% of the route, the two "alternatives" are actually the same.

5.2.2 Railroad Right-Of-Way Alternative

Due to interest in the possibility of routing a portion of the pipeline along an existing railroad, the following analysis was conducted. It should be noted that the pipeline would be located 100 to 200 feet or more from the tracks to prevent derailment accidents from threatening the pipeline.

Land Use

Land use along the railroad is entirely cultivated fields or pasture. This route makes the line 1.5 miles longer than the proposed route. About half of the distance between Hayfield and the Iowa border can be routed along the railroad. The rest of the route must be aligned to avoid towns or houses which the railroad passes through or near. The line must also enter Iowa near LeRoy due to routing restrictions imposed by the State of Iowa, so the route must leave the railroad near Taopi.

Surface Waters

Three major crossings (one on the North Branch Root River and two on the Upper Iowa River) are eliminated. None are added.

Soils

Where the route can follow the railroad, drain tiles will be cut near field edges or avoided entirely. This should minimize the effects of the cut upon the performance of the overall tile system. In those areas where the route must leave the railroad, it will be difficult or impossible to avoid cutting tile. All tile will be repaired as described in Section 3.1.3, Soils and Topography.

Geology

Impacts will be the same as for the proposed route.

Groundwater

Impacts will be the same as for the proposed route.

Biology

Impacts will be the same as for the proposed route.

Socio-Economics

Four additional railroad crossings will be required to avoid houses or other buildings.

Air Quality/Noise/Climate

Impacts will be the same as for the proposed route.

5.3 ALTERNATIVE STREAM CROSSING TECHNIQUES

See pages 105 to 106 of the Draft Environmental Impact Statement.

5.4 NO ACTION

See page 106 of the Draft Environmental Impact Statement.

6. UNAVOIDABLE ADVERSE IMPACTS

6. UNAVOIDABLE ADVERSE IMPACTS

See pages 107 to 109 of the Draft Environmental Impact Statement. It should be noted that on page 108 of the DEIS, it is stated that 20 acres of land will be removed from forest uses. The proposed route will remove only 6 acres.

7. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

7. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

See page 110 of the Draft Environmental Impact Statement.

8. RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

8. RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

See page 111 of the Draft Environmental Impact Statement.

9. IMPACT ON STATE GOVERNMENT OF RELEVANT FEDERAL CONTROLS

9. IMPACT ON STATE GOVERNMENT OF RELEVANT FEDERAL CONTROLS

See page 112 of the Draft Environmental Impact Statement.

10. MULTI-STATE RESPONSIBILITIES

10. MULTI-STATE RESPONSIBILITIES

See page 113 of the Draft Environmental Impact Statement.

11. COORDINATION WITH AGENCIES AND INDIVIDUALS

11. COORDINATION WITH AGENCIES AND INDIVIDUALS

Agencies and organizations contacted:

Agricultural Research Service (USDA)

Dakota County

Auditor, Assessor, Sheriff, Planning Office

Dodge County

Auditor, Assessor, Sheriff, Planning and Zoning Office

Fire Information Research and Education

(FIRE) Center, University of Minnesota

Minnesota Analysis Planning Systems (MAPS)

Minnesota Bureau of Economic Development

Minnesota Center for Health Statistics

Minnesota Crop and Livestock Reporting Service

Minnesota Department of Agriculture

Minnesota Department of Health

Minnesota Department of Natural Resources

Minnesota Department of Revenues

Minnesota Geological Survey

Minnesota Pollution Control Agency

Minnesota State Planning Agency (MLMIS)

Minnesota Tourist Information Center

Mower County

Auditor, Assessor, Sheriff, Planning and Zoning Office

Rice County

Auditor, Assessor, Sheriff, Planning and Zoning Office

Soil Conservation Service (USDA)

Steele County

Auditor, Assessor, Sheriff, Planning and Zoning Office

University of Minnesota

APPENDICES

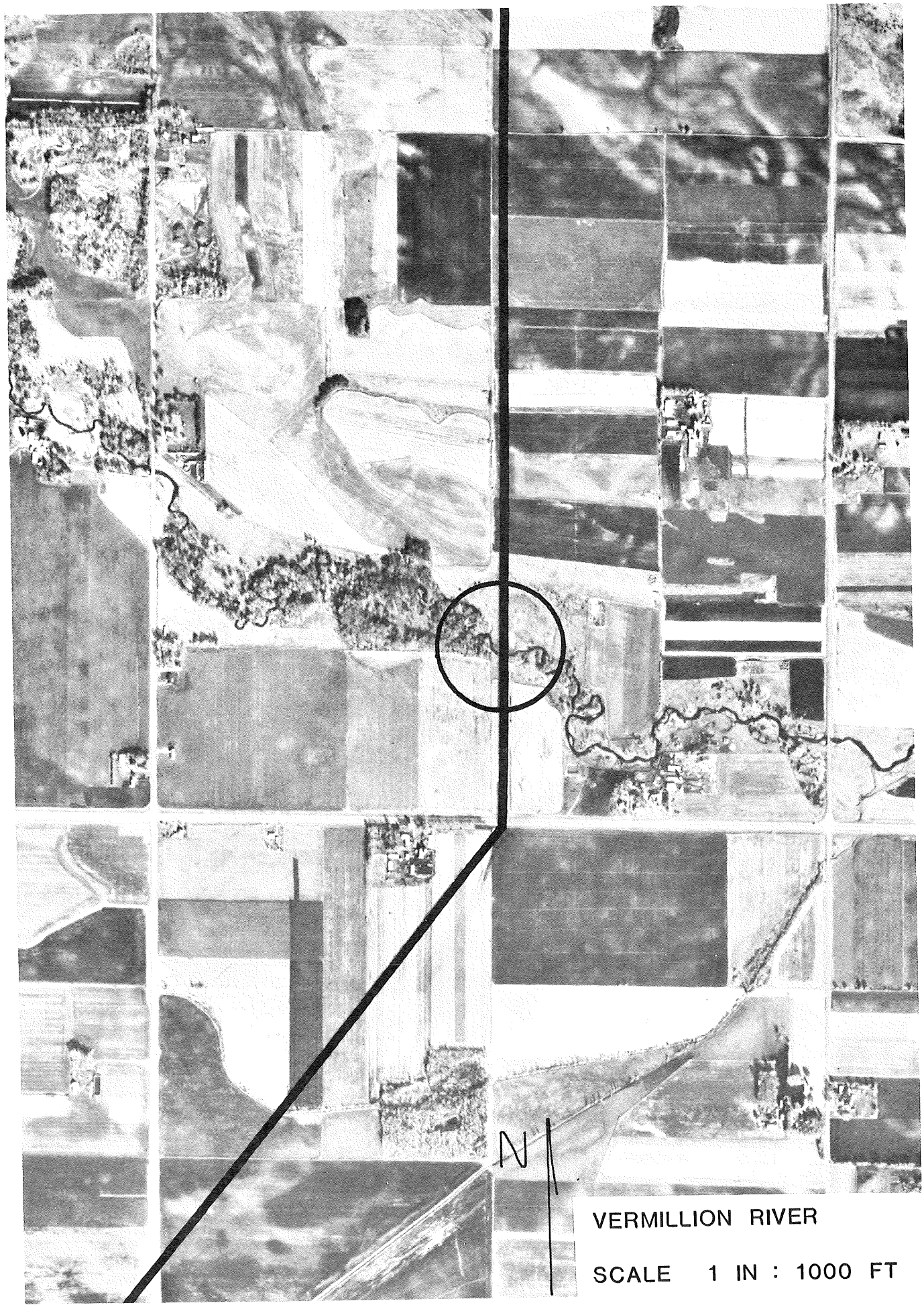
APPENDIX A

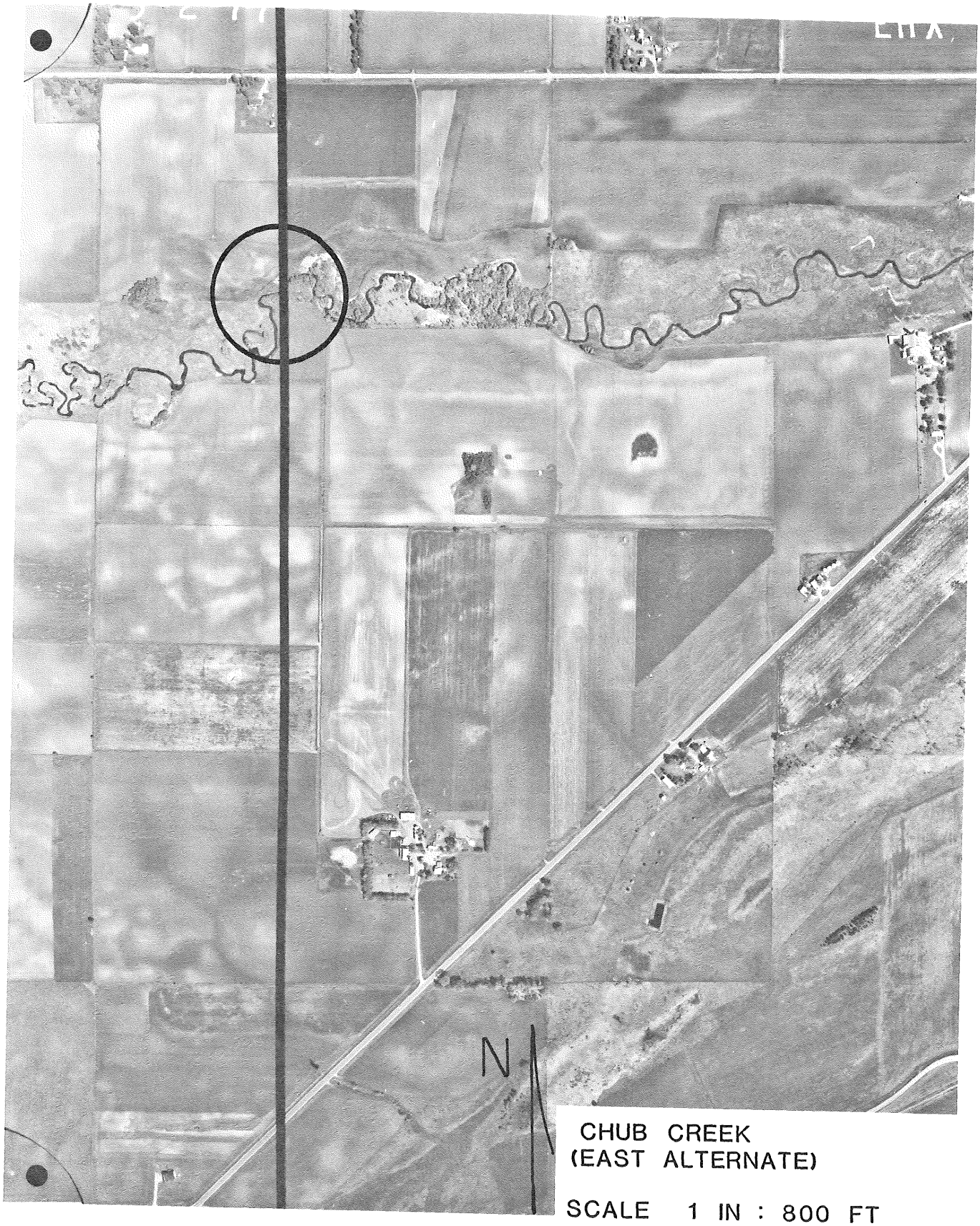
EMERGENCY PROCEDURES

See Appendix A of the Draft Environmental Impact Statement

APPENDIX B

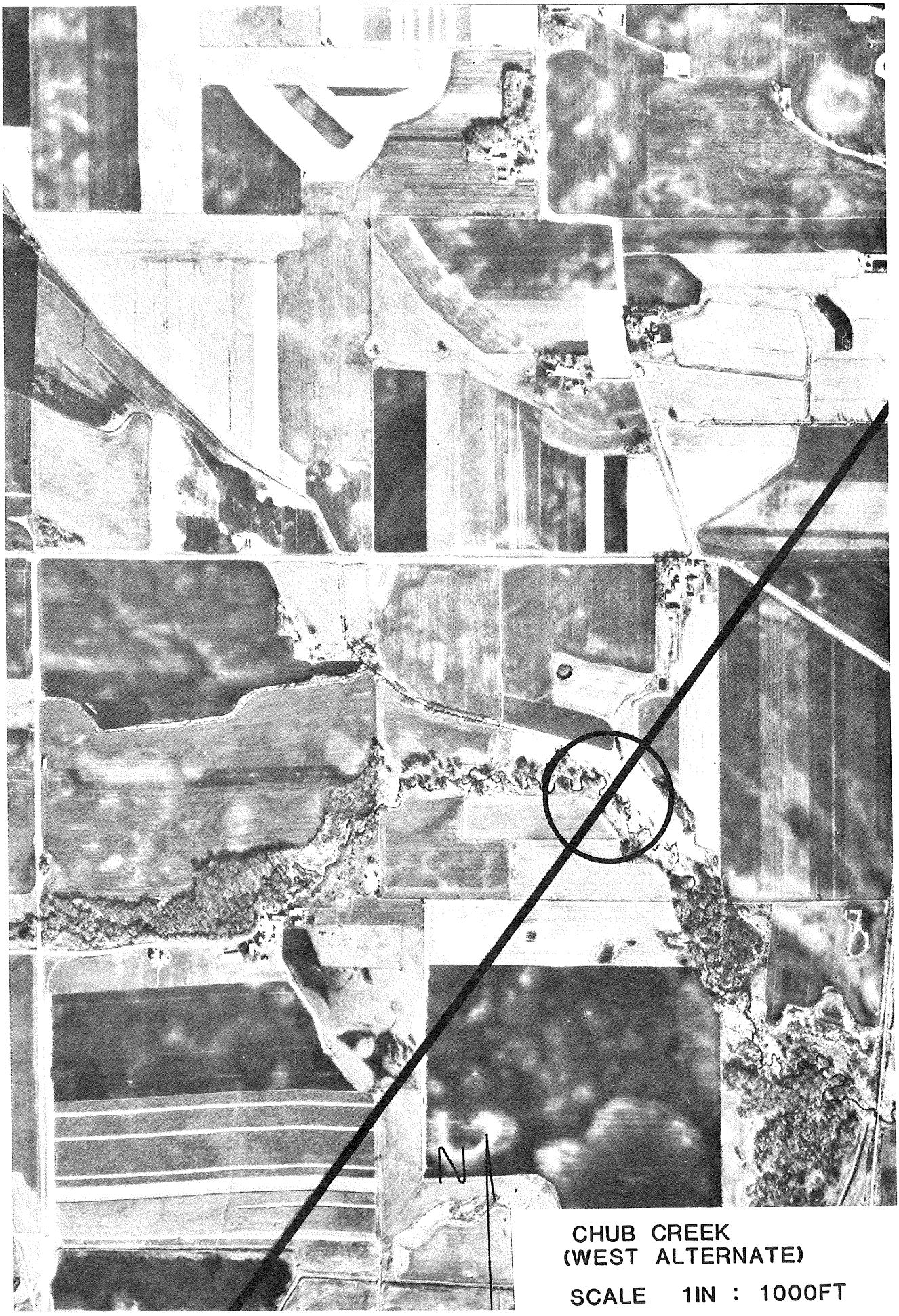
AIR PHOTOS OF STREAM CROSSINGS


N
VERMILLION RIVER
SCALE 1 IN : 1000 FT



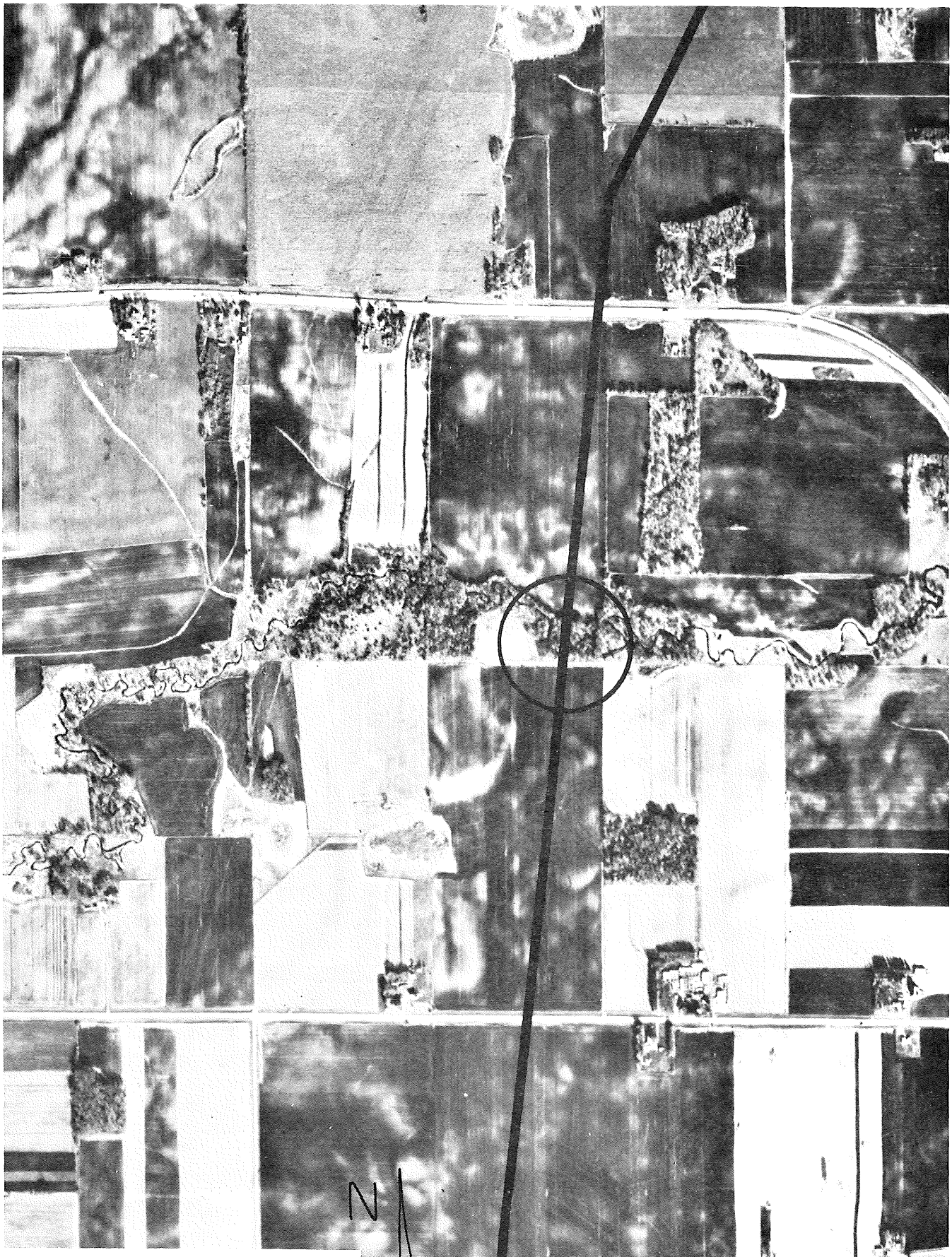
CHUB CREEK
(EAST ALTERNATE)

SCALE 1 IN : 800 FT



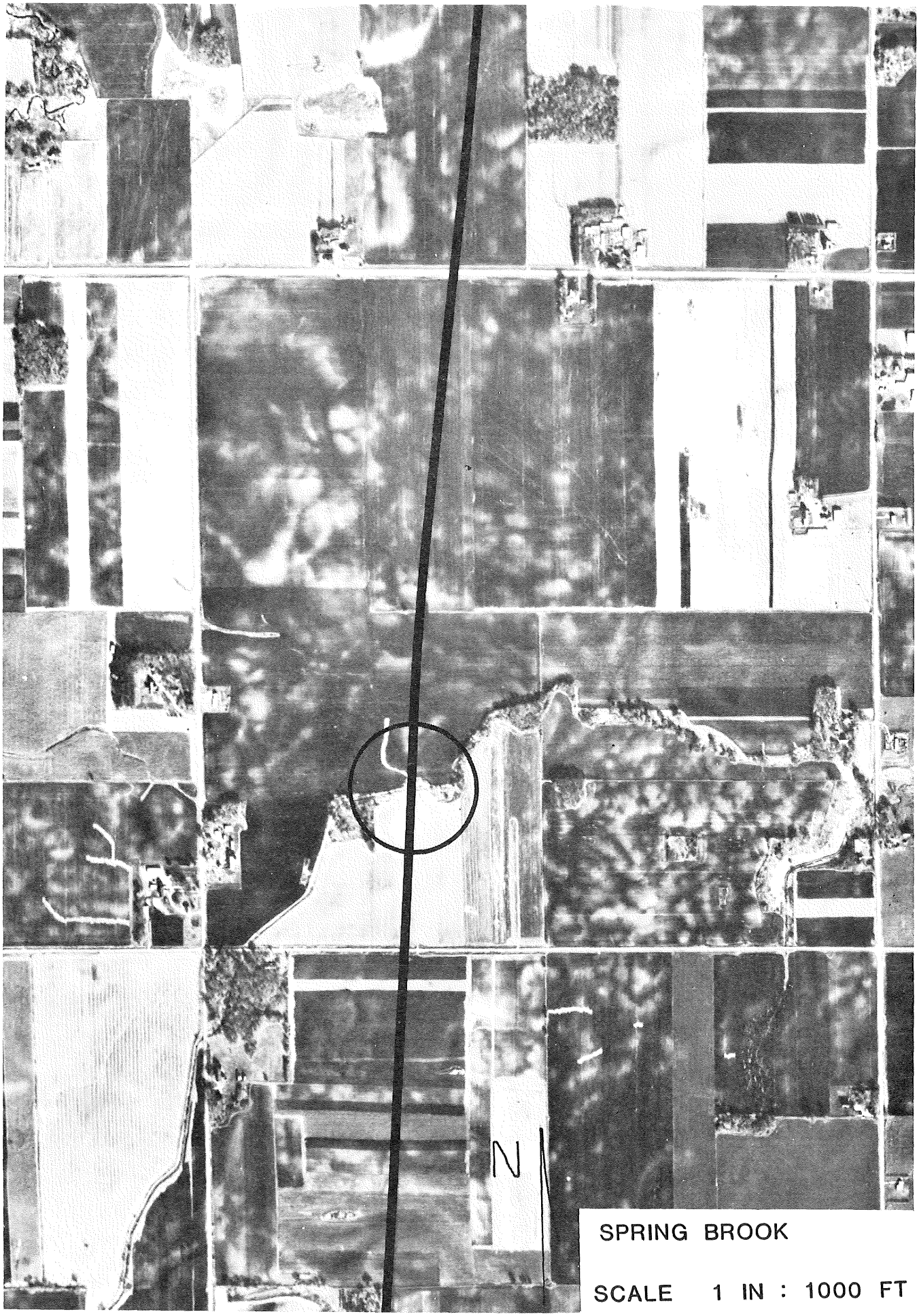
CHUB CREEK
(WEST ALTERNATE)

SCALE 1IN : 1000FT



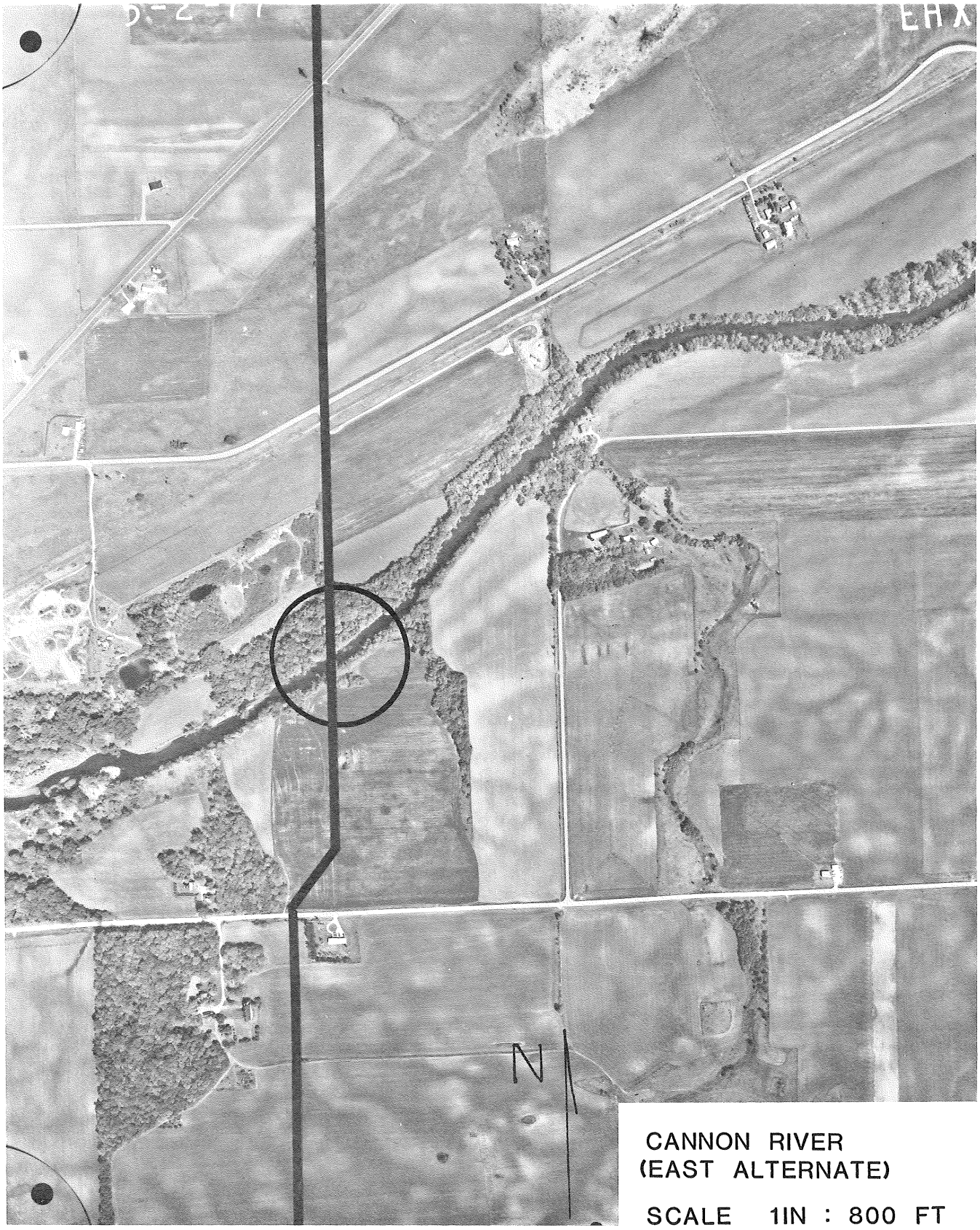
HEATH CREEK

SCALE 1 IN : 1000 FT



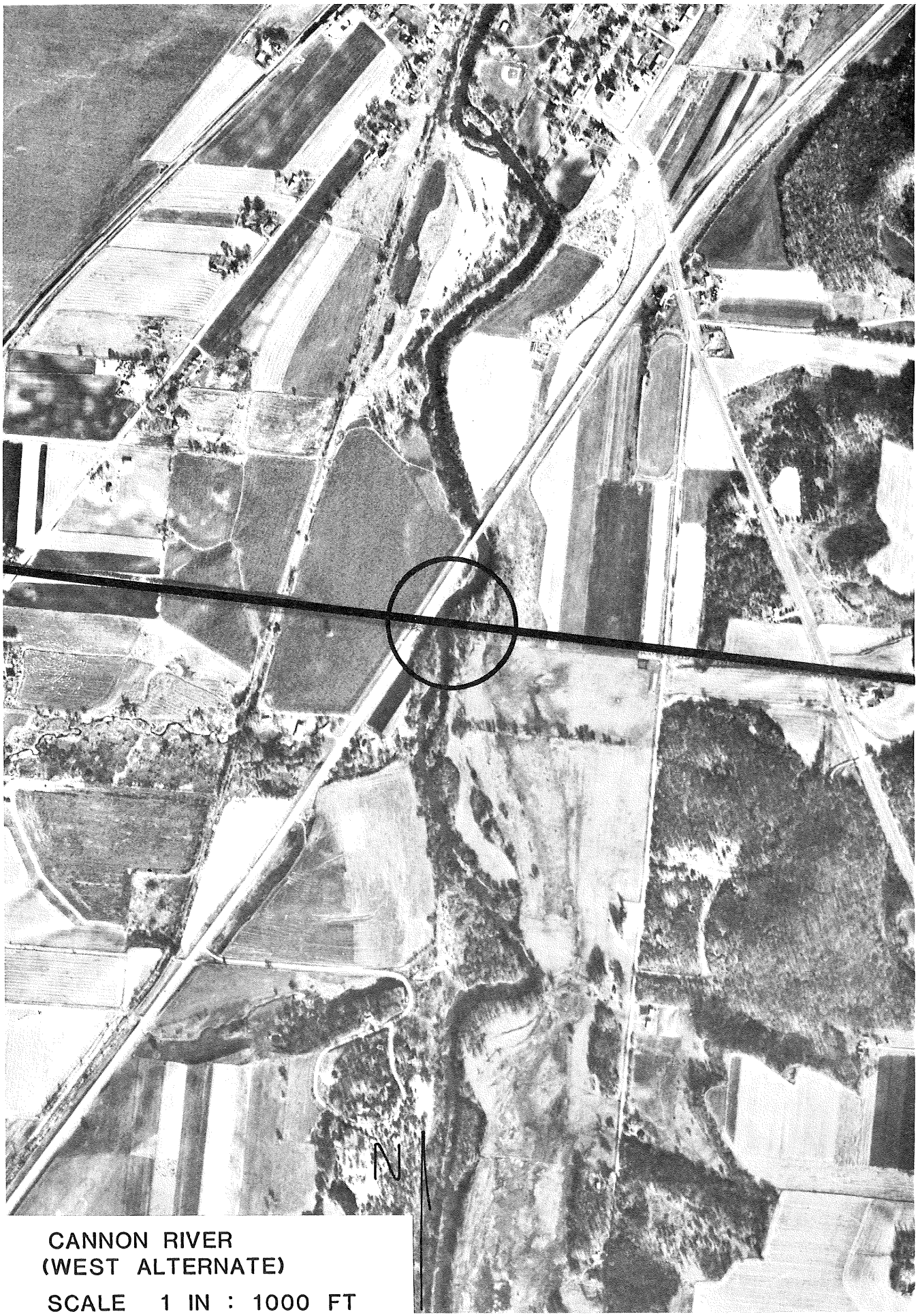
SPRING BROOK

SCALE 1 IN : 1000 FT



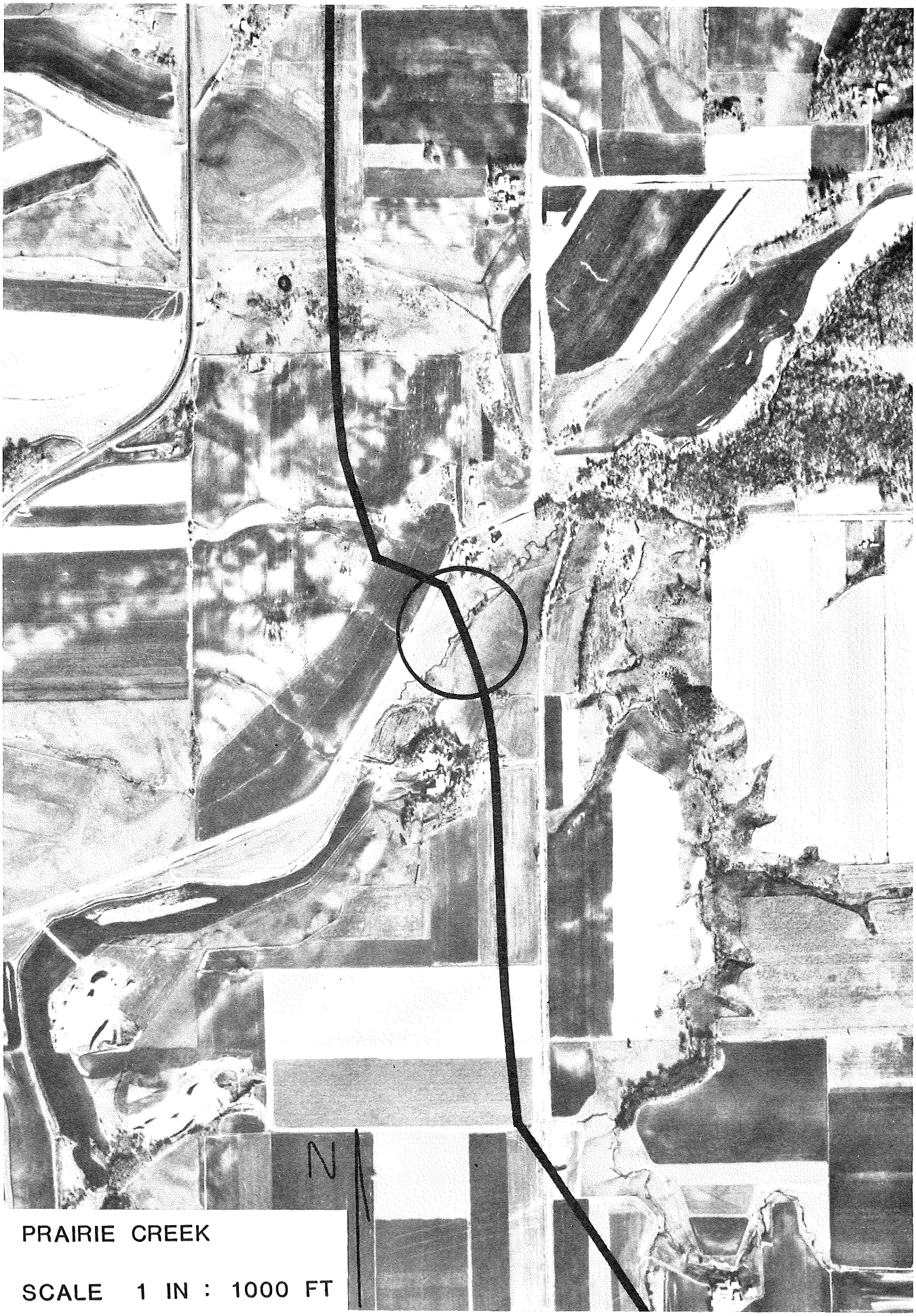
CANNON RIVER
(EAST ALTERNATE)

SCALE 1IN : 800 FT



CANNON RIVER
(WEST ALTERNATE)

SCALE 1 IN : 1000 FT

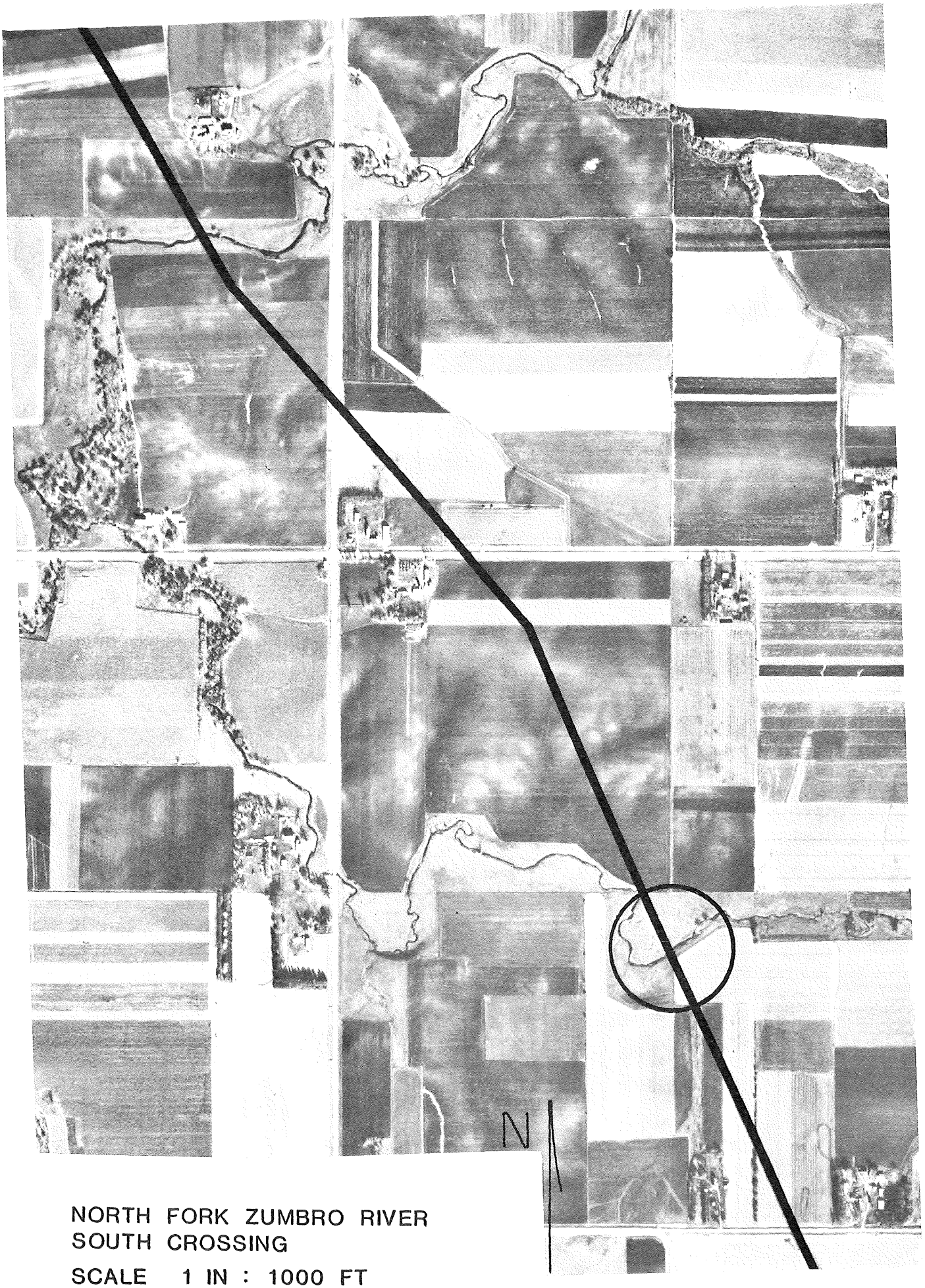


PRAIRIE CREEK

SCALE 1 IN : 1000 FT

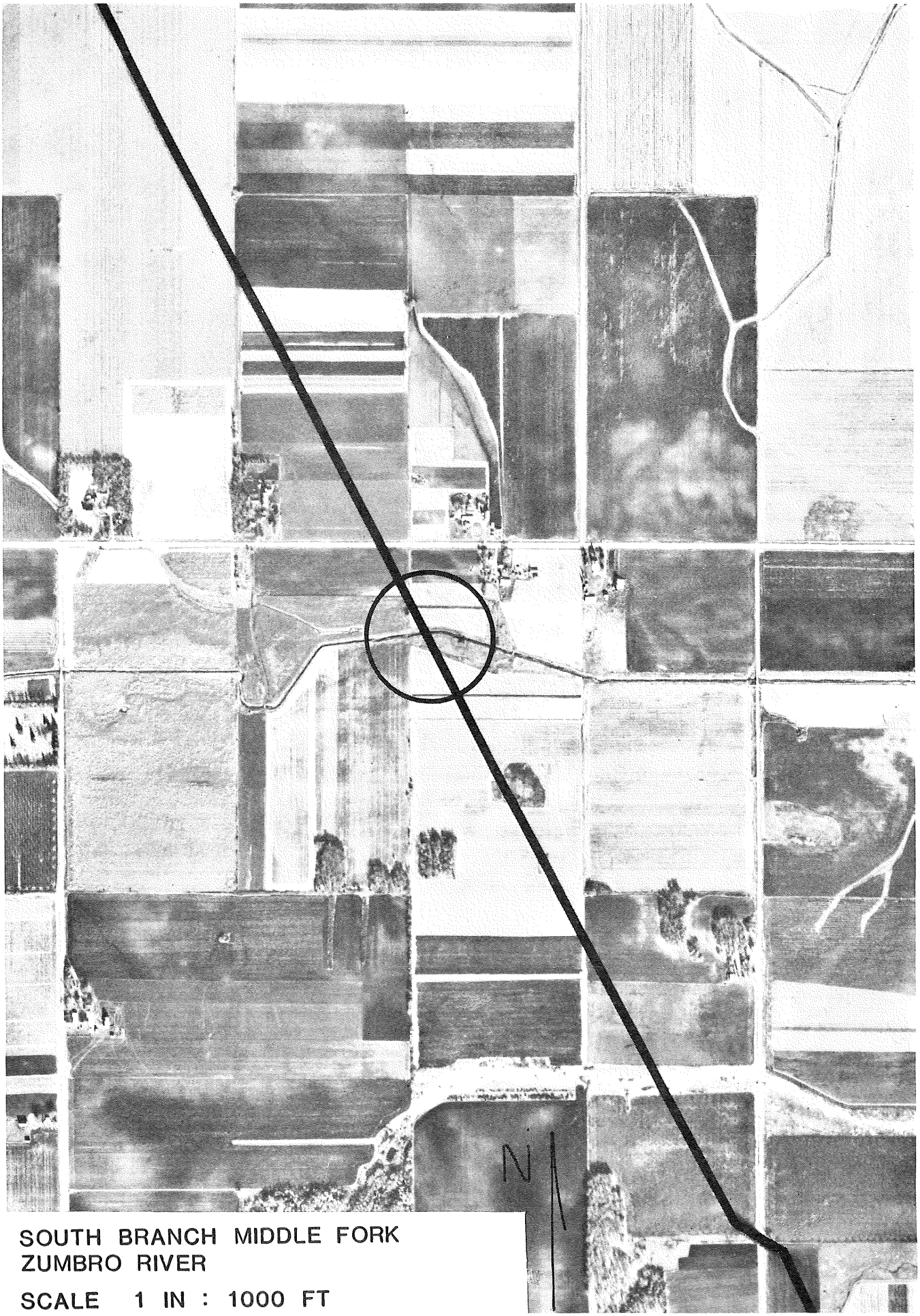
NORTH FORK ZUMBRO RIVER
NORTH CROSSING

SCALE 1 IN : 1000 FT



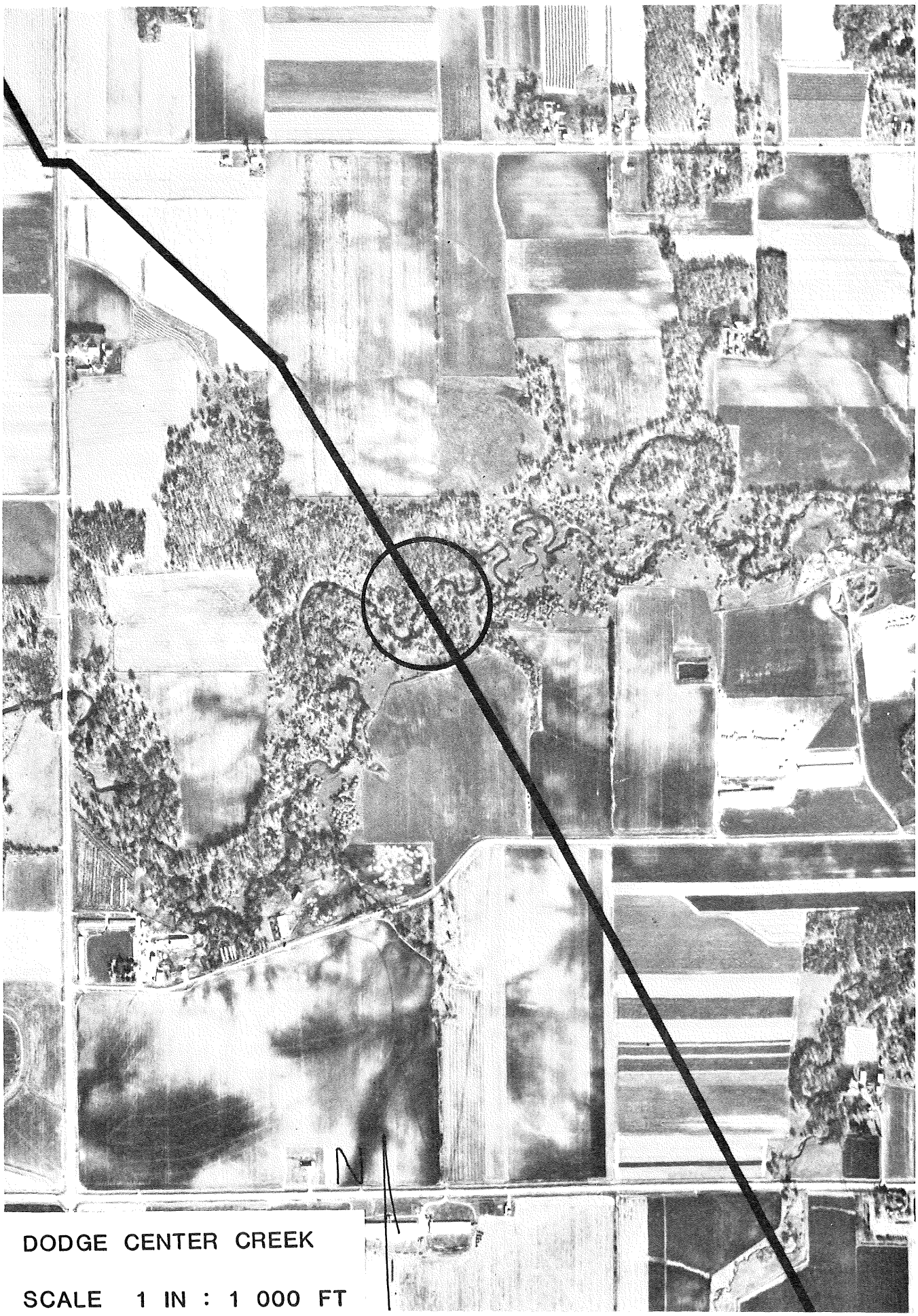
NORTH FORK ZUMBRO RIVER
SOUTH CROSSING

SCALE 1 IN : 1000 FT



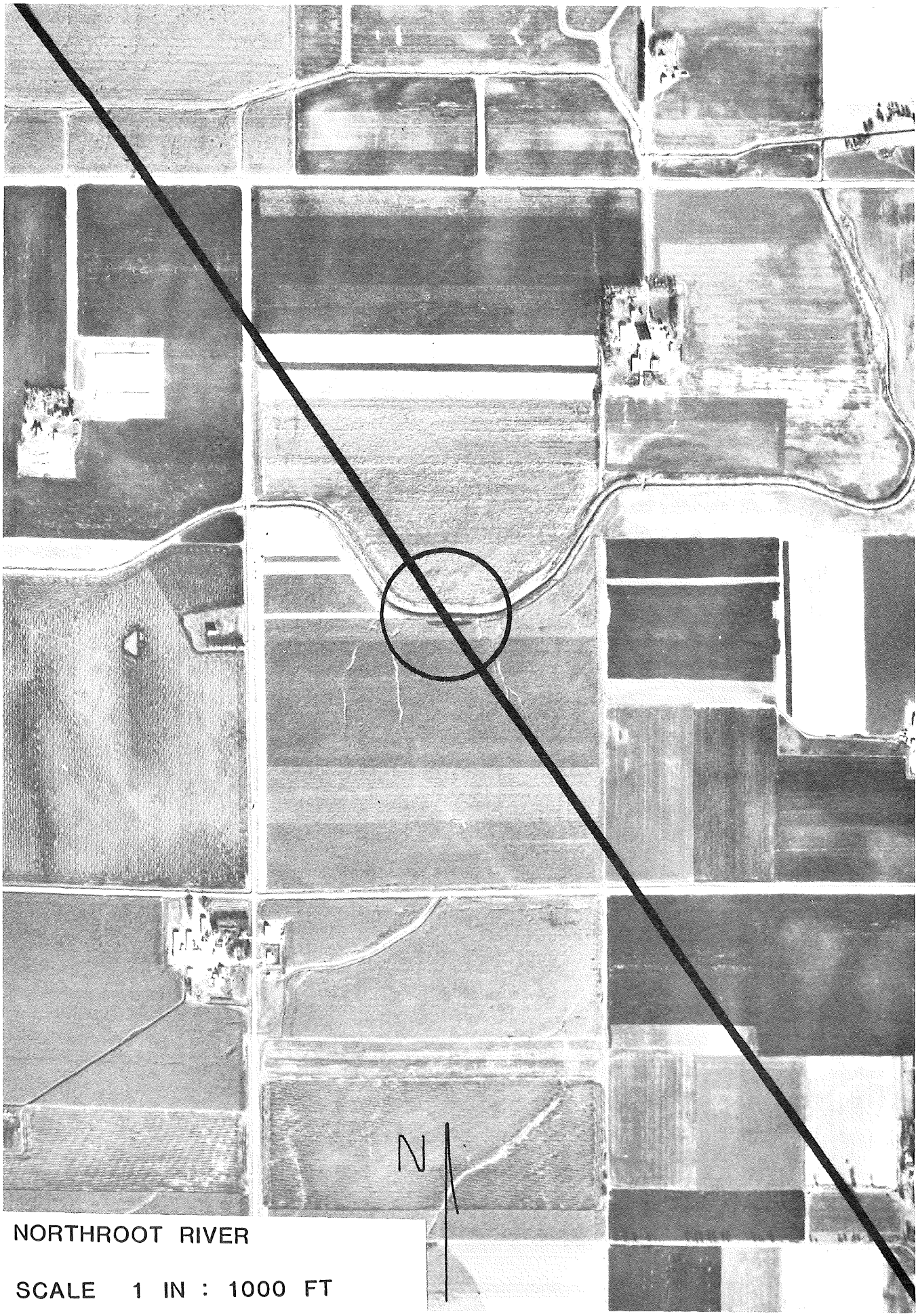
SOUTH BRANCH MIDDLE FORK
ZUMBRO RIVER

SCALE 1 IN : 1000 FT



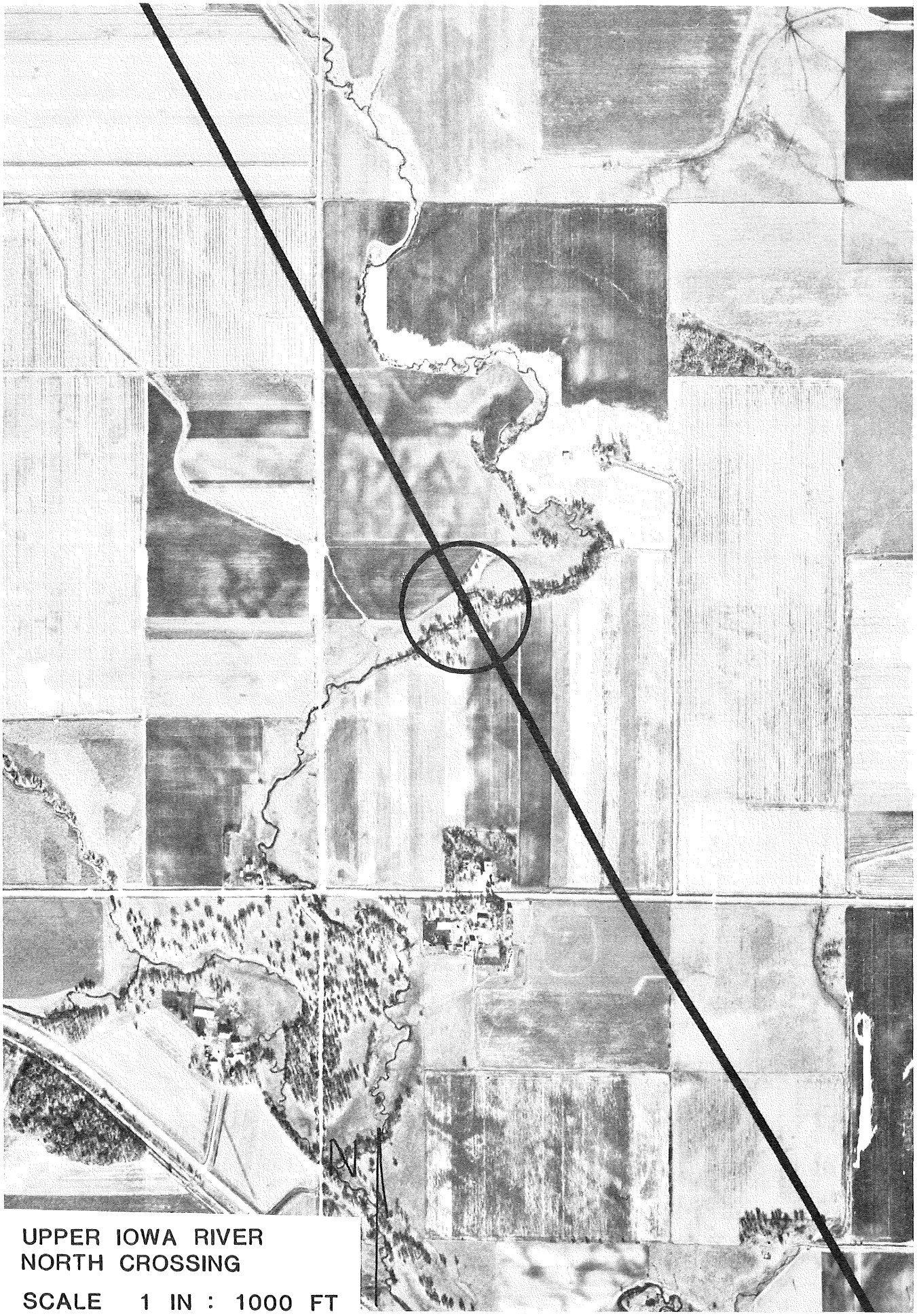
DODGE CENTER CREEK

SCALE 1 IN : 1 000 FT



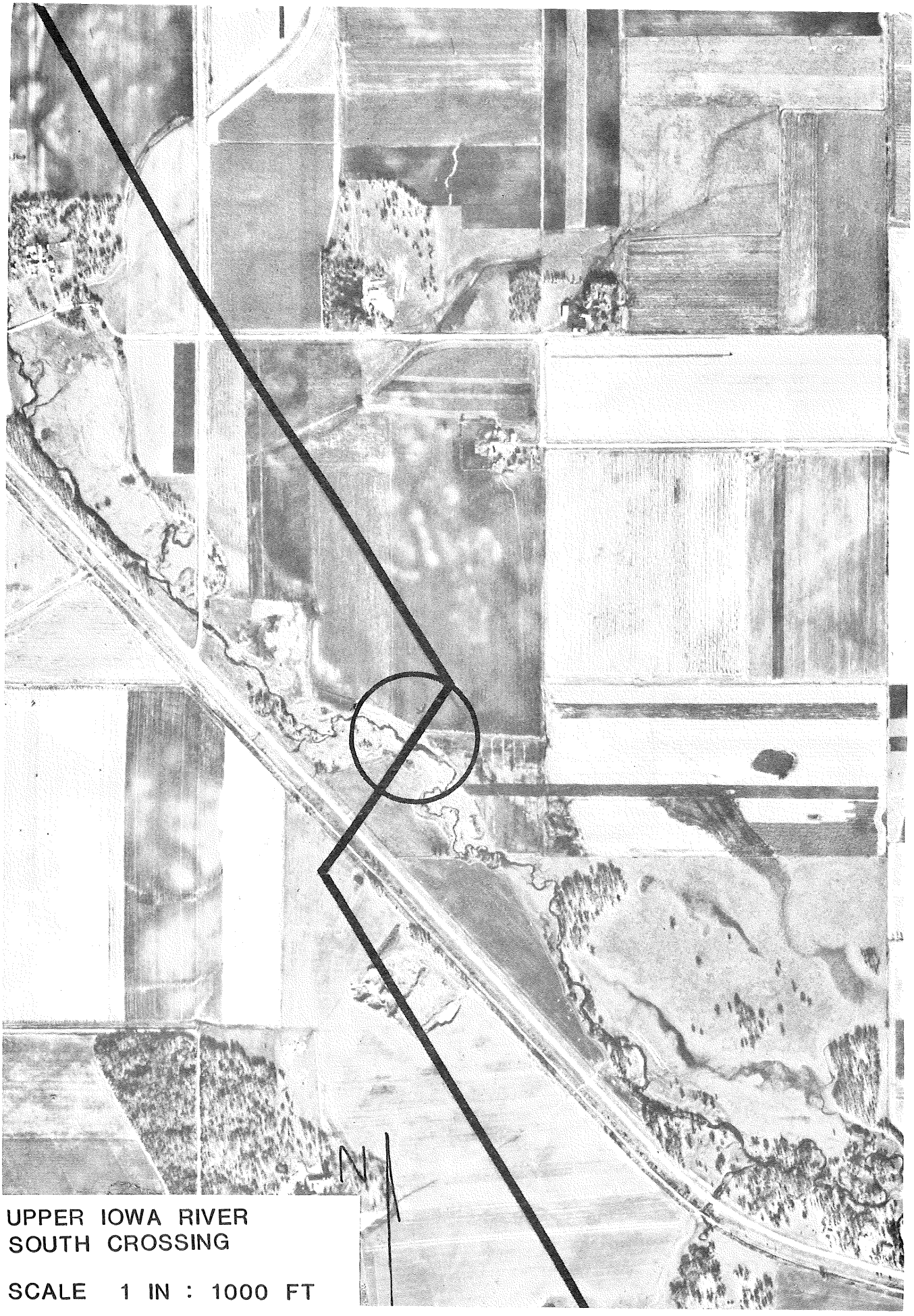
NORTHROOT RIVER

SCALE 1 IN : 1000 FT



UPPER IOWA RIVER
NORTH CROSSING

SCALE 1 IN : 1000 FT



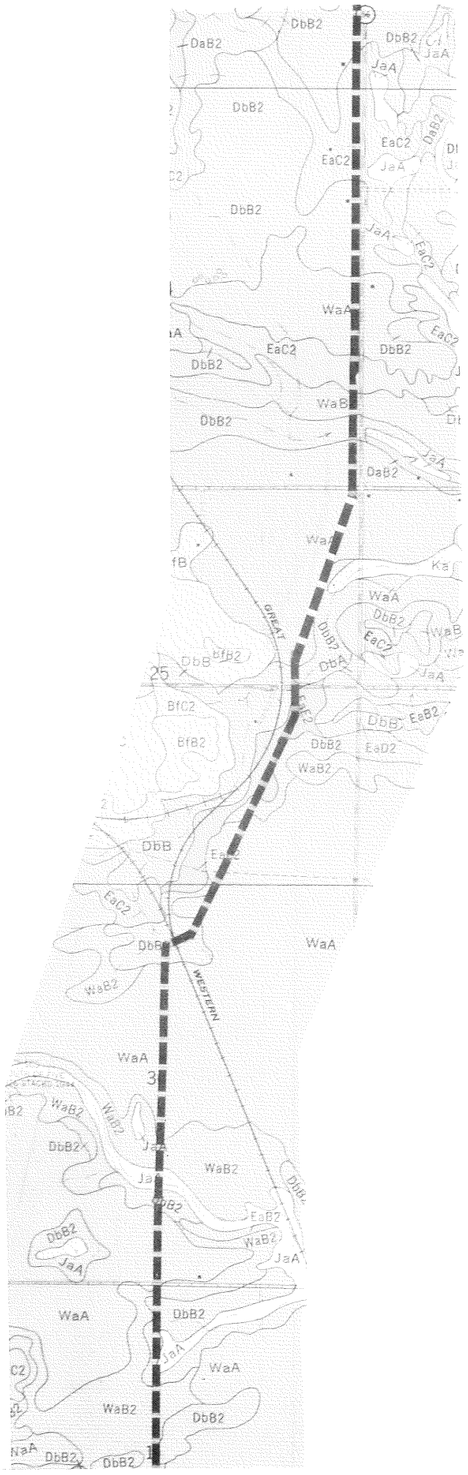
UPPER IOWA RIVER
SOUTH CROSSING

SCALE 1 IN : 1000 FT

APPENDIX C

SOIL DATA

PINE BEND



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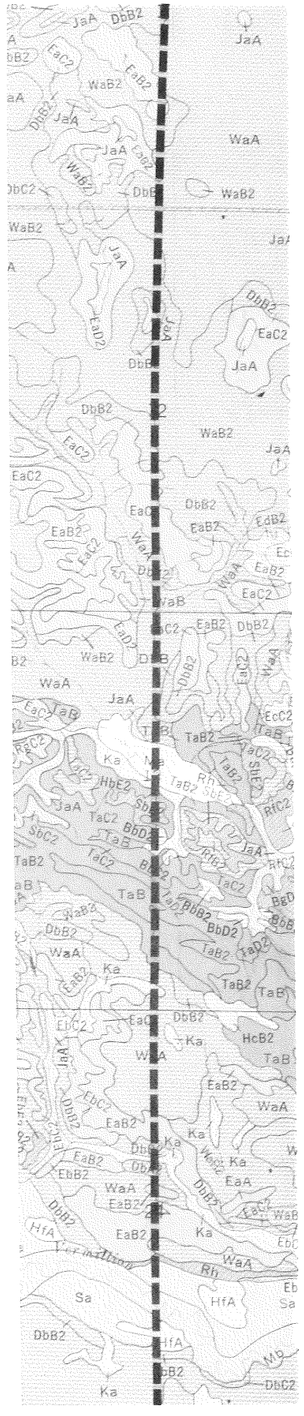


II

HH

N

0 ½ 1 Mile

Scale 1:24000

0 5000 Feet

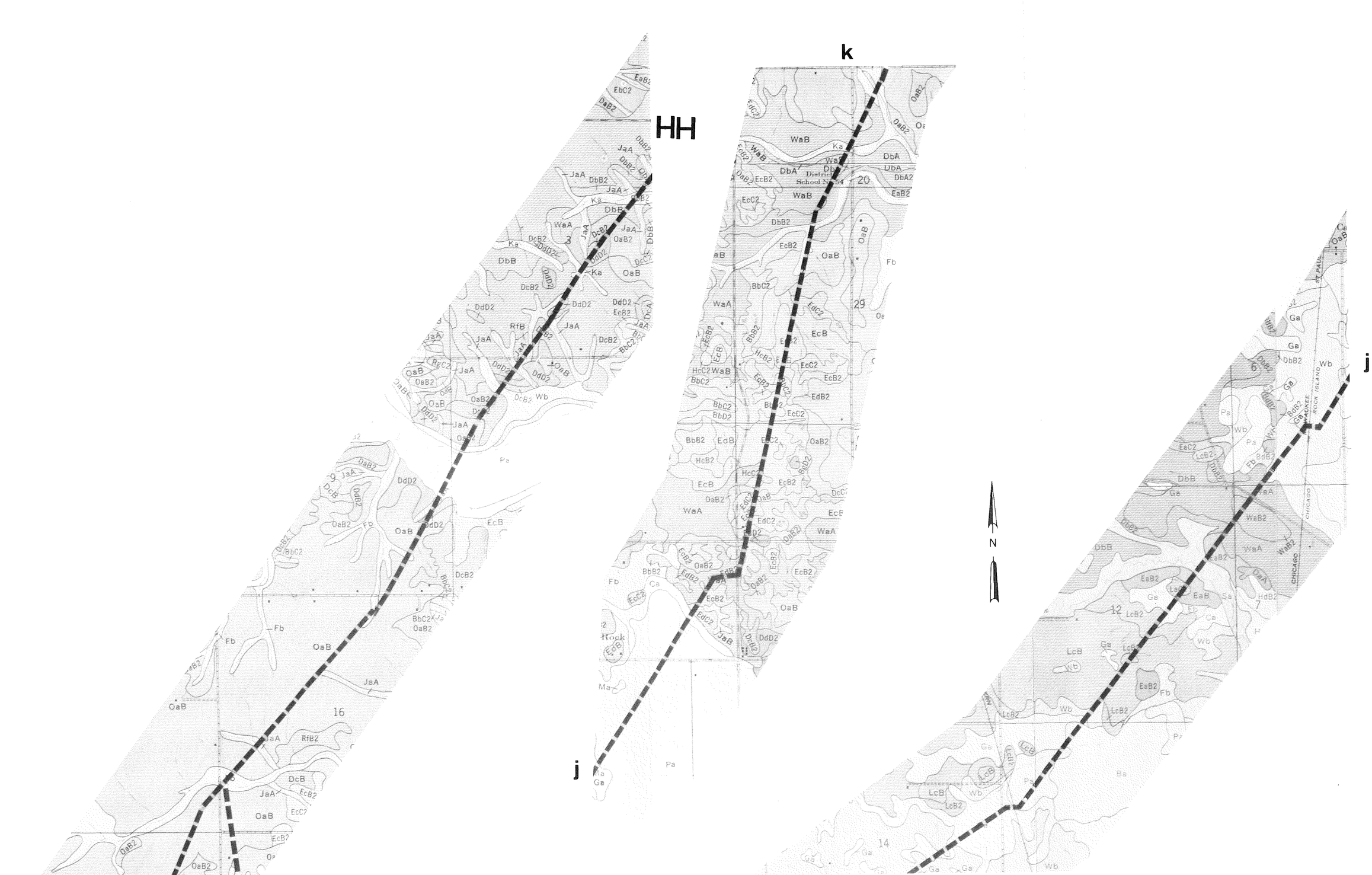
DAKOTA COUNTY

Northern Pipe Line Company of Delaware, Inc.

prepared by

NATIONAL BIOCENTRIC
2233 HAMLINE AVENUE NORTH
ST. PAUL, MINNESOTA 55113

Base maps are taken from
USDA Soil Conservation Service Surveys.


HH
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k
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N
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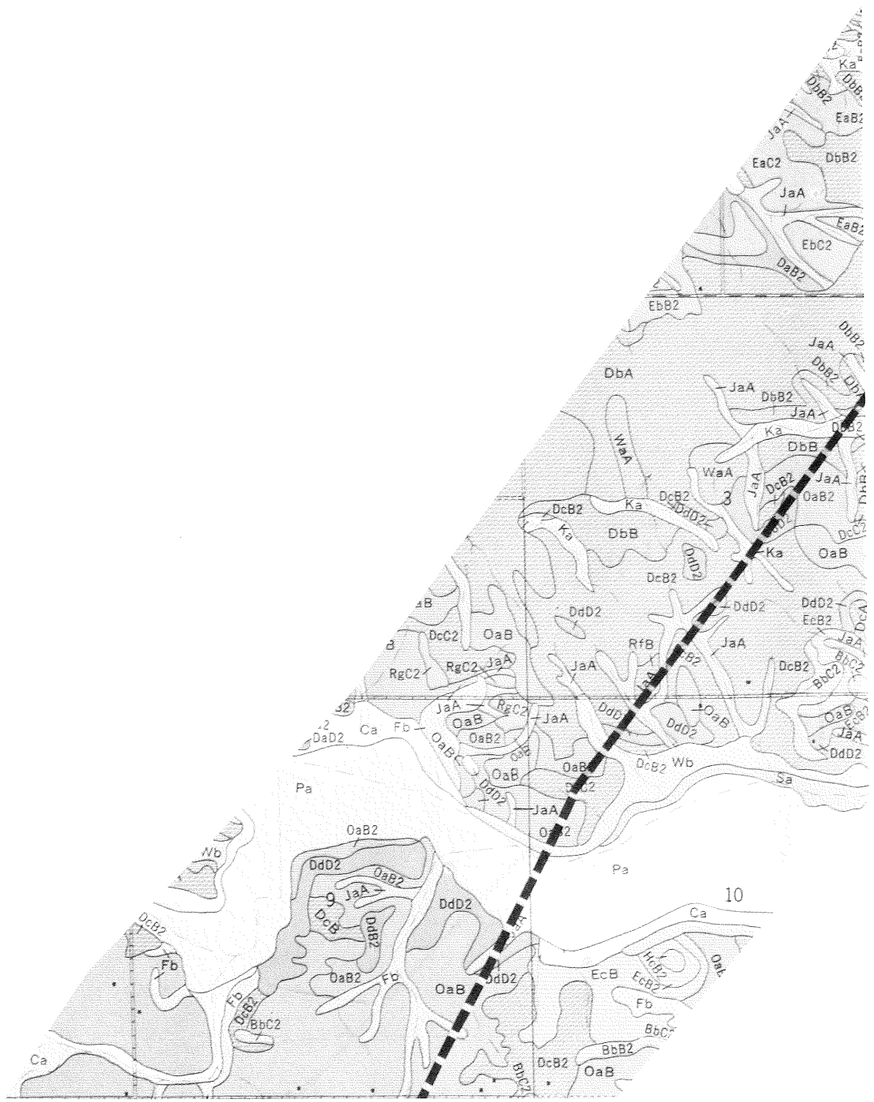
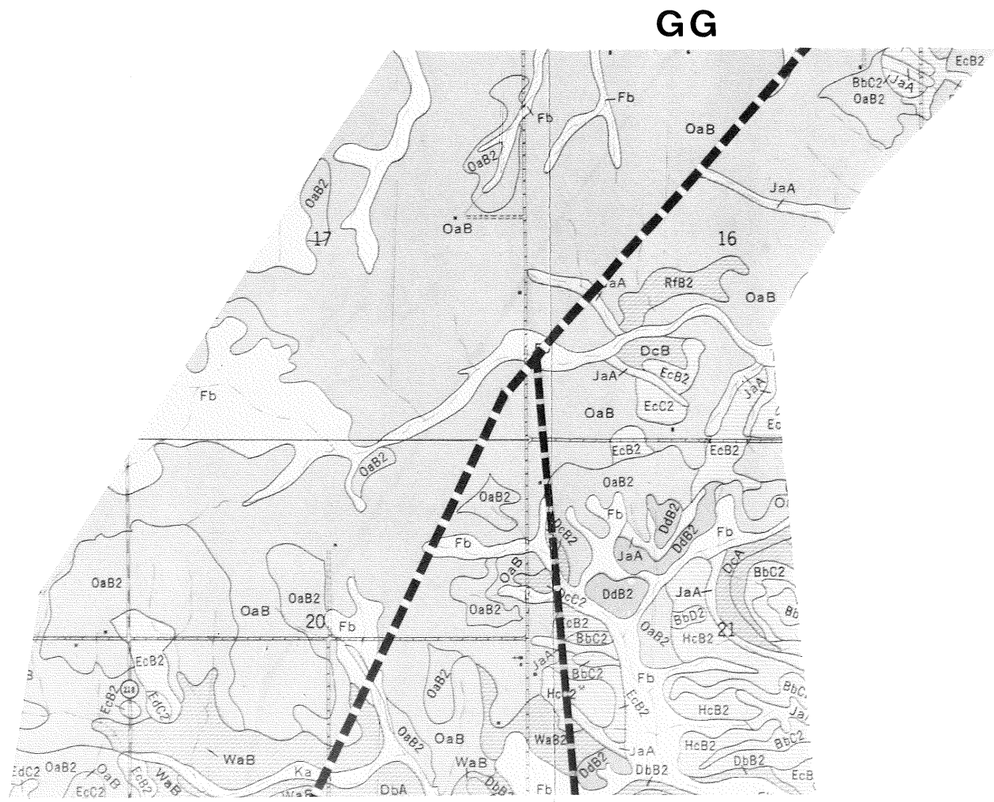
1/2
1 Mile
Scale 1:24000
0
5000 Feet
EAST ALTERNATE ROUTE
WEST ALTERNATE ROUTE
DAKOTA COUNTY





WEST ALTERNATE ROUTE

EAST ALTERNATE ROUTE

N

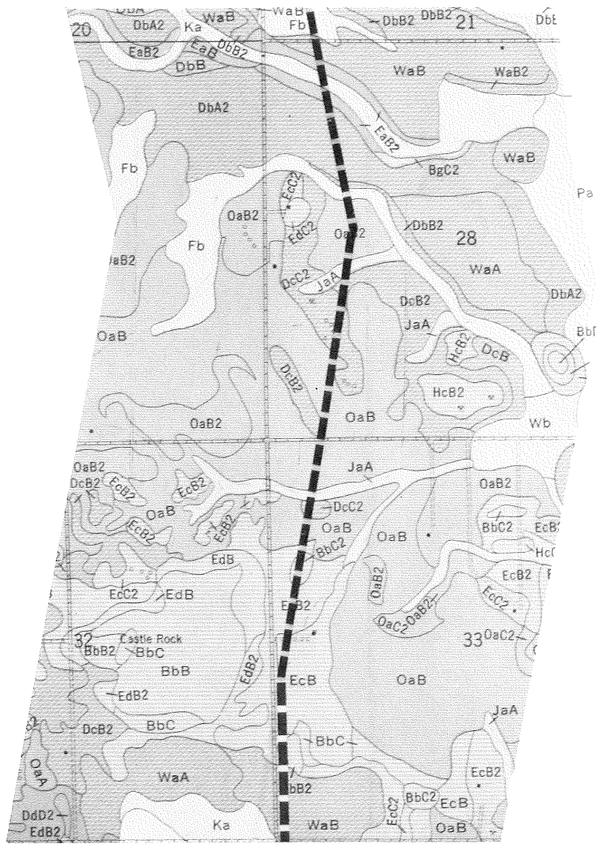
0 ½ 1 Mile

Scale 1:24000

0 5000 Feet

DAKOTA COUNTY

FF



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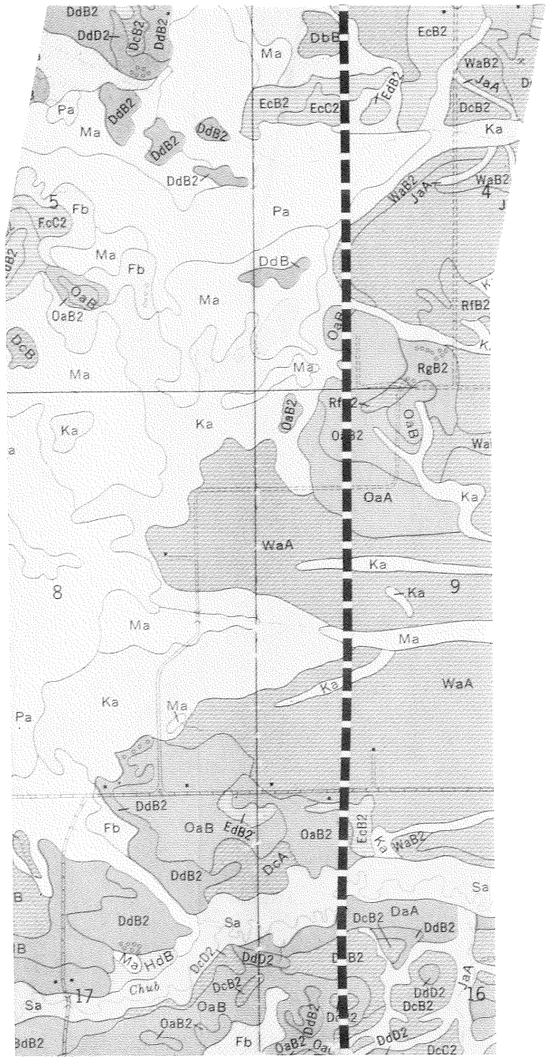

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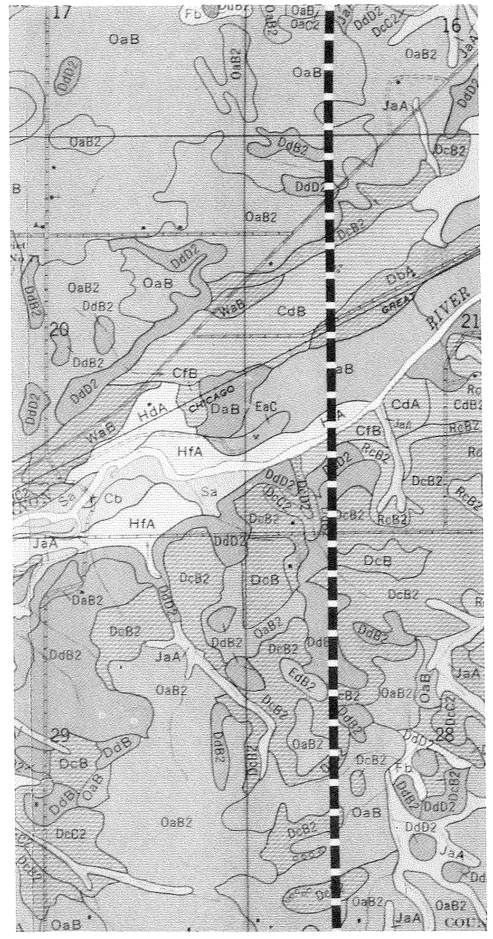

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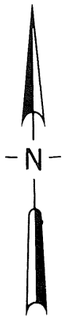


0 ½ 1 Mile

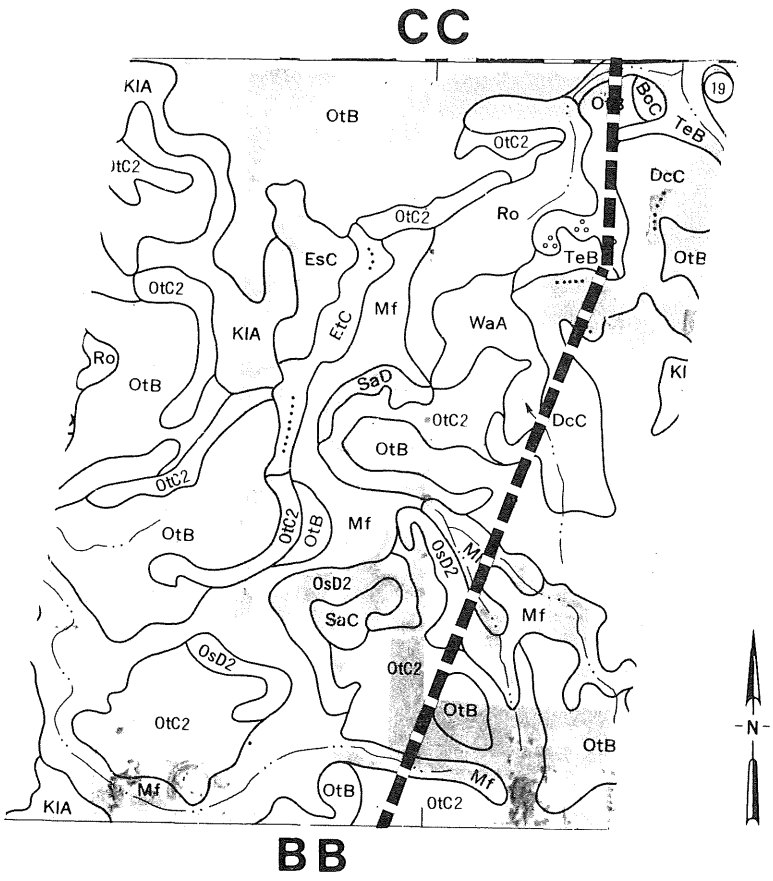
Scale 1:24000

0 5000 Feet

DAKOTA COUNTY

Map symbol	Mapping unit	Capability unit
Aa	Adolph silty clay loam	IIIw–1
Ba	Blue Earth-Talcot silty clay loams	IIIw–1
BbB	Boone loamy fine sand, 2 to 6 percent slopes	VIIs–1
BbB2	Boone loamy fine sand, 2 to 6 percent slopes, moderately eroded	VIIs–1
BbC	Boone loamy fine sand, 6 to 12 percent slopes	VIIs–1
BbC2	Boone loamy fine sand, 6 to 12 percent slopes, moderately eroded	VIIs–1
BbD2	Boone loamy fine sand, 12 to 40 percent slopes, moderately eroded	VIIs–1
BcB2	Burnsville-Lakeville loams, 0 to 6 percent slopes, moderately eroded	IIe–2a
BcC	Burnsville-Lakeville loams, 6 to 14 percent slopes	IIIe–2a
BcC2	Burnsville-Lakeville loams, 6 to 14 percent slopes, moderately eroded	IIIe–2a
BcD	Burnsville-Lakeville loams, 14 to 40 percent slopes	VIe–2
BcD2	Burnsville-Lakeville loams, 14 to 40 percent slopes, moderately eroded	VIe–2
BdB	Burnsville-Lakeville sandy loams and loamy sands, 0 to 6 percent slopes	IIIs–2a
BdB2	Burnsville-Lakeville sandy loams and loamy sands, 0 to 6 percent slopes, moderately eroded	IIIs–2a
BdC2	Burnsville-Lakeville sandy loams and loamy sands, 6 to 12 percent slopes, moderately eroded	IVs–2a
BdD	Burnsville-Lakeville sandy loams and loamy sands, 12 to 40 percent slopes	VIIs–1
BdD2	Burnsville-Lakeville sandy loams and loamy sands, 12 to 40 percent slopes, moderately eroded	VIIs–1
BfB	Burnsville, Hayden, Kingsley, and Scandia loams, 2 to 6 percent slopes	IIe–2a
BfB2	Burnsville, Hayden, Kingsley, and Scandia loams, 2 to 6 percent slopes, moderately eroded	IIe–2a
BfC	Burnsville, Hayden, Kingsley, and Scandia loams, 6 to 12 percent slopes	IIIe–2a
BfC2	Burnsville, Hayden, Kingsley, and Scandia loams, 6 to 12 percent slopes, moderately eroded	IIIe–2a
BgB	Burnsville, Hayden, Kingsley, and Scandia sandy loams, 0 to 6 percent slopes	IIIs–2a
BgB2	Burnsville, Hayden, Kingsley, and Scandia sandy loams, 0 to 6 percent slopes, moderately eroded	IIIs–2a
BgC	Burnsville, Hayden, Kingsley, and Scandia sandy loams, 6 to 12 percent slopes	IVs–2a
BgC2	Burnsville, Hayden, Kingsley, and Scandia sandy loams, 6 to 12 percent slopes, moderately eroded	IVs–2a
BgD	Burnsville, Hayden, Kingsley, and Scandia sandy loams, 12 to 45 percent slopes	VIIs–1
BgD2	Burnsville, Hayden, Kingsley, and Scandia sandy loams, 12 to 45 percent slopes, moderately eroded	VIIs–1
Ca	Clyde silty clay loam	IIIw–1
Cb	Colo silt loam	IIw–11
Cc	Colo silty clay loam	IIw–11
CdA	Copas loam, 0 to 2 percent slopes	IIe–2b
CdB	Copas loam, 2 to 6 percent slopes	IIe–2b
CdB2	Copas loam, 2 to 6 percent slopes, moderately eroded	IIe–2b
CdC2	Copas loam, 6 to 12 percent slopes, moderately eroded	VIe–2
CdD2	Copas loam, 12 to 18 percent slopes, moderately eroded	VIe–2
CfB	Copas sandy loam, 2 to 6 percent slopes	IIIs–2b
CfB2	Copas sandy loam, 2 to 6 percent slopes, moderately eroded	IIIs–2b
CfC2	Copas sandy loam, 6 to 12 percent slopes, moderately eroded	VIs–2
DaA	Dakota sandy loam, 0 to 2 percent slopes	IIIs–2d
DaA2	Dakota sandy loam, 0 to 2 percent slopes, moderately eroded	IIIs–2d
DaB	Dakota sandy loam, 2 to 6 percent slopes	IIIs–2c
DaB2	Dakota sandy loam, 2 to 6 percent slopes, moderately eroded	IIIs–2c
DaB3	Dakota sandy loam, 2 to 6 percent slopes, severely eroded	IVs–2b
DaC	Dakota sandy loam, 6 to 12 percent slopes	IVs–2b
DaC2	Dakota sandy loam, 6 to 12 percent slopes, moderately eroded	IVs–2b
DaC3	Dakota sandy loam, 6 to 12 percent slopes, severely eroded	VIs–2
DaD2	Dakota sandy loam, 12 to 25 percent slopes, moderately eroded	VIs–2
DbA	Dakota and Waukegan loams, 0 to 2 percent slopes	IIe–2c
DbA2	Dakota and Waukegan loams, 0 to 2 percent slopes, moderately eroded	IIe–2c
DbB	Dakota and Waukegan loams, 2 to 6 percent slopes	IIe–2d
DbB2	Dakota and Waukegan loams, 2 to 6 percent slopes, moderately eroded	IIe–2d
DbB3	Dakota and Waukegan loams, 2 to 6 percent slopes, severely eroded	IIIe–2c
DbC	Dakota and Waukegan loams, 6 to 12 percent slopes	IIIe–2c
DbC2	Dakota and Waukegan loams, 6 to 12 percent slopes, moderately eroded	IIIe–2c
DbC3	Dakota and Waukegan loams, 6 to 12 percent slopes, severely eroded	IVe–2
DbD2	Dakota and Waukegan loams, 12 to 25 percent slopes, moderately eroded	IVe–2
DcA	Dickinson loam, 0 to 2 percent slopes	IIe–2c
DcB	Dickinson loam, 2 to 6 percent slopes	IIe–2d
DcB2	Dickinson loam, 2 to 6 percent slopes, moderately eroded	IIe–2d
DcC2	Dickinson loam, 6 to 12 percent slopes, moderately eroded	IIIe–2c
DcD2	Dickinson loam, 12 to 25 percent slopes, moderately eroded	IVe–2
DdA	Dickinson sandy loam and loamy sand, 0 to 2 percent slopes	IIIs–2c
DdB	Dickinson sandy loam and loamy sand, 2 to 6 percent slopes	IIIs–2c
DdB2	Dickinson sandy loam and loamy sand, 2 to 6 percent slopes, moderately eroded	IIIs–2c
DdD2	Dickinson sandy loam and loamy sand, 6 to 25 percent slopes, moderately eroded	IVs–2b
EaA	Estherville loam and sandy loam, 0 to 2 percent slopes	IIIs–2d
EaB	Estherville loam and sandy loam, 2 to 6 percent slopes	IIIs–2d
EaB2	Estherville loam and sandy loam, 2 to 6 percent slopes, moderately eroded	IIIs–2d
EaC	Estherville loam and sandy loam, 6 to 12 percent slopes	IVs–2a
EaC2	Estherville loam and sandy loam, 6 to 12 percent slopes, moderately eroded	IVs–2a
EaD2	Estherville loam and sandy loam, 12 to 18 percent slopes, moderately eroded	VIs–2
EaE2	Estherville loam and sandy loam, 18 to 30 percent slopes, moderately eroded	VIIs–1
EbA	Estherville loamy sand, 0 to 2 percent slopes	IVs–3a
EbB	Estherville loamy sand, 2 to 6 percent slopes	IVs–3a
EbB2	Estherville loamy sand, 2 to 6 percent slopes, moderately eroded	IVs–3a
EbC	Estherville loamy sand, 6 to 12 percent slopes	VIIs–1
EbC2	Estherville loamy sand, 6 to 12 percent slopes, moderately eroded	VIIs–1
EbE	Estherville loamy sand, 12 to 30 percent slopes	VIIs–1
EbE2	Estherville loamy sand, 12 to 30 percent slopes, moderately eroded	VIIs–1
EcB	Etter loam, 2 to 6 percent slopes	IIe–2b
EcB2	Etter loam, 2 to 6 percent slopes, moderately eroded	IIe–2b
EcC2	Etter loam, 6 to 12 percent slopes, moderately eroded	IIIe–2b
EdB	Etter sandy loam, 2 to 6 percent slopes	IIIe–3
EdB2	Etter sandy loam, 2 to 6 percent slopes, moderately eroded	IIIe–3
EdC	Etter sandy loam, 6 to 12 percent slopes	IVe–3
EdC2	Etter sandy loam, 6 to 12 percent slopes, moderately eroded	IVe–3
EdD2	Etter sandy loam, 12 to 30 percent slopes, moderately eroded	VIIe–3
Fa	Faxon silty clay loam	Vw–16
Fb	Floyd silty clay loam	IIw–1a
Fc	Freer silt loam	IIw–1b
Ga	Glencoe silty clay loam	IIIw–1
Ha	Hampton silt loam	I–1
HbB	Hayden loam, 2 to 6 percent slopes	IIe–1b
HbB2	Hayden loam, 2 to 6 percent slopes, moderately eroded	IIe–1b
HbC	Hayden loam, 6 to 12 percent slopes	IIIe–1b
HbC2	Hayden loam, 6 to 12 percent slopes, moderately eroded	IIIe–1b
HbD	Hayden loam, 12 to 18 percent slopes	IVe–1
HbD2	Hayden loam, 12 to 18 percent slopes, moderately eroded	IVe–1
HbE	Hayden loam, 18 to 30 percent slopes	VIe–1
HbE2	Hayden loam, 18 to 30 percent slopes, moderately eroded	VIe–1
HcB2	Hixton sandy loam, 2 to 6 percent slopes, moderately eroded	IIIs–2b
HcC2	Hixton sandy loam, 6 to 12 percent slopes, moderately eroded	IVs–2b
HcD2	Hixton sandy loam, 12 to 30 percent slopes, moderately eroded	VIIs–1
HdA	Hubbard loamy sand, 0 to 2 percent slopes	IVs–3c
HdB	Hubbard loamy sand, 2 to 6 percent slopes	IVs–3c
HdB2	Hubbard loamy sand, 2 to 6 percent slopes, moderately eroded	IVs–3c
HdC	Hubbard loamy sand, 6 to 12 percent slopes	VIIs–1
HdC2	Hubbard loamy sand, 6 to 12 percent slopes, moderately eroded	VIIs–1
HdD	Hubbard loamy sand, 12 to 30 percent slopes	VIIs–1
HdD2	Hubbard loamy sand, 12 to 30 percent slopes, moderately eroded	VIIs–1
HfA	Hubbard soils, 0 to 2 percent slopes	IIIs–2d
JaA	Judson silt loam, 0 to 2 percent slopes	IIw–11
JaB	Judson silt loam, 2 to 6 percent slopes	IIe–1a
JaC	Judson silt loam, 6 to 12 percent slopes	IIIe–1a
JaC2	Judson silt loam, 6 to 12 percent slopes, moderately eroded	IIIe–1a
JaD	Judson silt loam, 12 to 30 percent slopes	IVe–1
JaD2	Judson silt loam, 12 to 30 percent slopes, moderately eroded	IVe–1
Ka	Kato silt loam	IIw–1a
LaC	Lester silt loam, 6 to 12 percent slopes	IIIe–1a
LaC2	Lester silt loam, 6 to 12 percent slopes, moderately eroded	IIIe–1a
LaD2	Lester silt loam, 12 to 18 percent slopes, moderately eroded	IVe–1
LbB	Lester-Burnsville loams, 2 to 6 percent slopes	IIe–1b
LbB2	Lester-Burnsville loams, 2 to 6 percent slopes, moderately eroded	IIe–1b
LbC	Lester-Burnsville loams, 6 to 12 percent slopes	IIIe–1b
LbC2	Lester-Burnsville loams, 6 to 12 percent slopes, moderately eroded	IIIe–1b
LbD	Lester-Burnsville loams, 12 to 30 percent slopes	VIe–1
LbD2	Lester-Burnsville loams, 12 to 30 percent slopes, moderately eroded	VIe–1
LcB	Lester-LeSueur silt loams, 2 to 6 percent slopes	IIe–1a
LcB2	Lester-LeSueur silt loams, 2 to 6 percent slopes, moderately eroded	IIe–1a
Ma	Marshan silt loam and silty clay loam	IIIw–1
Mb	Mixed alluvial land	VIw–11
NaB	Nininger silt loam, 0 to 6 percent slopes	IIe–2d
NaB2	Nininger silt loam, 0 to 6 percent slopes, moderately eroded	IIe–2d
NaC2	Nininger silt loam, 6 to 12 percent slopes, moderately eroded	IIIe–2c
NaD2	Nininger silt loam, 12 to 30 percent slopes, moderately eroded	IVe–2
NbA	Nymore loamy sand, 0 to 2 percent slopes	IVs–3c
NbB	Nymore loamy sand, 2 to 6 percent slopes	IVs–3c
NbB2	Nymore loamy sand, 2 to 6 percent slopes, moderately eroded	IVs–3c
NbC2	Nymore loamy sand, 6 to 12 percent slopes, moderately eroded	VIIs–1
NbD	Nymore loamy sand, 12 to 30 percent slopes	VIIs–1
OaA	Ostrander silt loam, 0 to 2 percent slopes	I–1
OaB	Ostrander silt loam, 2 to 6 percent slopes	IIe–1a
OaB2	Ostrander silt loam, 2 to 6 percent slopes, moderately eroded	IIe–1a
OaC2	Ostrander silt loam, 6 to 12 percent slopes, moderately eroded	IIIe–1a
OaD2	Ostrander silt loam, 12 to 30 percent slopes, moderately eroded	IVe–1
Pa	Peat and Muck	IIIw–8
PbB	Port Byron silt loam, 2 to 6 percent slopes	IIe–1a
PbB2	Port Byron silt loam, 2 to 6 percent slopes, moderately eroded	IIe–1a
PbC2	Port Byron silt loam, 6 to 12 percent slopes, moderately eroded	IIIe–1a
PbD2	Port Byron silt loam, 12 to 30 percent slopes, moderately eroded	VIe–1
Ra	Riverwash	VIIw–11
RbB	Rockton sandy loam, 2 to 6 percent slopes	IIIe–3
RbB2	Rockton sandy loam, 2 to 6 percent slopes, moderately eroded	IIIe–3
RbC2	Rockton sandy loam, 6 to 12 percent slopes, moderately eroded	IVe–3
RbD2	Rockton sandy loam, 12 to 30 percent slopes, moderately eroded	VIIe–3
RcB	Rockton silt loam, 2 to 6 percent slopes	IIe–2b
RcB2	Rockton silt loam, 2 to 6 percent slopes, moderately eroded	IIe–2b
RcC2	Rockton silt loam, 6 to 12 percent slopes, moderately eroded	IIIe–2b
RcD2	Rockton silt loam, 12 to 30 percent slopes, moderately eroded	VIe–2
RdB	Rockton silt loam, shallow, 2 to 6 percent slopes	IIIe–3
RdB2	Rockton silt loam, shallow, 2 to 6 percent slopes, moderately eroded	IIIe–3
RdC	Rockton silt loam, shallow, 6 to 12 percent slopes	IVe–3
RdC2	Rockton silt loam, shallow, 6 to 12 percent slopes, moderately eroded	IVe–3
RdD2	Rockton silt loam, shallow, 12 to 30 percent slopes, moderately eroded	VIe–3
RfB	Rosemount loam, 2 to 6 percent slopes	IIe–2a
RfB2	Rosemount loam, 2 to 6 percent slopes, moderately eroded	IIe–2a
RfC2	Rosemount loam, 6 to 12 percent slopes, moderately eroded	IIIe–2a
RfD2	Rosemount loam, 12 to 30 percent slopes, moderately eroded	IVe–2
RgB	Rosemount sandy loam, 2 to 6 percent slopes	IIIs–2a
RgB2	Rosemount sandy loam, 2 to 6 percent slopes, moderately eroded	IIIs–2a
RgC2	Rosemount sandy loam, 6 to 12 percent slopes, moderately eroded	IVs–2a
RgD2	Rosemount sandy loam, 12 to 30 percent slopes, moderately eroded	VIIs–1
Rh	Rough broken land	VIIe–3
Sa	Sawmill, Colo, and Lawson soils	IIIw–14
SbB	Scandia-Burnsville loamy sands, 2 to 6 percent slopes	IVs–3a
SbB2	Scandia-Burnsville loamy sands, 2 to 6 percent slopes, moderately eroded	IVs–3a
SbC	Scandia-Burnsville loamy sands, 6 to 12 percent slopes	VIIs–1
SbC2	Scandia-Burnsville loamy sands, 6 to 12 percent slopes, moderately eroded	VIIs–1
SbE	Scandia-Burnsville loamy sands, 12 to 45 percent slopes	VIIs–1
SbE2	Scandia-Burnsville loamy sands, 12 to 45 percent slopes, moderately eroded	VIIs–1
TaB	Tallula-Timula silt loams, 2 to 6 percent slopes	IIe–1a
TaB2	Tallula-Timula silt loams, 2 to 6 percent slopes, moderately eroded	IIe–1a
TaC	Tallula-Timula silt loams, 6 to 12 percent slopes	IIIe–1a
TaC2	Tallula-Timula silt loams, 6 to 12 percent slopes, moderately eroded	IIIe–1a
TaD	Tallula-Timula silt loams, 12 to 18 percent slopes	IVe–1
TaD2	Tallula-Timula silt loams, 12 to 18 percent slopes, moderately eroded	IVe–1
TaE	Tallula-Timula silt loams, 18 to 30 percent slopes	VIe–1
TaE2	Tallula-Timula silt loams, 18 to 30 percent slopes, moderately eroded	VIe–1
WaA	Waukegan silt loam, 0 to 2 percent slopes	I–1
WaB	Waukegan silt loam, 2 to 6 percent slopes	IIe–2d
WaB2	Waukegan silt loam, 2 to 6 percent slopes, moderately eroded	IIe–2d
WaC2	Waukegan silt loam, 6 to 18 percent slopes, moderately eroded	IIIe–2c
Wb	Webster silty clay loam	IIw–1a
WcB	Whalan silt loam, 0 to 6 percent slopes	IIIe–3
WcB2	Whalan silt loam, 0 to 6 percent slopes, moderately eroded	IIIe–3
WcC2	Whalan silt loam, 6 to 12 percent slopes, moderately eroded	IVe–3
WcD2	Whalan silt loam, 12 to 30 percent slopes, moderately eroded	VIe–3

DAKOTA COUNTY



RICE COUNTY

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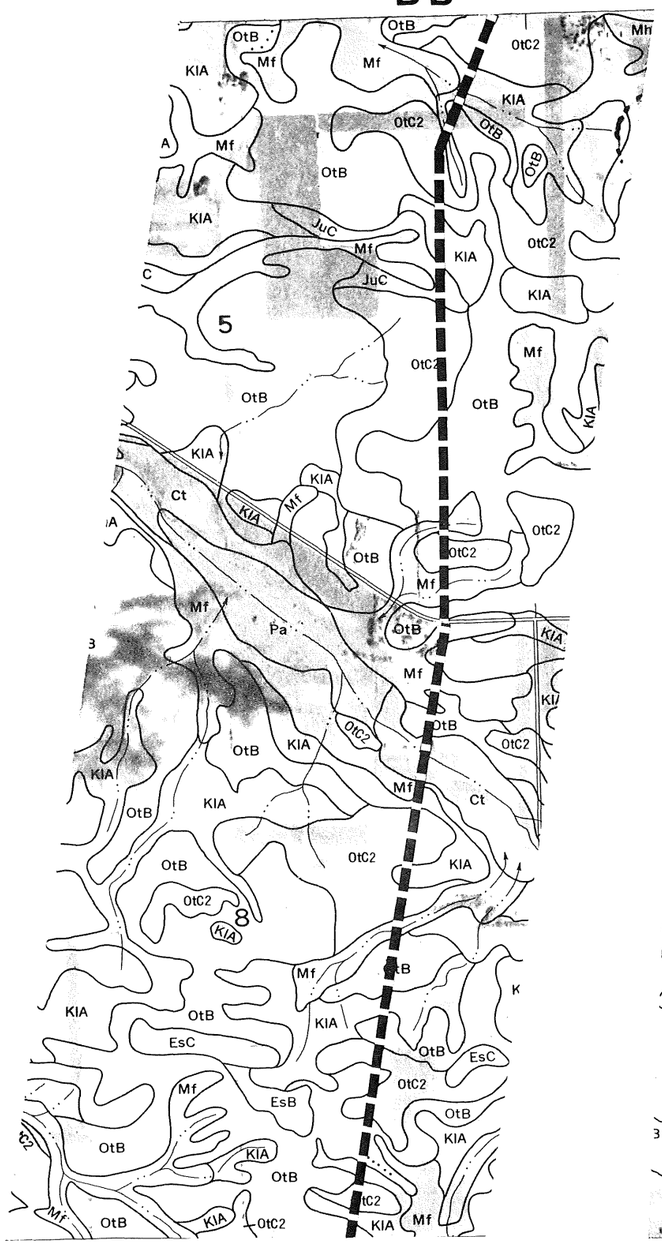

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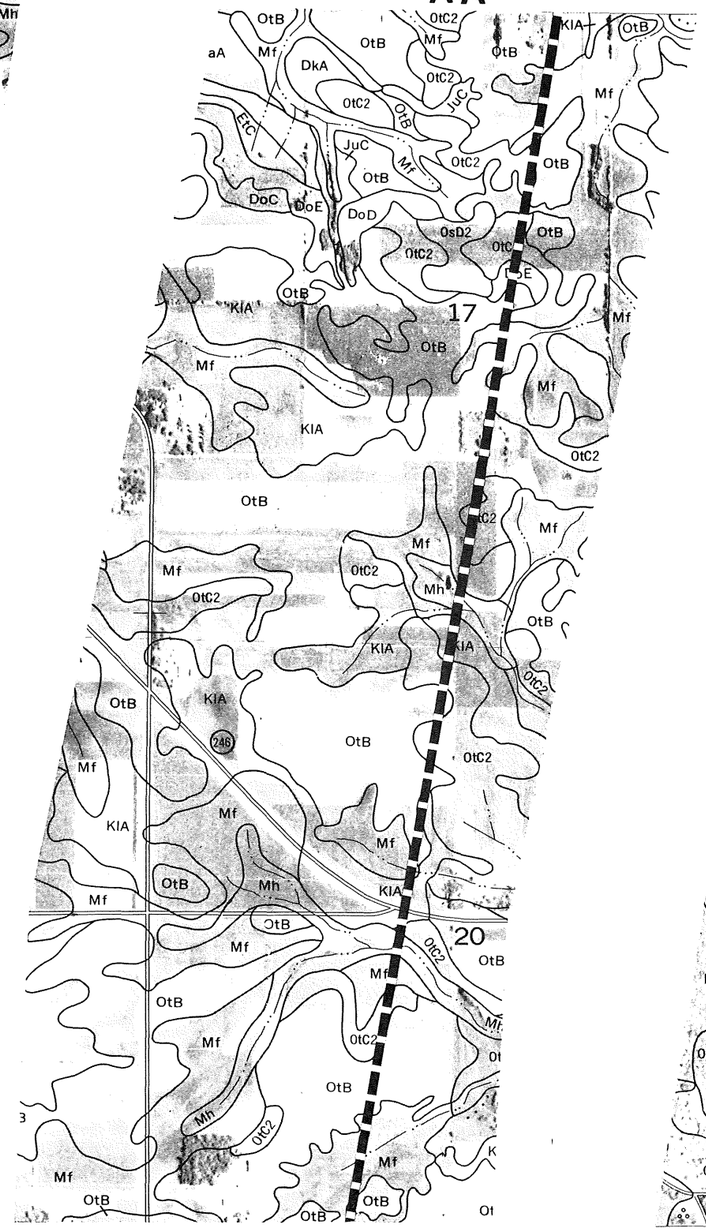

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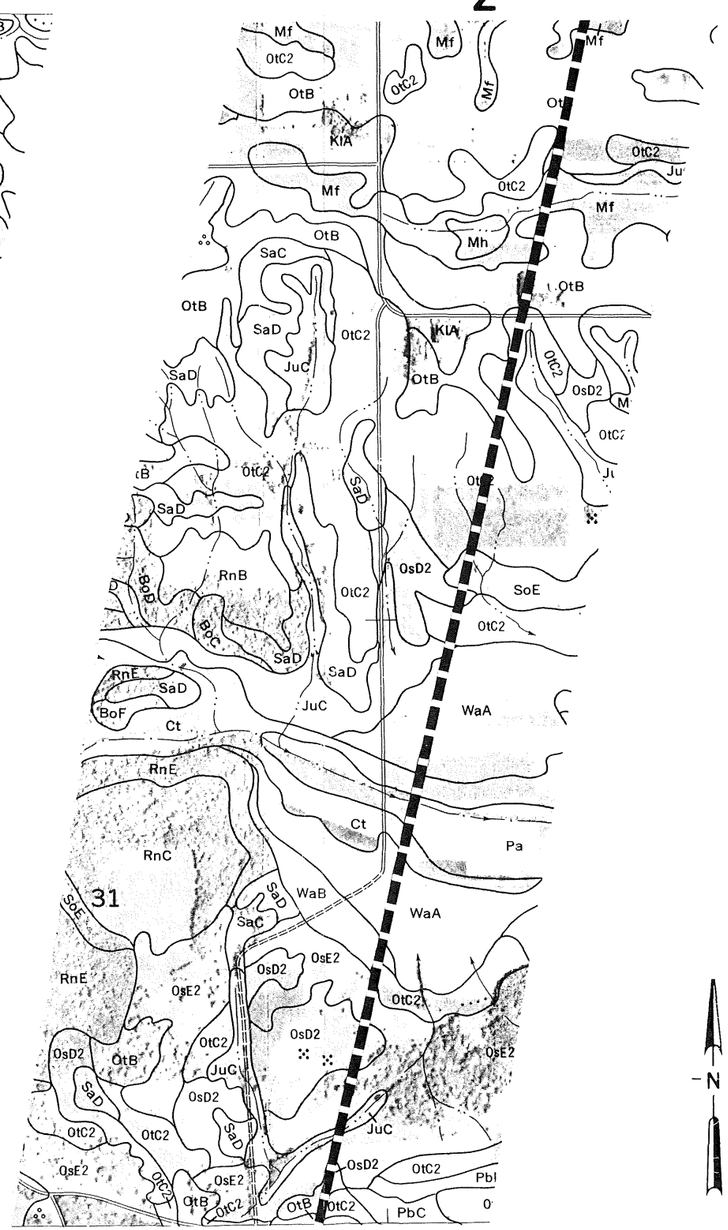

AA Z Y

1 ¾ ½ ¼ 0 1 Mile

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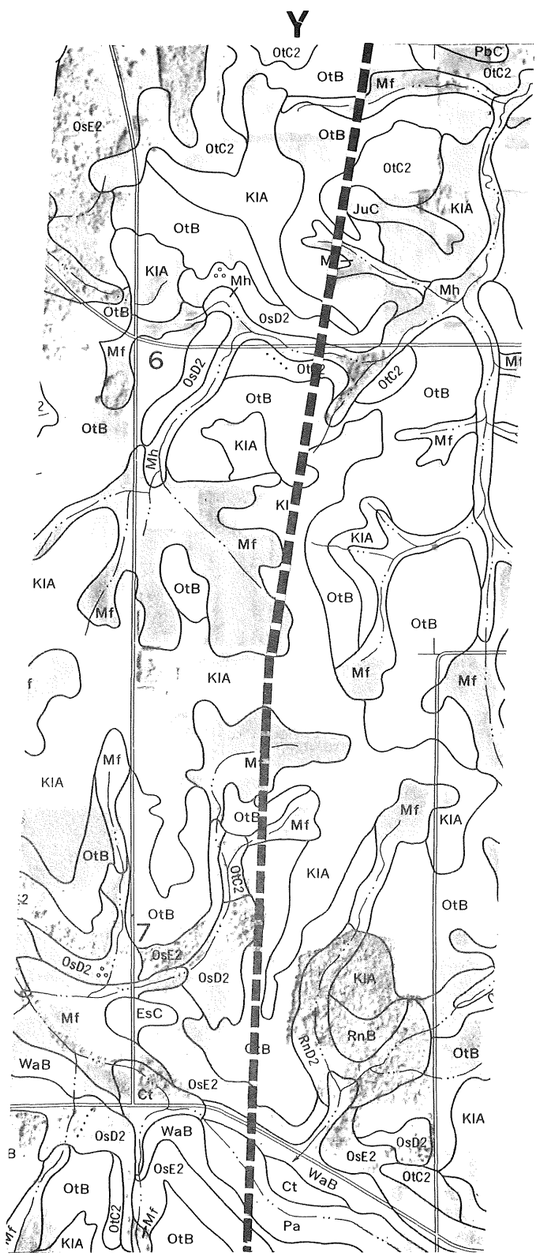
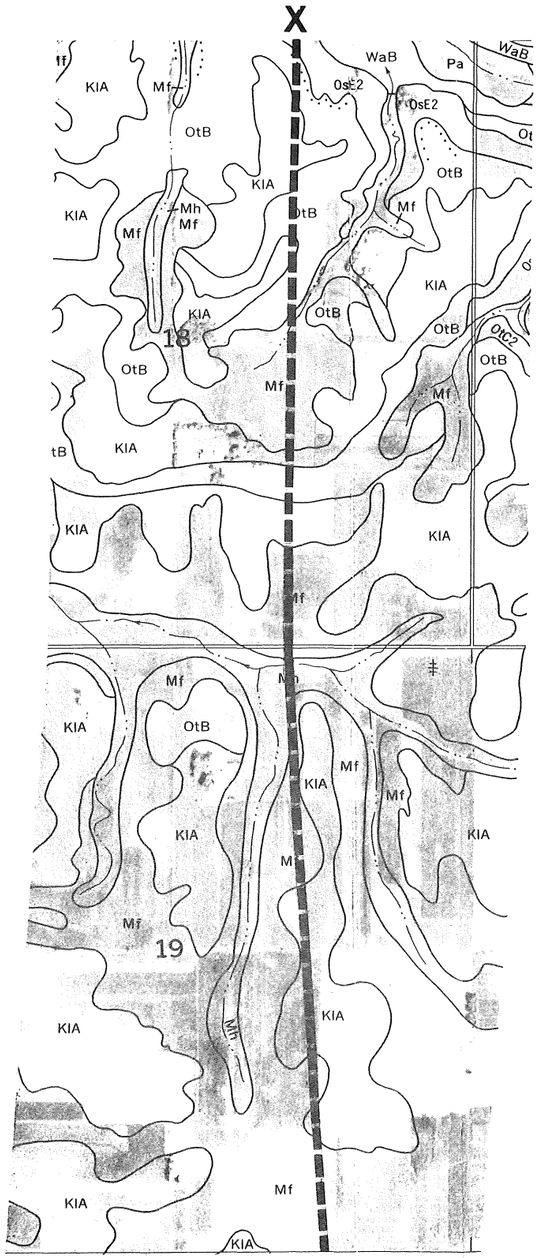
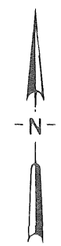
Scale 1 :15 840

N

RICE COUNTY







1 ¾ ½ ¼ 0 1 Mile

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RICE COUNTY

WEST ALTERNATE ROUTE

EAST ALTERNATE ROUTE

1 ¾ ½ ¼ 0 1 Mile

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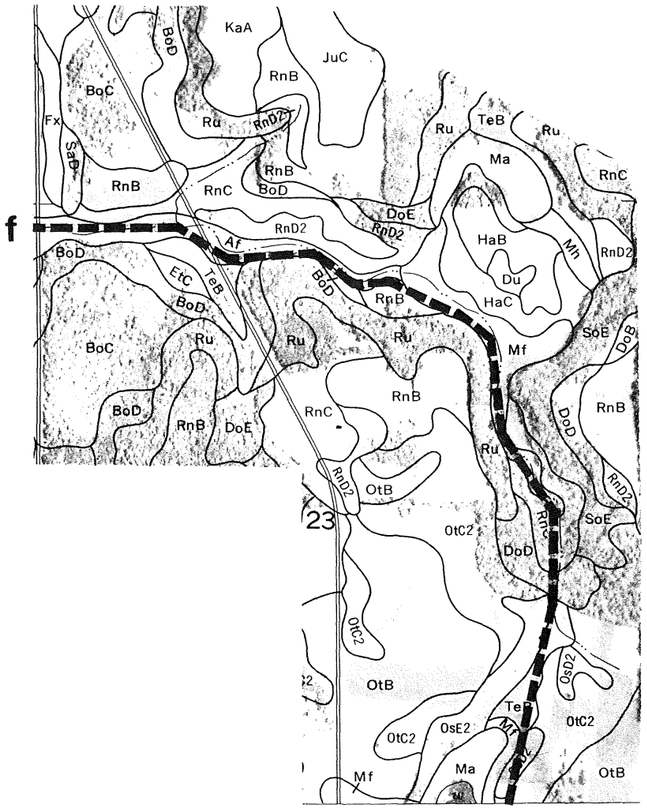
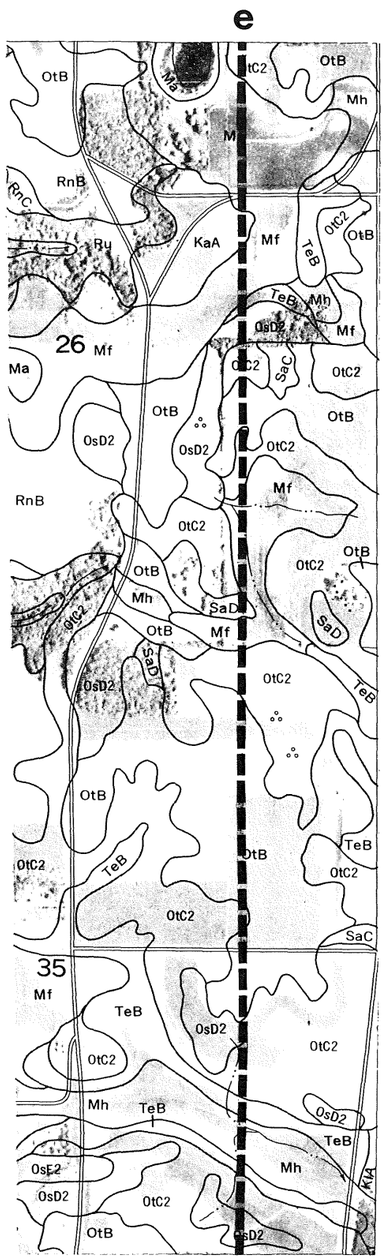
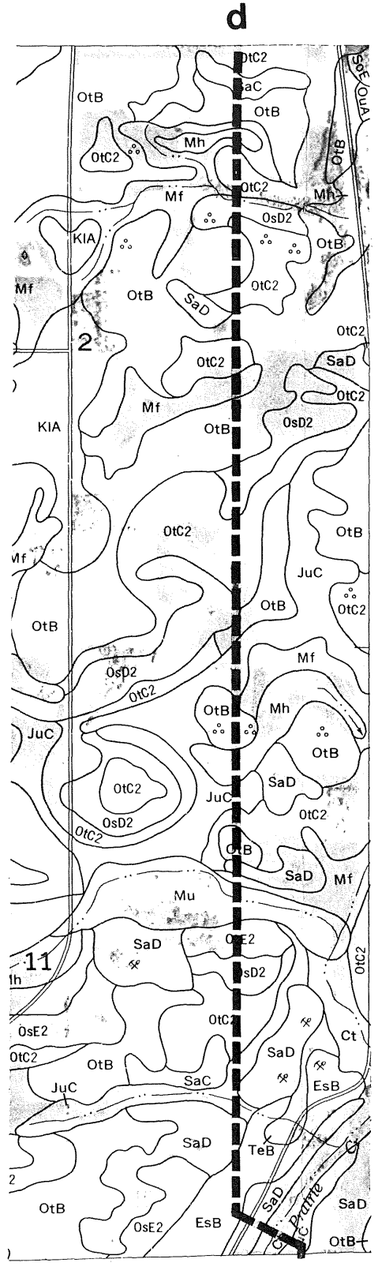
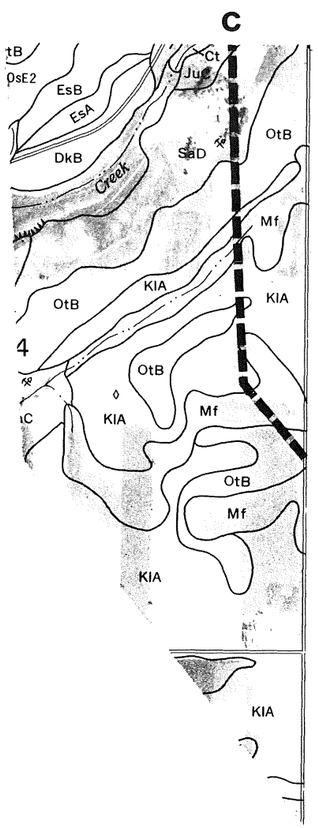
Scale 1 :15 840

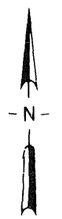
RICE COUNTY











1 ¾ ½ ¼ 0 1 Mile

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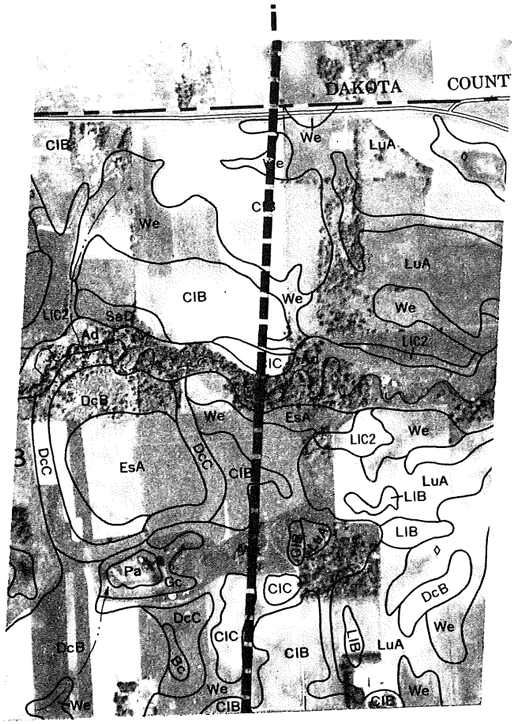
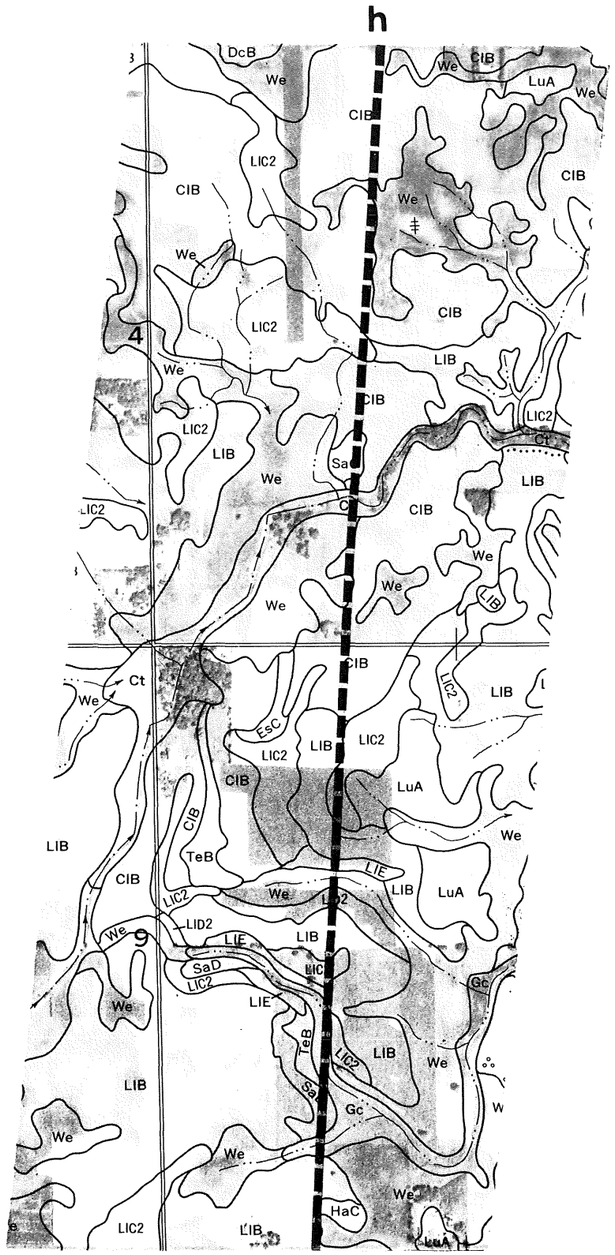
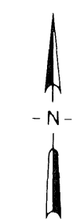
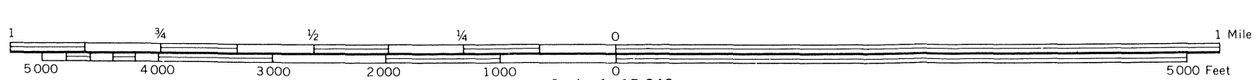
Scale 1 :15 840

RICE COUNTY









Scale 1 :15 840

RICE COUNTY

U
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OtB
Mf
Ad
KIA
OtC2
TeB
JuC
Mh
EsB
MoB
MnA
Mb
Mc
Mn.
MoC
1 Mile
5000 Feet
Scale 1 :15 840

RICE COUNTY

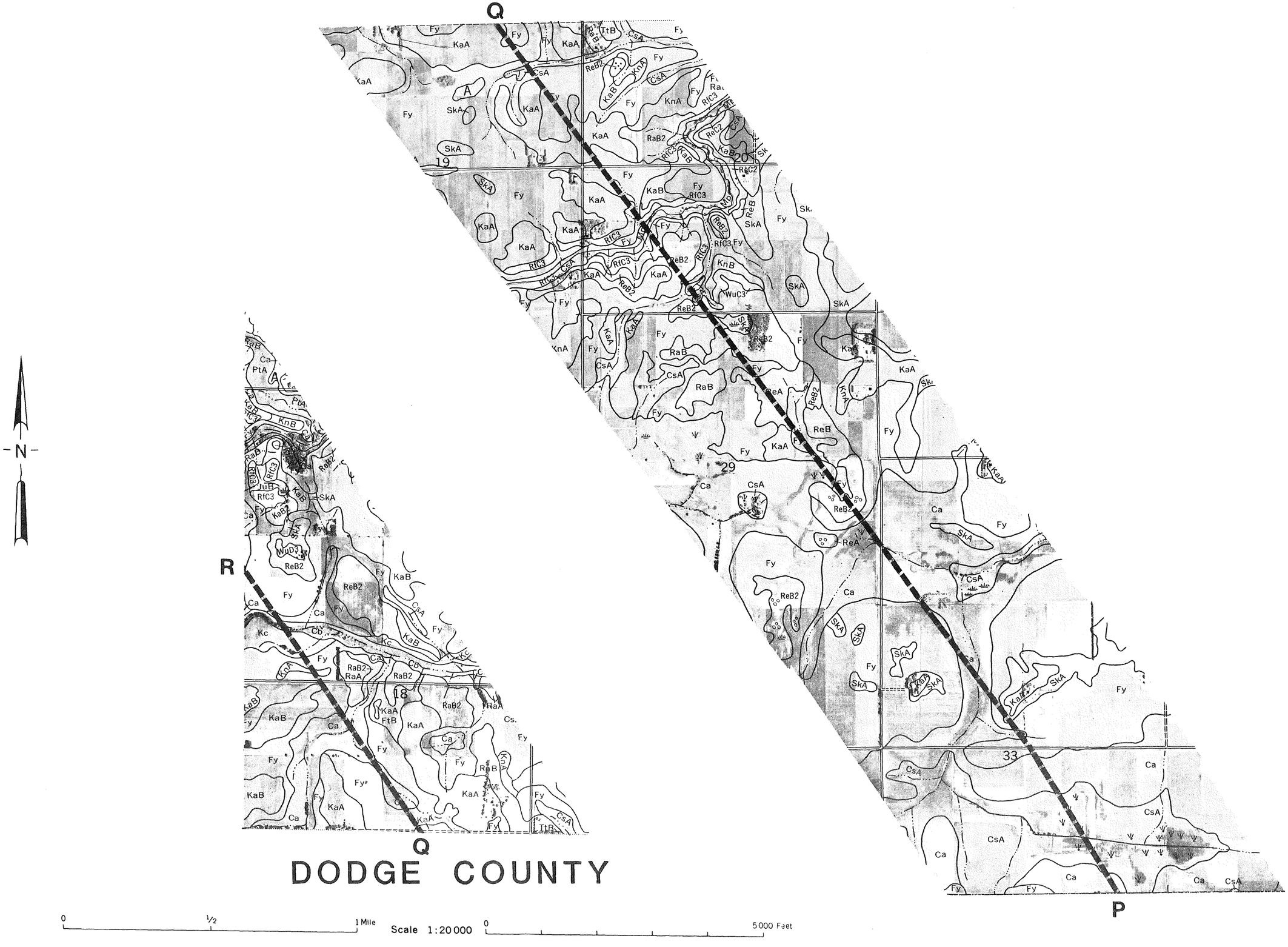
Map symbol	Mapping unit	Capability unit
Ad	Alluvial land	IIw-3
Af	Alluvial land, frequently flooded	VIw-1
Bc	Biscay loam	IIw-2
Bk	Biscay loam, seepy variant	VIw-2
BoC	Boone fine sand, 2 to 12 percent slopes	VIs-1
BoD	Boone fine sand, 12 to 25 percent slopes	VIIs-1
BoF	Boone fine sand, 25 to 40 percent slopes	VIIs-1
Ca	Canisteo clay loam	IIw-1
Cd	Canisteo clay loam, depressional	IIIw-1
Ck	Caron muck	IIIw-2
ClB	Clarion loam, 2 to 6 percent slopes	IIe-1
ClC	Clarion loam, 6 to 12 percent slopes	IIIe-1
CnC2	Clarion-Estherville-Storden complex, 4 to 12 percent slopes, eroded	IIIe-4
	Clarion and Storden	------
	Estherville	------
CsC	Clarion-Storden loams, 6 to 12 percent slopes	IIIe-1
CsD	Clarion-Storden loams, 12 to 18 percent slopes	IVe-1
CsE	Clarion-Storden loams, 18 to 25 percent slopes	VIe-1
Ct	Colo silty clay loam	IIw-1
CvA	Copaston sandy clay loam, 0 to 2 percent slopes	IIIs-1
Cy	Cordova clay loam	IIw-1
DcA	Dickman sandy loam, 0 to 2 percent slopes	IIIs-1
DcB	Dickman sandy loam, 2 to 6 percent slopes	IIIe-4
DoC	Dickman sandy loam, 6 to 12 percent slopes	IVe-4
DkA	Dickman sandy loam, benches, 0 to 2 percent slopes	IIIs-1
DkB	Dickman sandy loam, benches, 2 to 6 percent slopes	IIIe-4
DoB	Dodgeville silt loam, 2 to 6 percent slopes	IIIe-4
DoC	Dodgeville silt loam, 6 to 12 percent slopes	IVe-4
DoD	Dodgeville silt loam, 12 to 18 percent slopes	VIe-2
DoE	Dodgeville silt loam, 18 to 25 percent slopes	VIIe-1
Du	Dundas silt loam	IIIw-3
ErB	Erin silt loam, 2 to 6 percent slopes	IIe-3
ErC2	Erin silt loam, 6 to 12 percent slopes, eroded	IIIe-3
ErD2	Erin silt loam, 12 to 18 percent slopes, eroded	IVe-3
ErE	Erin silt loam, 18 to 30 percent slopes	VIe-1
EsA	Estherville sandy loam, 0 to 2 percent slopes	IIIs-1
EsB	Estherville sandy loam, 2 to 6 percent slopes	IIIe-4
EsC	Estherville sandy loam, 6 to 12 percent slopes	IVe-4
EtB	Etter fine sandy loam, 2 to 6 percent slopes	IIIe-4
EtC	Etter fine sandy loam, 6 to 15 percent slopes	VIe-2
FaA	Fairhaven silt loam, 0 to 2 percent slopes	IIs-1
FaB	Fairhaven silt loam, 2 to 6 percent slopes	IIe-4
FlA	Fairhaven silt loam, loamy subsoil variant, 0 to 2 percent slopes	I-1
FlB	Fairhaven silt loam, loamy subsoil variant, 2 to 6 percent slopes	IIe-1
Fx	Faxon clay loam	VIw-2
Ga	Garwin silty clay loam	IIw-1
Gc	Glencoe clay loam	IIIw-1
HaB	Hayden loam, 2 to 6 percent slopes	IIe-2
HaC	Hayden loam, 6 to 12 percent slopes	IIIe-2
HaD	Hayden loam, 12 to 18 percent slopes	IVe-2
HaE	Hayden loam, 18 to 30 percent slopes	VIe-1
JuC	Judson silt loam, 4 to 12 percent slopes	IIIe-1
KaA	Kasson silt loam, 1 to 3 percent slopes	IIe-3
Kc	Kato silty clay loam	IIw-2
KkB	Kilkenny clay loam, 2 to 6 percent slopes	IIe-3
KkC2	Kilkenny clay loam, 6 to 12 percent slopes, eroded	IIIe-3
KkD2	Kilkenny clay loam, 12 to 18 percent slopes, eroded	IVe-3
KkE	Kilkenny clay loam, 18 to 25 percent slopes	VIe-1
KlA	Klinger silt loam, 1 to 3 percent slopes	I-1
La	Lake beaches	VIw-1
LbB	Lerdal silt loam, 1 to 6 percent slopes	IIe-3
LeC2	Lerdal clay loam, 6 to 12 percent slopes, eroded	IIIe-3
LeD2	Lerdal clay loam, 12 to 18 percent slopes, eroded	IVe-3
LlB	Lester loam, 2 to 6 percent slopes	IIe-1
LlC	Lester loam, 6 to 12 percent slopes	IIIe-1
LlC2	Lester loam, 6 to 12 percent slopes, eroded	IIIe-1
LlD2	Lester loam, 12 to 18 percent slopes, eroded	IVe-1
LlE	Lester loam, 18 to 25 percent slopes	VIe-1
LuA	Le Sueur clay loam, 1 to 3 percent slopes	I-1
Ma	Marsh	VIIIw-1
Mb	Maxcreek silty clay loam	IIw-1
Mc	Maxcreek silty clay loam, swales	IIIw-1
Mf	Maxfield silty clay loam	IIw-1
Mh	Maxfield silty clay loam, swales	IIIw-1
Mk	Mazaska silty clay loam	IIw-1
MnA	Merton silt loam, 1 to 3 percent slopes	I-1
MoB	Moland silt loam, 2 to 6 percent slopes	IIe-1
MoC	Moland silt loam, 6 to 12 percent slopes	IIIe-1
MoD2	Moland silt loam, 12 to 18 percent slopes, eroded	IVe-1
Mu	Muskego muck	IIIw-2
NcA	Nicollet clay loam, 1 to 3 percent slopes	I-1
OsD2	Ostrander loam, 12 to 18 percent slopes, eroded	IVe-1
OsE2	Ostrander loam, 18 to 30 percent slopes, eroded	VIe-1
OtB	Ostrander silt loam, 2 to 6 percent slopes	IIe-1
OtC2	Ostrander silt loam, 6 to 12 percent slopes, eroded	IIIe-1
OuA	Ostrander silt loam, bedrock substratum, 0 to 2 percent slopes	I-1
Pa	Palms muck	IIIw-2
PbA	Port Byron silt loam, 0 to 2 percent slopes	I-1
PbB	Port Byron silt loam, 2 to 6 percent slopes	IIe-1
PbC	Port Byron silt loam, 6 to 12 percent slopes	IIIe-1
PbD	Port Byron silt loam, 12 to 18 percent slopes	IVe-1
PoC	Port Byron-Bold silt loams, 6 to 12 percent slopes	IIIe-1
PoD	Port Byron-Bold silt loams, 12 to 18 percent slopes	IVe-1
RnB	Renova silt loam, 2 to 6 percent slopes	IIe-2
RnC	Renova silt loam, 6 to 12 percent slopes	IIIe-2
RnD2	Renova silt loam, 12 to 18 percent slopes, eroded	IVe-2
RnE	Renova silt loam, 18 to 30 percent slopes	VIe-1
Ro	Rolfe silty clay loam	IIIw-1
Ru	Rough broken land	VIIe-1
SaC	Salida gravelly sandy loam, 4 to 12 percent slopes	VIs-1
SaD	Salida gravelly sandy loam, 12 to 30 percent slopes	VIIs-1
Sh	Shields silt loam	IIIw-3
Sk	Skyberg silt loam	IIIw-3
SoE	Sogn stony loam, 18 to 35 percent slopes	VIIs-1
TeB	Terril loam, 1 to 6 percent slopes	IIe-1
TeC	Terril loam, 6 to 12 percent slopes	IIIe-1
VlA	Vlasaty silt loam, 1 to 4 percent slopes	IIe-3
WaA	Waukegan silt loam, 0 to 2 percent slopes	IIs-1
WaB	Waukegan silt loam, 2 to 6 percent slopes	IIe-4
We	Webster clay loam	IIw-1
Zu	Zumbro sandy loam	IIw-3

RICE COUNTY

STEELE COUNTY

1 Mile
¾ ½ ¼ 0
5000 4000 3000 2000 1000 0 5000 Feet
Scale 1:20000

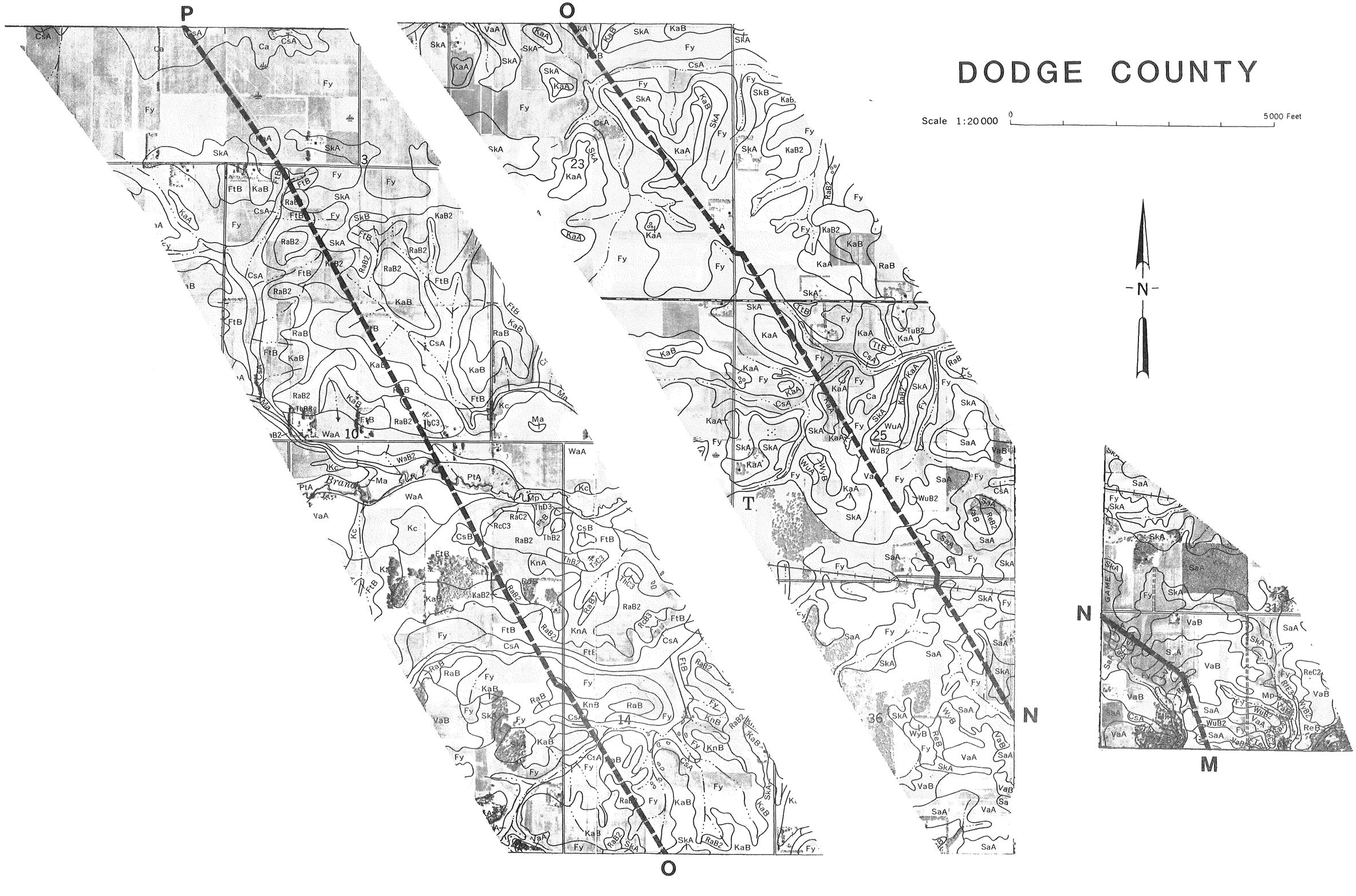
Map symbol	Mapping unit	Capability unit
Ad	Alluvial land, occasionally flooded	IIw-3
Af	Alluvial land, frequently flooded	VIw-1
Bc	Biscay loam	IIw-1
Bd	Biscay loam, depressional	IIIw-1
BlA	Bixby loam, 0 to 2 percent slopes	IIs-1
BlB	Bixby loam, 2 to 6 percent slopes	IIe-4
BlB2	Bixby loam, 2 to 6 percent slopes, eroded	IIe-4
BlC2	Bixby loam, 6 to 12 percent slopes, eroded	IIIe-4
BlD2	Bixby loam, 12 to 18 percent slopes, eroded	IVe-2
BoB2	Blooming silt loam, 2 to 6 percent slopes, eroded	IIe-1
BoC2	Blooming silt loam, 6 to 14 percent slopes, eroded	IIIe-1
BuB	Burnsville sandy loam, 2 to 6 percent slopes	IIIe-3
BuC	Burnsville sandy loam, 6 to 12 percent slopes	IVe-2
Ca	Calco silty clay loam, very wet	VIw-1
Cc	Canisteo silty clay loam	IIw-2
Cd	Canisteo silty clay loam, depressional	IIIw-3
Ce	Canisteo clay loam	IIw-2
Cf	Canisteo clay loam, depressional	IIIw-3
ChD	Chelsea loamy fine sand, 2 to 18 percent slopes	VIs-1
CkB2	Clarion sandy loam, 2 to 6 percent slopes, eroded	IIe-1
ClB	Clarion loam, 2 to 6 percent slopes	IIe-1
ClB2	Clarion loam, 2 to 6 percent slopes, eroded	IIe-1
ClC2	Clarion loam, 6 to 12 percent slopes, eroded	IIIe-1
CsC2	Clarion-Storden complex, 6 to 12 percent slopes, eroded	IIIe-1
CsD2	Clarion-Storden complex, 12 to 18 percent slopes, eroded	IVe-1
Ct	Colo silty clay loam, occasionally flooded	IIw-1
Cu	Colo silty clay loam, frequently flooded	VIw-1
DaA	Dakota sandy loam, 0 to 2 percent slopes	IIIs-1
DaB	Dakota sandy loam, 2 to 6 percent slopes	IIIe-4
DaC	Dakota sandy loam, 6 to 14 percent slopes	IVe-2
DkA	Dakota loam, 0 to 2 percent slopes	IIs-1
DkB	Dakota loam, 2 to 6 percent slopes	IIe-4
DtA	Dickinson sandy loam, terrace, 0 to 2 percent slopes	IIIs-1
DtB	Dickinson sandy loam, terrace, 2 to 6 percent slopes	IIIe-3
Du	Dundas silt loam	IIIw-2
EaA	Estherville sandy loam, 0 to 2 percent slopes	IIIs-1
EaB	Estherville sandy loam, 2 to 6 percent slopes	IIIe-3
EaC	Estherville sandy loam, 6 to 12 percent slopes	IVe-2
EaD	Estherville sandy loam, 12 to 18 percent slopes	VIe-2
Gc	Glencoe clay loam	IIIw-1
Hk	Hanska loam	IIw-1
Hm	Havana silt loam	IIIw-2
HnB2	Hayden sandy loam, 2 to 6 percent slopes, eroded	IIe-2
HnC2	Hayden sandy loam, 6 to 12 percent slopes, eroded	IIIe-2
HoB	Hayden loam, 2 to 6 percent slopes	IIe-2
HoB2	Hayden loam, 2 to 6 percent slopes, eroded	IIe-2
HoC	Hayden loam, 6 to 12 percent slopes	IIIe-2
HoC2	Hayden loam, 6 to 12 percent slopes, eroded	IIIe-2
HoD	Hayden loam, 12 to 18 percent slopes	IVe-1
HoD2	Hayden loam, 12 to 18 percent slopes, eroded	IVe-1
Hs	Hayfield silt loam	IIs-1
Kc	Kato silty clay loam	IIw-1
Kd	Kato silty clay loam, swales	IIIw-1
Ke	Kato silty clay loam, calcareous variant	IIw-2
Kf	Kato silty clay loam, calcareous variant, depressional	IIIw-3
KkB2	Kilkenny clay loam, 2 to 6 percent slopes, eroded	IIe-3
KkC2	Kilkenny clay loam, 6 to 12 percent slopes, eroded	IIIe-2
La	Lake beaches	VIw-1
LcB	Lamont sandy loam, 2 to 6 percent slopes	IIIe-3
LcC	Lamont sandy loam, 6 to 12 percent slopes	IVe-2
LcD	Lamont sandy loam, 12 to 18 percent slopes	VIe-2
Ld	Lemond loam	IIw-2
LeB	Lerdal silty clay loam, 2 to 6 percent slopes	IIe-3
LeB2	Lerdal silty clay loam, 2 to 6 percent slopes, eroded	IIe-3
LlB	Lester loam, 2 to 6 percent slopes	IIe-1
LlB2	Lester loam, 2 to 6 percent slopes, eroded	IIe-1
LlC	Lester loam, 6 to 12 percent slopes	IIIe-1
LlC2	Lester loam, 6 to 12 percent slopes, eroded	IIIe-1
LlD2	Lester loam, 12 to 18 percent slopes, eroded	IVe-1
LmB2	Lester-Estherville-Storden complex, 2 to 6 percent slopes, eroded	IIIe-4
LmD2	Lester-Estherville-Storden complex, 6 to 18 percent slopes, eroded	VIe-1
LnE	Lester and Hayden loams, 18 to 25 percent slopes	VIe-1
LnF	Lester and Hayden loams, 25 to 35 percent slopes	VIIe-1
LoC2	Lester-Storden complex, 6 to 12 percent slopes, eroded	IIIe-1
LoD2	Lester-Storden complex, 12 to 18 percent slopes, eroded	IVe-1
LuA	Le Sueur clay loam, 0 to 2 percent slopes	I-1
LuB	Le Sueur clay loam, 2 to 4 percent slopes	IIe-1
Ly	Lura silty clay loam	IIIw-1
Ma	Madelia silty clay loam	IIw-1
Mc	Marna silty clay loam	IIw-1
Mh	Marsh	VIIIw-1
Mm	Maxcreek silty clay loam	IIw-1
Mn	Maxcreek silty clay loam, swales	IIIw-1
Mo	Mayer loam	IIw-2
MrA	Merton silt loam, 0 to 2 percent slopes	I-1
MrB	Merton silt loam, 2 to 4 percent slopes	IIe-1
MsA	Moland silt loam, 0 to 2 percent slopes	I-1
MsB	Moland silt loam, 2 to 6 percent slopes	IIe-1
MsB2	Moland silt loam, 2 to 8 percent slopes, eroded	IIe-1
Mu	Muck	IIIw-4
Mv	Muck, calcareous	IIIw-4
Mw	Muck, sandy substratum	IIIw-4
My	Muck, loamy substratum	IIIw-4
NbA	Newry silt loam, 0 to 3 percent slopes	IIe-2
NcA	Nicollet clay loam, 0 to 2 percent slopes	I-1
NcB	Nicollet clay loam, 2 to 4 percent slopes	IIe-1
SaE	Salida gravelly loamy sand, 12 to 25 percent slopes	VIIs-1
Sh	Shields silty clay loam	IIIw-2
SkB	Sparta-Dickinson complex, 2 to 6 percent slopes	VIs-1
SkC	Sparta-Dickinson complex, 6 to 12 percent slopes	VIs-1
SkE	Sparta-Dickinson complex, 12 to 25 percent slopes	VIIs-1
Ta	Talcot clay loam	IIIw-3
Te	Terril loam, occasionally flooded	IIw-3
Tf	Terril loam, frequently flooded	VIw-1
Ud	Udolpho silt loam	IIw-1
WaA	Wadena loam, 0 to 2 percent slopes	IIs-1
WaB	Wadena loam, 2 to 6 percent slopes	IIe-4
WaC2	Wadena loam, 6 to 12 percent slopes, eroded	IIIe-4
WgA	Waukegan silt loam, 0 to 2 percent slopes	IIs-1
WgB	Waukegan silt loam, 2 to 6 percent slopes	IIe-4
Wt	Webster clay loam	IIw-1



DODGE COUNTY

DODGE COUNTY

Scale 1:20 000 0 5000 Feet



DODGE COUNTY

5000 Feet
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Scale 1:20000

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WESTERN

CHICAGO

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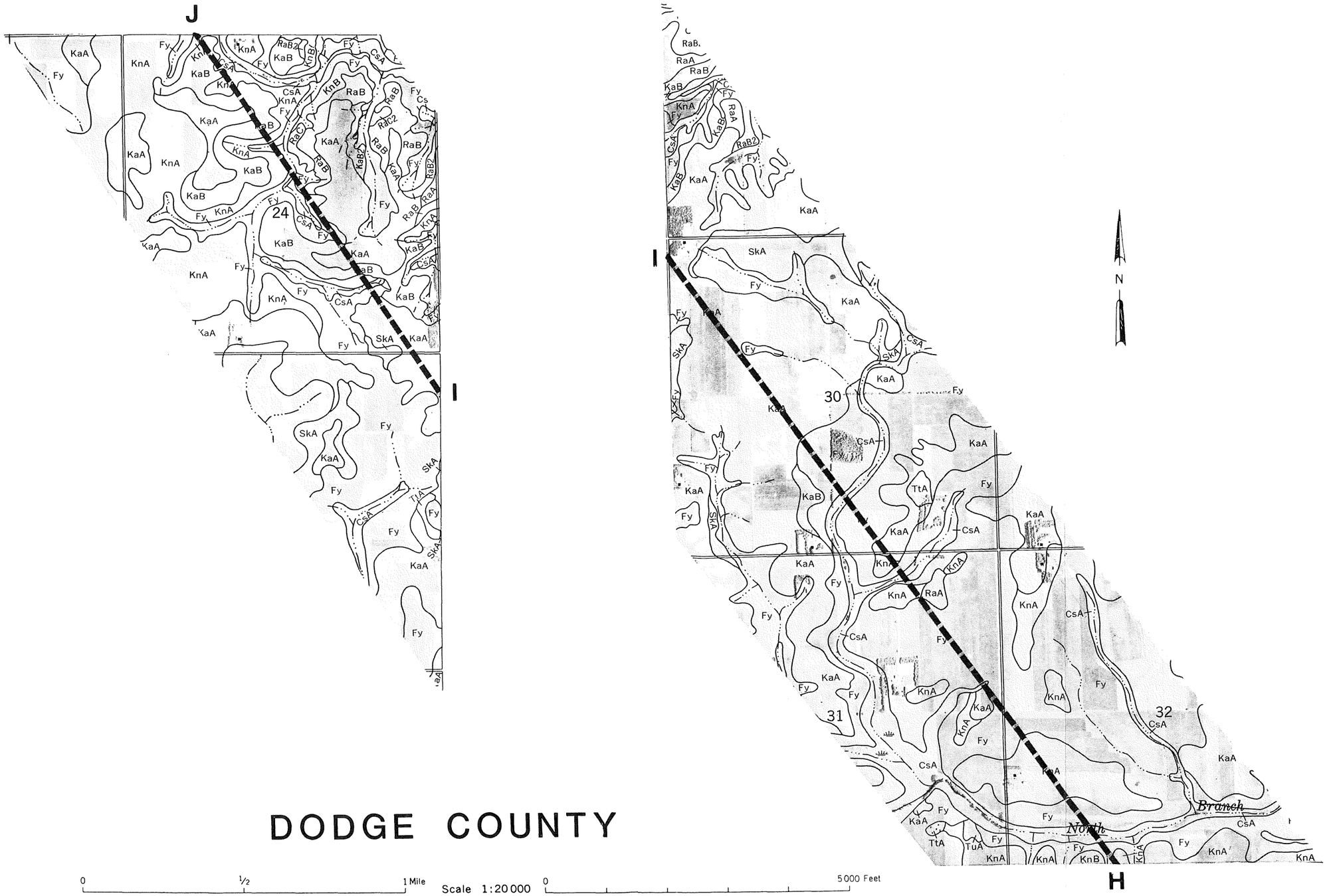


DODGE COUNTY

0 ½ 1 Mile

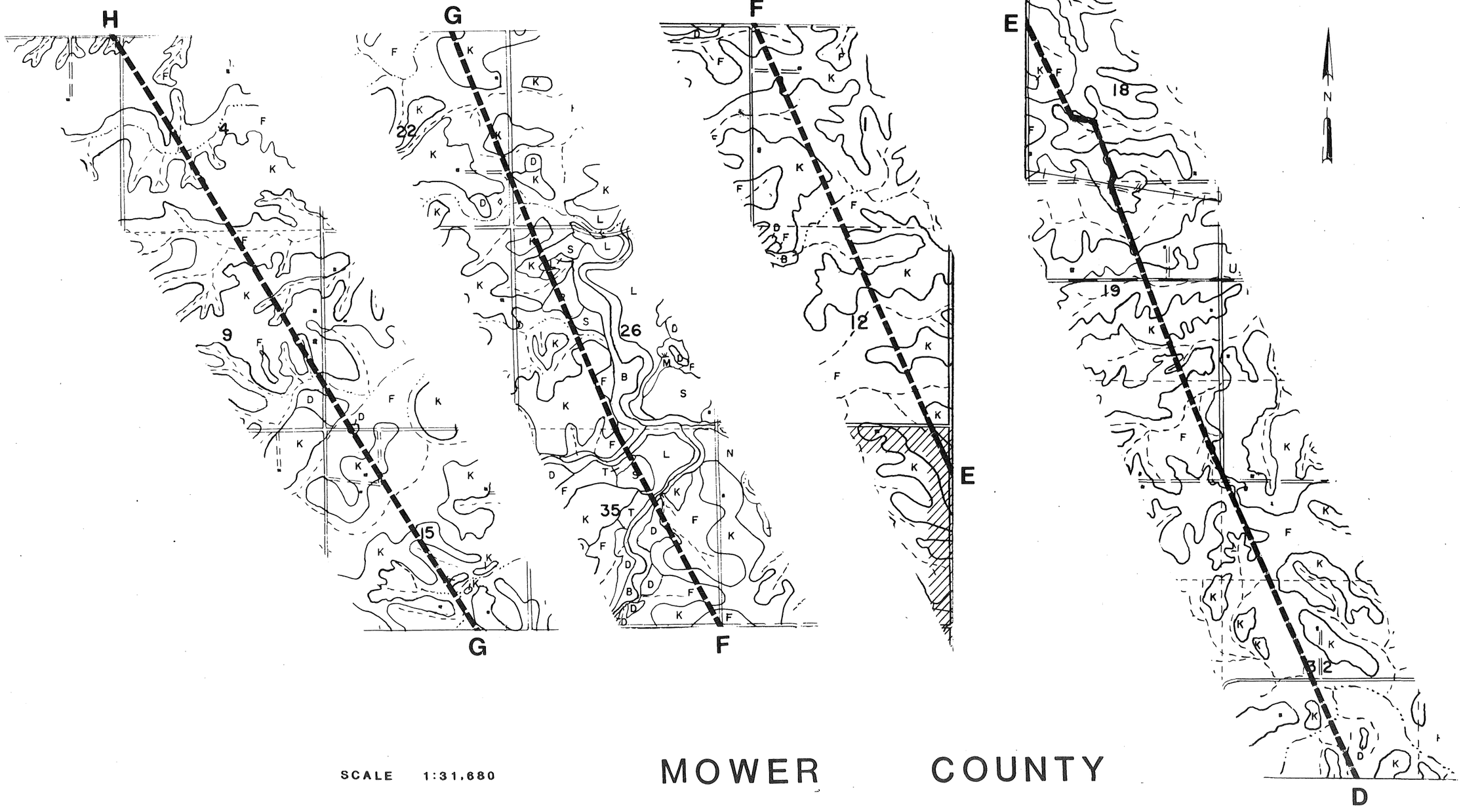
Scale 1:20000

0 5000 Feet

GUIDE TO MAPPING UNITS

Map symbol	*Mapping unit*	*Capability unit*
Ad	Alluvial land	IIw–4
BbA	Bixby loam, 0 to 2 percent slopes	IIs–1
BbB2	Bixby loam, 2 to 6 percent slopes, eroded	IIe–3
BxA	Bixby loam, shallow, 0 to 2 percent slopes	IIIs–1
BxB2	Bixby loam, shallow, 2 to 6 percent slopes, eroded	IIIs–3
Ca	Canisteo silty clay loam	IIIw–4
Cb	Canisteo silty clay loam, coarse substratum	IIIw–5
ChA	Chaseburg silt loam, 0 to 2 percent slopes	IIw–4
ChB	Chaseburg silt loam, 2 to 6 percent slopes	IIw–5
CsA	Clyde silty clay loam, 0 to 2 percent slopes	IIIw–4
CsB	Clyde silty clay loam, 2 to 6 percent slopes	VIw–2
DaA	Dakota sandy loam, 0 to 2 percent slopes	IIIs–1
DaB2	Dakota sandy loam, 2 to 6 percent slopes, moderately eroded	IIIs–2
DaC2	Dakota sandy loam, 6 to 12 percent slopes, moderately eroded	IVs–1
DoA	Downs silt loam, 0 to 2 percent slopes	I–1
DoB	Downs silt loam, 2 to 6 percent slopes	IIe–1
DoB2	Downs silt loam, 2 to 6 percent slopes, moderately eroded	IIe–1
DoC2	Downs silt loam, 6 to 12 percent slopes, moderately eroded	IIIe–1
DoC3	Downs silt loam, 6 to 12 percent slopes, severely eroded	IIIe–1
DoD2	Downs silt loam, 12 to 25 percent slopes, moderately eroded	IVe–1
FaA	Fayette silt loam, 0 to 2 percent slopes	I–2
FaB	Fayette silt loam, 2 to 6 percent slopes	IIe–2
FaB2	Fayette silt loam, 2 to 6 percent slopes, moderately eroded	IIe–2
FaC	Fayette silt loam, 6 to 12 percent slopes	IIIe–1
FaC2	Fayette silt loam, 6 to 12 percent slopes, moderately eroded	IIIe–1
FaD	Fayette silt loam, 12 to 18 percent slopes	IVe–1
FaD2	Fayette silt loam, 12 to 18 percent slopes, moderately eroded	IVe–1
FaC3	Fayette silt loam, 6 to 12 percent slopes, severely eroded	IIIe–1
FaD3	Fayette silt loam, 12 to 18 percent slopes, severely eroded	IVe–1
FsE2	Fayette and Seaton silt loams, 18 to 25 percent slopes, eroded	VIe–1
FsF2	Fayette and Seaton silt loams, 25 to 35 percent slopes, moderately eroded	VIIe–1
FsE3	Fayette and Seaton silt loams, 18 to 25 percent slopes, severely eroded	VIe–1
FtB	Floyd silty clay loam, 2 to 6 percent slopes	IIw–2
Fy	Floyd and Clyde silty clay loams	IIw–1
HaA	Hayfield silt loam, 0 to 2 percent slopes	IIs–1
HaB	Hayfield silt loam, 2 to 6 percent slopes	IIe–3
JuA	Judson silt loam, 0 to 2 percent slopes	IIw–4
JuB	Judson silt loam, 2 to 6 percent slopes	IIw–5
KaA	Kasson silt loam, 0 to 2 percent slopes	IIs–1
KaB	Kasson silt loam, 2 to 6 percent slopes	IIe–2
KaB2	Kasson silt loam, 2 to 6 percent slopes, moderately eroded	IIe–2
Kc	Kato silty clay loam	IIw–3
KnA	Kenyon silt loam, 0 to 2 percent slopes	I–1
KnB	Kenyon silt loam, 2 to 6 percent slopes	IIe–1
KnB2	Kenyon silt loam, 2 to 6 percent slopes, moderately eroded	IIe–1
Lo	Lawson and Orion silt loams	IIw–4
Ma	Marshan silty clay loam	IIIw–5
Mp	Mixed alluvial land, poorly drained	VIw–1
Mx	Mixed alluvial land, moderately well drained	VIw–1
OsA	Ostrander silt loam, 0 to 2 percent slopes	I–1
OsB	Ostrander silt loam, 2 to 6 percent slopes	IIe–1
OsB2	Ostrander silt loam, 2 to 6 percent slopes, moderately eroded	IIe–1
OsC2	Ostrander silt loam, 6 to 12 percent slopes, moderately eroded	IIIe–1
PmA	Peat and Muck, coarse substrata, 0 to 2 percent slopes	IIIw–7
PtA	Peat and Muck, medium textured substrata, 0 to 2 percent slopes	IIIw–6
PtB	Peat and Muck, medium textured substrata, 2 to 6 percent slopes	VIw–2
RaA	Racine silt loam, 0 to 2 percent slopes	I–1
RaB	Racine silt loam, 2 to 6 percent slopes	IIe–1
RaB2	Racine silt loam, 2 to 6 percent slopes, moderately eroded	IIe–1
RaC	Racine silt loam, 6 to 12 percent slopes	IIIe–1
RaC2	Racine silt loam, 6 to 12 percent slopes, moderately eroded	IIIe–1
RcB3	Racine soils, 2 to 6 percent slopes, severely eroded	IIe–2
RcC3	Racine soils, 6 to 12 percent slopes, severely eroded	IIIe–1
ReA	Renova silt loam, 0 to 2 percent slopes	I–2
ReB	Renova silt loam, 2 to 6 percent slopes	IIe–2
ReB2	Renova silt loam, 2 to 6 percent slopes, moderately eroded	IIe–2
ReC	Renova silt loam, 6 to 12 percent slopes	IIIe–1
ReC2	Renova silt loam, 6 to 12 percent slopes, moderately eroded	IIIe–1
ReD	Renova silt loam, 12 to 18 percent slopes	IVe–1
ReD2	Renova silt loam, 12 to 18 percent slopes, moderately eroded	IVe–1
ReE	Renova silt loam, 18 to 25 percent slopes	VIe–1
ReE2	Renova silt loam, 18 to 25 percent slopes, moderately eroded	VIe–1
ReF2	Renova silt loam, 25 to 35 percent slopes, eroded	VIIe–1
RfB3	Renova soils, 2 to 6 percent slopes, severely eroded	IIe–2
RfC3	Renova soils, 6 to 12 percent slopes, severely eroded	IIIe–1
RfD3	Renova soils, 12 to 18 percent slopes, severely eroded	IVe–1
RfE3	Renova soils, 18 to 25 percent slopes, severely eroded	VIe–1
RoB2	Rockton silt loam, 2 to 6 percent slopes, moderately eroded	IIIs–2
RoD	Rockton silt loam, 12 to 18 percent slopes	VIs–1
RoD2	Rockton silt loam, 12 to 18 percent slopes, moderately eroded	VIs–1
RpA	Rockton silt loam, moderately deep, 0 to 2 percent slopes	IIs–1
RpB	Rockton silt loam, moderately deep, 2 to 6 percent slopes	IIe–3
RpC	Rockton silt loam, moderately deep, 6 to 12 percent slopes	IIIe–2
RsC3	Rockton soils, 6 to 12 percent slopes, severely eroded	IVs–1
RsD3	Rockton soils, 12 to 18 percent slopes, severely eroded	VIs–1
Ru	Rough broken and stony land	VIIe–1
SaA	Sargeant silt loam, 0 to 2 percent slopes	IIIw–1
SeB	Seaton silt loam, 2 to 6 percent slopes	IIe–2
SeB2	Seaton silt loam, 2 to 6 percent slopes, moderately eroded	IIe–2
SeC	Seaton silt loam, 6 to 12 percent slopes	IIIe–1
SeC2	Seaton silt loam, 6 to 12 percent slopes, moderately eroded	IIIe–1
SeC3	Seaton silt loam, 6 to 12 percent slopes, severely eroded	IIIe–1
SeD	Seaton silt loam, 12 to 18 percent slopes	IVe–1
SeD2	Seaton silt loam, 12 to 18 percent slopes, moderately eroded	IVe–1
SeD3	Seaton silt loam, 12 to 18 percent slopes, severely eroded	IVe–1
SkA	Skyberg silt loam, 0 to 2 percent slopes	IIIw–1
SkB	Skyberg silt loam, 2 to 6 percent slopes	IIIw–3
TaA	Tama silt loam, 0 to 2 percent slopes	I–1
TaB	Tama silt loam, 2 to 6 percent slopes	IIe–1
TaB2	Tama silt loam, 2 to 6 percent slopes, moderately eroded	IIe–1
Te	Terrace escarpments	VIIe–1
ThB2	Thurston loam, 2 to 6 percent slopes, moderately eroded	IIe–3
ThB3	Thurston loam, 2 to 6 percent slopes, severely eroded	IIe–3
ThC	Thurston loam, 6 to 12 percent slopes	IIIe–3
ThC2	Thurston loam, 6 to 12 percent slopes, moderately eroded	IIIe–3
ThC3	Thurston loam, 6 to 12 percent slopes, severely eroded	IIIe–3
ThD3	Thurston loam, 12 to 18 percent slopes, severely eroded	VIs–1
TsB3	Thurston soils, 2 to 6 percent slopes, severely eroded	IIIs–3
TsC2	Thurston soils, 6 to 12 percent slopes, moderately eroded	IVs–1
TsC3	Thurston soils, 6 to 12 percent slopes, severely eroded	IVs–1
TtA	Thurston and Dickinson loams, 0 to 2 percent slopes	IIs–1
TtB	Thurston and Dickinson loams, 2 to 6 percent slopes	IIe–3
TuA	Thurston and Dickinson soils, 0 to 2 percent slopes	IIIs–1
TuB	Thurston and Dickinson soils, 2 to 6 percent slopes	IIIs–2
TuB2	Thurston and Dickinson soils, 2 to 6 percent slopes, moderately eroded	IIIs–2
Ud	Udolpho silt loam	IIIw–2
VaA	Vlasaty silt loam, 0 to 2 percent slopes	IIs–1
VaB	Vlasaty silt loam, 2 to 6 percent slopes	IIe–2
VaB2	Vlasaty silt loam, 2 to 6 percent slopes, moderately eroded	IIe–2
WaA	Waukegan silt loam, 0 to 2 percent slopes	IIs–1
WaB	Waukegan silt loam, 2 to 6 percent slopes	IIe–3
WaB2	Waukegan silt loam, 2 to 6 percent slopes, moderately eroded	IIe–3
WdA	Waukegan silt loam, deep, 0 to 2 percent slopes	I–1
WkA	Waukegan silt loam, thick surface variant, 0 to 2 percent slopes	I–1
WmC2	Waukegan-Bixby silt loams, 6 to 12 percent slopes, moderately eroded	IIIe–3
WnB	Whalan silt loam, 2 to 6 percent slopes	IIIs–3
WnB2	Whalan silt loam, 2 to 6 percent slopes, moderately eroded	IIIs–3
WnC	Whalan silt loam, 6 to 12 percent slopes	IVs–1
WnC2	Whalan silt loam, 6 to 12 percent slopes, moderately eroded	IVs–1
WnD	Whalan silt loam, 12 to 18 percent slopes	VIs–1
WnD2	Whalan silt loam, 12 to 18 percent slopes, moderately eroded	VIs–1
WoB	Whalan silt loam, moderately deep, 2 to 6 percent slopes	IIe–3
WoB2	Whalan silt loam, moderately deep, 2 to 6 percent slopes, moderately eroded	IIe–3
WoC	Whalan silt loam, moderately deep, 6 to 12 percent slopes	IIIe–2
WoC2	Whalan silt loam, moderately deep, 6 to 12 percent slopes, moderately eroded	IIIe–2
WoD	Whalan silt loam, moderately deep, 12 to 18 percent slopes	IVe–1
WoD2	Whalan silt loam, moderately deep, 12 to 18 percent slopes, moderately eroded	IVe–1
WoE	Whalan silt loam, moderately deep, 18 to 25 percent slopes	VIe–1
WoE2	Whalan silt loam, moderately deep, 18 to 25 percent slopes, moderately eroded	VIe–1
WpC3	Whalan soils, 6 to 12 percent slopes, severely eroded	IVs–1
WpD3	Whalan soils, 12 to 18 percent slopes, severely eroded	VIs–1
WsB3	Whalan soils, moderately deep, 2 to 6 percent slopes, severely eroded	IIe–3
WsC3	Whalan soils, moderately deep, 6 to 12 percent slopes, severely eroded	IIIe–2
WsD3	Whalan soils, moderately deep, 12 to 18 percent slopes, severely eroded	IVe–1
WuA	Wykoff loam, 0 to 2 percent slopes	IIs–1
WuB	Wykoff loam, 2 to 6 percent slopes	IIe–3
WuB2	Wykoff loam, 2 to 6 percent slopes, moderately eroded	IIe–3
WuC	Wykoff loam, 6 to 12 percent slopes	IIIe–3
WuC2	Wykoff loam, 6 to 12 percent slopes, moderately eroded	IIIe–3
WuC3	Wykoff loam, 6 to 12 percent slopes, severely eroded	IIIe–3
WuD2	Wykoff loam, 12 to 18 percent slopes, eroded	IVe–1
WuD3	Wykoff loam, 12 to 18 percent slopes, severely eroded	IVe–1
WyB	Wykoff soils, 2 to 6 percent slopes	IIIs–3
WyB2	Wykoff soils, 2 to 6 percent slopes, moderately eroded	IIIs–3
WyC2	Wykoff soils, 6 to 12 percent slopes, eroded	IVs–1
WyC3	Wykoff soils, 6 to 12 percent slopes, severely eroded	IVs–1
WzD2	Wykoff and Thurston soils, 12 to 18 percent slopes, eroded	VIs–1
WzD3	Wykoff and Thurston soils, 12 to 18 percent slopes, severely eroded	VIs–1

DODGE COUNTY



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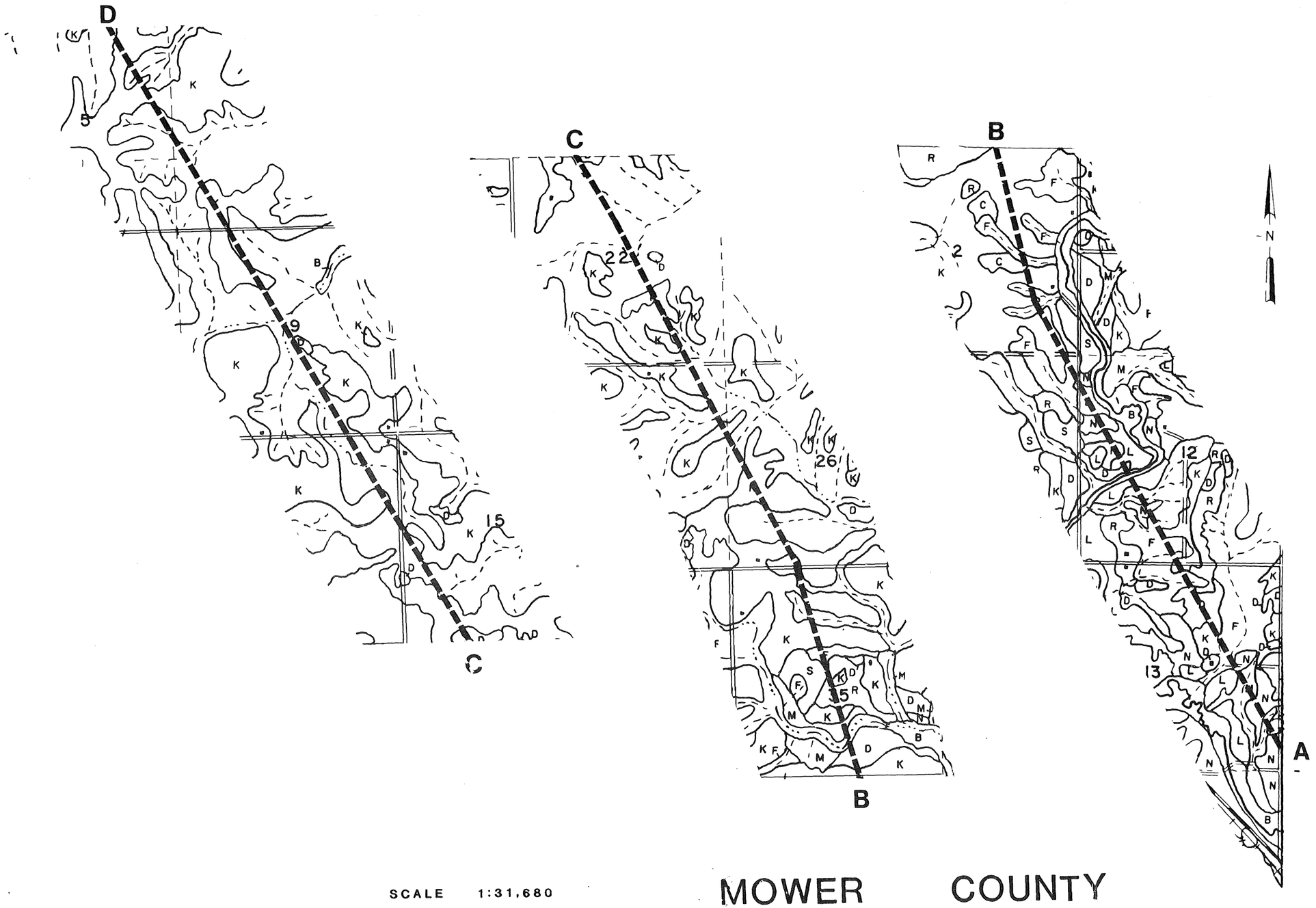
MOWER COUNTY

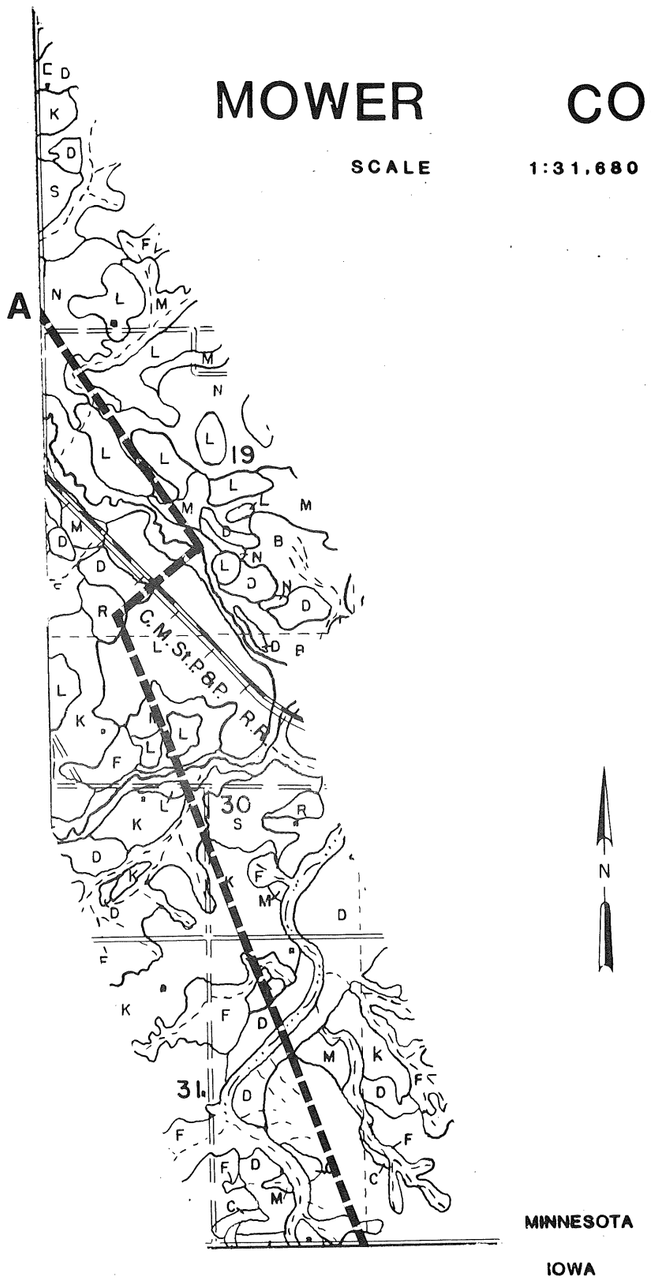


SCALE 1:31,680

MOWER COUNTY

MOWER COUNTY

SCALE 1:31,680



LEGEND

- K — Dark colored, fine textured, moderately well drained soils on gentle slopes (0 to 7 per cent slopes)
- C — Dark dolored, fine textured, well drained soils on gentle to moserate slopes (2 to 12 per cent slopes)
- R — Moderately light colored, fine textured, well drained soils on gentle slopes (0 to 7 per cent slopes)
- D — Dark colored, well drained loams, silt loams, and sand or gravel, on gentle slopes (0 to 7 per cent slopes)
- T — Dark and light colored silt loams, loams, and sandy loams, overlying sand, gravel, or bedrock, on moderate to strong slopes (7 to 18 per cent slopes)
- S — Moderately light colored, fine textured, moderately well and imperfectly drained soils, on nearly level to gentle slopes (0 to 7 per cent slopes)
- W — Moderately light colored, fine textured, well drained soils on moderate slopes (7 to 12 per cent slopes)
- L — Light colored silt loams, loams, and sandy loams on terraces and uplands, overlying sand and gravel, on gentle slopes (0 to 7 per cent slopes)
- F — Dark colored, fine textured, imperfectly and poorly drained, nearly level to undulating soils (0 to 7 per cent slopes)
- M — Dark colored, fine textured, imperfectly and poorly drained, nearly level soils (0 to 2 per cent slopes)
- N — Light colored, fine textured, imperfectly and poorly drained, nearly level soil (0 to 2 per cent slopes)
- G — Light colored, fine textured, poorly drained soils, on nearly level to gentle slopes (0 to 7 per cent slopes)
- B — Soils of the bottoms and organic soils (0 to 2 per cent slopes)

APPENDIX D

MAMMALS OF SOUTHEASTERN MINNESOTA

See Appendix D of the Draft Environmental Impact Statement

APPENDIX E

ROADWAY CROSSINGS

ROADWAY CROSSINGS

Dakota County

County-State Aid Highway No. 42
County-State Aid Highway No. 66
County-State Aid Highway No. 72
County-State Aid Highway No. 79
State Trunk Highway No. 50
County-State Aid Highway No. 78
County Road No. 80S

East Alternate

County Road No. 82
County Road No. 51
County-State Aid Highway No. 86
County-State Aid Highway No. 47
County Road No. 94
State Trunk Highway No. 19

West Alternate

State Trunk Highway No. 3
County-State Aid Highway No. 86
County Road No. 90
County-State Aid Highway No. 23
County Road No. 96
State Trunk Highway No. 19

Rice County

East Alternate

State Trunk Highway No. 19
County Road No. 79
County-State Aid Highway No. 28
County Road No. 81
State Trunk Highway No. 246

County-State Aid Highway No. 30
County Road No. 82
County-State Aid Highway No. 29
County Road No. 88
County-State Aid Highway No. 27

West Alternate

State Trunk Highway No. 19
County Road No. 59
County-State Aid Highway No. 1
County-State Aid Highway No. 8
State Trunk Highway No. 3
County-State Aid Highway No. 20
County-State Aid Highway No. 22
County-State Aid Highway No. 82
County State Aid Highway No. 29
County-State Aid Highway No. 23

Both Routes

County Road No. 87
State Trunk Highway No. 60
County Road No. 186
County-State Aid Highway No. 19
County-State Aid Highway No. 32

Dodge County

County-State Aid Highway No. 24
County-State Aid Highway No. 1
County-State Aid Highway No. 20
County Road No. G
County Road No. G
County-State Aid Highway No. 5
U.S. Highway No. 14
County-State Aid Highway No. 5
County-State Aid Highway No. 10

County-State Aid Highway No. 6
State Trunk Highway No. 56
County Road No. K
County-State Aid Highway No. 4
State Trunk Highway No. 30
County-State Aid Highway No. 9
County Road No. M
County-State Aid Highway No. 9

Mower County

County-State Aid Highway No. 1
County-State Aid Highway No. 7
County-State Aid Highway No. 2
U. S. Interstate No. 90
U. S. Trunk Highway No. 16
County-State Aid Highway No. 13
County-State Aid Highway No. 3
County-State Aid Highway No. 9
County-State Aid Highway No. 4
County-State Aid Highway No. 11
County-State Aid Highway No. 8
State Trunk Highway No. 56
County-State Aid Highway No. 6

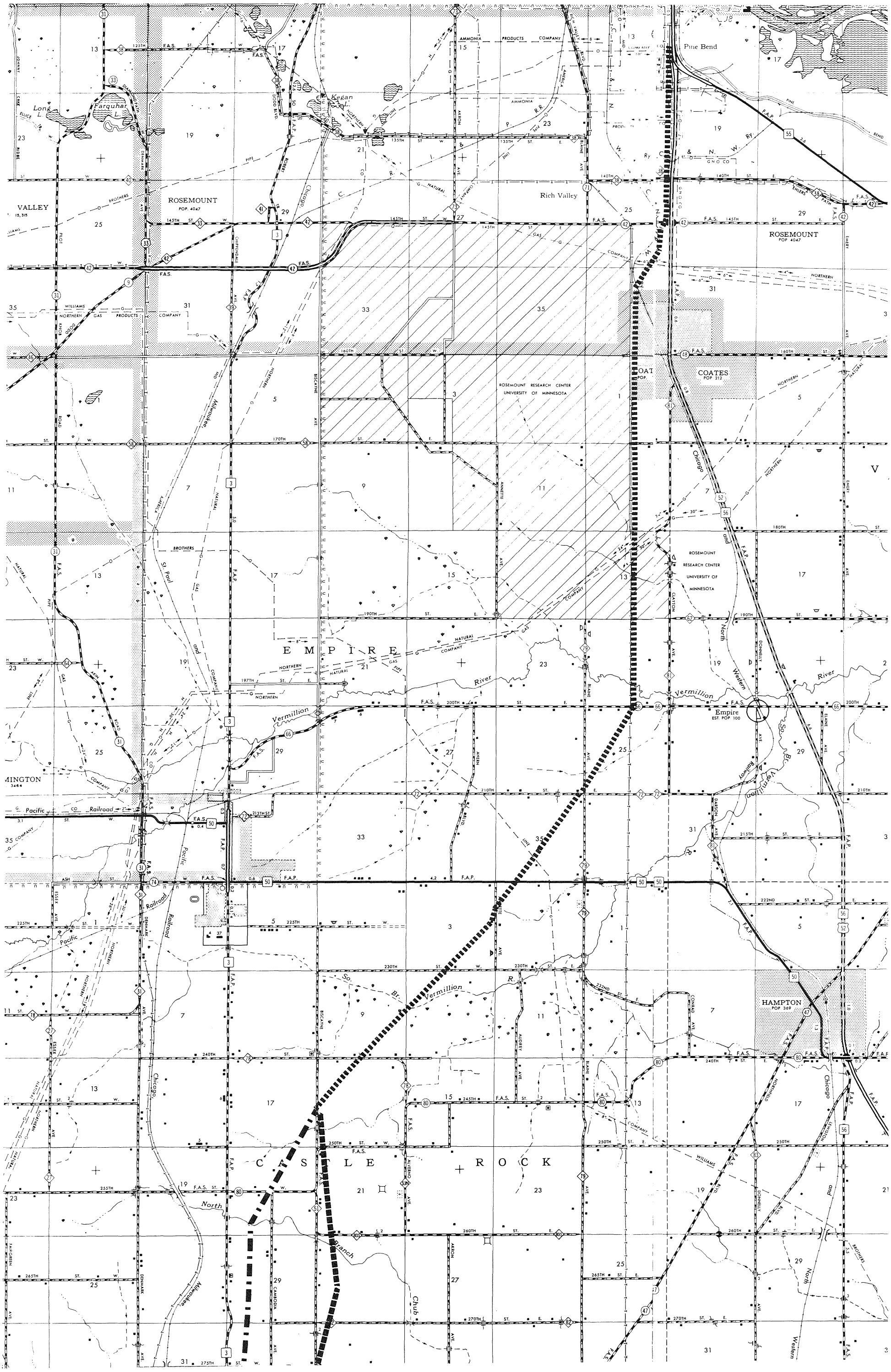
APPENDIX F

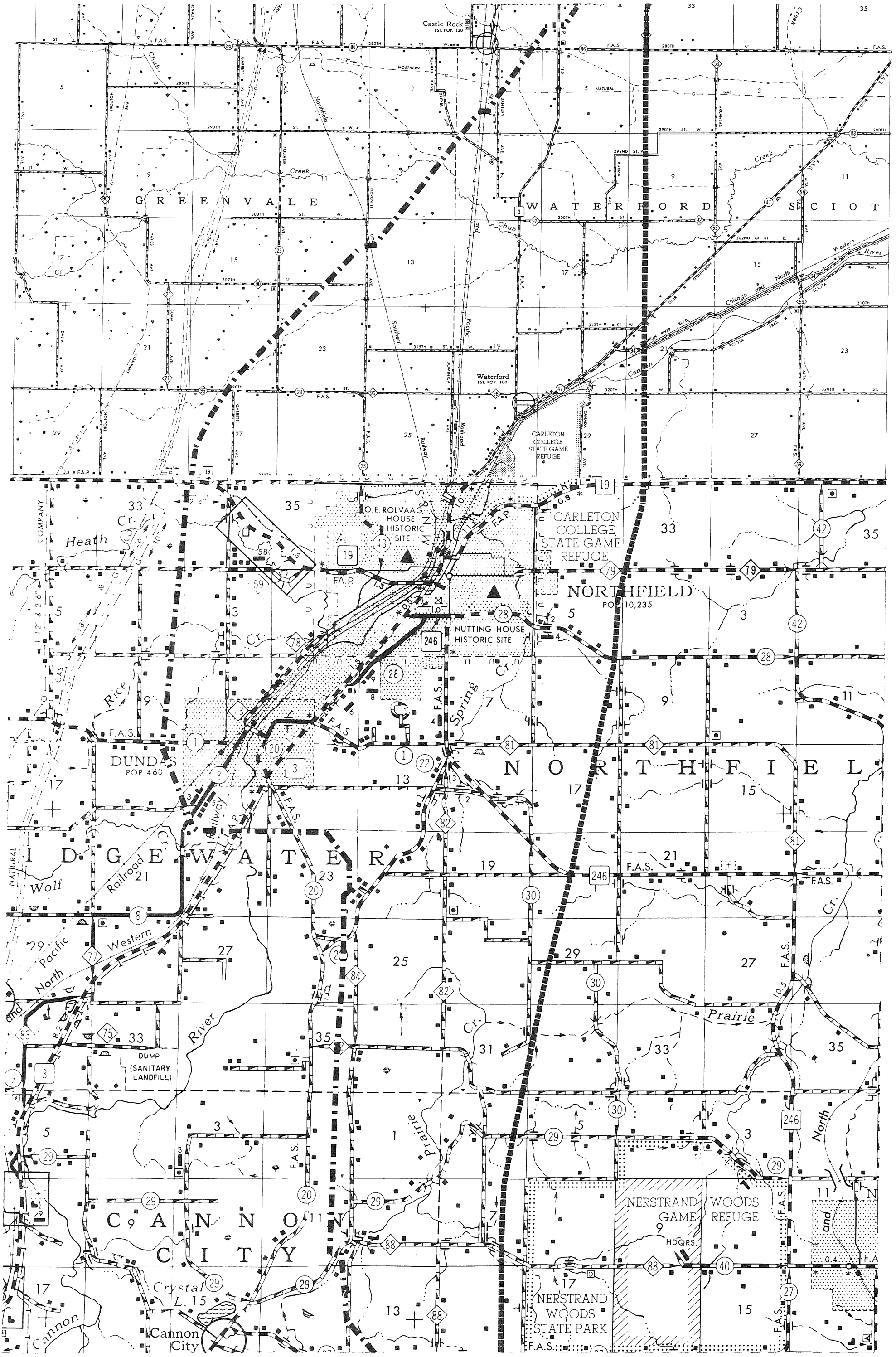
CAMPSITE AVAILABILITY

See Appendix F of the Draft Environmental Impact Statement

APPENDIX G

ROUTE MAPS


ROSEMOUNT
POP. 4047
VALLEY
15,315
Rich Valley
Pine Bend
ROSEMOUNT
POP 4047
COATES
POP 212
ROSEMOUNT RESEARCH CENTER
UNIVERSITY OF MINNESOTA
ROSEMOUNT
RESEARCH CENTER
UNIVERSITY OF
MINNESOTA
EMPIRE
Empire
EST. POP 100
HAMPTON
POP 389
CASTLE ROCK
Farquhar L.
Long L.
Keegan L.
AMMONIA PRODUCTS COMPANY
NORTHERN NATURAL GAS COMPANY
WILLIAMS PIPE LINE COMPANY
Chicago and North Western Railway
Pacific Railroad
Milwaukee Road
Vermillion River
So. Br. Vermillion R.
North Branch Chub
Pine Bend Bypass
F.A.S.
F.A.P.
125TH ST. W.
135TH ST. W.
135TH ST. E.
140TH ST. E.
145TH ST. W.
145TH ST. E.
150TH ST. W.
160TH ST. W.
170TH ST. W.
180TH ST.
190TH ST. E.
197TH ST. E.
200TH ST. E.
210TH ST. E.
213TH ST.
215TH ST. E.
222ND ST. E.
225TH ST. W.
230TH ST. W.
230TH ST. E.
232ND ST. E.
240TH ST. E.
245TH ST. E.
250TH ST. W.
250TH ST. E.
255TH ST. W.
260TH ST. E.
265TH ST. W.
270TH ST. E.
275TH ST. W.
DIAMOND PATH
DENMARK AVE.
CHIPPENDALE AVE.
BISCAYNE AVE.
ANNETTE AVE.
AKRON AVE.
BLAINE AVE.
CLAYTON AVE.
DONNELLY AVE.
EMERY AVE.
DAWSON AVE.
ESSEX AVE.
FAIRGREEN AVE.
CAMBODIA AVE.
ALVERNO AVE.
ATHENS AVE.
ARGENTA TRAIL
DODD BLVD.
LAMBERTON BLVD.
ROBERT TRAIL
CONRAD AVE.
AUDREY AVE.
ANNETTE AVE.
ROLLINGSTONE BLVD.
DONNELLY BLVD.
WILLIAMS PIPE LINE COMPANY
NORTHERN NATURAL GAS COMPANY
NORTHERN GAS PRODUCTS COMPANY
MILWAUKEE ROAD
ST. PAUL and PACIFIC GAS COMPANY
CHICAGO & NORTH WESTERN R.R.
CHICAGO GREAT WESTERN R.R.
CHICAGO, MILWAUKEE, ST. PAUL & PACIFIC R.R.
SOUTHERN PACIFIC R.R.
PINE BEND BYPASS
EHLERS PATH
BROTHERS ROAD
NATURAL GAS PIPE
GNO CO
Western Railway


Castle Rock
EST. POP. 120
Waterford
EST. POP. 100
GREENVALE
WATERFORD
SCIOT
DUNDAS
POP. 460
NORTHFIELD
POP. 10,235
CANNON CITY
O.E. ROLVAAG HOUSE HISTORIC SITE
NUTTING HOUSE HISTORIC SITE
CARLETON COLLEGE STATE GAME REFUGE
CARLETON COLLEGE STATE GAME REFUGE
NERSTRAND WOODS STATE PARK
NERSTRAND WOODS GAME REFUGE
HDQRS
DUMP (SANITARY LANDFILL)
Crystal L.
Cannon City
Chub
Creek
Northfield
Pacific and Southern Railway
Chicago and North Western Railway
Western River Trail
Cannon River Blvd.
Sciota Trail
Railroad Cr.
Heath Cr.
Rice Cr.
Spring Cr.
Wolf Cr.
Prairie Cr.
Cannon River
Prairie
F.A.S.
F.A.P.
NORTHERN GAS
NATURAL GAS
ARKANSAS GAS
12" & 26" GAS
18" GAS
Railway
Railroad
Railroad Ave.
Dunbar Ave.
Danbury Ave.
Arkansas Ave.
Burma Ave.
Foliage Ave.
Elsenth Ave.
Dorset Ave.
Garrett Ave.
Holyoke Ave.
Renada Ave.
Idalia Ave.
Guam Ave.
Hayes Ave.
Dominica Ave.
Canada Ave.
Oak Ave.
Alta Ave.
Company Ave.
Nonesuch Ave.
Sciota Ave.
280th St. W.
285th St. W.
290th St. W.
292nd St. W.
300th St. W.
302nd St. E.
307th St. W.
310th St.
313th St. W.
315th St. W.
320th St. W.
320th St.

WHEELING

RICHLAND

MERTON

ELLIN

T 110 N

T 109 N

R 7 W

44°15'

F.A.S.

F.A.P.

Chicago

Falls

Cr.

Ruskin
EST. POP. 10

Fork

Milwaukee

St. Paul

and

Pacific

Railroad

River

Zumbro

11 Epsom
EST. POP. 10

To Kenyon

To Jct. T.H. 56

Moland
EST. POP. 20

Rush

Creek

Merton
EST. POP. 20

Rice Lake
EST. POP. 10

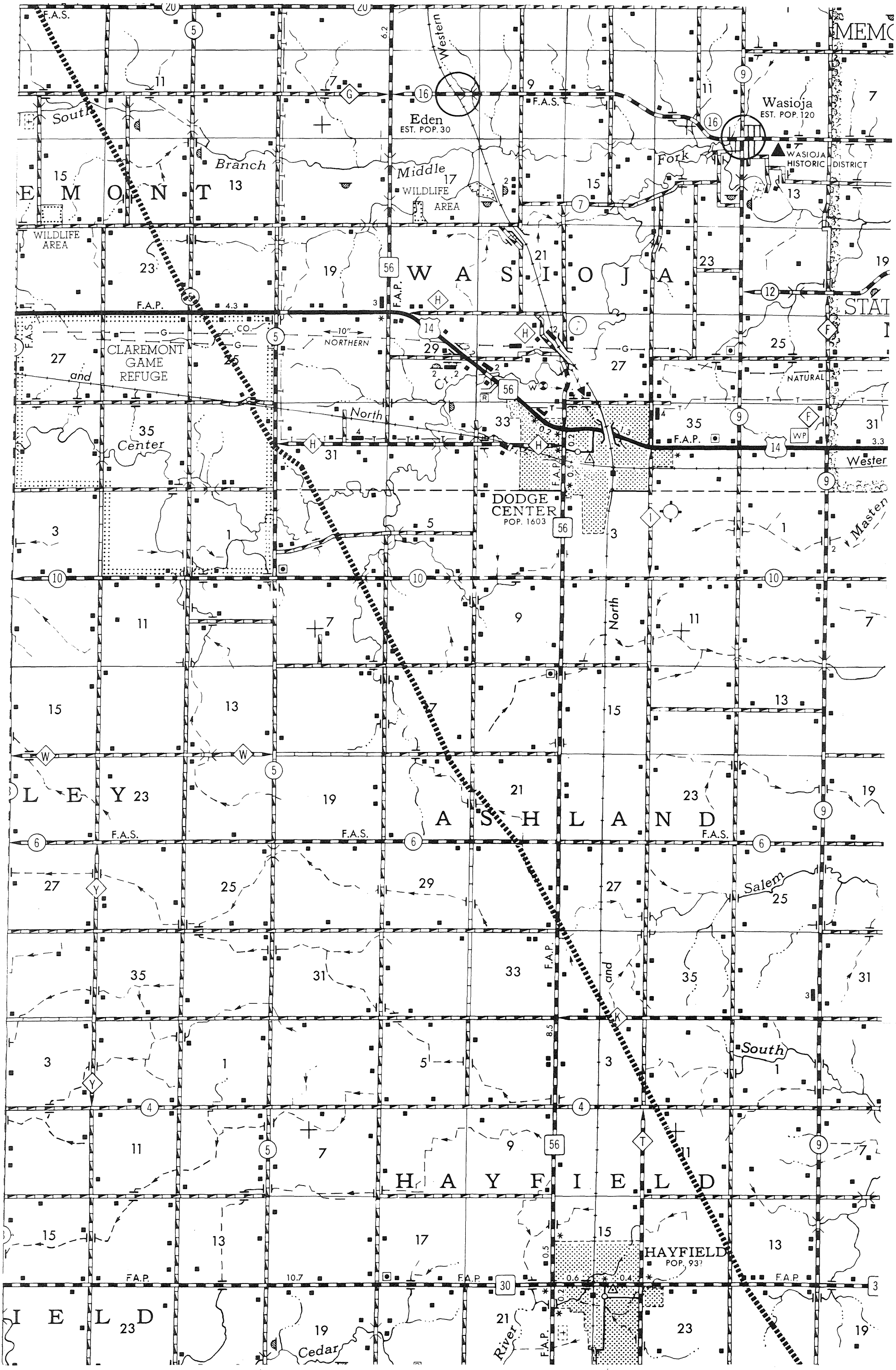
Rice Lake
EST. POP. 10

Millike

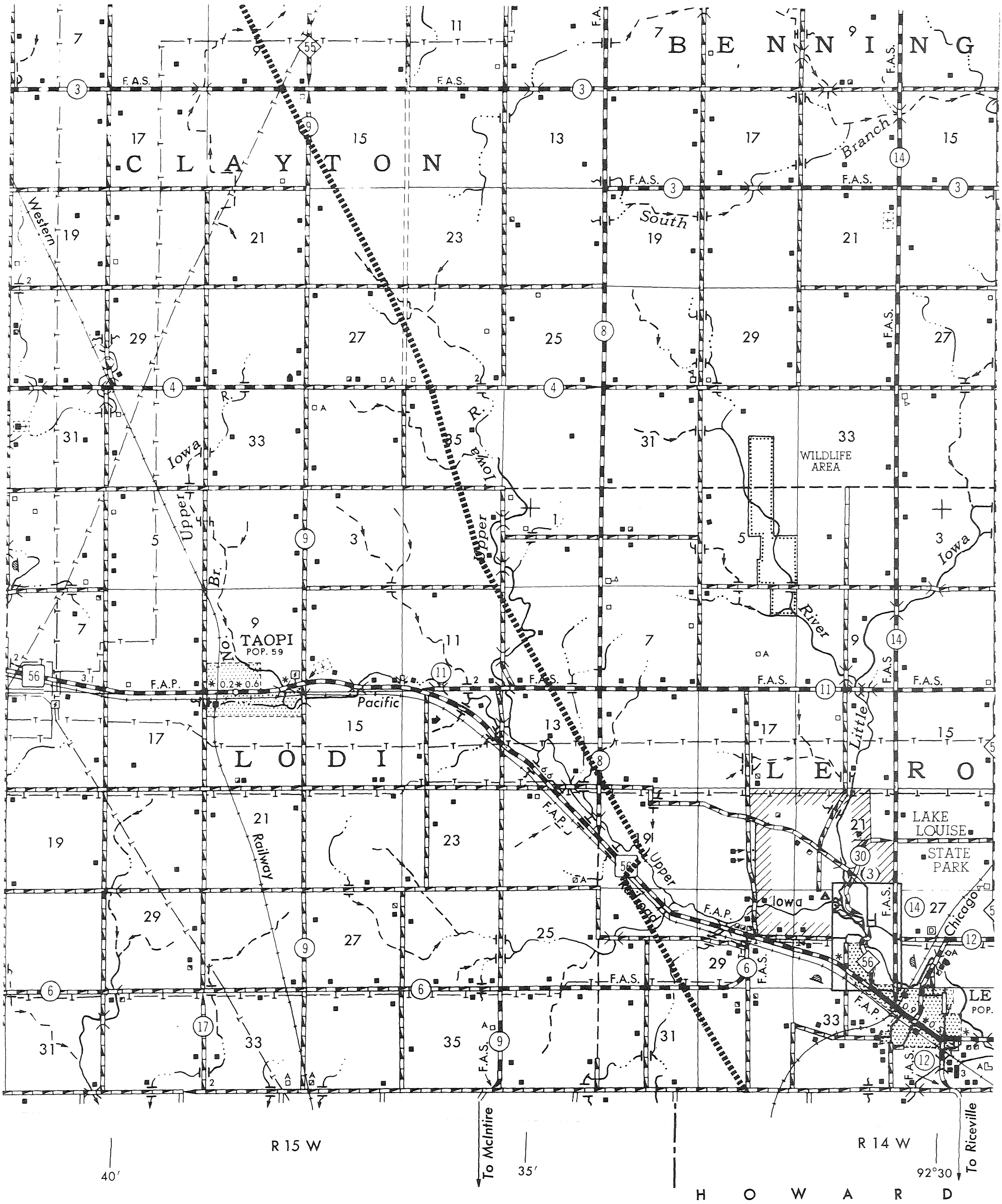
Maple

COMPANY

NATURAL GAS


F.A.S.
Eden
EST. POP. 30
Wasioja
EST. POP. 120
WASIOJA HISTORIC DISTRICT
South Branch
Middle Fork
Western
WILDLIFE AREA
CLAREMONT GAME REFUGE
and
Center
North
DODGE CENTER
POP. 1603
Masten
Salem
South
HAYFIELD
POP. 93?
Cedar River
F.A.P.
F.A.S.
CO.
10" NORTHERN
NATURAL
WP
EMONT
WASIOJA
LEY
ASHLAND
HAYFIELD

SARGEANT
POP. 85
SARGEANT
DEXTER
POP. 252
ELKTON
POP. 134
Renova
PLEASANT VALLEY
GRANDMEADOW
R 15 W
To Jct. T.H. 3
40'
(3)
COMPANY
16"
GAS
F.A.S.
F.A.P.
F.A.I.
U.S. 13
Root
Robinson
North
Rose
Cr.
Milwaukee,
and
St. Paul
Bear
Fork
Schwerin
Deer Cr.


CLAYTON
BENNING
TAOPI
POP. 59
LODI
LE ROY
LAKE LOUISE
STATE PARK
WILDLIFE AREA
Western
Upper Iowa R.
Upper Iowa Br.
Pacific & Iowa River Railway
Little Iowa River
Chicago & Iowa
F.A.S.
F.A.P.
R 15 W
R 14 W
To McIntire
To Riceville
40'
35'
92°30
HOWARD

APPENDIX H

LANDOWNERS' RIGHTS

THE PIPELINE PROJECT AND YOUR PROPERTY

Prepared by Northern Pipe Line Co. of Delaware, Inc.

A WORD TO THE READER

The State of Minnesota receives approximately 43% of its energy needs from petroleum supplies. In 1973, the Canadian government started limiting crude oil exports to the United States. The curtailment plans call for a complete cut-off by 1982. Concurrently, the continuing decline of natural gas supplies in Minnesota means that more people will be dependent upon petroleum. To avoid disastrous economic and social consequences to the people of the State of Minnesota, it becomes imperative to initiate a vigorous plan to secure alternative sources of crude oil.

This pipeline project involves a plan to secure crude oil available through the Gulf of Mexico, and to construct a petroleum pipeline from central Illinois entering Minnesota near the common boundary between Mower and Fillmore Counties and traversing essentially a direct route to the refineries near Minneapolis-St. Paul. The pipeline would be used in transporting crude oil.

The primary purpose of this booklet is to inform those property owners whose land will be crossed by the pipeline of their rights under Minnesota law and of the procedures followed by the Company in acquiring right-of-way for the pipeline.

PROCEDURE FOR EASEMENT ACQUISITION BY DIRECT PURCHASE

Under the direct purchase method of acquisition, representatives of the Company deal directly with you, the property owner, in an attempt to purchase an easement across your land. After it has been determined that your land will be crossed by the pipeline, the Company will send a right-of-way agent to determine how much, if any, your

land will be damaged. When the appraisal of your property has been completed, you will receive an offer in an amount which the Company feels justly compensates you. The offer will be presented personally, whenever pratical, or by mail. The offer to purchase the easement is based on information furnished to the Company by various sources. In addition, the Company also will pay you for actual damages, if any, directly resulting to crops, fences, and drain tiles from the construction.

You will have a reasonable length of time of consider the offers. During this time, you should feel free to call the right-of-way agent or to request an appointment with the right-of-way agent. In addition, if you so desire, you may wait until after construction to agree upon any actual damages to crops, fences, and drain tiles.

If you elect to accept the offers, you will be asked to sign two instruments of acquisition granting the Company the right to purchase an easement across your property. One is a Grant of Easement conditioned upon construction of the pipeline, and the other is a Receipt and Release for damages resulting from the construction. These are intended to be legally binding documents, and for legal advice in connection with the transaction, you should consult your attorney. However, the Company will at its own expense, furnish all documents necessary to complete the purchase of the easement, make the necessary examination of title, and record the instruments of conveyance.

If you, as the property owner, have problems with the acquisition of the easement, or the construction of the pipeline, you should thoroughly discuss those problems with the right-of-way agent. The Company will comply with all reasonable requests for greater cover and segregation of topsoil in agricultural cropland areas, and will attempt to

minimize any discomfort to you through the use of modern pipeline construction practices and techniques.

PROCEDURE FOR EASEMENT ACQUISITION THROUGH EMINENT DOMAIN PROCEEDINGS

Eminent domain proceedings are commenced by the Company when it is not possible to agree on terms for the purchase of an easement directly from you. These proceedings are commenced early enough so that the Company can be assured that the easement will be acquired in time to meet construction contract requirements.

Eminent domain proceedings are commenced by the filing of a petition with the Clerk of Court and service of a copy thereof in the form of a notice of a hearing on you, the property owner. The pitition requests the Court to appoint three qualified and disinterested residents of the County in which the land is located to act as commissioners to appraise the damages the property will, in their opinion, sustain as a result of the taking.

The notice will inform you of the terms of the acquisition and of the date, place, and time that the hearing on the petition will be held. The notice will describe the easement to be acquired, and will contain a list of the names of all parties who are shown to have an interest in the property.

The hearing on the petition is held in the Courthouse of the County in which the property is located. An attorney from the Company will formally present the petition to the Court. Also present at the hearing will be another person from the Company who will explain engineering details pertaining to the construction which will affect the property. The person will have a right-of-way map, and if you so request, he will send to you or your representative, a copy of the map as it pertains to your property.

When the three Court-appointed commissioners have taken their oath of office, they will arrange for hearings and viewings with you and other affected property owners. The chairman of the commission will inform you of the time that the viewings and hearings will be held.

The chairman of the commission who presides over the hearings will most likely invite you to express your opinion as to the amount of damages you feel your property has sustained, and to furnish such evidence as you may wish to present to the commissioners for purposes of assisting them in determining an award of damages. You may represent yourself at these hearings or you may choose to be represented by legal counsel. You should understand that you bear the cost of any attorney's fees; whether or when you require an attorney is at your discretion.

The Constitutions of the United States and of the State of Minnesota provide that property cannot be acquired, damaged, or destroyed for public purposes without payment of just compensation.

The State eminent domain law sets forth procedures which guarantee full compliance with these requirements. The Courts have interpreted "just compensation" to mean that the owner is entitled to any damages determined by comparing the fair market value of the property before and after taking of the pipeline easement. Fair market value is generally defined to mean that amount which a willing buyer would pay and which a willing seller would accept when neither party is forced to sell or buy. You may wish to retain a real estate appraiser to provide you with information and an opinion on damages. The commissioners may, at their discretion, allow reimbursement for an appraisal not to exceed $300.00.

When the Company requires possession of the easement prior to the filing of an award by the Court-appointed commissioners, at least 90 days prior to the date on which possession is to be taken, the Company will notify you of its intent to possess the easement. The written notice will be served by registered mail, and the Company will pay to you or deposit with the court, an amount equal to the Company's approved appraisal of damages.

WHEN DOES CONSTRUCTION START?

Minnesota law provides that after a Grant of Easement has been signed by you, the property owner, or after the expiration of 90 days, whichever occurs first, the Company has the right to enter upon your land and begin construction. Generally, the Company does not immediately start construction on the property, but in rare cases, construction will proceed at an early date.

APPEALING THE COMMISSIONERS' AWARD OF DAMAGES

It is important to note that, if you are dissatisfied with the commissioners' award, you have the right to take an appeal to the District Court from that award. This will be the first time that it might be essential for you to engage the services of an attorney. This is a matter of choice; the legal expense involved is borne by you. The Company also has the right to take an appeal from the award. Any appeal must be taken with 40 days from the date the commissioners file their award, and must be filed with the Clerk of District Court.

(Note: The 40 days are counted from the date of the filing of the commissioners' award with the Clerk of District Court, not from the date you receive notice of the award from the Company.) If the Company appeals the award, you will be notified by letter from the attorneys for the Company. The

law provides that unless proper appeal is taken by either party within 40 days, niether party can amend or adjust the amount, terms, or conditions of the award. If no appeal is taken, payment will usually be made within 40 days to 60 days after the expiration of the 40-day appeal. If only one party appeals from the award of commissioners, the appealing party may later dismiss his appeal and the award plus interest will be paid.

About three weeks after the filing of an appeal by either party, partial payment may be made to you. Maximum partial payment under any circumstances cannot exceed 75% of the award of the Court-appointed commissioners. If you so request, the Company will pay 75% of the award; the Company may, however, request the court to reduce the amount of partial payment. A partial payment, when no request has been made, will be in the amount of the Company's appeal figure or an amount which is 75% of the award, whichever is the smaller amount. If you refuse to accept the partial payment offer, the check will be cancelled and a new check will be issued in the same amount and deposited with the Clerk of District Court. All persons named on the original check will be sent a notice of the deposit with the District Court. Partial payment checks are made payable to the holder of title and anyone else who has a vested interest in the property. It may include the County Treasurer of the County in which the property is located when there is any tax liability on the part of the property owner to the date of the Company's acquisition, which date is concurrent with the filing of the State's petition.

DETERMINATION OF "JUST COMPENSATION" BY THE JUDGE OR BY JURY

If you or the Company, or both, appeal to the District Court, the compensation to which you are entitled becomes a question to be decided in a trial by a judge or by jury.

Simply because an appeal is taken by either party does not necessarily mean the matter will go to court; the Company will make a diligent effort to settle the case prior to trial. However, as noted earlier, the law provides the Company cannot amend or adjust the amount of the commissioners' award unless proper appeal is taken by either party within the time allowed.

If the appeal is settled out of Court, you can usually expect final payment within 30 to 60 days of receipt by the Company of a properly signed stipulation and settlement. If the appeal goes to trial in District Court, final payment can be expected within 30 to 60 days after either the judge or the jury returns its verdict, unless the verdict is appealed from, in which case, final payment will depend on the disposition of that appeal.

NOTE: This booklet is not to be construed as a legal opinion of your rights under the law, and should not be viewed as a substitute for the advice of your attorney.