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MINNESOTA DEPARTMENT OF NATURAL RESOURCES **DIVISION OF MINERALS** SAINT PAUL, MINNESOTA **AUGUST 1976**

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MINESITE Data Manual

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Division of Minerals Minnesota Department of Natural Resources St. Paul, Minnesota August 1976

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STATE OF MINNESOTA

M64.2

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Acknowledgments

Financial support and resource data for this project has been provided primarily by the Department of Natural Resources. Additional funding has been received from the Legislative Committee on Minnesota's Resources, Land Exchange Review Board, and the Environmental Quality Council. Numerous private and public organizations have also provided significant input into the study.

Consultants

Bather, Ringrose, Wolsfeld, Inc. Edina, Minnesota

Earth Systems Research, Inc. Minneapolis, Minnesota

Limnological Research Center University of Minnesota

Minnesota Land Management Information System (MLMIS) Center For Urban and Regional Affairs University of Minnesota

Remote Sensing Laboratory College of Forestry University of Minnesota

St. Anthony Falls Hydraulic Laboratory Department of Civil and Mineral Engineering University of Minnesota

Other Information Sources

Environmental Planning Division Minnesota State Planning Agency

Environmental Services Section Minnesota Highway Department

North Central Forest Experiment Station U.S. Forest Service Department of Agriculture

Soil Conservation Service Department of Agriculture

Superior National Forest U.S. Forest Service Department of Agriculture

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- Appendix B Description of Soil Landscape Units (V10)
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- Appendix D Vegetation Inventory (V16)
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- Appendix F Vegetation Size and Density Classes (V18, V19)
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Other Information Sources

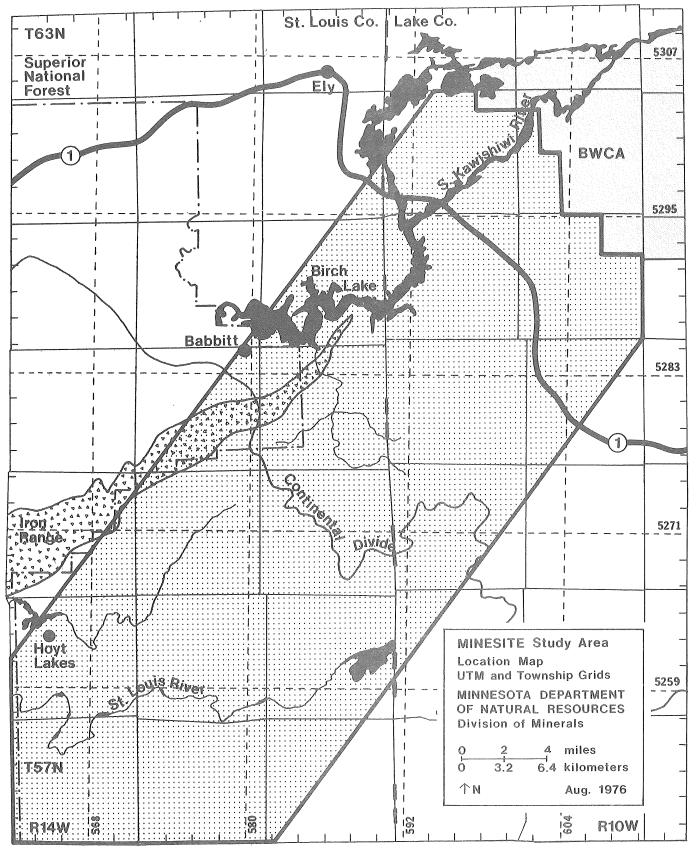
Environmental Planning Division Minnesota State Planning Agency

Environmental Services Section Minnesota Highway Department

North Central Forest Experiment Station U.S. Forest Service Department of Agriculture

Soil Conservation Service Department of Agriculture

Superior National Forest U.S. Forest Service Department of Agriculture

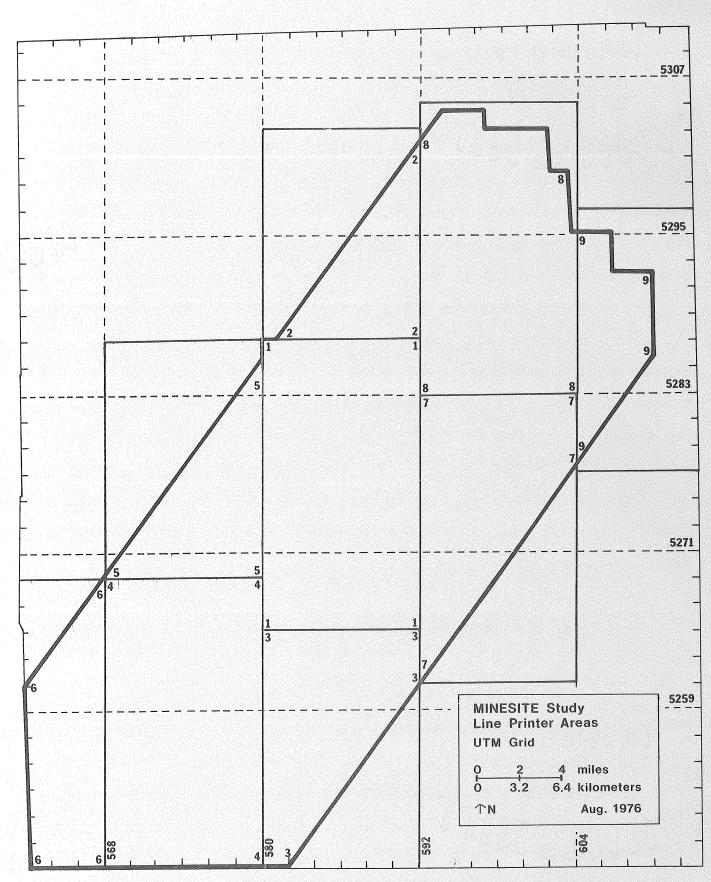


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Description of Variables

Based on the study area previously outlined, a total of twenty-eight separate compilations of data, or variables, have been computerized and mapped. These variables are listed in the table of contents. Twenty-five of the variables are resource inventories and the three remaining variables serve other purposes. V30 breaks the study area into watershed areas. V91 divides the area into 9 smaller study areas. V95 provides access and orientation to the Minnesota Land Management Information System (MLMIS) 40-acre data base.

Data is plotted using a cell system based on Universal Transverse Mercator (UTM) coordinates for all variables, except VO8 Surface Ownership and V95 MINESITE Area. Variables 8 and 95 use the MLMIS standardized 40-acre grid based on Township-Range designations. The best possible fit for the 2 grids has been obtained.

Each cell in the UTM system is a square cell 100 meters on a side. The metric definition for an area of this size is 1 hectare. This corresponds to an area in the English system of approximately $2\frac{1}{2}$ acres.

Two of the data variables, as mentioned previously, use a standardized Township-Range grid where data was originally plotted according to standardized square 40-acre cells. As a result of this standardization and the fact that the government surveyed townships are not composed of perfect square forties, the Township-Range grid cannot be perfectly superimposed over the UTM grid which is a uniform metric grid. This may have resulted in some internal distortion within V08 and V95, although the two grids have been fit

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together as accurately as possible.

In the handbook, each data variable has an identification sheet followed by a photographed computer map. On the identification sheet, the data variable is listed, along with its identifying number, name, its source, group responsible for interpretation and date of the information source. This is followed by a brief description of the variable and, beginning at the bottom of the sheet, a listing of data levels that have been coded for each inventory.

The verification section of the sheet refers to the system used in error checking the transformation of data from a base map to a final computer map. It does not refer to the reliability of the original data source, only to the computerization process. Two verification techniques were used in computerizing data: an individual cell check and a statistical check. The method of statistical checking is outlined in Appendix I. This section also includes the final verification date or approval date for each data variable.

The data maps which follow the identification sheets are dot plots of the resource inventories in the computer files. In the title block on each map all of the data levels inventoried within the study area have been listed along with the symbol plotted on the map and the frequency of its occurrence. In most cases, the symbols used are tones which create the appearance of shading. If many levels occur on the map, the data levels are grouped and the shades follow a logical sequence. For example, on the percent slope variable the shades become more intense as the slope becomes steeper. An orientation overlay has been placed over each data map

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before it was photographed and reduced.

In several instances, the variables required additional explanation beyond that provided on the identification sheets. These explanations are included in the appendices.

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(VO1)

DATA BIOGRAPHY

SOURCE: MINESITE Study, Division of Minerals, DNR

INTERPRETATION: MINESITE Staff, DNR

SOURCE DATE: June 1973

DESCRIPTION

The site map represents the MINESITE study boundaries. These boundaries contain the area in Northeastern Minnesota assessed to have the greatest potential for the development of copper-nickel resources found in the Duluth Complex formation.

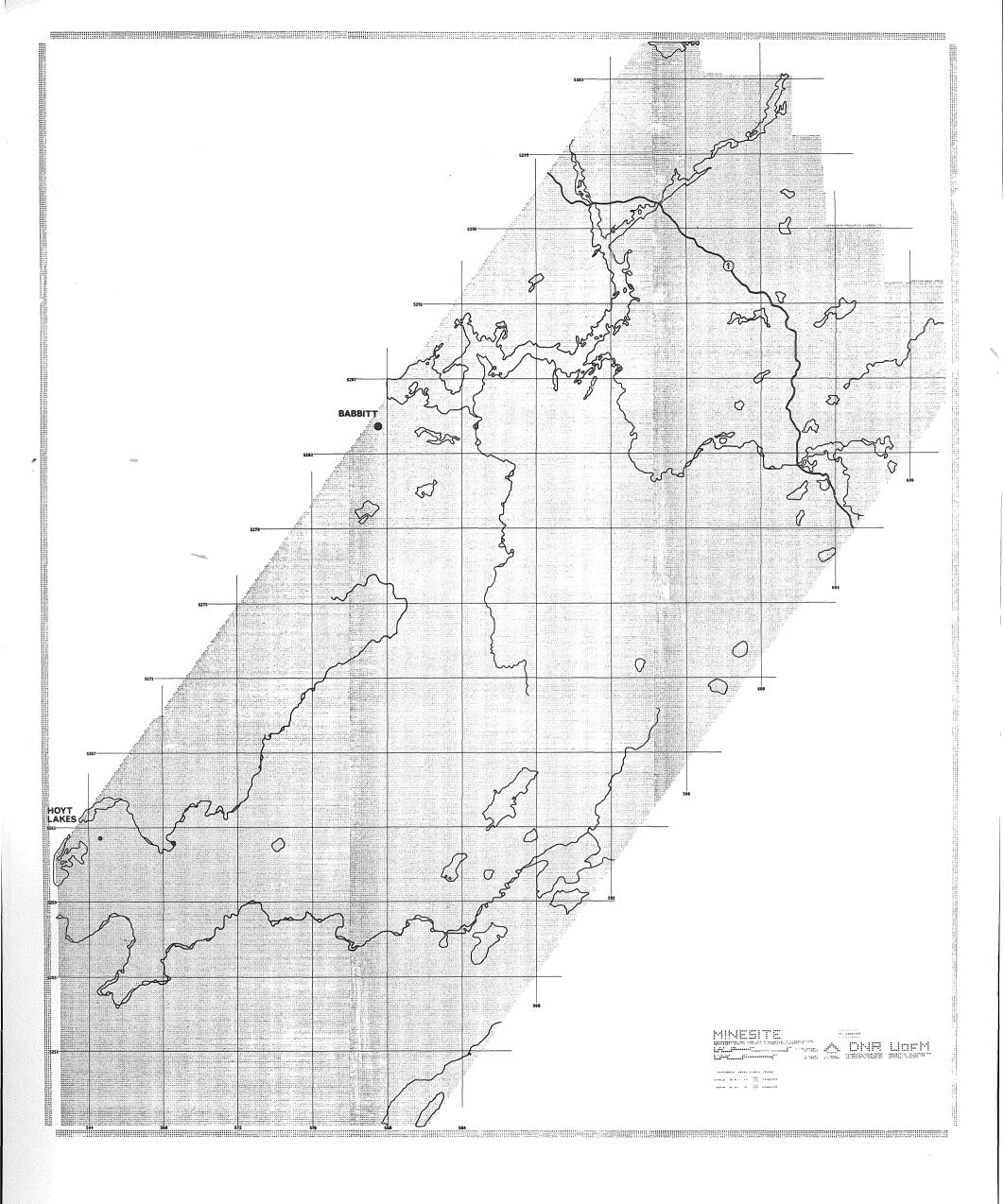
VERIFICATION

TECHNIQUE: All cells checked

FINAL DATE VERIFIED: August 16, 1976

LEVELS

<u>Data Level</u>	Legend
44	MINESITE
45	MINESITE





Slope

DATA BIOGRAPHY

SOURCE: USGS Topo Maps: Greenwood Lake (1954); Gabbro Lake, Markham, Brimson (1957); Bear Island, Kangas Bay (1965); Babbitt (NW,NE,SW,SE), Allen, Isaac Lake, Aurora (1969PR*). INTERPRETATION:

MINESITE Staff, DNR

SOURCE DATE:

See map dates listed above

DESCRIPTION

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- 1

The predominant slope range for each cell is determined based on the most current elevation contour interval data (Appendix A – Definition of Slope Categories).

VERIFICATION

TECHNIQUE: Statistical Check - Appendix I

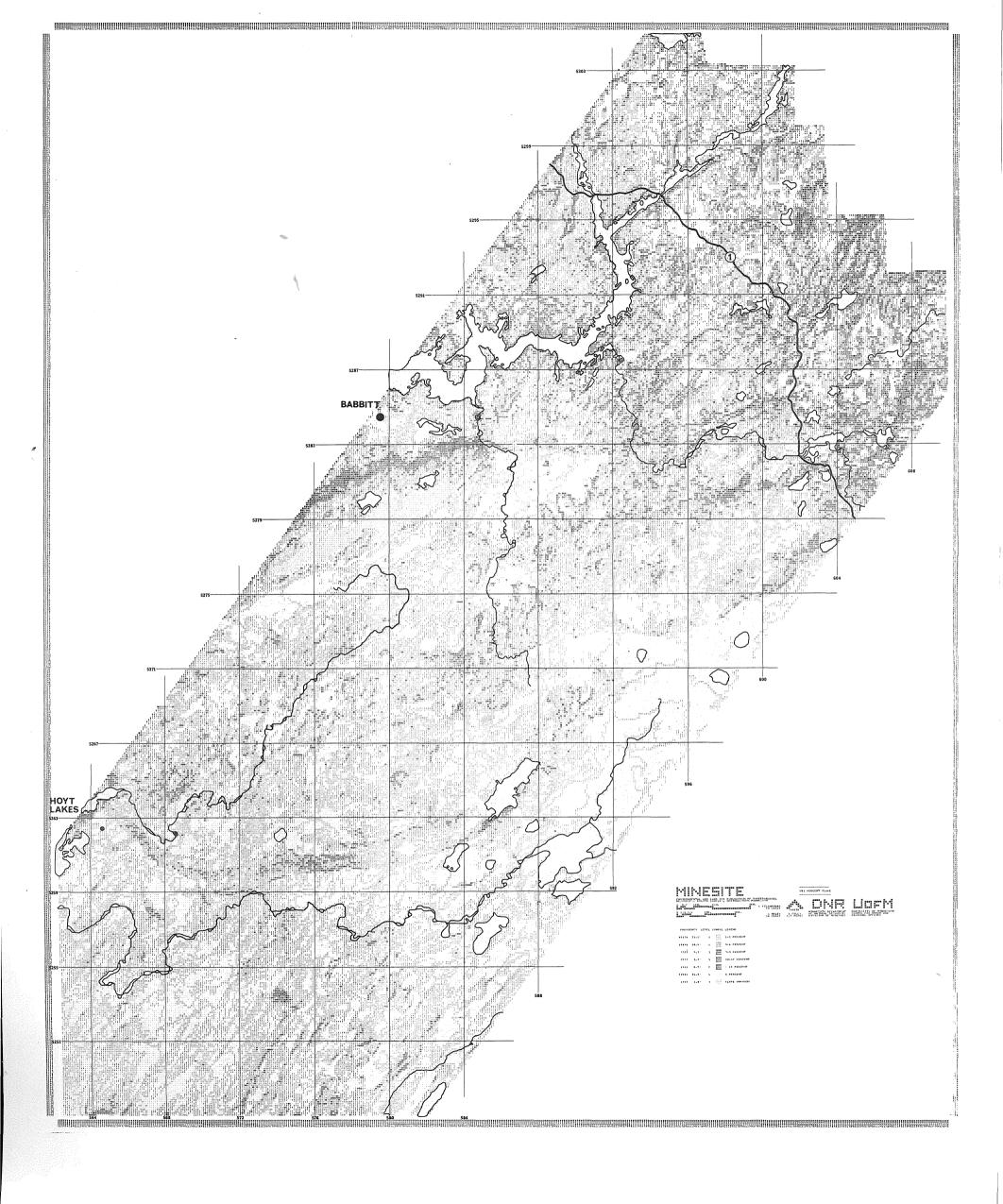
FINAL DATE VERIFIED: October 12, 1976 *photo revised

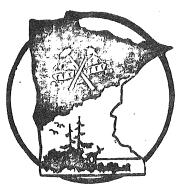
LEVELS

Data Level	Legend
1	1-3%
2	4-6%
3	7-9%
4	10-15%
5	>15%
6	0%
7	Slope Unknown*

*areas recently disturbed, usually by mining activities

(VO2)





Slope Orientation

DATA BIOGRAPHY

SOURCE: See maps listed in VO2

INTERPRETATION: MINESITE Staff, DNR

SOURCE DATE: See map dates listed in VO2

DESCRIPTION

Predominant slope orientation is based on the direction that contour lines cross a given cell. The orientation direction is determined by the direction one would be facing if looking directly down a slope. On a contour map the orientation is found by drawing a down slope line perpendicular to the predominant alignment of the contour lines.

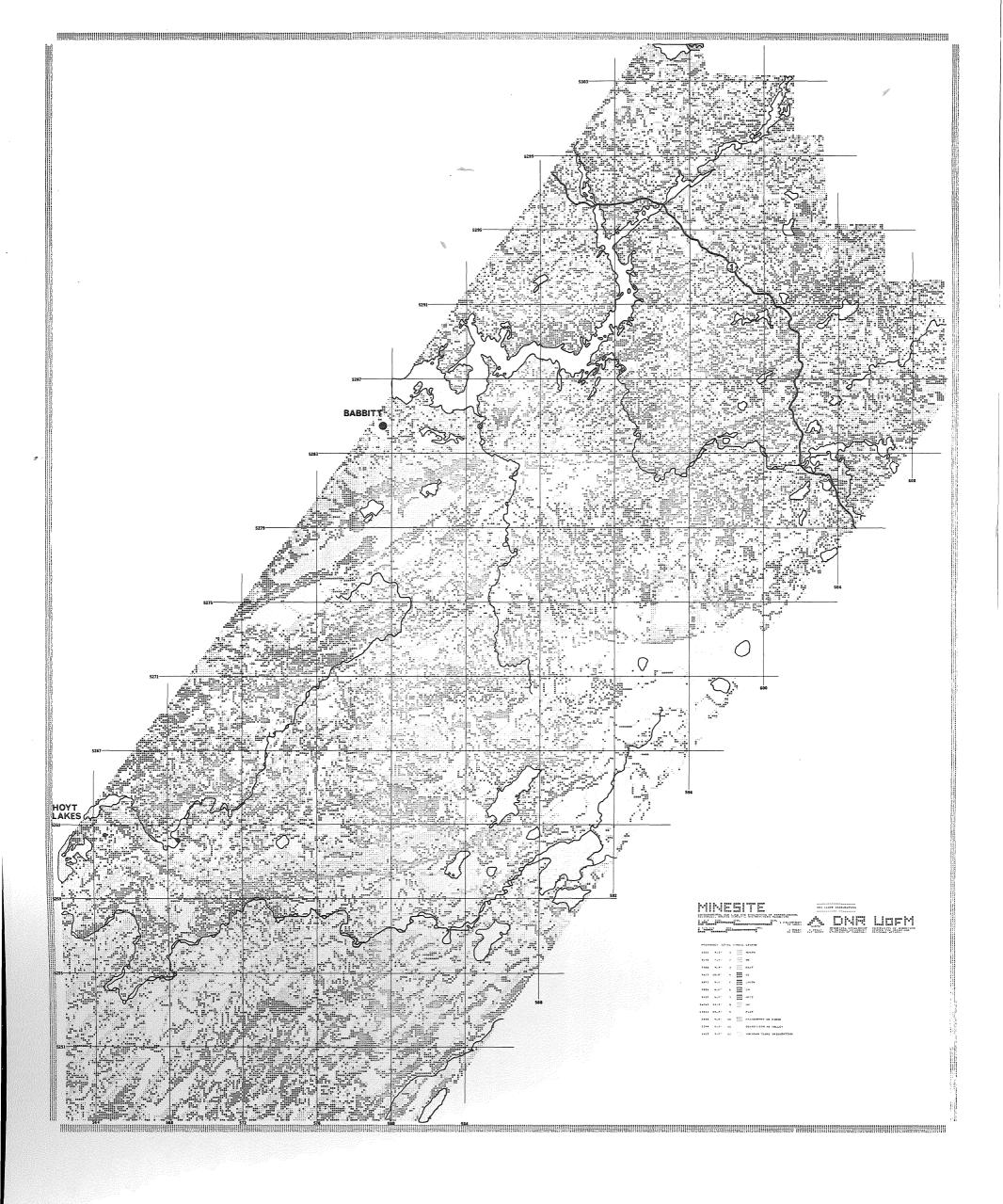
VERIFICATION

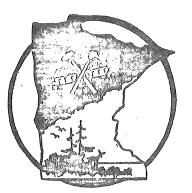
TECHNIQUE: Statistical Check - Appendix I FINAL DATE VERIFIED: October 12, 1976

LEVELS

<u>Data Level</u>	Legend	<u>Data Level</u>	Legend
1	North	7	West
2	Northeast	8	Northwest
3	East	9	Flat
4	Southeast	10	Promintory or Ridge
5	South	11	Depression or Valley
6	Southwest	12	Slope Orientation
			Unknown*

*areas recently disturbed, usually by mining activities





DATA BIOGRAPHY

SOURCE: MGS Publications: Open file geologic maps Allen, Babbitt (NW, NE, SW, SE), Ely, Kangas Bay; SP-8; M-2; M-11; Hibbing Sheet. DNR Two Harbors Geologic Map. INTERPRETATION:

MINESITE Staff

SOURCE DATE: MGS Open file Maps (1970); SP-8 (1969); M-2 (1966); M-11 (1971); Hibbing Sheet (1970). DNR Two Harbors (1972). DESCRIPTION

Bedrock geology is most accurately mapped in areas where surface exposures are abundant. However, where bedrock is buried by surficial material, rock types are largely inferred by geophysical data. Continuity between map sheets is resolved by interpretation. The legend describes a map code followed by a descriptive title of the rock group.

VERIFICATION

TECHNIQUE: All cells checked FINAL DATE VERIFIED: August 18, 1976

LEVELS

<u>Data Level</u>	Lege	ene	d		
	scz	6000	Troctolite		
2	sat	61027 9	Troctolite		
3	st	60000	Troctolite		
4	spt	1 5133	Troctolite		
5	sp	6156	Troctolite		
6	t	8 -33	Troctolite		
7	ta	62003	Troctolite		
8	tam	6250	Troctolite		
9	\mathbf{tu}	6239	Troctolite		1
10	bt	eran	Troctolite		
11	h	6013	Hornfels		
12	mas	600	Mixed Troctolite	and	Anorthosite

(V04)

Data Level	Legen	<u>d</u>
13	mta -	Mixéd Troctolite and Anorthosite
14		Gabbro, Ferrogabbro Undivided Undifferentiated Intrusive
15	g1 -	Gabbro, Ferrogabbro Undivided Undifferentiated Intrusive
16	<u>б</u> —	Gabbro, Ferrogabbro Undivided Undifferentiated Intrusive
17	bg –	Gabbro, Ferrogabbro Undivided Undifferentiated Intrusive
18	dmu -	Gabbro, Ferrogabbro Undivided Undifferentiated Intrusive
19	du –	Gabbro, Ferrogabbro Undivided Undifferentiated Intrusive
20	at -	Anorthosite
21		Anorthosite
22		Anorthosite
23		Anorthosite
24		Anorthosite
25		Anorthosite
26	a –	Anorthosite
28	agu –	Anorthosite
29	au -	Anorthosite
30		Anorthosite
31		-Virginia Formation
32		Biwabik Iron Formation
33		Pokegama Quartzite
34		Giants Range Granite
35		Giants Range Granite
36		Giants Range Granite
37		Giants Range Granite
39		Diabase
40		Knife Lake Group
41		Disseminated Sulfides
43	0	Giants Range Granite
44	gd -	Giants Range Granite

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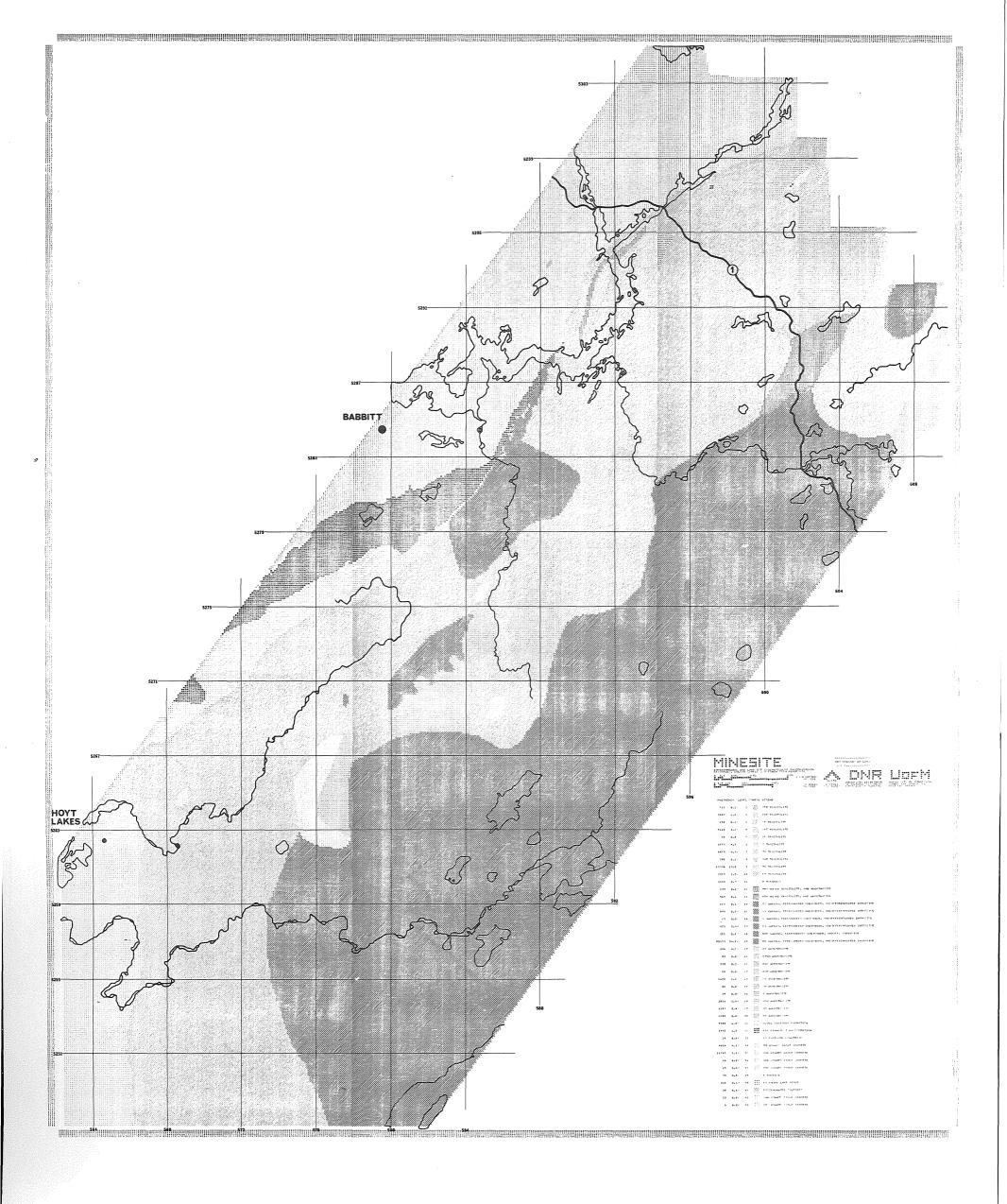
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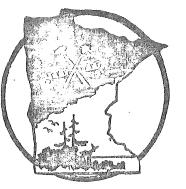
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Surface Hydrology

DATA BIOGRAPHY

USGS Topo Maps: Aurora, Embarrass, Isaac L., Allen SOURCE: (1950); Babbitt (SW,NW) (1951); Babbitt (SE,NE) (1952); Greenwood L. (1954); Ely, Bear Island, Kangas Bay (1965); Gabbro Lake, Markham, Brimson (1957). INTERPRETATION:

Division of Waters Staff, DNR

SOURCE DATE:

See map dates listed above

DESCRIPTION

Surface hydrology was plotted using two types of interpretation. When surface water is predominant within a cell, it is coded as a lake, marsh, tailings basin, or pond. A cell containing a river or stream is coded the appropriate data level regardless of whether it covered more than half of a cell.

VERIFICATION

TECHNIQUE: All cells checked

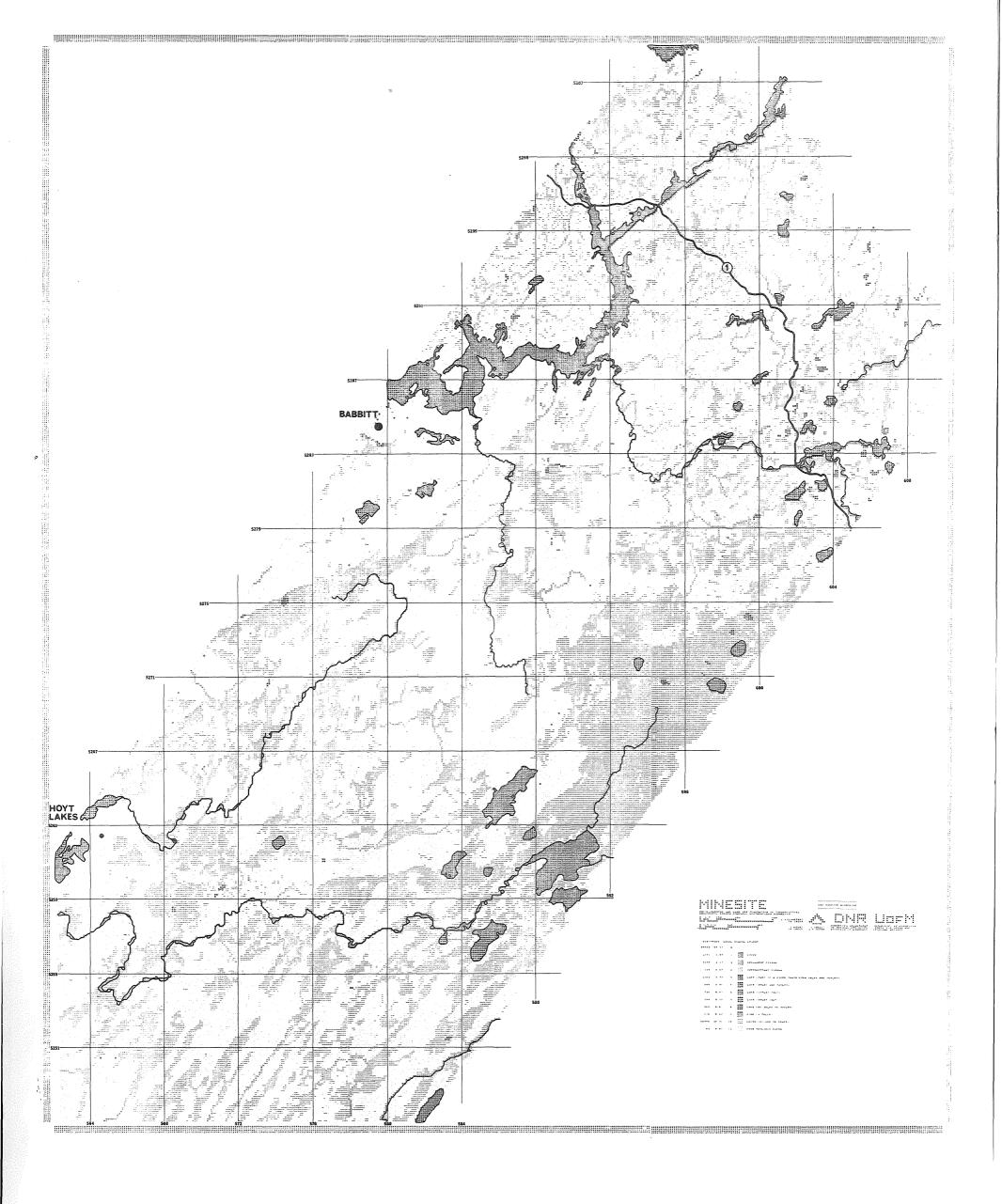
FINAL DATE VERIFIED: September 2, 1976

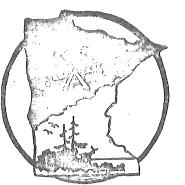
LEVELS

Data Level Legend

	0	
	1	River
	2	Permanent Stream
	3	Intermittant Stream
	4	Lake (Part of a river chain with inlet and outlet)
	5	Lake (Inlet and outlet)
	6	Lake (Outlet only)
	7	Lake (Inlet only)
	8	Lake (No inlet or outlet)
	9	Pond (2 cells)
	10	Marsh (Wooded or grass)
	12	Mine Tailings Basin
1		

(V05)





Watersheds

DATA BIOGRAPHY

USGS Topo Maps: Aurora, Embarrass, Isaac L., Allen SOURCE: (1950); Babbitt (SW,NW) (1951); Babbitt (SE,NE) (1952); Greenwood L. (1954); Ely, Bear Island, Kangas Bay (1965); Gabbro Lake, Markham, Brimson (1957). INTERPRETATION:

Division of Waters, DNR

SOURCE DATE:

See map dates listed above

DESCRIPTION

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The watershed boundaries are based on the cells adjoining that boundary. Cells on each side of a watershed boundary were plotted with the appropriate name. Stream order drainage was established for rivers and streams, as well as lakes and ponds within a river system, with first order represented by the two main streams flowing out of the study area, the South Kawishiwi and St. Louis Rivers. Stream branches were then numbered consecutively upstream as 2nd through 6th order. Levels are classified according to stream order or corresponding watershed boundary. VERIFICATION

TECHNIQUE: All cells checked

FINAL DATE VERIFIED: September 2, 1976

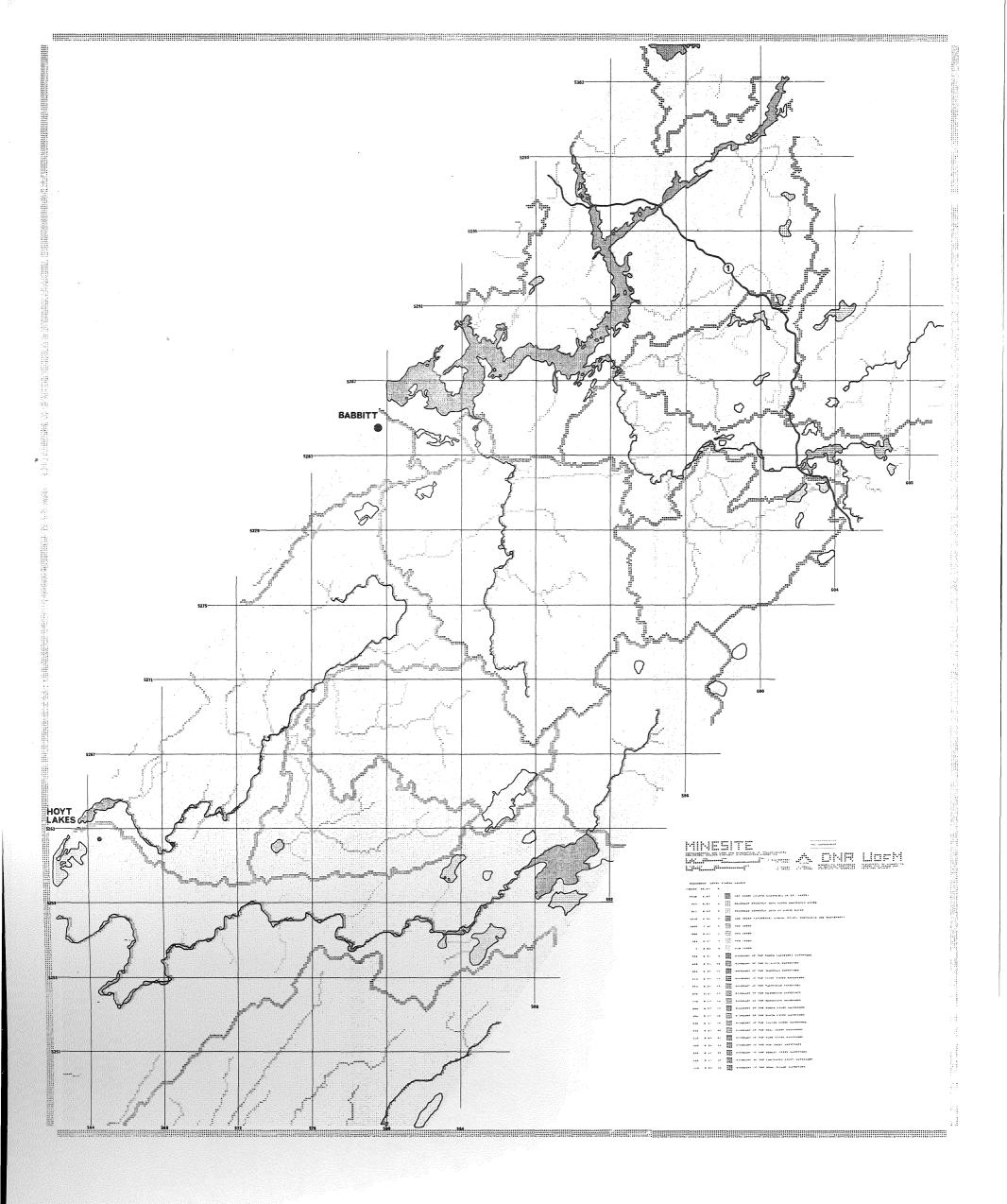
LEVELS

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Data Level Legend

0	
1	lst Order (South Kawishiwi or St. Louis)
2	Drainage Directly into South Kawishiwi River
3	Drainage Directly into St. Louis River
4	2nd Order (Isabella, Dunka, Stony, Partridge,
	and Whiteface)
5	3rd Order
6	4th Order
7	5th Order
8	6th Order
9	Boundary of the South Kawishiwi Watershed

Data Level	Legend			
$ \begin{array}{r} 10\\ 11\\ 12\\ 13\\ 14\\ 16\\ 17\\ 18\\ 19\\ 20\\ 21\\ 22\\ 23\\ 25 \end{array} $	Boundary Boundary Boundary Boundary Boundary Boundary Boundary Boundary Boundary Boundary Boundary Boundary Boundary Boundary	of of of of of of of of of of of	the the the the the the the the the the	St. Louis Watershed Isabella Watershed Stony River Watershed Partridge Watershed Whiteface Watershed Embarrass Watershed Dunka River Watershed North River Watershed Colvin Creek Watershed Argo Creek Watershed Sand River Watershed Nip Creek Watershed Denley Creek Watershed Kawishiwi River Watershed
26	Boundary	ot	the	Bear Island River Watershed





Surface Ownership

DATA BIOGRAPHY

Surface ownership was obtained from MLMIS regional data -SOURCE: V05 Public Ownership: Federal, State, and County. MLMIS used Agency Land Ownership Records; Department of Natural Resources, Land Classification Study. INTERPRETATION:

MLMIS Staff

SOURCE DATE: State, BIA, and Forest Service - 1973. All other Federal ownership - 1969.

DESCRIPTION In V95, sixteen MINESITE cells were assigned to a single forty acre MLMIS cell based upon MLMIS Township and Range standard section line designations. Using these assignments, the MLMIS surface ownership data was superimposed on the MINESITE UTM grid. Due to the discrepancy in cell size and difficult nature of assigning cells to a standardized land survey grid, this variable is regional and should not be considered cell specific. It should be noted that the MLMIS files contain other ownership categories existing throughout the state which do not appear in this study area.

VERIFICATION

TECHNIQUE: Checked by MLMIS Staff

FINAL DATE VERIFIED: October 20, 1976

LEVELS

Data Level Legend 0 No Public Ownership $\mathbf{2}$ Federal - National Forests 3 Multiple - Lands coded Federally Owned, but show State Ownership 4 Multiple - Federally Owned Lands sharing County Ownership 5 State - DNR Forestry Lands within State Forests 6 State - DNR Forestry outside State Forests 7 State - DNR Waters, Soils and Minerals 10 State - Enforcement and Field Service 14 State - Minnesota Highway Department Rest Areas

(VO8)

<u>Data Level</u>	Legend
15	State – Minnesota Highway Department Maintenance, Storage and Gravel Pits
18 19	County – Other County (Tax Forfeit) County – Partial Ownership

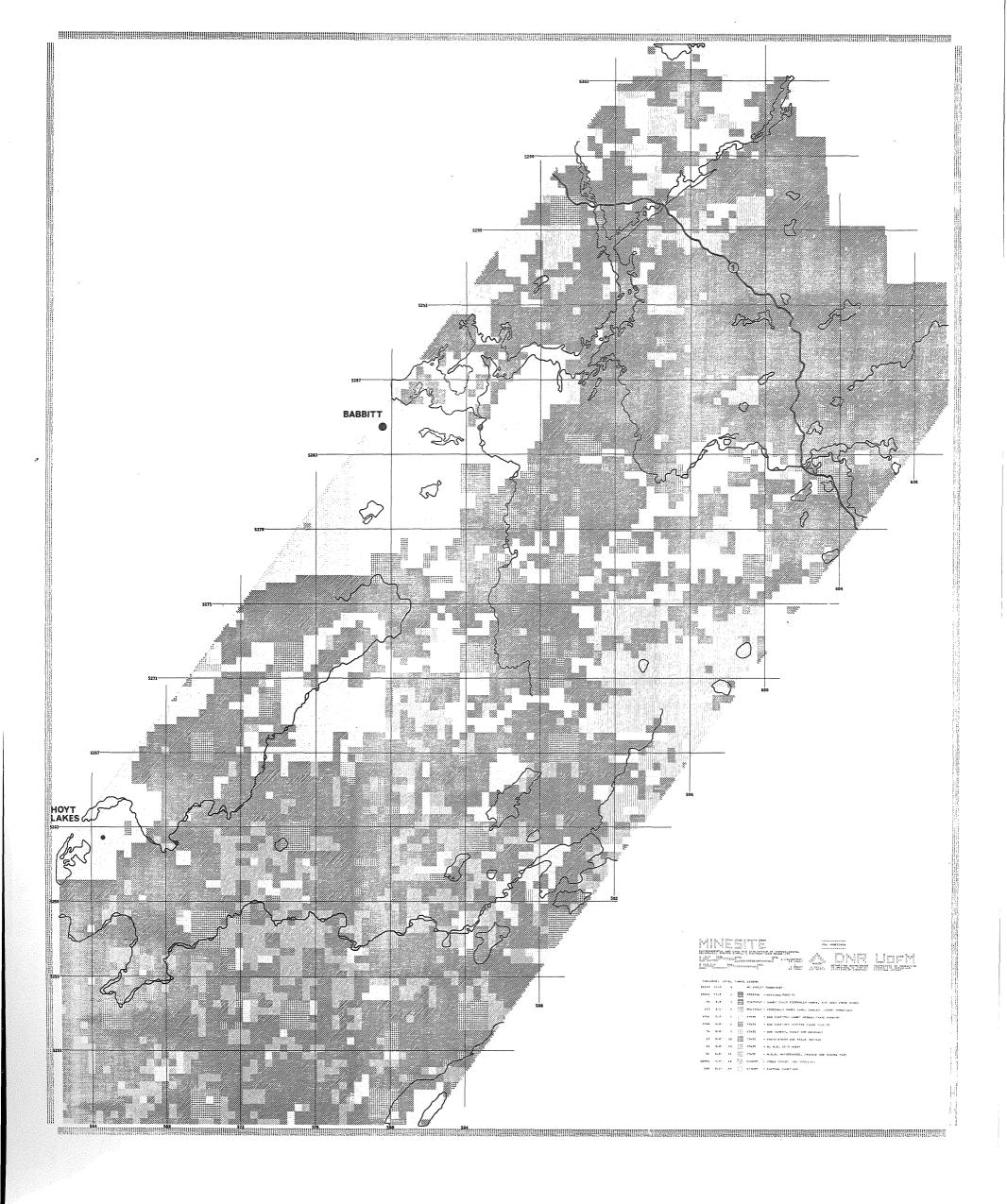
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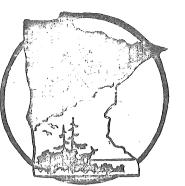
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Elevation

(V09)

DATA BIOGRAPHY

SOURCE: See maps listed in VO2

INTERPRETATION: MINESITE Staff, DNR

SOURCE DATE: See map dates listed in VO2

DESCRIPTION

Elevation is coded based on the predominant line passing through each cell. When multiple contour lines pass through a cell, the interpreter is required to select the most representative elevation for that cell.

VERIFICATION

TECHNIQUE: Statistical Check - Appendix I FINAL DATE VERIFIED: September 16, 1976

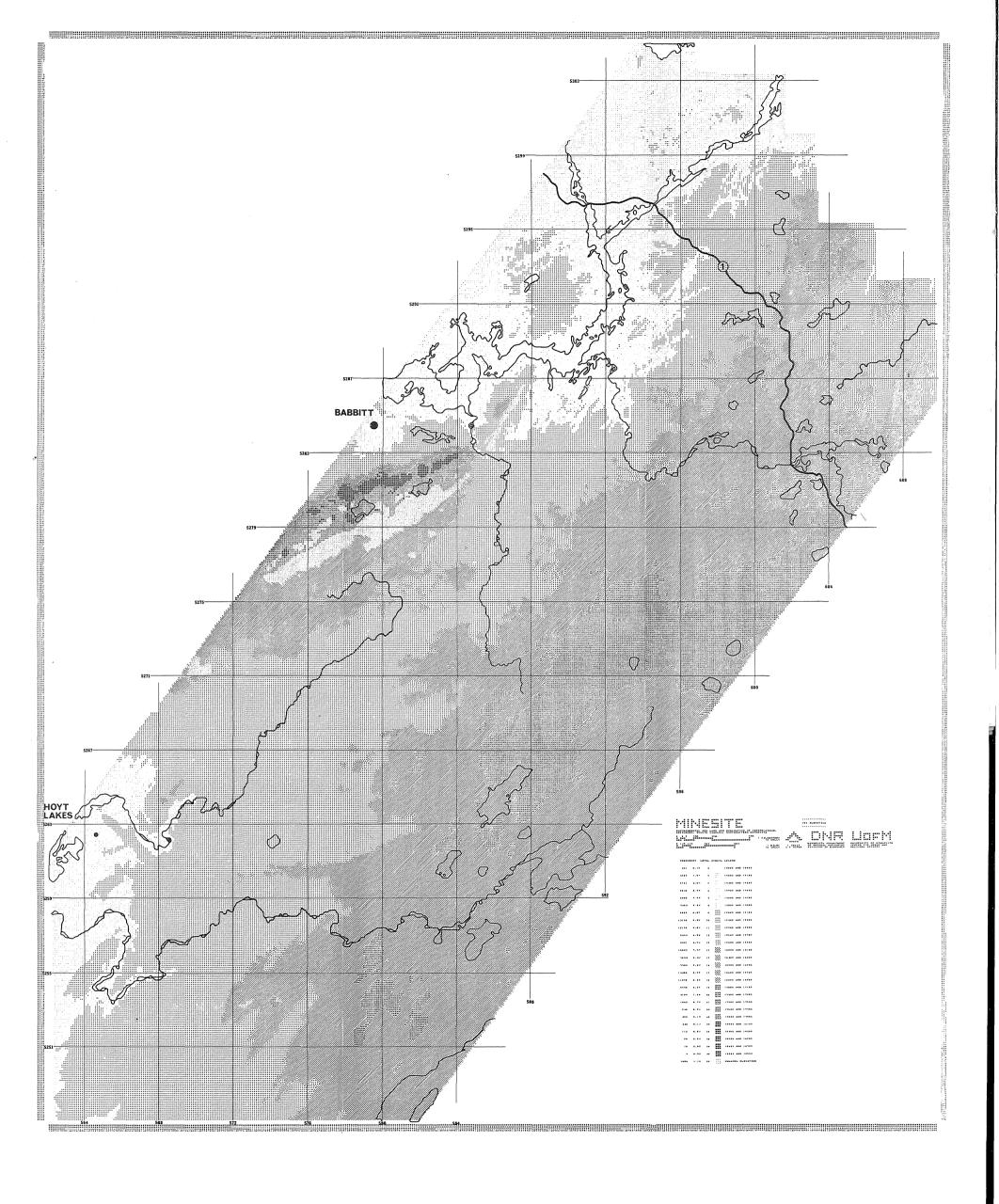
LEVELS

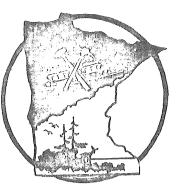
Data Level Legend	<u>Data Level</u>	Legend
4 1400's and 5 1420's and 6 1440's and 7 1460's and 8 1480's and 9 1500's and 10 1520's and	1370's131390's141410's151430's161450's171470's181490's191510's20	1560's and 1570's 1580's and 1590's 1600's and 1610's 1620's and 1630's 1640's and 1650's 1660's and 1670's 1680's and 1690's 1700's and 1710's 1720's and 1730's 1740's and 1750's 1760's and 1770's

Data Level	Legend	Data Level	Legend
23	1780's and 1790's	30	1900's and 1910's
24	1800's and 1810's	31	1920's and 1930's
25	1820's and 1830's	32	1940's and 1950's
26	1840's and 1850's	33	1960's and 1970's
28	1860's and 1870's	34	1980's and 1990's
29	1880's and 1890's	35	Elevation Unknown*

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*areas recently disturbed, usually by mining activities





DATA BIOGRAPHY

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SOURCE: Superior National Forest, U.S. Forest Service, U.S. Dept. of Agriculture

INTERPRETATION: Donald Prettyman, Forest Soil Scientist, Superior National Forest

SOURCE DATE: July 1976

DESCRIPTION

Soil Landscape Units were mapped based upon geology, drainage patterns, local relief, slope, vegetation, and topographic patterns identified from aerial photography and topographic maps, as well as from direct field observation. The smallest mapping unit shown on the soil map is 5-10 acres. See Appendix B for detailed information on soil units present in the MINESITE area.

VERIFICATION

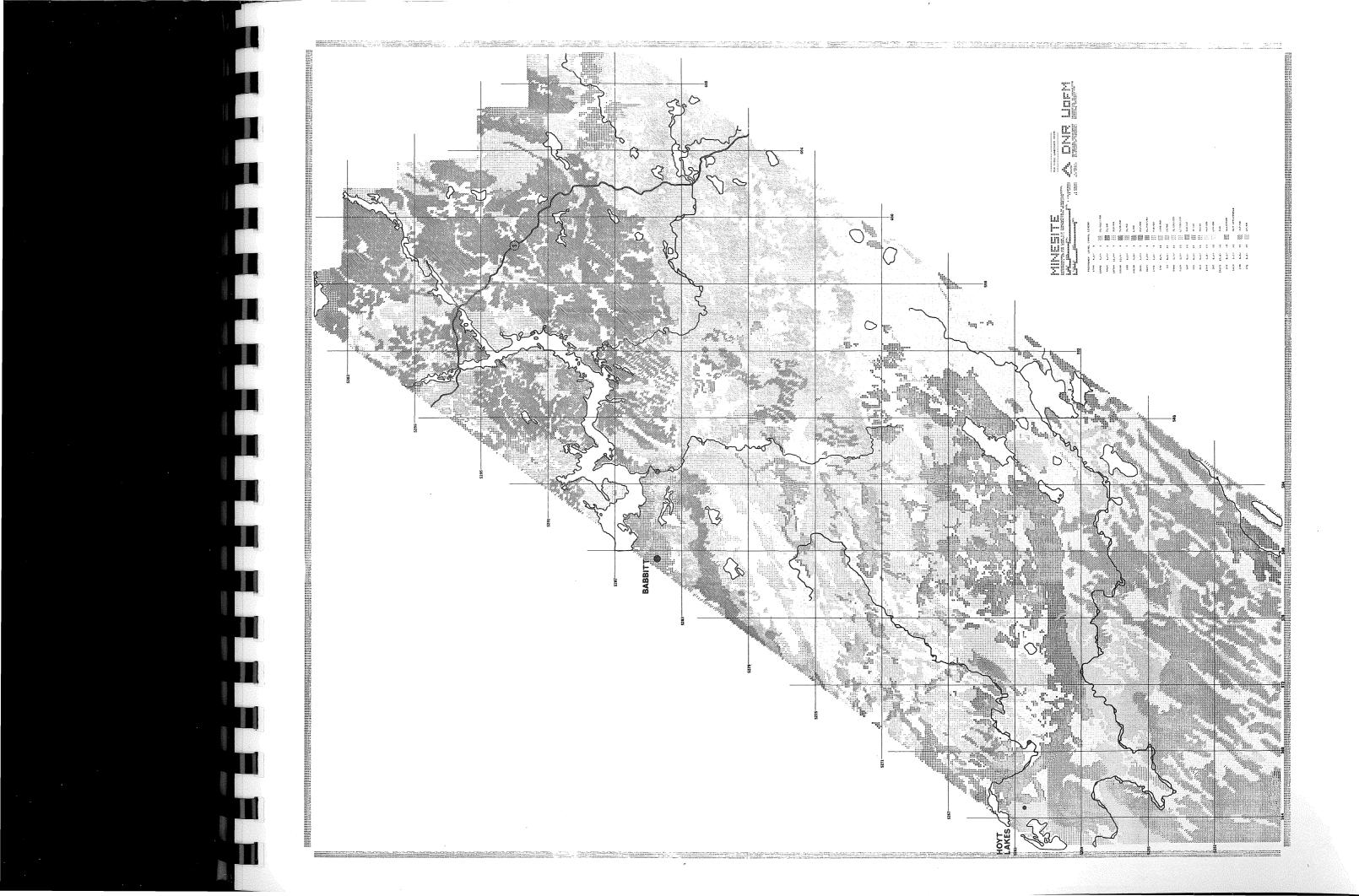
TECHNIQUE: Statistical Check - Appendix I FINAL DATE VERIFIED: October 20, 1976

LEVELS

Data Level	Legend	Data Level	Legend
0			
1	SL/GLS	6	
	RM		RD
2	SL	7	SLP
	RM		RM
3	SLB	8	<u>SL/SG</u>
	RM		RO
4	SLVB	9;	SGB
	RM		RO
5	SL RD	10	SGVB
	RD		RO

(V10)

<u>Data Level</u>	Legend		<u>Data Level</u>	Legend
11	$\frac{SG}{RE}$	1 S	17	OLP DR
12	$\frac{SL/SG}{SO}$		18	LOP DR
13	LS/SG SO		19 20	Bog Alluvium
14	SGP SO		$\begin{array}{c} 21 \\ 24 \end{array}$	Not applicable <u>SLP</u> RD
15	SP SO		25	LP
16	SG SE			RM





Depth to Duluth Complex Contact

(V11)

DATA BIOGRAPHY

SOURCE: Division of Minerals, DNR

INTERPRETATION: Division of Minerals, DNR

SOURCE DATE: December 1975

DESCRIPTION

The area within a few hundred feet of the basal contact of the Duluth Complex contains the majority of the known sulfide mineralization and is therefore most likely to contain mineable ore deposits. The basal contact, or footwall, of the Duluth Complex occurs along the western margin of the formation between the complex and underlying rock units, and dips to the southeast. Determination of the dip of this contact was made from bedrock outcrop mapping and available drill core. Using this data, the depth to this contact was projected and plotted. VERIFICATION

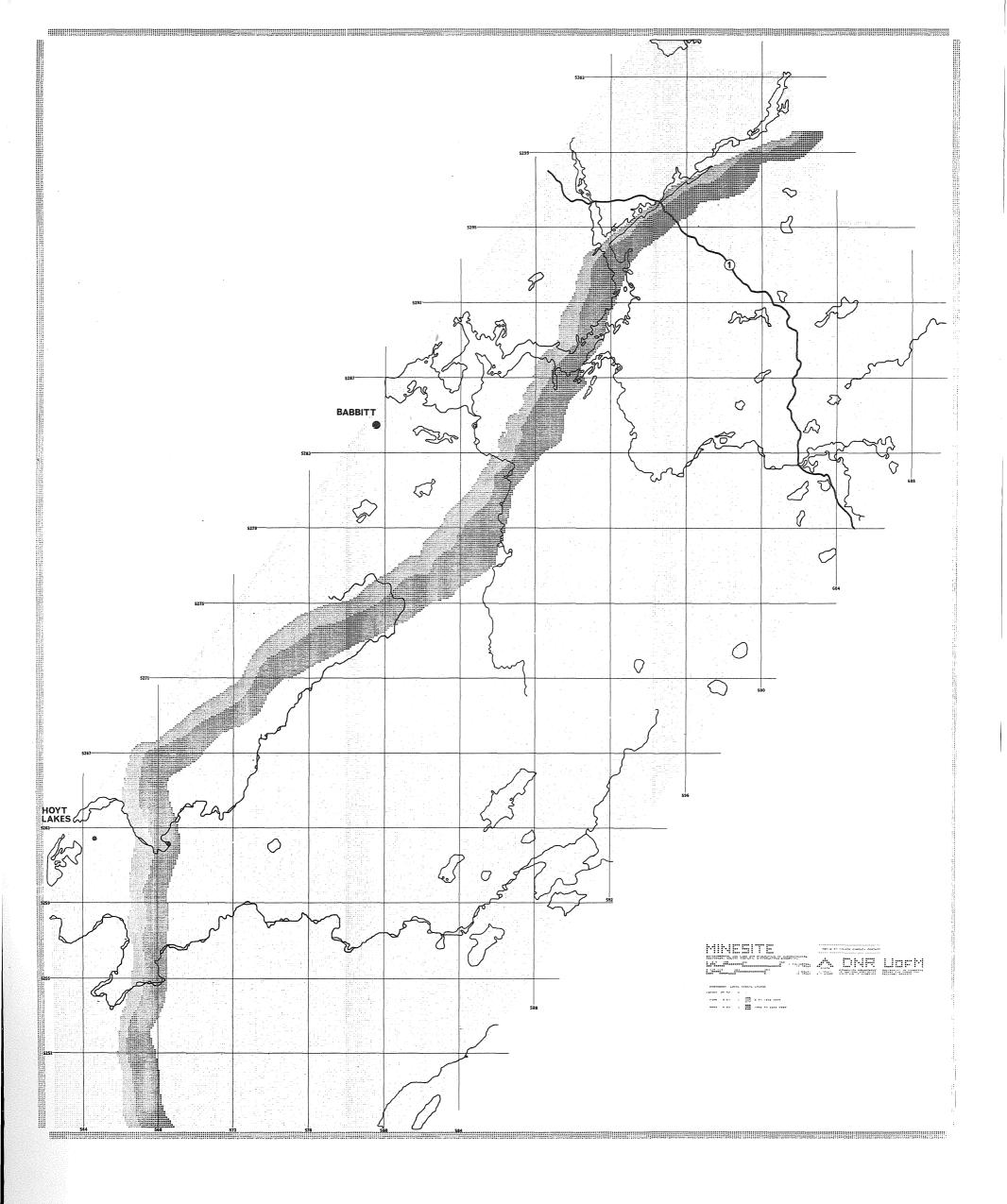
All cells checked TECHNIQUE: FINAL DATE VERIFIED: August 18, 1976

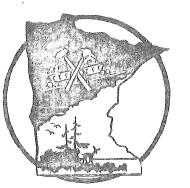
LEVELS

0

Data Level Legend

ل است	0	to	1,	00	0	feet	ե
2	1,	000	t	0	З,	000	feet





Land Use

DATA BIOGRAPHY

I.

DNR Reclamation Maps (1975), SCORP (State Comprehensive SOURCE: Outdoor Recreation Plan) Maps (July 1974), MLMIS Data Maps (January 1976), Aerial Photographs (1970), Quadrangle Maps, US Forest Service Ownership Maps, Superior National Forest Map. INTERPRETATION:

MINESITE Staff, DNR

SOURCE DATE:

See map dates listed above

DESCRIPTION

Existing man-made land use activities are shown with emphasis on mining activities. This variable does not include land uses covered in other variables.

VERIFICATION

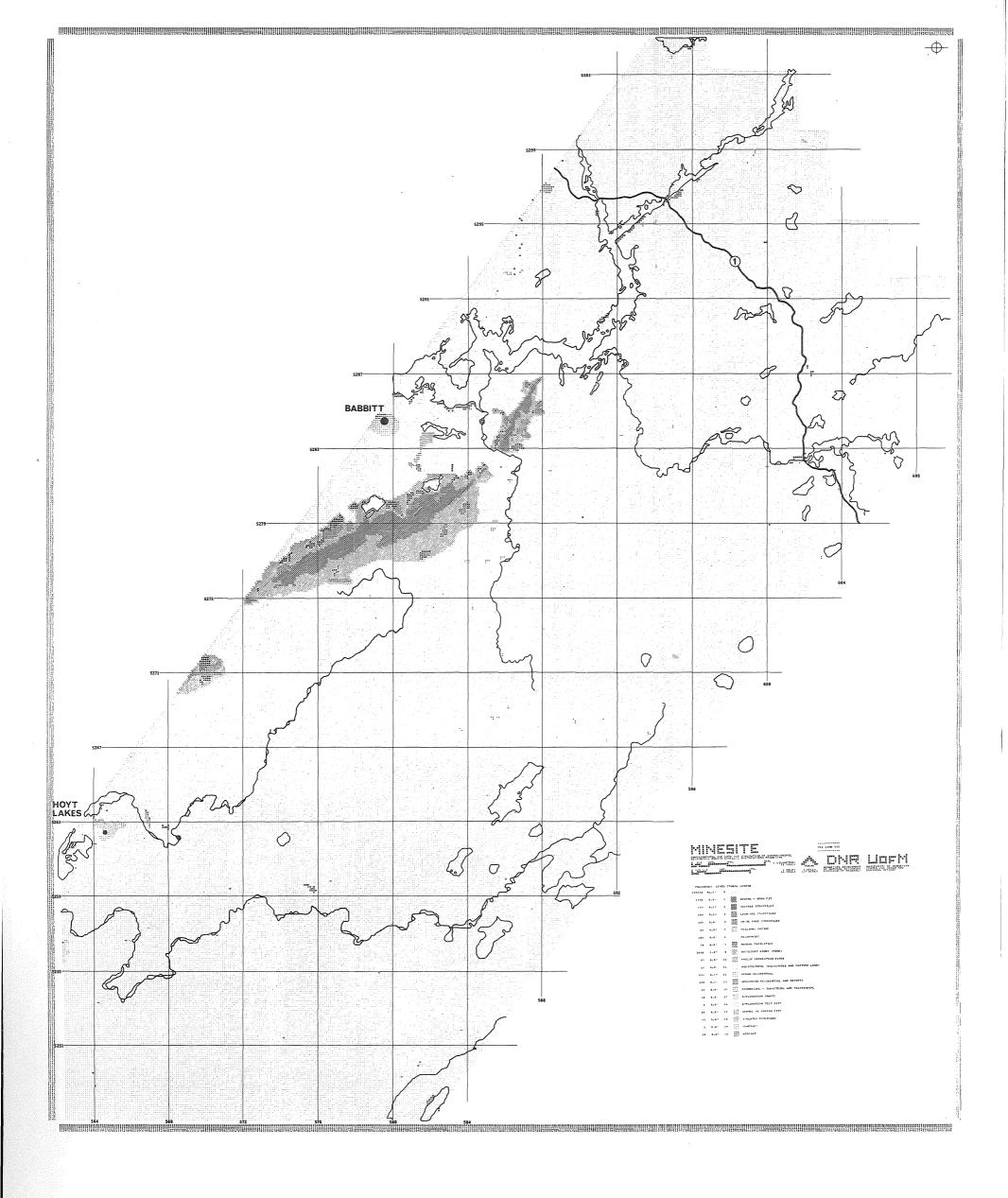
TECHNIQUE: All cells checked

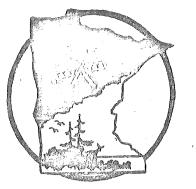
FINAL DATE VERIFIED: October 19, 1976

LEVELS

Data Level	Legend
0	
1	Mining - Open Pit
2	Surface Stockpiles
3	Lean Ore Stockpiles
4	Waste Rock Stockpiles
5	Tailings Basins
6	Reservoirs
7	Mining Facilities
8	Auxiliary Lands (Mine)
10	Public Recreation Sites
	Agriculture (Cultivated and pasture land)

Data Level	Legend
12 13	Urban Residential Non-Urban Residential and Resorts (Some possibly
14 15	abandoned) Commercial-Industrial and Residential Exploration Shafts
16	Exploration Test Pits
17	Gravel or Borrow Pits
18	Isolated Buildings (Some possibly abandoned)
19	Cemetery
20	Airport





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Shipstead Newton Nolan--Superior National Forest Areas

(V13)

DATA BIOGRAPHY

SOURCE: Superior National Forest Map (1972) Shipstead Newton Nolan Act of 1930

INTERPRETATION: MINESITE Staff, DNR

SOURCE DATE: See map dates listed above

DESCRIPTION

The Superior National Forest is administered by the U.S. Forest Service, Dept. of Agriculture as a National Forest. One area within the Superior National Forest is regulated by the Shipstead Newton Nolan Act which imposes water level and shoreline restrictions.

VERIFICATION

TECHNIQUE: All cells checked

FINAL DATE VERIFIED: September 24, 1976

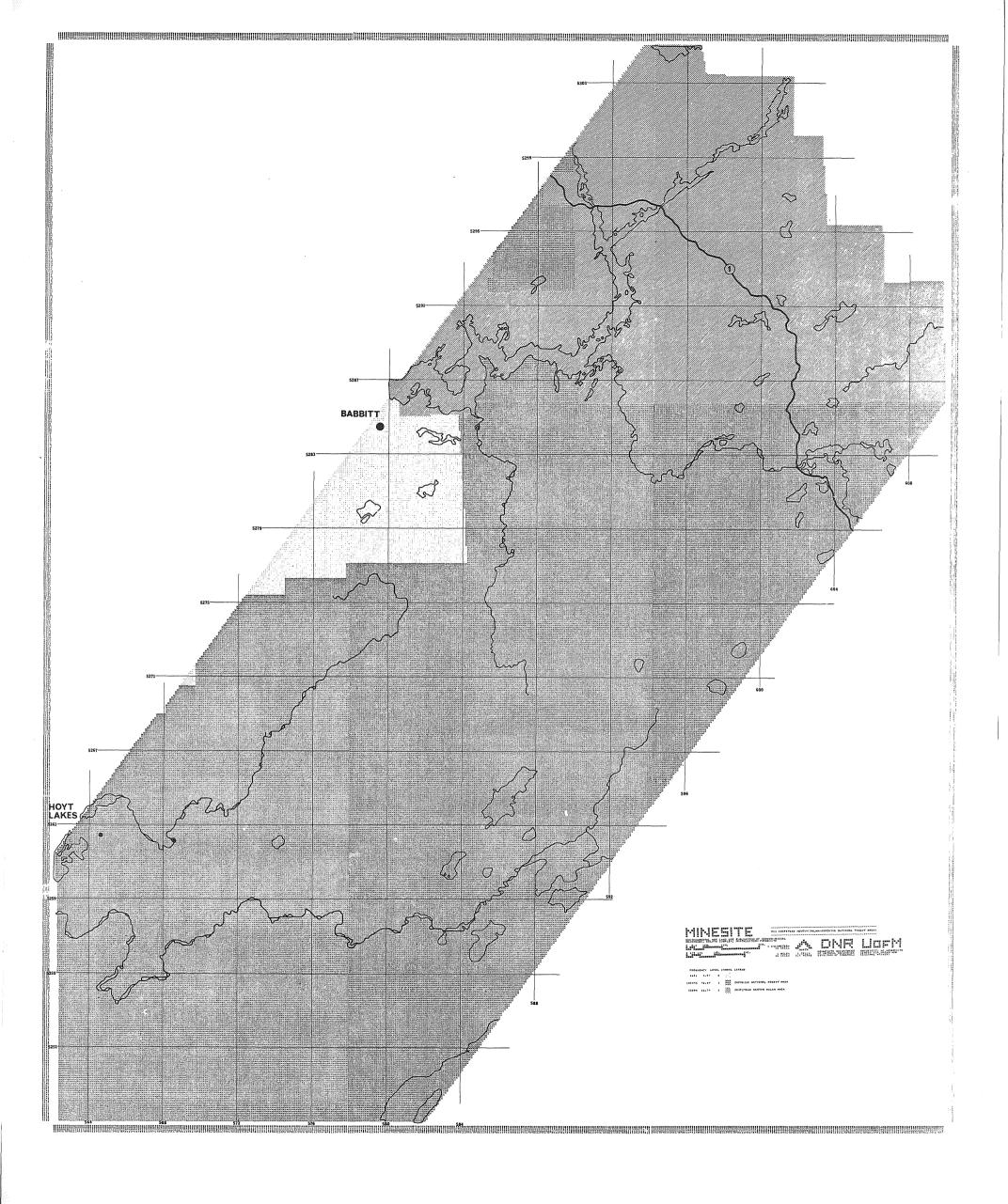
LEVELS

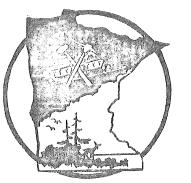
Ω

Data Level Legend

0				
1	Superior	National	Fores	st Area
2	Shipstead	Newton	Nolan	Area*

*Also within the Superior National Forest





Recreation-Historical-Archeological Sites

DATA BIOGRAPHY DNR; USFS; Superior Nat'l Forest Maps; Project 80 Natural & Historical Areas of MN (1971); USGS Maps; SOURCE: "Exploring St. Louis Co. Historical Sites" (1971); MN Outdoor Recreation Area Inventory, DNR (1976); Background to the General Plan, Lake Co.; Trygg Map, Sheet 17 (1966). INTERPRETATION:

MINESITE Staff, DNR

SOURCE DATE:

September 1976

DESCRIPTION

This inventory includes existing or potential historical sites and cultural land uses that are traditionally associated with recreational-educational activities. The data levels have been mapped as either areas or boundaries. In several cases, such as with the historical site data levels, the exact location of the sites is approximate, based upon the best available information.

VERIFICATION

TECHNIQUE: All cells checked

FINAL DATE VERIFIED: October 20, 1976

LEVELS

Data Level	Legend
0	
1	Lumbering Site
2	Approximate Mine Site Location
3	Keeley Creek Research Natural Area Boundary
4	Approximate Ghost Town Location
5	Indian Cultural Site
6	Boat Launching Site – Public Access
7	Proposed Seven Beaver Recreation Area Boundary
8	Nature Trails
9	Outward Bound School
10	Birch Lake Plantation

(V14)

<u>Data Level</u>	Legend
11	Lookout Tower
12	Snowmobile Trail
13	Scenic Wayside
14	Kawishiwi Experimental Forest Boundary
15	Snowmobile Trail and Proposed Seven Beaver Recreation
- 6	Area Boundary
16	Lumbering Site and Proposed Seven Beaver Recreation
	Area Boundary
17	Early Road
18	Indian Trail
19	Indian Trail and Birch Lake Plantation
20	Indian Trail and Proposed Seven Beaver Recreation
ð"	Area Boundary
21	Indian Trail and Snowmobile Trail
22	Indian Trail and Snowmobile Trail and Proposed
	Seven Beaver Recreation Area Boundary

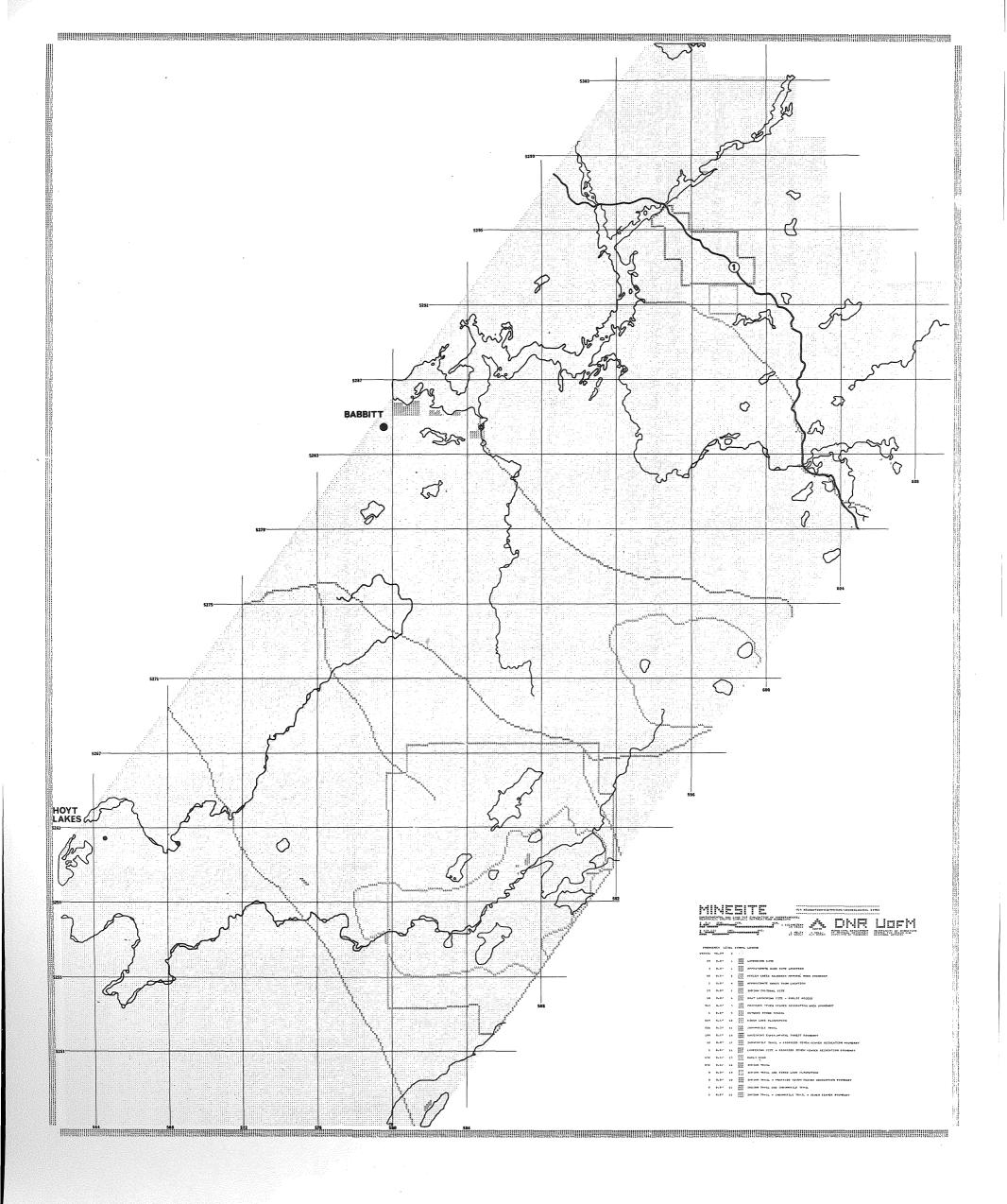
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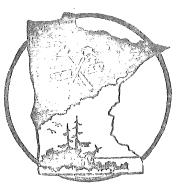
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REAL ROOM

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Taconite Reserves and Potential Taconite Resources

DATA BIOGRAPHY

SOURCE: See Appendix C References

INTERPRETATION: MINESITE Staff, DNR

SOURCE DATE: April 1976

DESCRIPTION

Taconite reserves and potential resources are delineated based on the mining type (Open pit or Underground), the dip of the mineral layers, the depth of the mineral layers, the thickness of the upper and lower cherty horizons and the southerly extent of the potential mineral layers. Appendix C, Definition of Taconite Reserves and Potential Resources, provides the criteria for this interpretation.

VERIFICATION

TECHNIQUE: All cells checked

FINAL DATE VERIFIED: August 20, 1976

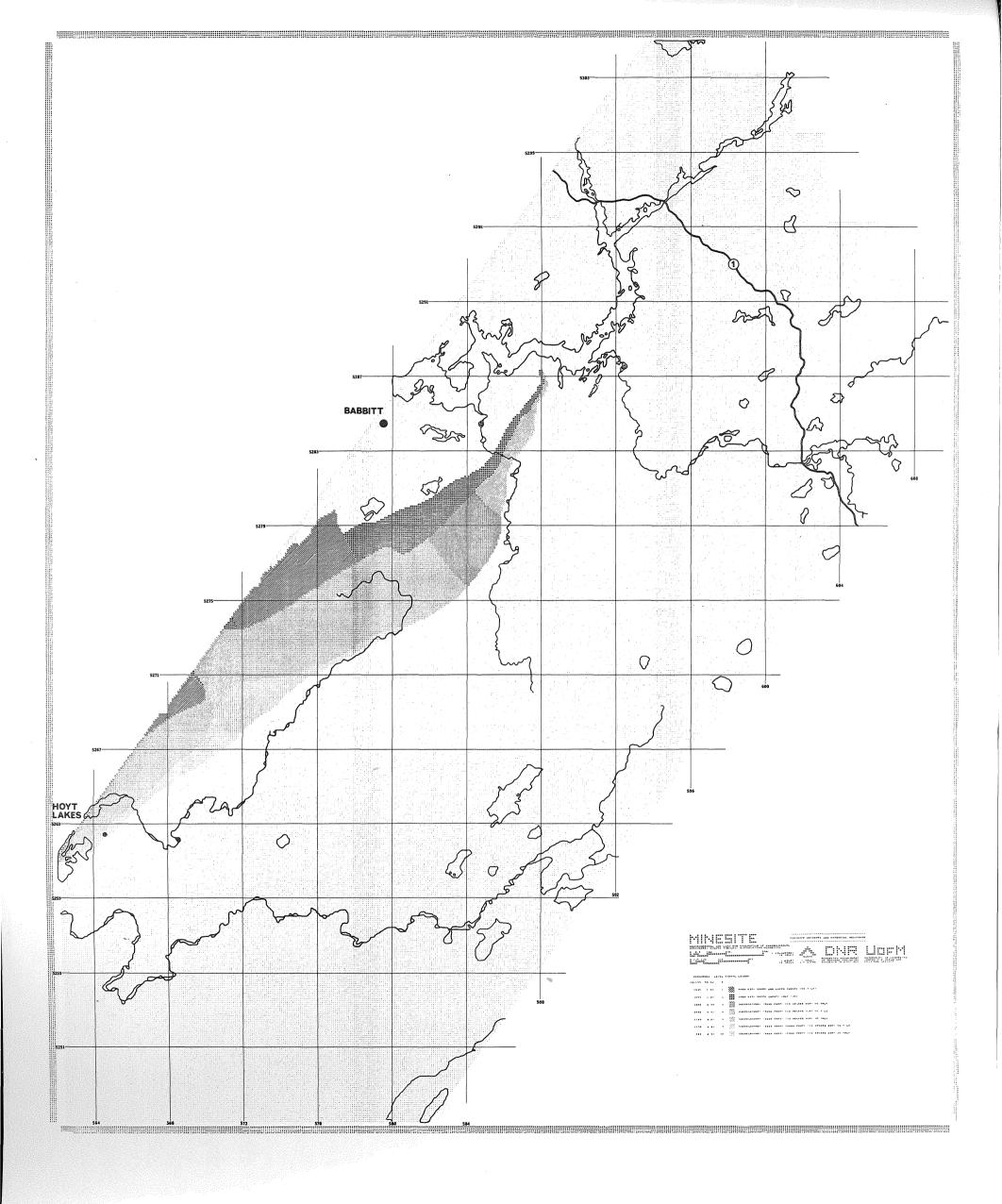
LEVELS

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Data Level Legend

0	
1	Open Pit - Upper and Lower Cherty (UC & LC)
2	Open Pit - Upper Cherty only (UC)
3	Underground (UG) - $<10^{\circ}$, ≤ 3000 ft. Max.Depth, UC only
4	UG - $<10^{\circ}$, ≤ 3000 ft. Max. Depth, UC & LC
5	UG - >10°, \leq 3000 ft. Max. Depth, UC only
6	UG - >10°, ≤3000 ft. Max. Depth, UC & LC
7	UG - $<10^{\circ}$, > 3000 ft. but <5000 ft., UC & LC
8	UG $- >10^{\circ}$, > 3000 ft. but < 5000 ft., UC & LC
9	UG - <10°, >3000 ft. but <5000 ft., UC only
10	UG - $>10^{\circ}$, >3000 ft. but <5000 ft., UC only

(V15)





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Vegetation

DATA BIOGRAPHY

SOURCE: See reference for Appendix D - Vegetation Inventory

INTERPRETATION: Same as source. V16, V18, V19, and V20 interpreted concurrently

SOURCE DATE: February 1975

DESCRIPTION

Standard methods of aerial photo interpretation and vegetation type classification are used to classify the cover types by predominant species, and are related to a previously developed ecosystem classification. Types delineated are commonly used timber management classes which could be assigned marketing and pricing factors and could be distinguished on black and white infrared aerial photographs (Appendix D - Vegetation Survey).

VERIFICATION

TECHNIQUE: Statistical check - Appendix I FINAL DATE VERIFIED: September 16, 1976

LEVELS

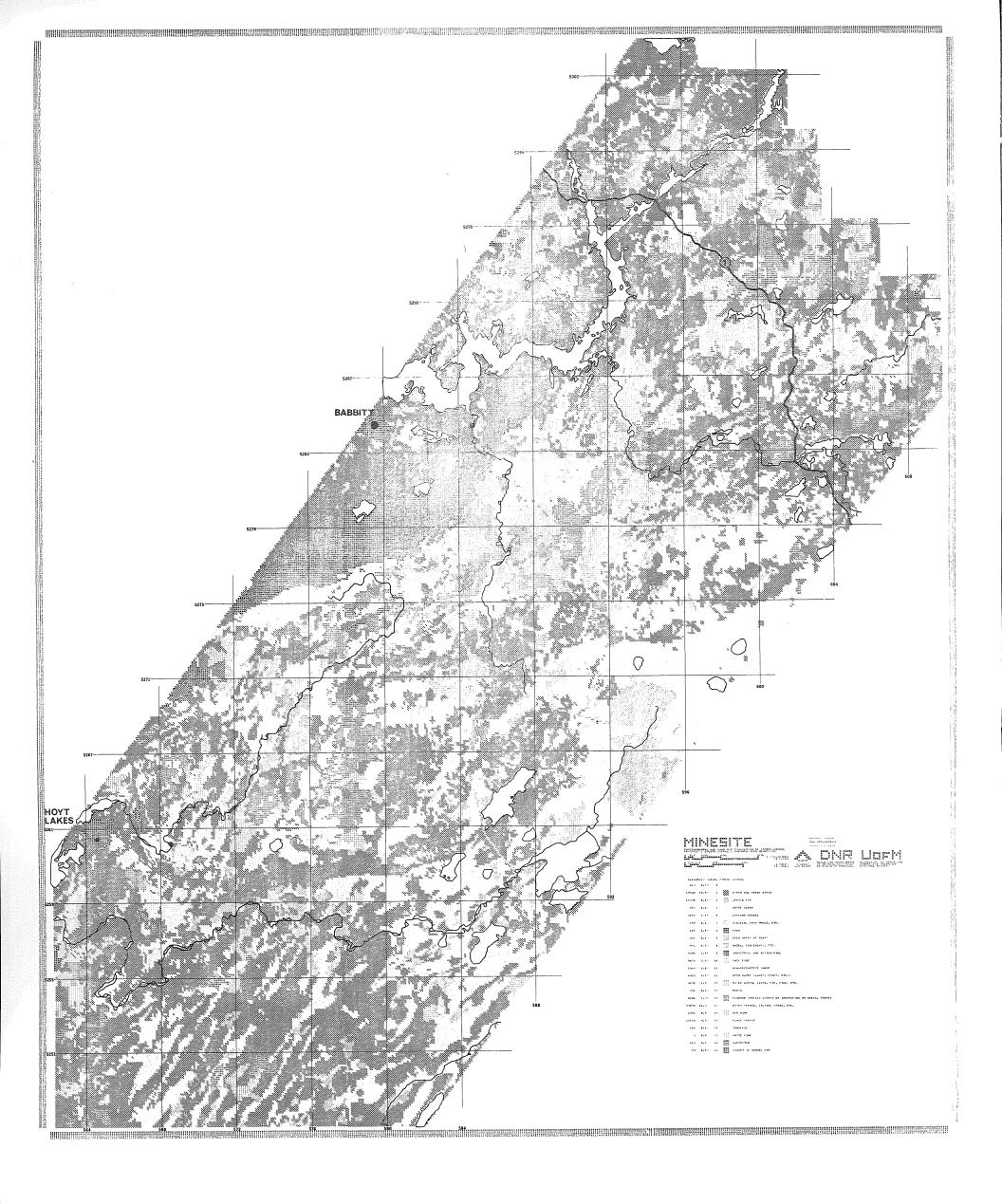
<u>Data Level</u>	Legend
0	
	Aspen and paper birch
2	Spruce-fir
3	White cedar
4	Lowland shrubs
5	Ash, elm, soft maple, etc.
6	Farm
7	Open areas of grass ;
8	Hazel, pin cherry, etc.
9	Industrial and residential
1.0	Jack pine

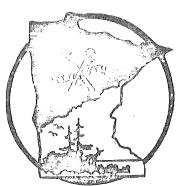
(V16)

Data Level Legend

11	Non-productive swamp
12	Open water (lakes, ponds, etc.)
13	Northern hardwoods
14	Mixed aspen, birch, fir, pine, etc.
15	Marsh
16	Planted species - species cannot be
	identified on aerial photos
17	Mixed spruce, balsam, cedar, etc.
18	Red pine
19	Black spruce
20	Tamarack
23	White pine
24	Harvested
26	Quarry or gravel pit

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DATA BIOGRAPHY

SOURCE: Limnological Research Center, University of Minnesota

INTERPRETATION: Limnological Research Center

SOURCE DATE: July 1975

DESCRIPTION

Using aerial photography from the period 1934 (or 1937) to 1970 several map units depicting cutting history are detailed. Logging occurring after 1970 is not shown because it is reflected in the forest cover-type inventory (V16) that has been corrected to 1975 by Earth Resource Technology Satellite (ERTS) imagery.

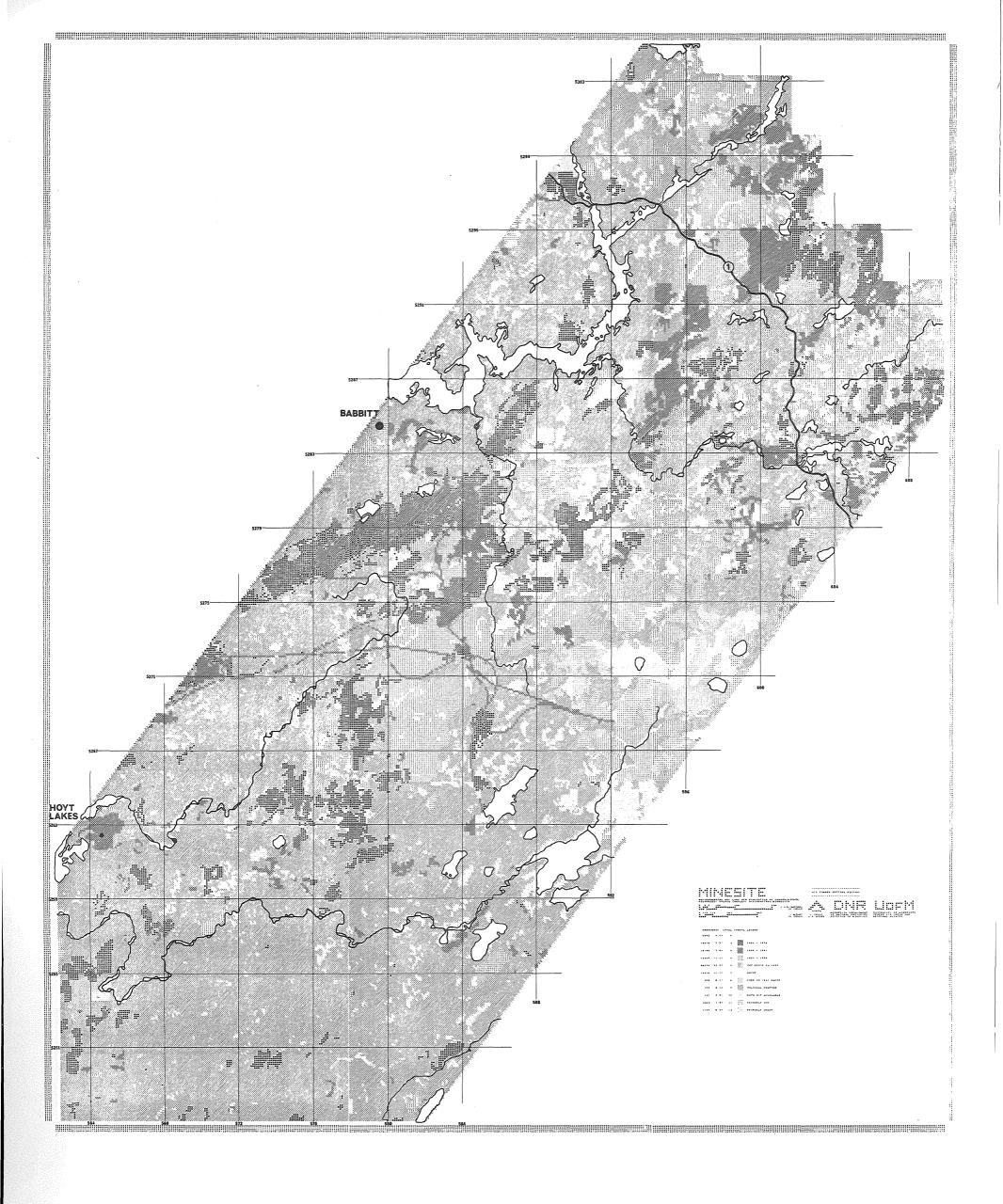
VERIFICATION

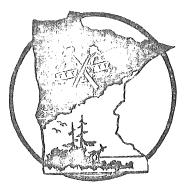
TECHNIQUE: All cells checked FINAL DATE VERIFIED: September 16, 1976

LEVELS

<u>Data Level</u>	Legend
0	
2	1962-1970
3	1949-1961
4	1937-1948
5	Cut prior to 1937
7	Uncut
8	Fire area on 1961 photos
9	Cultural features
10	Data not available
11	Probably cut
12	Probably uncut

(V17)





Crown Density

DATA BIOGRAPHY

SOURCE: See references for Appendix D - Vegetation Inventory

INTERPRETATION: Same as source. V16, V18, V19, and V20 interpreted concurrently

SOURCE DATE: February 1975

DESCRIPTION

Vegetation units delineated in V16 are interpreted into density classes as poor, medium, or good. Density classes for poles and saw timber are based upon percentage crown closure; seedlings and saplings are based upon number of trees per acre (Appendix F -Vegetation Size and Density Classes (V18 and V19)).

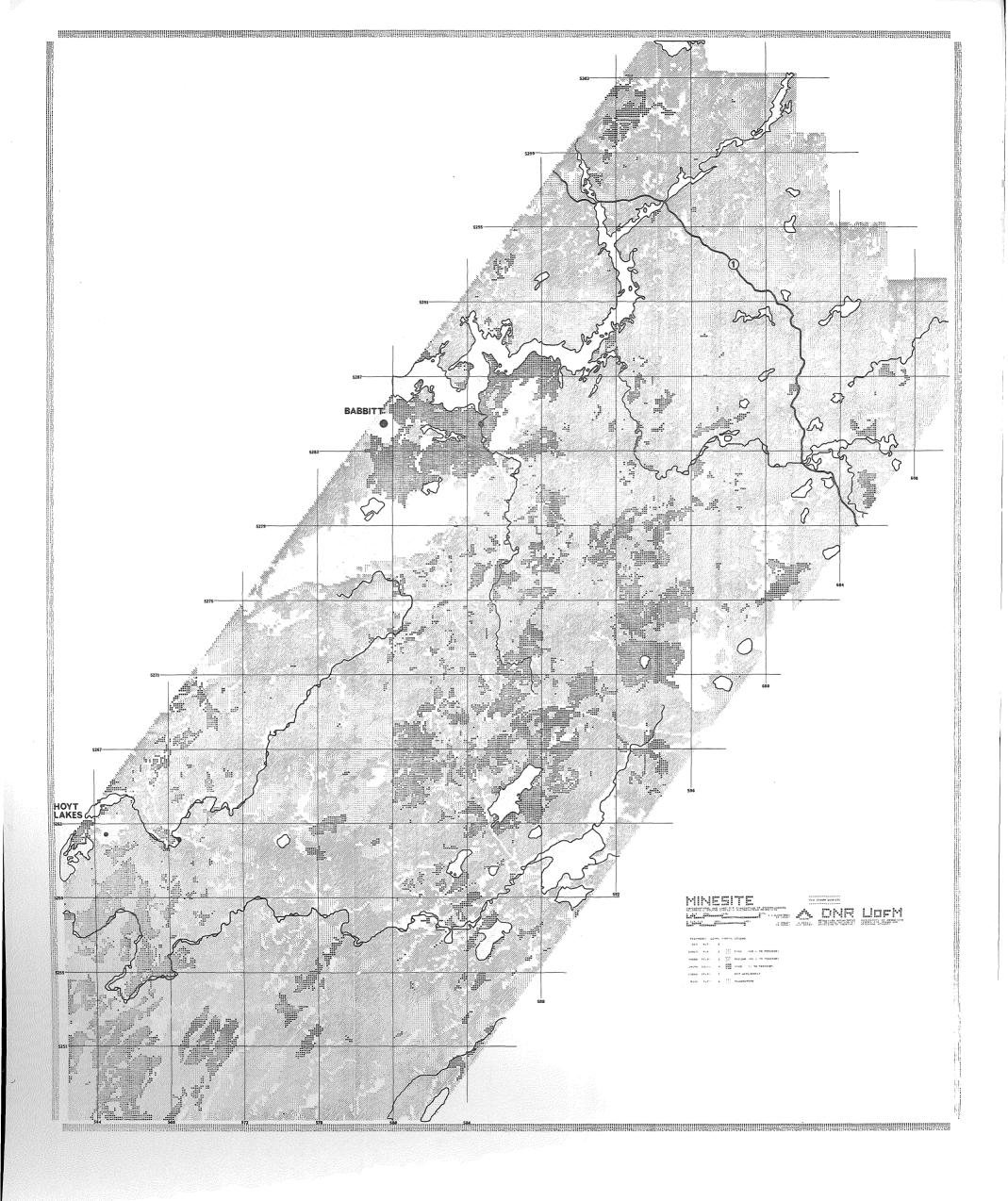
VERIFICATION

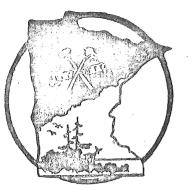
TECHNIQUE: Statistical check - Appendix I FINAL DATE VERIFIED: September 12, 1976

LEVELS

Legend
Poor (10-40%)
Medium (41-70%)
Good (>70%)
Not applicable
Plantation

(V18)





Forest Size Classes

(V19)

DATA BIOGRAPHY

SOURCE: See references for Appendix D - Vegetation Inventory

INTERPRETATION: Same as source. V16, V18, V19, and V20 interpreted concurrently

SOURCE DATE: February 1975

DESCRIPTION

Vegetation units delineated in V16 are interpreted into size classes from seedling size to large sawtimber. Size classes are interpreted using the dbh (diameter at breast height) which is defined as the diameter $4\frac{1}{2}$ feet above ground (Appendix F).

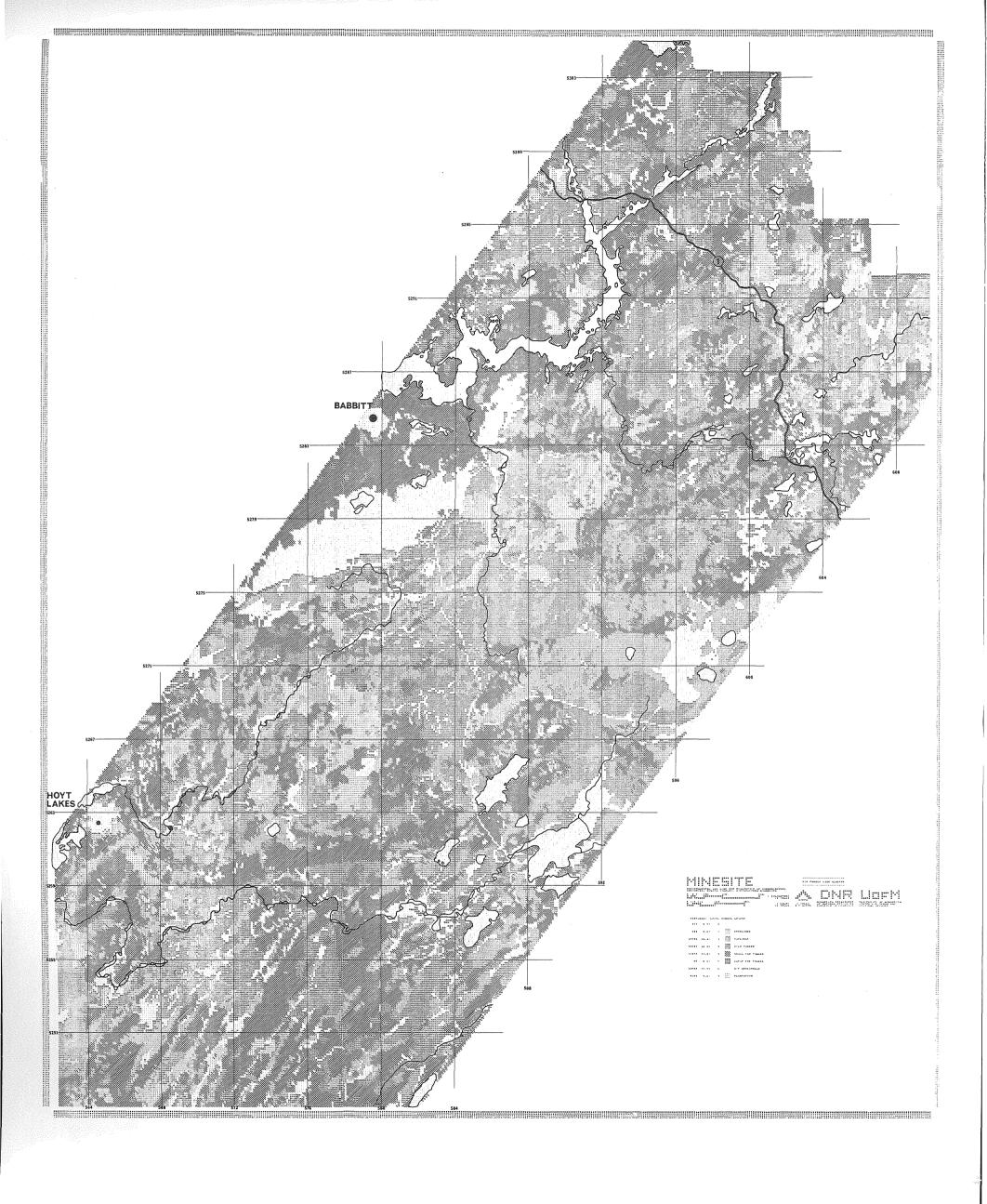
VERIFICATION

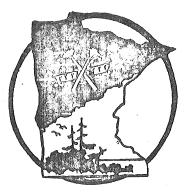
TECHNIQUE: Statistical check-Appendix I

FINAL DATE VERIFIED: September 15, 1976

LEVELS

Data Level Legend 0 Seedlings (0-1 in. dbh) 1 Saplings (1-5 in. dbh) 2 3 Pole Timber (5-9 in. dbh) Small Saw Timber (9-15 in. dbh) 4 5 Large Saw Timber (15 in. dbh) Not applicable 6 7 Plantation





Forest Height Classes

DATA BIOGRAPHY

SOURCE: See references for Appendix D - Vegetation Inventory

INTERPRETATION: Same as source. V16, V18, V19, and V20 interpreted concurrently

SOURCE DATE: February 1975

DESCRIPTION

Vegetation units delineated in V16 are identified by the height of the dominant tree species. Data levels are, for the most part, identified in 20 ft. height class intervals.

VERIFICATION

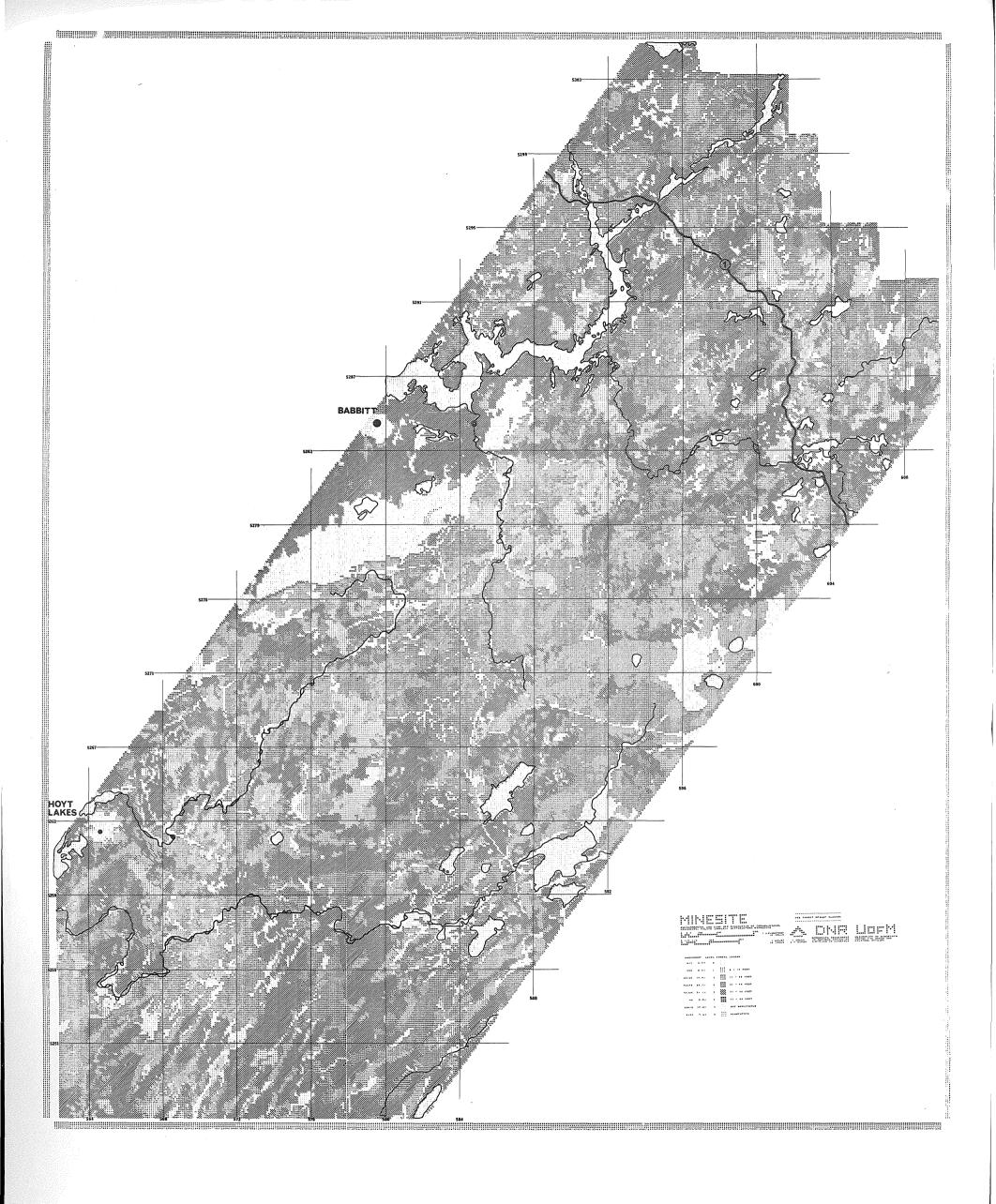
TECHNIQUE: Statistical check-Appendix I

FINAL DATE VERIFIED: September 15, 1976

LEVELS

Data Level	Legend
0 1 2 3	0-10 ft. 11-30 ft. 31-50 ft.
5 4 5 6 7 8	51-50 ft. 51-70 ft. 71-90 ft. 91-110 ft. Not applicable Plantation

(V20)





DATA BIOGRAPHY

Division of Game & Fish, DNR; Dr. David Mech, US Fish & SOURCE: Wildlife Service; Dr. Lynn Rogers, North Central Forest Experiment Station, USFS; Project 80 Natural and Historic Areas of Minnesota (September 1971). **INTERPRETATION:**

MINESITE Staff, DNR

SOURCE DATE:

September 1976

DESCRIPTION

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This inventory contains identified natural resource sites. Since the area has not been uniformly surveyed, additional sites undoubtedly exist in the area which will require map updating when located. The Caribou Release Site should be considered as a habitat area potentially suitable for reintroduction of caribou. Data levels are plotted as either areas or boundaries. Several mapped data levels show approximate boundaries based on the best information available. In some cases unique wildlife species areas have been expanded when mapped so that specific sites are not readily locatable. VERIFICATION

All cells checked TECHNIQUE:

FINAL DATE VERIFIED: October 19, 1976

LEVELS

0

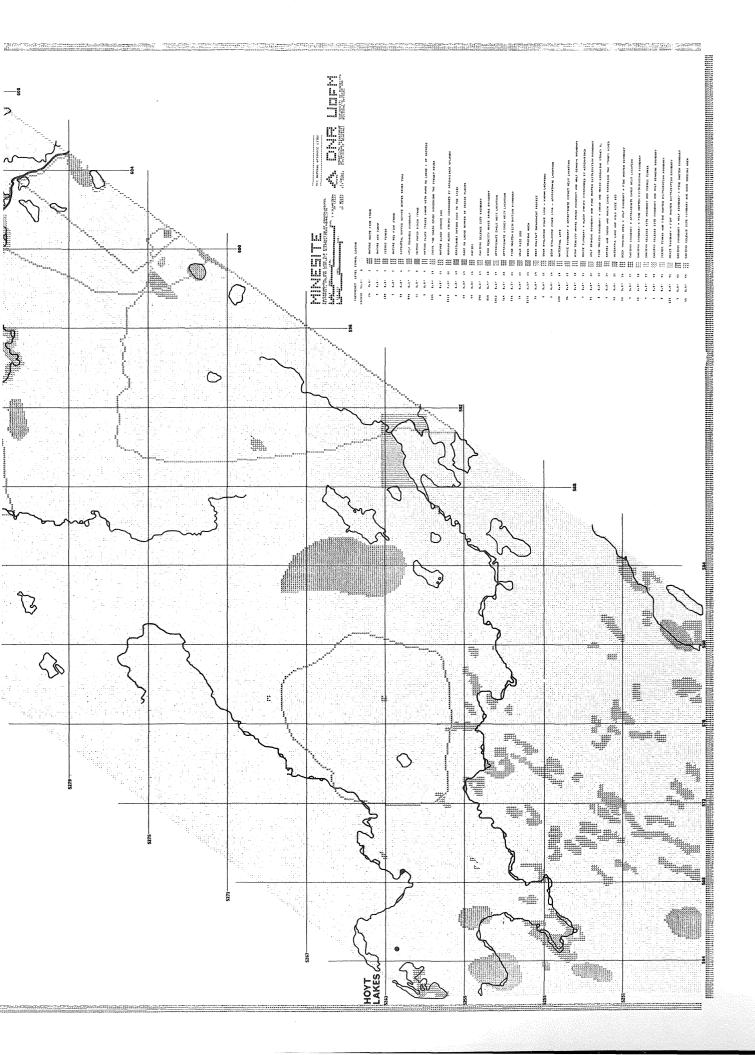
6

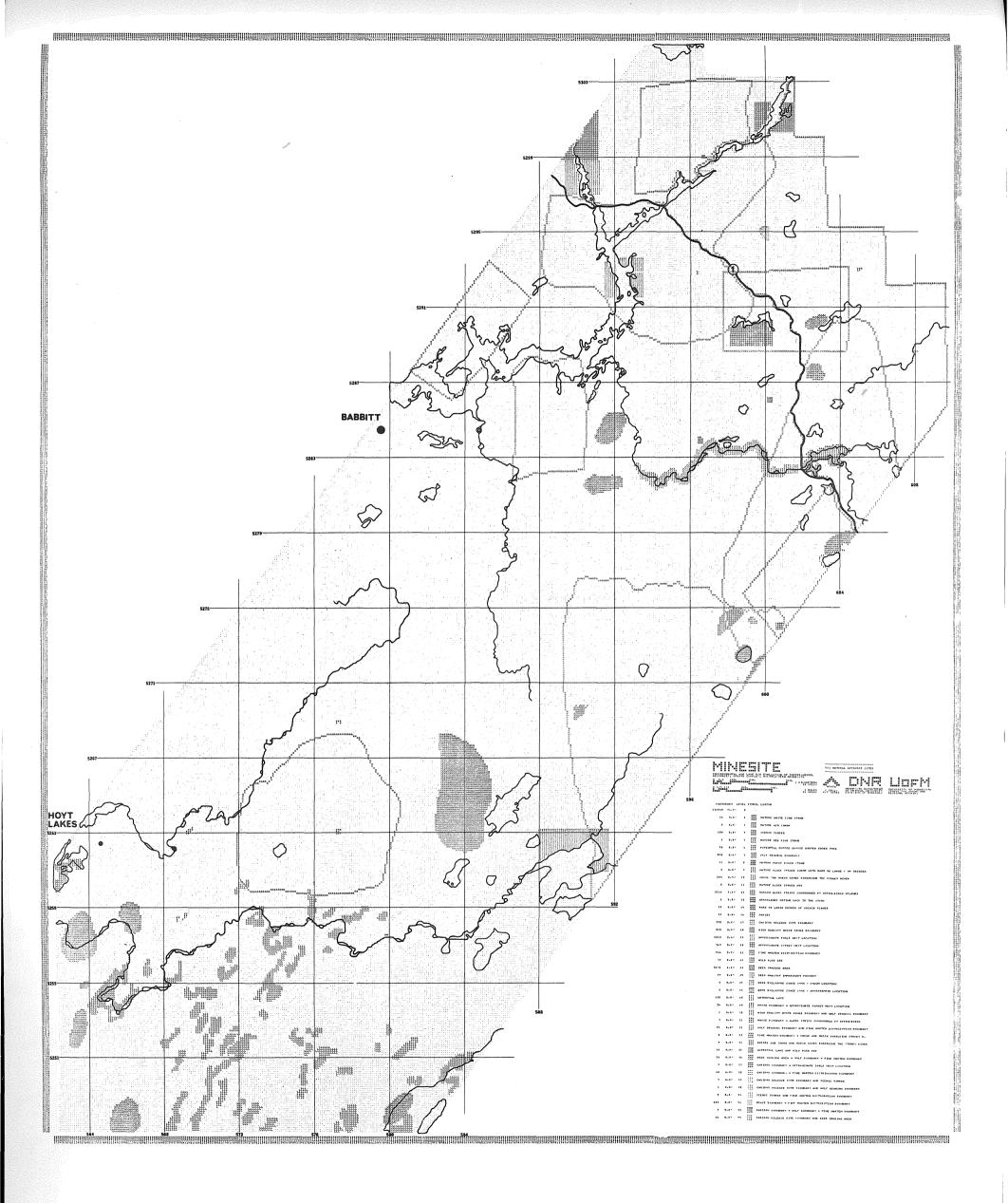
Data Level Legend

> Mature White Pine Stand 1 $\mathbf{2}$ Mature Ash Swamp 3 Exceptional Wildlife and Fish Habitat 4 Scenic Timber 5

- Mature Red Pine Stand
- Potential Ruffed Grouse Winter Cover Type
- 7 Wolf Denning Boundary 8
- Mature Paper Birch Stand 9
 - Mature Black Spruce Swamp with rare or large numbers of orchids

Data Level	Legend
10	Shrub and marsh cover bordering the Stoney River
11	Mature Black Spruce Bog
12	Narrow Alder strips surrounded by Aspen-Birch Uplands
13	Grassland dating back to 1920s
14	Rare or large number of orchid plants
15	Water Falls
16	Rapids
17	Caribou Release Site Boundary
18	High Density Moose Range Boundary
19	Approximate Eagle Nest Location
20	Approximate Osprey Nest Location
21	Pine Marten Distribution Boundary
22	Wild Rice Bed
23	Deer Yarding Area
24	Deer Habitat Improvement Project 🔨 🔶
25	Deer Exclosure since 1948 - Known Location
26	Deer Exclosure since 1948 - Approximate Location
28	Waterfowl Lake
29	High Density Moose Range Boundary and Approximate Osprey Nest Location
30	High Density Moose Range Boundary and Wolf Denning Boundary
31	High Density Moose Range Boundary and Narrow Alder strips surrounded by Aspen-Birch Uplands
32	Wolf Denning Boundary and Pine Marten Distribution Boundary
33	Pine Marten Distribution Boundary and Shrub and marsh
24	cover bordering the Stoney River Rapids and Shrub and marsh cover bordering the
34	Stoney River
35	Waterfowl Lake and Wild Rice Bed
36	Deer Yarding Area and Wolf Denning Boundary and Pine Marten Distribution Boundary
37	Caribou Release Site Boundary and Approximate Eagle Nest Location
38	Caribou Release Site Boundary and Pine Marten Distribution Boundary
39	Caribou Release Site Boundary and Scenic Timber
40	Caribou Release Site Boundary and Wolf Denning Boundary
. 41	Scenic Timber and Pine Marten Distribution Boundary
42	High Density Moose Range Boundary and Pine Marten Distribution Boundary
43	Caribou Release Site Boundary and Wolf Denning Boundary and Pine Marten Distribution Boundary
44	Caribou Release Site Boundary and Deer Yarding Area







Lake and Stream Surveys (Fish Habitat)

(V22)

DATA BIOGRAPHY

SOURCE: Lake and Stream Surveys, Division of Fisheries, DNR

INTERPRETATION: Division of Fisheries, DNR

SOURCE DATE: April 23, 1976

DESCRIPTION

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Streams and lakes are classified based on a combination ecological/management classification prepared by the DNR. The lake classification denotes the basic lake type, which is described in terms of the natural and characteristic fish populations that are best adapted to the physical, chemical, and biological characteristics of the lake. The stream classification system used has not been officially adopted by the DNR, however, it is representative of the system expected to be adopted (Appendix G - Lake and Stream Surveys).

VERIFICATION

TECHNIQUE: All cells checked

FINAL DATE VERIFIED: September 7, 1976

LEVELS

<u>Data Level</u>	Legend
0	
	Type A – Trout streams with enough natural repro-
	duction to sustain a fishery.
	l. Main
2 -	2. Feeder
3	Type B - Trout streams with lack of natural repro-
	duction or overabundant competing species.
4	Type C - Steelhead streams.
5	Type D – Associated streams – trout (put and take
\$	stocking necessary).

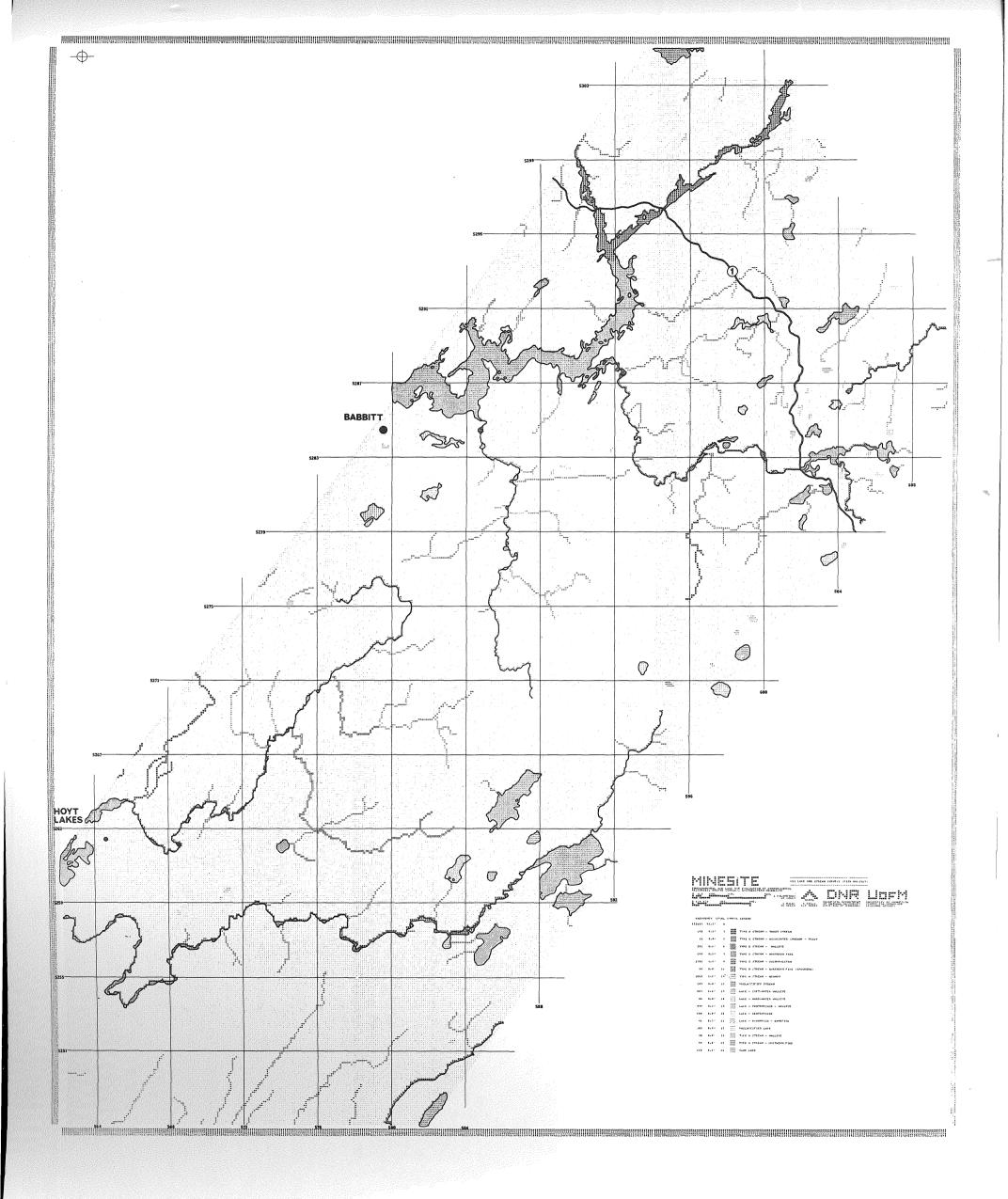
<u>Data Level</u>	Legend
	Type E – Warmwater gamefish streams
6	1. Walleye
7	2. Northern pike
8	3. Catfish-smallmouth bass
9	4. Cosmopolitan
10	5. Muskellunge
11	Type F – Warmwater streams dominated by carp.
	Type H – Warmwater feeder streams
12	1. Northern pike (spawning)
13	2. Walleye (spawning)
14	3. Minnow
15	Unclassified stream
16	Trout lake
17	Soft-water walleye lake
,18	Hard-water walleye lake
19	Centrarchid-walleye lake
20	Centrarchid lake
21	Roughfish-gamefish lake
22	Bullhead lake
23	Unclassified lake
	Type G - Warmwater connector streams
24	l. Walleye
25	2. Northern pike
26	Game Lake

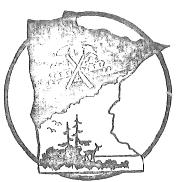
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DATA BIOGRAPHY

SOURCE: Division of Minerals, DNR; and Bureau of Land Management, U.S. Dept. of the Interior.

INTERPRETATION: Division of Minerals, DNR

SOURCE DATE: January 1976

DESCRIPTION

Active State mineral leases are shown for both iron ore and copper-nickel. Cu-Ni leases active for greater than five years are listed separately because they reflect longer-term company interest, probably because of mineral discovery. Federal prospecting permit applications, prospecting permits, preferential rights, mineral leases, and private iron ore and Cu-Ni leases are also represented.

VERIFICATION

TECHNIQUE: All cells checked

FINAL DATE VERIFIED: September 27, 1976

LEVELS

<u>Data Level</u>	Legend
0	
1	Bear Creek State Lease, >5 years old
2	Inco State Lease, >5 years old
3	Duval State Lease, >5 years old
4	Lloyd K. Johnson State Lease, >5 years old
5	Inco Federal Lease
6	Hanna Federal Preferential Rights
7	Heart Lake Association Federal Preferential Rights
8	Erie Mining Co. Federal Preferential Rights,
	Iron Ore
10	Inco Federal Preferential Rights

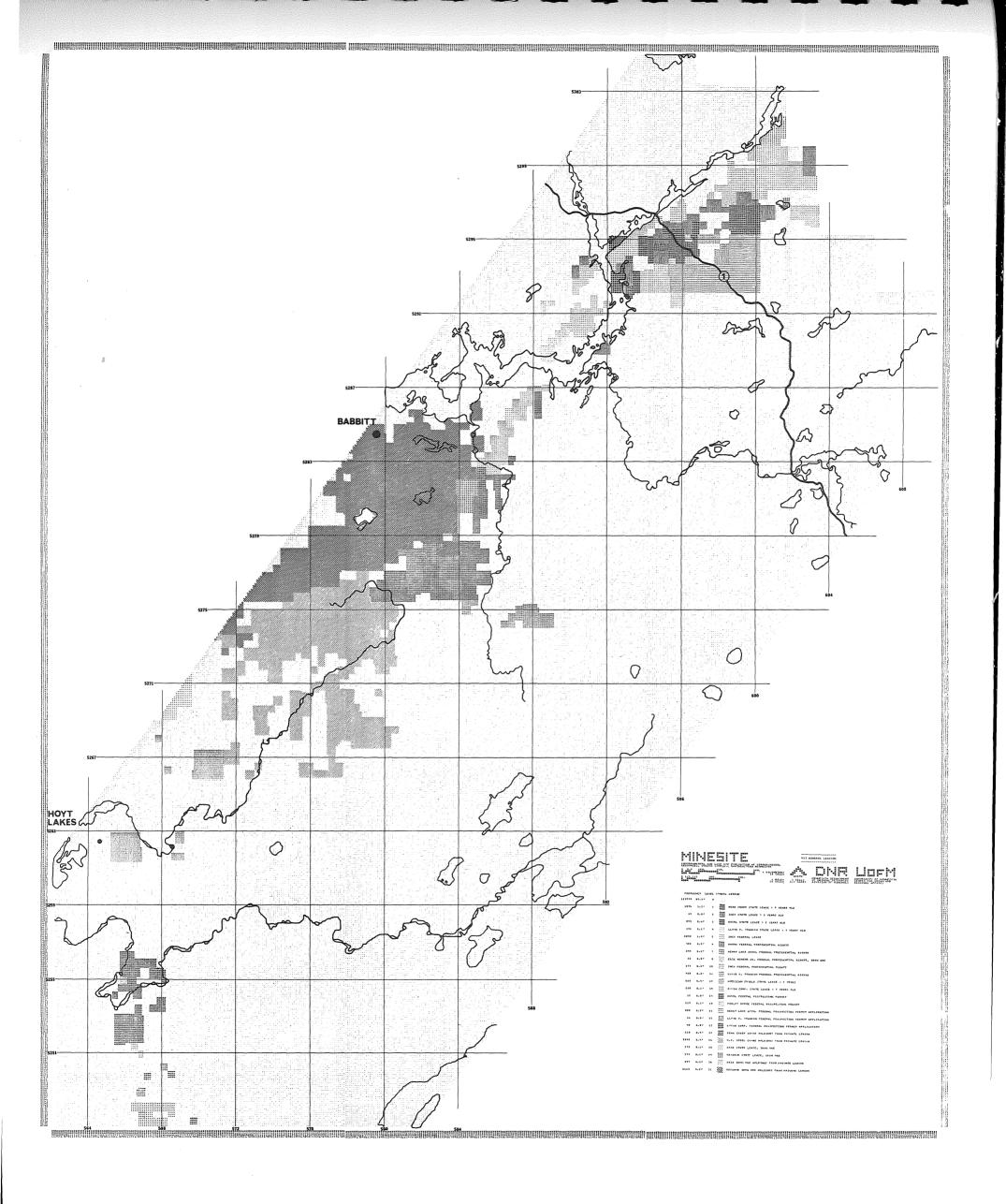
<u>Data Level</u>	Legend
11	Lloyd K. Johnson Federal Preferential Rights
13	American Shield State Lease, <5 years old
14	Exxon Corp. State Lease, <5 years old
17	Duval Federal Prospecting Permit
20	Phelps Dodge Federal Prospecting Permit
21	Heart Lake Association Federal Prospecting Permit Application
22	Lloyd K. Johnson Federal Prospecting Permit Application
23	Exxon Corp. Federal Prospecting Permit Application
25	Bear Creek Cu-Ni Holdings from Private Leasor
26	United States Steel Cu-Ni Holdings from Private Leasor
28	Erie State Lease, Iron Ore
29	Reserve State Lease, Iron Ore
30	Erie Iron Ore Holdings from Private Leasor
31	Reserve Iron Ore Holdings from Private Leasor

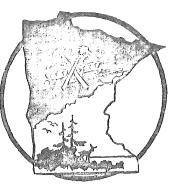
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Soil Associations

DATA BIOGRAPHY

SOURCE: U.S. Soil Conservation Service, General Soil Map of the Arrowhead Region.

INTERPRETATION: U.S. Soil Conservation Service

SOURCE DATE: General Soil Map of St. Louis County, parts 4 & 6 - April '74; General Soil Map of Lake County, parts 3 & 2 - March '74.

DESCRIPTION

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Soil Associations are grouped and defined according to characteristic geographic patterns shown on aerial photographs. These associations are further defined through some field investigation and compilations from available detailed soils maps. Factors considered in defining soil series and associations are profile, color, structure, consistency, sequence of horizons, conditions of relief and drainage, and origin and mode of formation. The smallest mapping unit shown on the soil map is about 40 acres. See Appendix H for detailed information on soils series present in MINESITE area. VERIFICATION

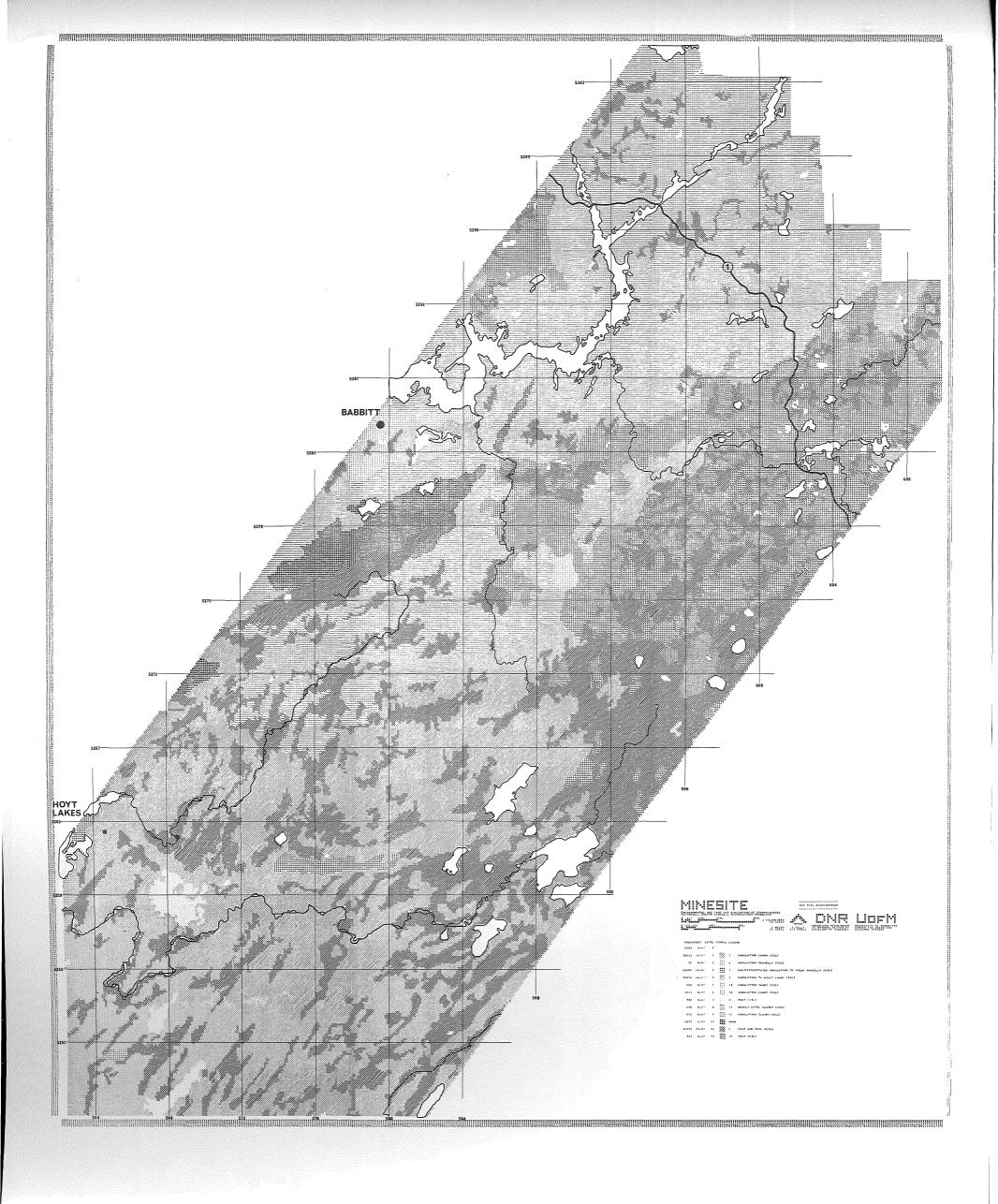
TECHNIQUE: Statistical Check - Appendix I FINAL DATE VERIFIED: October 6, 1976

LEVELS

Data Level	Legend
0 1	5 - Undulating loamy soils
2	6 – Undulating gravelly soils
3	7 - Undifferentiated, undulating to steep gravelly
	soils
4	9 - Undulating to hilly loamy soils
5	28 - Undulating sandy soils
6	40 - Undulating loamy soils;
7	G - Peat soils
8	54 - Nearly level clayey soils
9	55 - Undulating clayey soils

(V24)

Data LevelLegend13Mine16P - Peat and muck soils19SP - Peat soils





DATA BIOGRAPHY

SOURCE: Same as maps listed for VO2, and Superior National Forest Map (1972).

INTERPRETATION: MINESITE Staff, DNR

SOURCE DATE: See map dates listed for VO2

DESCRIPTION

Individual cells containing a transportation data level were coded according to the classification system used on USGS Quadrangle Maps.

VERIFICATION

TECHNIQUE: All cells checked

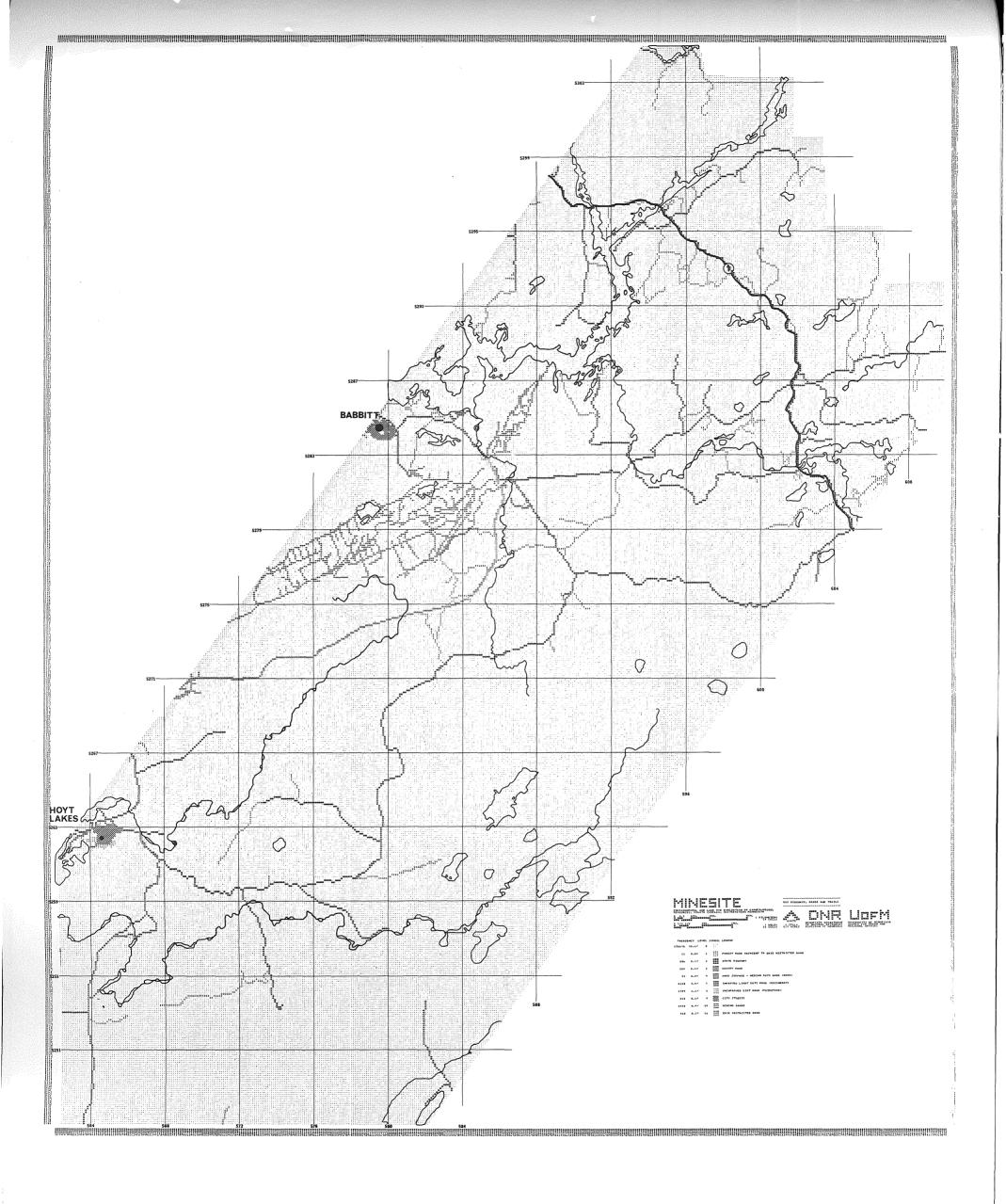
FINAL DATE VERIFIED: September 24, 1976

LEVELS

Data Level Legend

0 Forest Road Adjacent to Erie Restricted Road 1 $\mathbf{2}$ State Highway 3 County Road Hard Surface - Medium Duty Road (Good) 4 5 Improved Light Duty Road (Secondary) 'Unimproved Dirt Road (Primitive) 6 9 City Streets Mining Roads 14Erie Restricted Road 1516 Federal Highway

(V25)





Railroads and Utilities

DATA BIOGRAPHY

USGS Topo Maps: Greenwood L. (1954); Gabbro L., Markham, SOURCE: Brimson (1957); Bear Island, Kangas Bay (1965); Babbitt (NW,NE,SW,SE), Allen, Isaac L., Aurora (1969PR*); Superior National Forest Map (1972). INTERPRETATION:

MINESITE Staff, DNR

SOURCE DATE:

See map dates listed above

DESCRIPTION

Individual cells containing a railroad or utility are coded according to the classification system used on the USGS Quadrangle Maps. In cases where two data levels occur within a cell, a common level is assigned to that cell.

VERIFICATION

TECHNIQUE: All cells checked

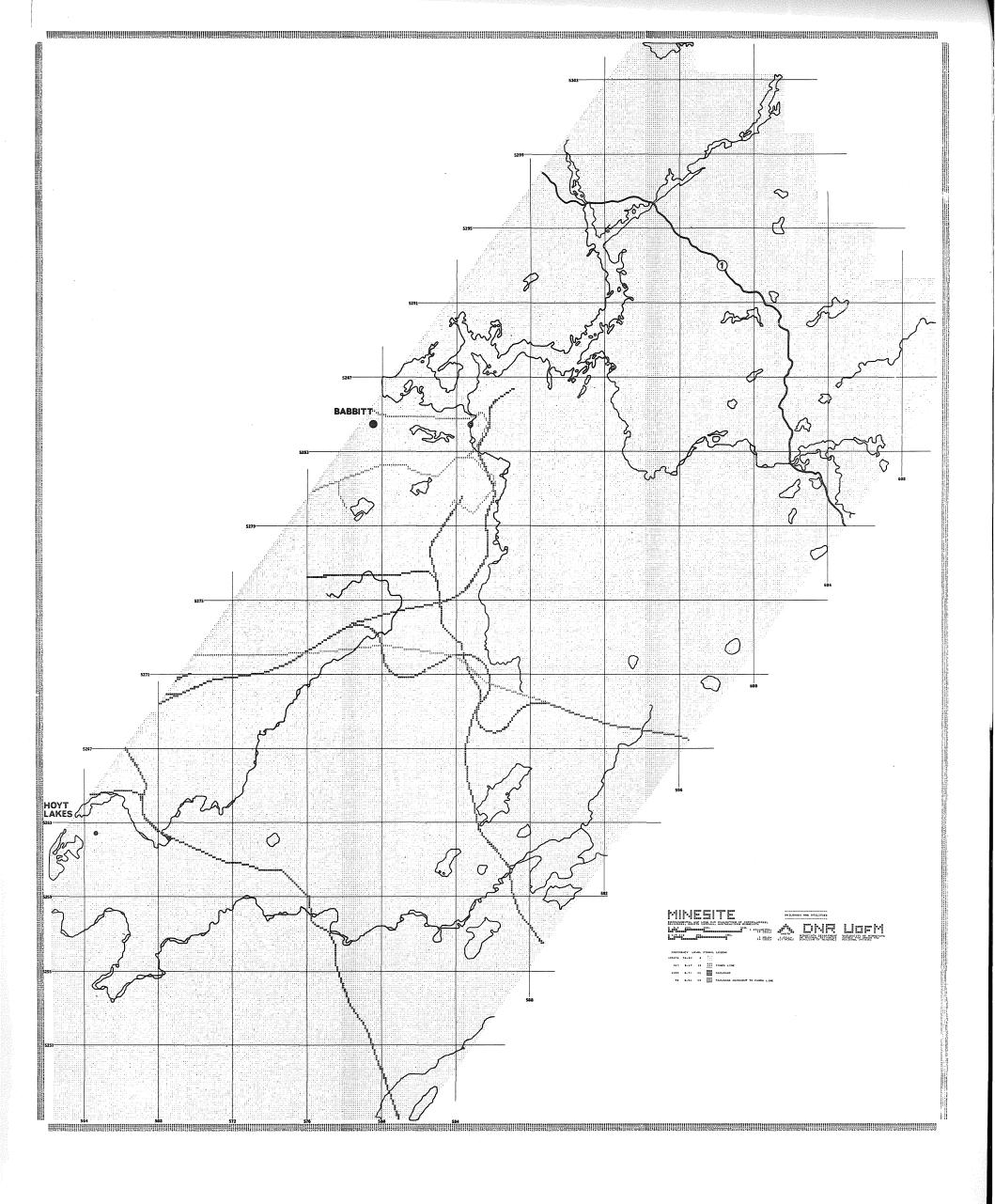
FINAL DATE VERIFIED: August 24, 1976 *photo revised

LEVELS

Data Level Legend

0	
10	Power line
11	Railroad
13	Railroad adjacent to power line

(V26)





Watershed Areas

7

(V30)

DATA BIOGRAPHY

SOURCE: Derived from VO6 Watersheds

INTERPRETATION: MINESITE Staff, DNR

SOURCE DATE:

DESCRIPTION

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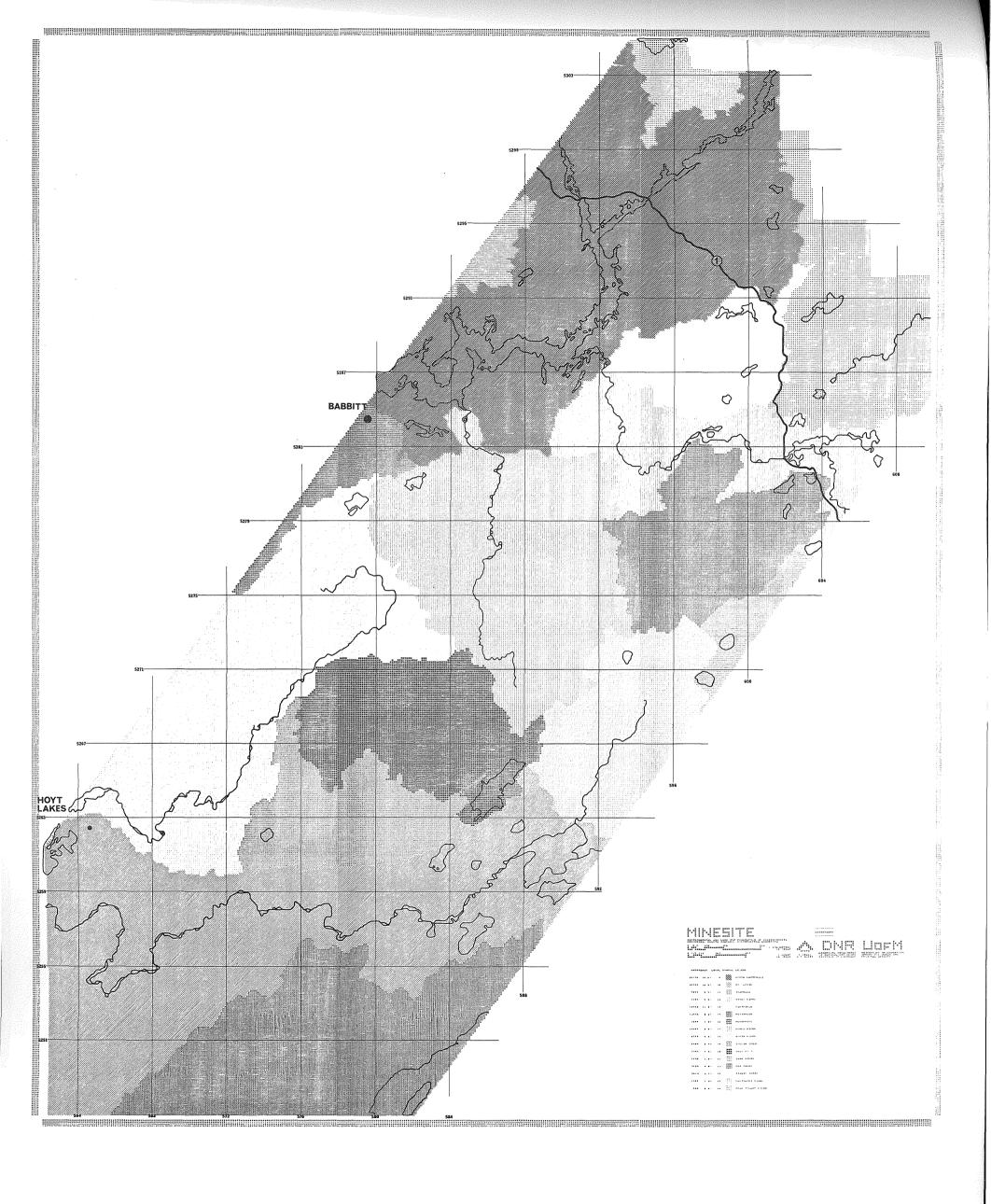
All cells within a watershed boundary are assigned the appropriate data level. Watersheds are named according to the major river or stream in that watershed.

VERIFICATION

TECHNIQUE: All cells checked FINAL DATE VERIFIED: May 18, 1976

LEVELS

<u>Data Level</u>	Legend	<u>Data Level</u>	Legend
9	South Kawishiwi	22	Nip Creek
10	St. Louis	23	Denley Creek
11	Isabella	25	Kawishiwi River
12	Stony River	26	Bear Island River
· 13	Partridge		
14	Whiteface		
16	Embarrass		
17	Dunka River	'	
18	North River		
19	Colvin Creek		
20	Argo Creek		
21	Sand River		





DATA BIOGRAPHY

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SOURCE: Division of Minerals, DNR

INTERPRETATION: Division of Minerals, DNR

SOURCE DATE: June 1973

DESCRIPTION

This variable defines 9 sub-units for the MINESITE study area. Area 1 is the pilot study area.

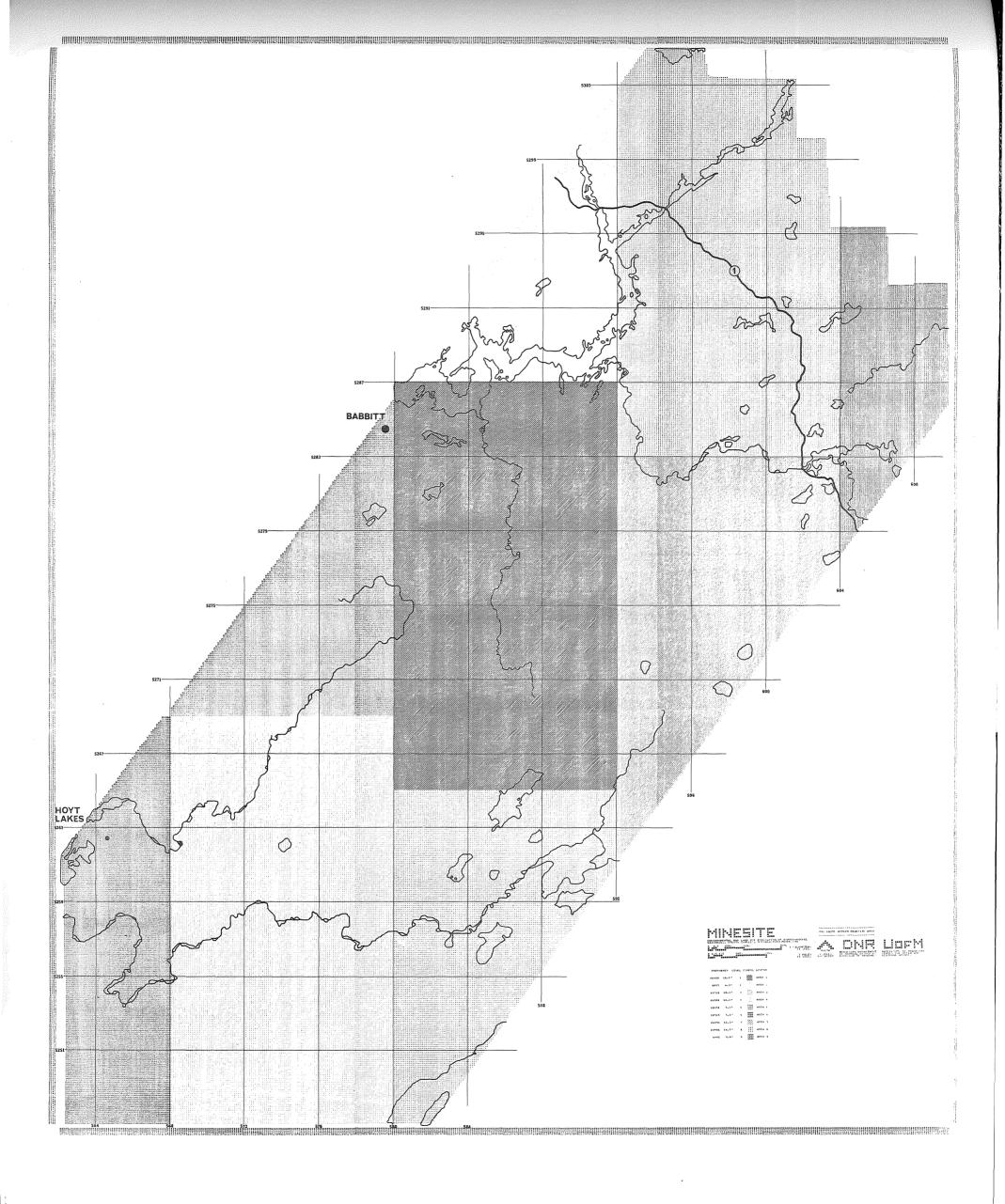
VERIFICATION

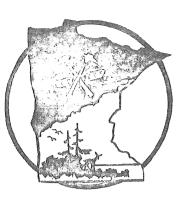
TECHNIQUE: All cells checked FINAL DATE VERIFIED: September 2, 1976

LEVELS

Data Level	Legend
1	Area 1 - Pilot Area
2	Area 2
3	Area 3
4	Area 4
5	Area 5
6	Area 6
7	Area 7
8	Area 8
9	Area 9

(V91)





(V95)

DATA BIOGRAPHY

SOURCE: Division of Minerals, DNR

INTERPRETATION: MINESITE Staff, DNR and MLMIS

SOURCE DATE: August 1976

DESCRIPTION

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The MINESITE area was superimposed upon the MLMIS regional 40acre study area. This allows for cross referencing of the $2\frac{1}{2}$ acre MINESITE study cells and the 40-acre MLMIS regional study cells. However, this data should be carefully used because the MLMIS standardized township grid results in some $2\frac{1}{2}$ acre MINESITE cells not being completely correct as to location. Nevertheless, the best possible fit has been achieved and should be adequate for many uses.

VERIFICATION

TECHNIQUE: All cells checked

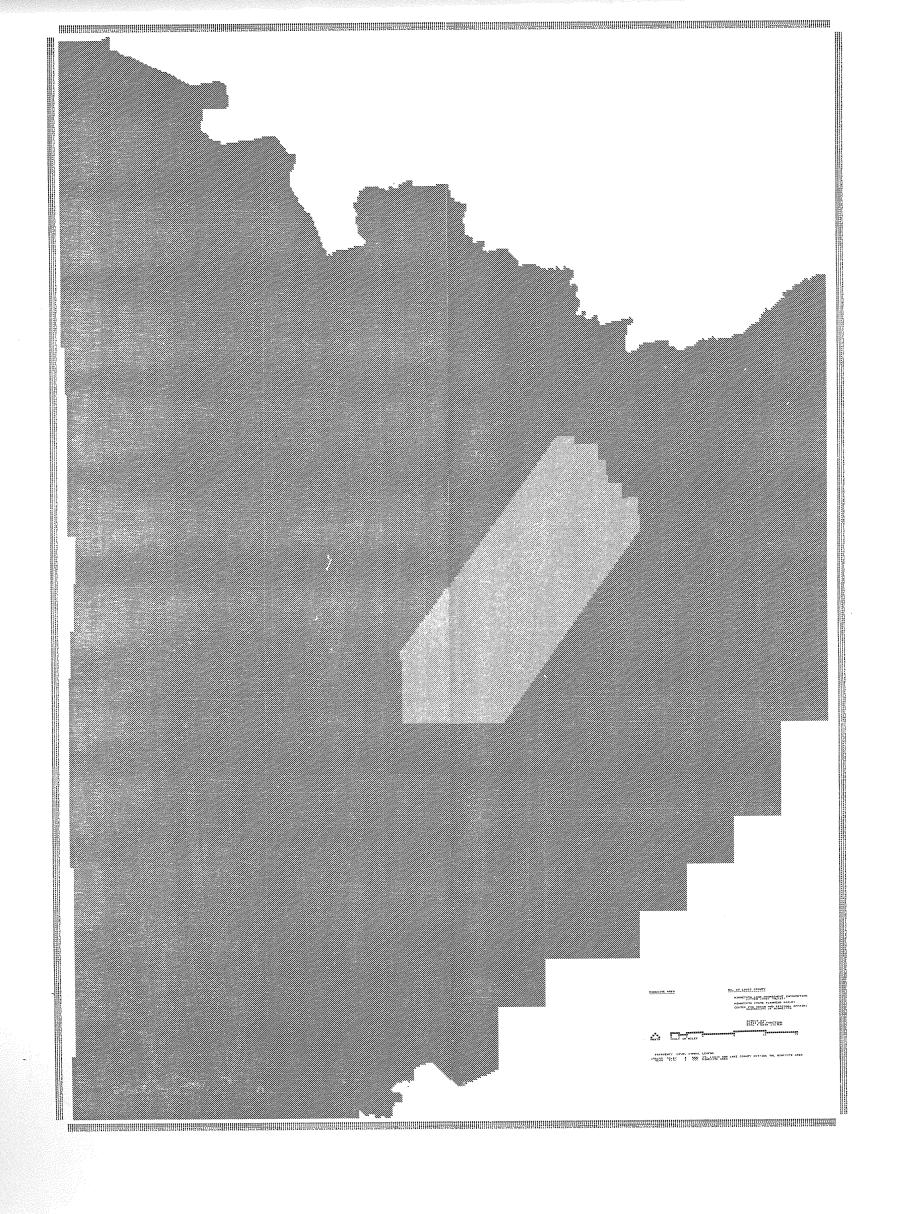
FINAL DATE VERIFIED: September 17, 1976

LEVELS

0 1

Data Level Legend

St. Louis and Lake County outside the MINESITE area MINESITE Area



Appendix A - Definition of Slope Categories (VO2)

The percent slope variable, VO2, is based on the number of topographic contour lines intersecting a geographic cell. The data was derived from USGS topographic maps. Contour intervals on these maps are 10 and 20 ft. intervals for 7.5 and 15 minute quadrangles respectively.

To determine the percent slope in a given cell, the number of contour lines intersecting that cell are counted. Using conversion factors and the established data levels, each cell is assigned its proper percent slope. An example assignment, using a 10 ft. contour line, is as follows: one line crossing the cell horizontally or vertically is an approximate 3% slope. If the line crosses the cell diagonally, the slope is approximately 2.2%. Therefore, one line crossing a cell at any angle is automatically assigned data level 1 which represents a 1 to 3% slope. If one contour line crosses a single cell using a 20 ft. contour interval, it corresponds to two lines crossing a cell for a map using a 10 ft. contour. If the line crosses vertically or horizontally it corresponds to a slope of approximately 6%, and if it crosses diagonally it corresponds to a slope of approximately 4.5%. This cell is assigned data level 2 which represents a 4 to 6% slope.

When using this variable in later analysis models, care should be taken in grouping data because of the 10 ft. and 20 ft. elevation intervals from the original data. When appropriate, data levels 1 and 2 should be grouped together and levels 3 and 4 should also be grouped together.

Data level 7 is defined as an area of unknown slope. These

A-1

areas are predominately mining areas where significant mining activity has occurred since the last time the topographic map for the specific areas was updated. The mining activity is usually either stockpiling or open pit mining.

The following calculations provide conversions for the VO2 data level assignments.

Definition of % Slope Categories (Topographic maps with a 10 foot elevation interval)

Cell Size



100 m	X	$\sqrt{2}$	Ci. North	141.4m
100 m	Ж	3.28ft/m	6 22	328 ft.
141.4	m	x 3.28ft/m	6	464 ft.

A 1-3% Slope (1 elevation contour line)

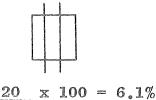


 $10 \times 100 = 2$

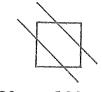
 $\frac{10}{328}$ x 100 = 3.0%

 $\frac{10}{464}$ x 100 = 2.2%

B 4-6% Slope (2 elevation contour lines)

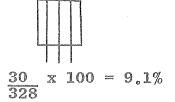


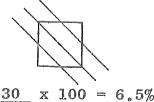
328



 $\frac{20}{464}$ x 100 = 4.3%

C 7-9% Slope (3 elevation contour lines)







A-2

D

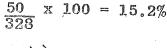
10-15% Slope (4-5 elevation contour lines)



 $\frac{40}{328}$ x 100 = 12.2%



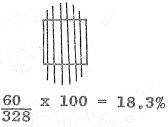
 $\frac{40}{464}$ x 100 = 8.6%





 $\frac{50}{464}$ x 100 = 10.8%

E > 15% Slope (>5 elevation contour lines)



 $\frac{60}{464}$ x 100 = 12.9%

F 0% Slope (No elevation contour lines)

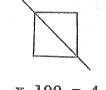
G Unknown slope orientation - areas recently disturbed, generally from mining activities, and as yet have not been updated on USGS quadrangle maps.

Definition of % Slope Categories (Topographic maps with a 20 foot elevation interval)

B 4-6% Slope (1 elevation contour line)

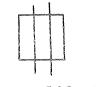


 $\frac{20}{328} \times 100 = 6.1\%$



 $\frac{20}{464}$ x 100 = 4.3%

D 10-15% Slope (2 elevation contour lines)





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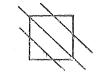
Î

 $\frac{40}{328}$ x 100 = 12.2%

 $\frac{40}{464}$ x 100 = 8.6%

E >15% Slope (3 or more elevation contour lines)





 $\frac{60}{328}$ x 100 = 18.3%

 $\frac{60}{464} \times 100 = 12.9\%$

Appendix B - Description of Soil Landscape Units (V10)

The Soil Landscape Units map was prepared for use in Superior National Forest planning. The information mapped is inadequate for site specific planning but can be helpful in locating areas that are generally well suited, poorly suited, or unsuited for specific uses.

About 22 percent of the MINESITE area has a detailed soil resource inventory developed from field observation. Based upon these observations a soil landscape model was developed to project classifications to those areas not inventoried. These models are based upon geology, drainage patterns, local relief, slope, vegetation, and topographic patterns identified from aerial photography and topographic maps. Quality control checks of the areas projected were made through selected ground traverses.

Rainy moraine, sandy loam over gravelly loamy sand, well SL/GLS drained, >4' to bedrock. RM Rainy moraine, sandy loam, well drained, >4' to bedrock SLRM Rainy moraine, bedrock controlled, sandy loam, well SLB RMdrained, some < 4", mostly \geq 4' to bedrock. SLVB Rainy moraine, bedrock controlled, sandy loam, well drained, < 40" to bedrock. RM SLRainy drumlin, sandy loam, well drained, >4' to bedrock. RD L RD Rainy drumlin, loam, well drained, >4' to bedrock. SLP Rainy moraine, sandy loam, poorly to somewhat poorly RM drained, >4' to bedrock. Rainy outwash plain, sandy loam over sand and gravel, SL/SG RO well drained, >4' to bedrock.

B-1

- $\frac{SGB}{RO}$ Rainy outwash plain, bedrock controlled, sand and gravel, well drained, $\geq 4'$ to bedrock.
- $\frac{SGVB}{RO}$ Rainy outwash plain, bedrock controlled, sand and gravel, well drained, <40" to bedrock.
- $\frac{SG}{RE}$ Rainy esker, sand and gravel, well drained, >4' to bedrock.
- <u>SL/SG</u> SO Superior outwash plain, sandy loam over sand and gravel, well drained, >4' to bedrock.
- $\frac{LS/SG}{SO}$ Superior outwash plain, loamy sand over sand and gravel, well drained, >4' to bedrock.
- $\frac{SGP}{SO}$ Superior outwash plain, sand and gravel, poorly drained, >4' to bedrock.
- $\frac{SP}{SO}$ Superior outwash plain, medium and fine sand, poorly drained, >4' to bedrock.
- SGSuperior esker, sand and gravel, well drained, >4' toSEbedrock.
- $\frac{OLP}{DR}$ Drainway, peat with inclusions of loam, poorly drained, >4' to bedrock.
- $\frac{LOP}{DR}$ Drainway, loam with inclusions of peat, poorly drained, >4' to bedrock.
- Bg Bog, peat, poorly drained, >4' to bedrock.
- Al Alluvial, soils varied, well to poorly drained, >4' to bedrock.
- SLP
RDRainy drumlin, sandy loam, poorly to somewhat poorly
drained, >4' to bedrock.

 $\frac{LP}{RM}$ Rainy moraine, loam, poorly drained, >4' to bedrock.

B-2

Appendix C - Taconite Reserves and Potential Resources (V15)

The purpose of this variable is to delineate possible open pit and underground taconite resources beyond existing mining company plans. This is important for determining long-term taconite resource priorities. Data used in the evaluation is primarily public information previously published or on open file at the Minnesota Geological Survey or the Division of Minerals, Department of Natural Resources, Hibbing Office. A reference list is included at the back of this Appendix.

The analysis contains several data limitations, particularly on the down dip extension of the Biwabik Iron Formation. These limitations include minimal data on the thickness of the iron formation layers, the dip as the formation approaches the Duluth Gabbro Contact and the southerly extent of the iron formation. Consequently, lines separating resource categories are approximate and are designed to provide regional indications of iron formation characteristics. No attempt was made to calculate quantities of taconite available in a category. However, rough calculations could be completed if an average thickness was assumed.

The established resource categories provide no indication of the timing of mining within any specific category. This is due to the problems of projecting resource demands, economics, technology, and individual mining company resources and requirements. However, between categories, an indication of probable sequence and timing can be made based on current trends. The open pit limits represent a period greater than 40 years into the future and probably represent a range of 80 to 100 years. For an indi-

C-1

vidual company, an important factor is mineral and surface ownership control. A specific company may approach the open pit limits sooner depending on its resource requirements and its control of adequate ore supplies either by ownership or lease.

The progression from open pit to underground taconite mining could be 60 or more years into the future. The most probable reasons for progression from open pit to underground would be if an operator was unable to maintain production due to limited open pit operating space, to improve ore quality, to extend the mine life, or a combination of these.

The initial stage of the study was to plot the following available data.

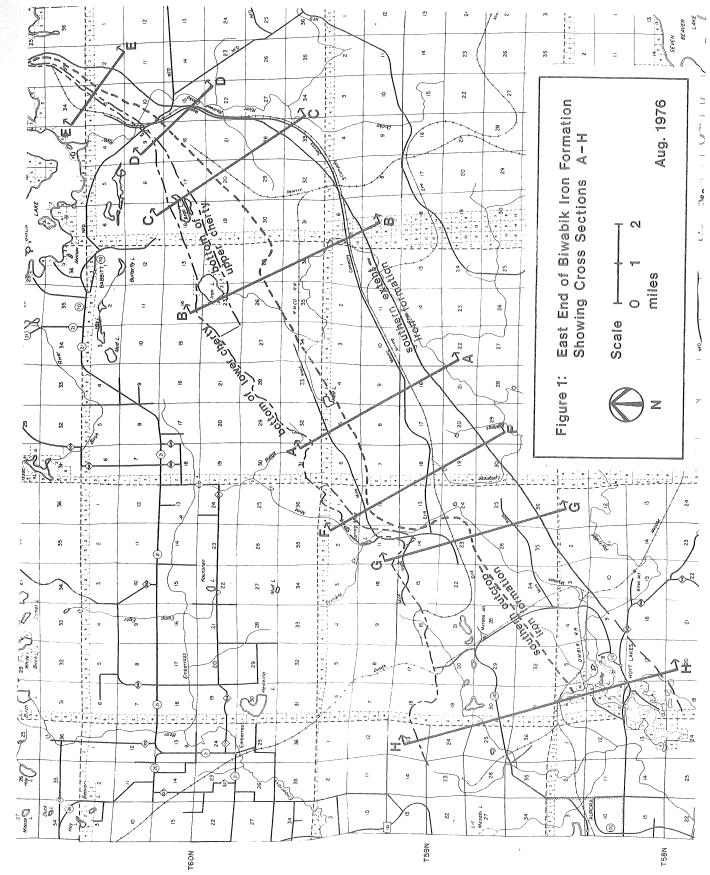
- 1. Surface outcrop of the Biwabik Iron Formation.
- 2. Surface outcrop contact of the base of the upper cherty layer (6).
- 3. Strike and dip of surface outcrops and dips from published cross sections and drill core (2, 3, 5, 6, 9, 14, 15, 16).
- 4. Southern extent of the Biwabik Iron Formation (4).
- 5. Depth to the top of the Biwabik Iron Formation from available open file and confidential copper-nickel drilling.
- 6. Thickness of the iron formation layers (1, 2, 5, 8, 15, 16).

This data was then interpreted using several cross sections labeled A-H. Figure 1 shows a plan map of section locations and Figure 2 illustrates a typical cross section. The data interpretation was completed using the following assumptions.

1. The average depth of surface overburden is 20 ft. (13).

2. One foot of rock stripping can be removed at a cost similar to 2 feet of unconsolidated overburden (17).

C-2



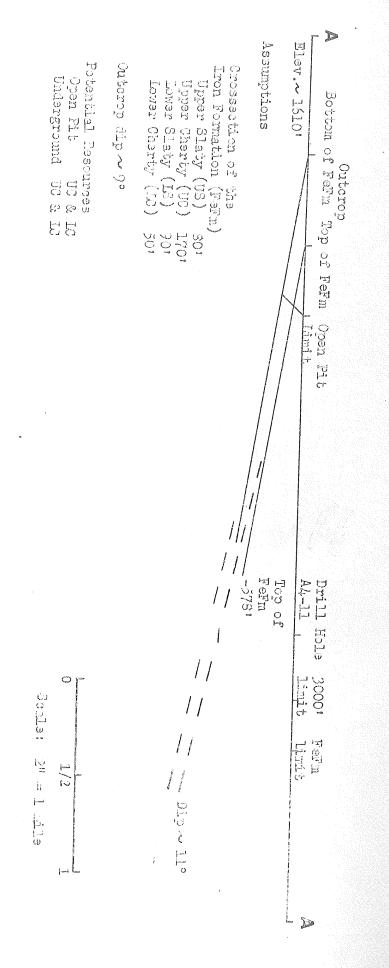


Figure 2 Grossection A-A Biwabik Irm Formation

6-4

- 3. The open pit stripping limit is 2:1 on a ton for ton basis. This corresponds to an approximate $2\frac{1}{2}$:1 ultimate stripping limit on a yard for yard basis. Waste rock density is assumed at 12-14 cubic feet/ton and taconite ore at 10-12 cubic feet/ton (16, 17).
- 4. The ultimate stripping limit can be approximated by a ratio of the thickness of waste rock to the ore layer thickness plus $\frac{1}{2}$ the overburden depth measured vertically.
- 5. The hanging wall open pit limit has a pit slope ratio of 1:1 (17).
- 6. The minimum ore layer thickness for open pit mining would be approximately 30-40 feet (16, 17).
- 7. The upper cherty and lower cherty layers are the mineable ore layers within the Biwabik Iron Formation. The total ore layer thickness was utilized in the stripping ratio calculation. It was assumed that lean ore within the ore horizon would be stockpiled and processed near the end of an operation or that lean ore remaining in the ground would be mined during later stages of the operation as it became economical (17).
- 8. The minimum ore layer thickness for underground mining would be approximately 20 feet (17).
- 9. A maximum underground mining depth of 5,000 feet is assumed and two depth categories are delineated (17).
- 10. Underground mining of taconite ore with a dip greater than 10^o would require a new or modified large scale mining technique (17).
- 11. Typical iron formation thicknesses and dips are assumed for each cross section.

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17. Yardley, D.H., Personal Communication, 3/18/76.

Appendix D - Vegetation Inventory (V16)

Four vegetation variables were mapped for the MINESITE project under a contract with the Remote Sensing Laboratory, College of Forestry, University of Minnesota. These variables include: (1) vegetation cover types, (2) density class, (3) size class, and (4) height class.

Standard methods of aerial photo interpretation and vegetation type classification are used to map the cover types. A classification scheme was developed which met the following criteria:

- 1. The types are ones commonly used by forest managers.
- 2. Types could be assigned marketing and pricing factors singly or aggregately.
- 3. Types could be distinguished on the available black and white infrared aerial photos.
- 4. The scheme is related to the ecosystem classification which has been previously developed by the Limnological Research Center, University of Minnesota.

Interpreters used both the cover type classification scheme detailed in V16 as well as the key below to delineate boundaries and symbolize the cover types on matte acetate photo overlays.

This key is used only as an aid in identification of cover types in conjunction with other characteristics.

	ALC Y	to Inoto appeara	mee or mee ppeeres	(COVCI IYPC)
Tone		Cover Type	Texture	Remarks
Very gray	dark	J S	Velvety Hard	Hazy, smooth Carpet-like
to			Hard Hard	, which does have many more party many have have have not does not any bank was not and and
Dark	gray	T C	Hard Hard	

Key to Photo Appearance of Tree Species (Cover Type)

D-1

Medium gray	R W G	Soft Soft Smooth	Circular outline Star shaped
Light gray to very light gray	H A E D O	Carpet-like Fluffy Soft Carpet-like Smooth	

A classification scheme was also described by the Limnological Research Center, University of Minnesota, which grouped species into ecosystems. Groupings include upland, transitional, and bog ecosystems. A tabulation of the descriptions of the two classifications is given in the order they appear in the data levels for V16.

CLASSIFICATION SCHEME

COVER TYPE¹:

Species	Cover Type Description
Aspen and paper birch*	More than 50% trembling aspen, large tooth aspen, Balm of Gilead and paper birch.
Jack pine*	More than 50% pine with jack pine out- weighing white and red pine.
Red pine*	More than 50% pine with red pine out- weighing white and jack pine.
White pine*	More than 50% pine with white pine outweighing red pine and jack pine.
Northern hardwoods*	More than 50% northern hardwood species (maple, yellow birch, basswood, elm).
Mixed conifer and deciduous*	Matural or logged upland areas containing a mix of aspen, birch, pines and spruce. May also contain red maple and balsam fir.
Upland shrubs	Upland shrubs (hazel, pin cherry, etc.) with less than 10% stocked commercial tree species.
Grassland	All upland open areas of grass with less than 10% stocked commercial tree species. Include administrative areas. D-2

Plantation

Spruce-fir*

Lowland shrubs

Marsh

Water

Non-productive swamp

White cedar*

Black spruce*

Mixed conifer swamp*

Tamarack*

Swamp or bottomland hardwoods*

Cutover

Farm

Industrial and residential

Areas that have been planted but species cannot be identified on the aerial photographs.

A mixed hardwood-coniferous type composed of more than 50% white spruce and balsam fir.

Lowland shrubs (alder, etc.) with less than 10% stocked commercial tree species.

Marsh (grass, sedges, and some lowland brush), bog or open muskeg.

Lakes, ponds, flowage, streams.

Spruce, tamarack or cedar bog which will not produce trees of pulpwood size in 100 years.

More than 50% swamp conifers with white cedar outweighing other species.

More than 50% swamp conifers with black spruce outweighing other species.

Spruce, cedar, balsam, and tamarack comprising more than 50% of the stand.

More than 50% swamp conifers with tamarack outweighing other species.

More than 50% composed of bottomland hardwoods (ash, elm, Balm of Gilead, soft maple).

Only one growing season elapsed since area harvested.

Crop, orchard, or pasture, but not farm woodland.

Platted areas used for industry or residence.

Quarry or gravel pit

*All asterisked cover types must be further described with a size class, a 20° height class and a density class (V18, V19, V20). All other types are considered non-forested or plantations.

ECOSYSTEM²: Ecosystem Species Aspen and paper birch Ul - Aspen and birch comprising about 90% of the canopy. This unit occurs mainly on uplands either as young stands following logging or as very old stands with a fir understory that is not apparent on photos. Jack pine U2 - Natural pure pine stands, mixed red and jack pine or pure jack pine. They occur mainly on outwash plains, and to date they are about 60 years old, rimmed with natural U3 where Red pine there are topographic breaks. They were probably just young enough to escape cutting until now. Even-aged stands suggest they are of fire origin. The forest floor is often dry, White pine with interrupted herb layer and only a scattered shrub layer. Wherever possible such stands are aged by boring the trees and counting the rings. Northern hardwoods U3 - Mixed conifers and deciduous elements. These stands come in several varieties. 1. Natural stands of mixed aspen, birch, pines, and some spruce on topographic breaks. 2. After logging with no apparent Mixed conifer and planting. These stands appear to date from the late 1940's. Many large birch and aspen trees were left standing, deciduous creating a savanna-like appearance. Some old pines were often left as well. There is regeneration of scattered conifers, young aspen, and often red maple and cherry. Shrub layer varies with dryness of soil and often is thick. Upland shrubs U4 - Upland shrubs (hazel, pin cherry, etc.) and grass with less than 10% Grassland stocked commercial tree species. Plantation U6 - Plantation*。 Wherever possible these stands have been aged and so far fall into two main age classes: 5-7

	years and 18-23 years. The latter may give the appearance of the second category of U3 above. Most recently cut areas that show as clearcuts on photos have been replanted, some with fire after cutting and some without. Evidence of such fire is noted when known. In one case the fire escaped, leaving an adjoining area with natural pine regeneration that should probably be categorized as U2. *Older plantation stands have been grouped in U2 or U3 above.
Spruce-fir	T1 - Mixed spruce, pine, and fir. Often occurs on topographic breaks and intergrades into both U3 (with addition of deciduous elements) and B2 below. When former logging left scattered coni- ferous remnants, a savanna-like version of T1 occurs, characterized by widely spaced broad-branching jack pines. When the structure of the forest is un- usual, as in this case, it is noted on the map.
Lowland shrubs	Bl - Wetlands giving an even grey ap-
Marsh	pearance on photos, comprised of five different types: 1. Carex (sedge) fens, open grassy wetlands with much standing water.
Water	2. Carex and shrub fens. The shrubs are usually alder and dogwood. 3. Cutover wetlands that have become
Non-productive swamp	drier since cutting but still contain wetland elements. 4. Ericaceous bogs (heather family) without spruce. 5. Ericaceous bogs with <u>Larix</u> (tama- rack).
White cedar Black spruce Mixed conifer swamp Tamarack	B2 - Conifer wetlands. 1. With spruce. 2. With cedar, only separable when they occur in large pure stands.

D~5

Swamp or bottomland hardwoods	B3 - Ash wetlands. Occur where there is a good supply of nutrients from neighboring uplands, usually along rivers or in draws. May have a cedar understory. The herb component of these communities is unique and has affinities with the flora of southern Minnesota.
Harvested	D1 – Cutover with only one growing season elapsed,
Farm Industrial and residential	D2 – Under permanent unnatural use.

Industrial and residential Quarry or gravel pit

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Appendix E - Timber Cutting History (V17)

Timber cutting history was determined by aerial photo interpretation followed by some field checking. Stereoscopic air photo coverage of most of the area was available in four series, spaced roughly 11 years apart. Photos were not strictly comparable because of inherent differences between them which created some problems in interpretation. Attempts were made to resolve these problems during interpretation.

Laboratory procedure was carried out as follows. Acetate was layed over alternate photos in the 1937 and 1970 series with logged areas then encircled in colored pencil. Cut areas from intervening years were visually transferred onto the 1970 acetates. Map units were then transferred from acetates to U.S. Geological Survey topographic maps using a reflecting projector. Where recent logging overlaps older logging, the area was then shaded the color of the most recent.

The following criteria were used to identify logged areas on the air photos:

- 1. Presence of parallel cut lines in the forest.
- 2. Presence of networks of roads and trails in the vicinity of forests that show openings in the canopy.
- 3. Presence of extensive young forests dotted with taller conifers, aspen, and birch.
- 4. Areas with no trees at all or with a homogenous soft grey tone. (This tone on uplands denotes very young plantations, but in wetlands it denotes either meadow or carr).
- 5. Presence of linear patterns resulting from regular thinning or other treatments.
- 6. Disappearance of individual trees or clumps of trees that were visible on earlier photos.

- 7. Landings and piles of logs.
- 8. Open landscape with high windrows (rock raking).
- 9. Presence of roads and trails in inaccessible areas, across swamps, or ending blindly in the vicinity of the forest with unusually open canopies.

Areas mapped as "uncut" are those in which it is most certain that cutting has never taken place. Upland uncut areas are probably either conifer stands that must have been too young for logging in an earlier era, or mixed stands dominated by decadent aspen and birch with an understory of fir. Most uncut areas are in wetlands, but wetlands are the least reliable to map because early logging of black spruce in wetlands preceded logging of upland jack pine. A conservative guideline for understanding a wetland is not to consider it uncut unless it consists of lowland shrubs, marsh, or sedge meadows with very few trees.

Two additional map units were needed to explain other possibilities within the wetlands. Areas coded "probably uncut" are raised bogs and closed spruce stands with roads close to them but no apparent cutting visible within them. Areas coded "probably cut" include:

- 1. Spruce bogs with fairly open canopies and a reticulate appearance on the photos but no visible slash lines.
- 2. Raised bogs that appear to have a cut pattern superimposed on the natural pattern.
- 3. Areas coded as nonproductive swamp on the vegetation map.
- 4. Areas that have obviously been cut but the date is uncertain.

E-2

Appendix F - Vegetation Size and Density Classes (V18, V19)

Crown Density Classes (V18)

Seedlings, Saplings 1. Density Class

> Poor Medium Good

Description (trees/acre) Seedlings Saplings 200 - 750175-350 800-1350 400 - 7001400 +750 +

2. Poles, Saw timber Density Class Poor Medium Good

> Not applicable Plantation

3.

Description 10 to 40% crown closure 41 to 70% crown closure 71% crown closure and over

Description Non-forested vegetation types in V16. Areas that have been planted but species cannot be identified on the aerial photo.

Size Classes (V19)

Size Class

Seedlings (0-1")

Saplings (1-5")

Poles (5-9")

Description

Young stands of commercial tree species from 1" high to 0.9" dbh.

Stands of trees ranging between 1.0" dbh and the minimum pole timber size.

Stands in which most of the merchantable volume is in trees between 5.0" dbh and the minimum sawtimber size. Not less than 10% stocking.

Small sawtimber (9-14") Most of the bf volume in trees less than 15.0" dbh.

Appendix G - Summary: Lake and Stream Surveys (Fish Habitat) (V22)

LAKES: Ecological Classification for Fisheries Management

The Ecological Classification of lakes denotes the basic lake type. This classification is described in terms of the natural and characteristic fish populations which are best adapted to the physical, chemical, and biological characteristics of a lake and which the lake could be expected to support if it were left alone with no special management applied to it. The arrangement in each system is in order of progression from the oligotrophic to the eutrophic.

The northern pike, as a species, has been omitted from the name designations because it is generally found in nearly all types of lakes; with the exception, perhaps, of trout lakes.

A brief description of the characteristics for each type of lake is given below as a guide in classification. The principal ecological types and their descriptions are as follows:

Trout	Deep, rocky, infertile lakes with oxy-
	gen throughout. Tullibee and suckers
	are other principal components of the
	population. Typical lakes: Mountain,
	ClearwaterCook County.

Soft-water walleye Infertile, medium to large size lakes in northeastern Minnesota with natural walleye populations. Typical lakes: Pike--Cook County, Vermilion--St. Louis County.

Hard-water walleye Moderately fertile, medium to large size lakes in which walleyes are well established naturally. Typical lakes: Mille Lacs, Winnibigoshish, Leech.

Centrarchid--walleye Medium to large sized, usually lakes consisting of many ecologically different bays or sections some being natural walleye habitat, others more suitable for panfish species. May also have substantial bullhead and/or carp and/or buffalo populations. Typical lakes: Minnetonka, Sally, Minnewaska.

Medium and small sized, weedy, fertile, hardwater lakes. Usually no large open areas. May also contain moderate to substantial populations of carp, and/or buffalo and/or bullheads. Typical lakes: Gladstone--Crow Wing County, Maple--Douglas County.

Fertile hardwater lakes in southern and central Minnesota characterized by relatively large rough-fish (carp, buffalo, sheepshead, bullhead) populations. Many may occasionally winterkill. Typical lakes: Tetonka--Le Sueur County, Long--Ramsey County, and Washington--Blue Earth County.

Shallow lakes, in which frequent winterkills promote the dominance of bullheads. Typical lakes: Christina, Star, Bear.

These are often small lakes whose native fish populations do not fit any of the above categories. Lakes reclaimed for stream trout stocking may fall in this category. Use this classification with caution; it is not intended as a catchall or a substitute for careful analysis.

STREAMS: Classification for Fisheries Management

Defined as streams capable of supporting an acceptable sport fishery through natural reproduction. Streams in this group will be managed by protection of the stream from physical abuse of the habitat; by development of the stream for public fishing areas through acquisition of stream frontage and improvement of habitat; and by regulation to promote the optimum sustained recreational use. As a general procedure trout populations in these streams will not be maintained at artificial levels by maintenance or put-and-take stocking.

Due to the fact that streams in this category will range from small brushy feeder streams characterized by cold water and small trout to the large produc-

Centrarchid

Roughfish--gamefish

Bullhead

TYPE A.

Trout Streams

Unclassified

tive main channel areas, streams in this type should be divided into two subcategories:

- A-1 Main channel streams Streams large enough to support a significant fishery with all types of common gear-bait, spin-cast, and fly fishing.
- A-2 Feeder streams Defined as too small or brushy to provide more than a limited trout fishery.

NOTE : It is probable that Type A2 (Feeder streams) will comprise a significant mileage of the total Minnesota trout streams. It is important both for inventory and management purposes to differentiate these small streams from the more fishable downstream areas. First, it would be unwise to confuse these small streams with our top-notch large fishable trout streams on a quantitative basis; secondly, the fceder streams are unique in some aspects. In some cases these small streams may be directly tributary to non-trout water, but still may afford a bona fide trout fishery in their own right. In many cases the greatest value of these small streams is found in their contribution of cold water and recruitment of small trout to the larger downstream areas. In any case such streams as have more than one type should be divided into sectors and each classified individually.

Defined as streams capable of supporting a trout population of dominant interest to the sport fishery except for the lack of natural reproduction or over-abundant competing species. Streams in this group will be managed similarly to Type A streams except that efforts may be called for to maintain trout populations at artificially high levels. Population manipulation practices for this purpose may include artificial spawning areas, maintenance stocking of fish, and population control with fish toxicants.

TYPE B. Trout Streams TYPE C. Steelhead Streams Defined as streams providing a principal sport fishery for anadromous trout or salmon species. These are waters where the migration of anadromous fish provide a significant fall and spring sport fishery. Management will principally lie in public access along stream banks, maintaining ingress and egress from the lake and regulations permitting the taking of fish during the migration periods. Maintenance stocking of trout may be a beneficial management practice in some instances.

NOTE: Streams in this category may actually be all, or in part, Type A, B, or D trout streams, but should be designated in this group if an existing anadromous population warrants the extended trout season.

TYPE D. Associated streams--Trout

Warmwater gamefish

TYPE E.

streams

Defined as streams not capable of supporting trout populations over extended periods of time, or streams which may contain limited populations of trout, but which have a greater interest or value to the sport fishery in supporting other species of fish. Streams in this group will not be regulated as designated trout waters. If managed for trout fishing, it should be on a put-and-take basis utilizing catchable sized rainbow trout.

Defined as streams capable of supporting an acceptable resident sport fishery through natural reproduction. Such stream classification will be subdivided according to the principal species sought although other game and coarse fish species may be present. Streams in this group will be managed by preservation and development of the habitat and natural spawning sites by development of the stream for public fishing areas through acquisition of stream frontage; maintenance of minimum water flows where regulated by upstream reservoirs; and by regulations to promote the optimum sustained recreational use. Generally gamefish populations in these streams will not be maintained at artificial levels by maintenance or put-andtake stocking except that trophy fish species such as muskellunge may be stocked in certain streams managed for

this species.

The subdivisions of warmwater gamefish stream classification are as follows:

E-1 Walleye

E-2 Northern pike

E-3 Catfish--smallmouth bass

E-4 Cosmopolitan (large river)

E-5 Muskellunge

TYPE F. Warmwater carp streams	Defined as streams dominated by carp to the extent that management for gamefish species is not feasible because of the cost of carp control. Management of these streams will be restricted to adoption of regulations for optimum sus- tained harvest of bait species. When practical methods for carp control are found such streams may be re-classified.
TYPE G. Warmwater connector streams	Defined as streams having a sport fish- ery owing its existence to fish populations in adjacent lakes or larger tributaries. In general such streams may vary from mouths of large tributaries to streams conducting the flow from lake to lake. Streams in this group will be managed by protection of the stream habitat including their free-flowing condition and minimum flows; by development of the stream for public fishing areas through acquisition of stream frontage.
	These streams will be of two types. G-1 Warmwater connector streams - walleye G-2 Warmwater connector streams - northern pike

TYPE H. Warmwater feeder streams

F

Defined as streams not capable of providing any significant sport fishery because of small size, shallow character or intermittant nature. Streams of this group will only be managed if utilized in migration of spawning gamefish species.

In such a case acquisition of the stream through easement or purchase will protect it from channelization or barriers.

The subdivisions of warmwater feeder stream classification are as follows:

(Sninwsqz) sike (spawning)

(gninwage) systic (grander)

wonnim E-H

REFERENCES

- 1. Kuehn, J.H., "Classification of Minnesota Streams for Fisheries Management Purposes (Tentative 1966)", <u>Minnesota</u> <u>Stream Survey Instructions</u>, p. 40-44, Division of Game and Fish, Minnesota Department of Natural Resources.
- 2. Scidmore, W.J., <u>Manual of Instructions For Lake Surveys</u>, Special Publication No. 1, Minnesota Department of Conservation, Division of Game and Fish, Revised 1970.

Appendix H - Soil Association Survey Sheets (V24)

On the following pages Soil Survey Interpretations are listed for the soil classifications which occur within the MINESITE area. These interpretations were developed by soil scientists of the Soil Conservation Service, Forest Service and the Agricultural Experiment Station, University of Minnesota.

The information contained within the Soil Survey Interpretation sheets, along with V24 Soil Associations, will be useful tools for general or preliminary planning. The interpretative data will be used to group the soil classifications into specific data levels reflecting the desired properties or selected uses needed for an analysis step.

Soil Assn.	Major Soil	Interpretative	Proportion of
Number	Interpretations	Sheet Numbers	Major Soils (%)
5	5A 5B Minor Soils	5A 5B; 51B	65 15 20
6	6A 6B Minor Soils	6A; 7B 6B; 7A	75 15 20
7	7A	6B; 7A	60
	7B	6A; 7B	15
	7C	7C; 43A; 44A;	15
	Minor Soils	46A; 47A	10
. 9	9A	9A; 40A	45
	9B	9E; 40B	40
	9C	9C; 10C;	5
	Minor Soils	11A; 40C	10

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Soil Assn. Number	Major Soil Interpretations	Interpretative Sheet Numbers	Proportion of Major Soils (%)
28	28A 28B Minor Soils	28A; 29A 28B; 29B	60 30 10
	WINOL DOITS		
40	40A	9A; 40A	45
	40B	9B; 40B	40
	40C	9C; 10C 11A; 40C	5
	Minor Soils	114, 100	10
54	54A	54A; 55B	60
~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	54B	54B; 55A	30
	Minor Soils		10
55	55A	54B; 55A	60
	55B	54A; 55B	30
	Minor Soils		10
G	GA	GA	65
	Minor Soils	-	35
р	PA	19B; PA	65
	Minor Soils	, , , , , , , , , , , , , , , , , , ,	35
SP	SPA	SPA	50
	SPB	SPB	35
	Minor Soils		15

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# U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

# SOIL SURVEY INTERPRETATIONS 1/

SERIES <u>54</u> STATE <u>Microsota</u> MLRA <u>89, 90</u> Pov. DHP-FLP 11/71

This series consists of gently sloping to steep well drained soils formed in more than 40 inches of brownish, medium and strongly acid gravelly sandy loam over bedrock. At depths of 14 to 28 inches there occurs a well developed fraginan ranging in thickness from 10 to 35 inches or more. Percent of coarse fragment typically is 25 to 35 percent. The fraginan restricts root renetration. The terrain is sloping to hilly and is located in the Laurentian Shield country of northeastern Minnesota.

# ESTIMATED SOIL PROPERTIES SIGNIFICANT TO ENGINEERING

Major Soll	Class	ification		Coarse Percentage less than 3 inches Fract. Pansing Sieve Neuro					LL	PI	Permea- billiy	Avail, Water	Soil Reac-	Shrink Swell
Horizons (inches)	USDA Texture	Unified	AASHO	>3 in. %	4	10	40	200			In./hr.	Capac, in./!n.	tion pH	Poten- tial
C to 16	Gravelly sandy loam	SM	A-2		50-75	40-65	30~55	20-35	10~20	0-4	2.0-6.3	0.10- 0.14	4.5 - 6.0	Low
l6 to 50 (fragipar	°,	SM	A-2		50-75	40-65	30-55	20-35	10-20	0=4	0.06-0.2	.05- .09	5.1 - 6.0	L04
Flooding	None			i no hake i i kango ni nampo linitar	der filter antes y lines	4			Hydrclog	ic grou	p; C			
Depth to w	ater table:	Below 5	feet						Depth to	hedroc	k: Below	v 5 feet		
Corrosivity	y - uncoate	d steel:	Low						Corrosiv	lty - co	ncrete: Mr	oderate		
2	SUITABIL	ITY OF S	SOIL AS S	OURCE	OF SE	ELECT	ed ma'	TERIAL	AND F	EATU	RES AFFI	ECTING	USE	
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1/ Use in conjunction with Guide to Soil Survey Interpretation Sheets.

# DEGREE OF SOIL LIMITATION AND MAJOR FEATURES AFFECTING RECREATION USES

Camp Areas	Moderate to severe: slow permeability, sloping to hilly terrain								
Picnic Areas	Moderate to sovere: sloping to hilly terrain								
Playgrounds	Severe: most slopes over 6 percent								
Paths and Trails	Slight to moderate sloping to hilly terrain								

# CAPABILITY, SOIL LOSS FACTORS, AND POTENTIAL YIELDS--(High level management)

Phases of Series	Capability	Soll K	Loss T				
2 to 18 percent slopes	VIe	.37	3,2				· · · · · · · · · · · · · · · · · · ·
18 to 25 percen slopes	t VIe						
And the second sec			ang dilinit. Del	PAS	TURELAN	D AND HAY	LAND
Phases of Series	Group			Spec	eles, Yield in	n AUMs for D	ryland (Irrigated) Forage Production

### WILDLIFE HABITAT SUITABILITY

		9499499 ⁹ ********************************	Poie	Potential for						
Phases of Series	Grain and Grasses, Seed Crops Legumes		Wild Herbaceous Plants	Hardwood Trees and Shrubs	Coniferous Plants	Wetland Food and Cover	Shallow Water Devel,	Openland Wildlife	Woodland Wildlife	Wetland Wildlife
	Poor	Fair	Fair	Fair	Fair	V. Poor	V. Poor	Poor	Fөiт	Very pont

# WOODLAND SUITABILITY

ſ	Phases of	Ordi-	Potential F	Productivity		Woodland Mana	gement Haza	rds	Suitable	Species	Other
	Series	nation	Important	Site	Erosion	Equipment	Seeding	Plant	To Favor	To Plant	
L			Trees	Index	Hazard	Limitations	Mortality	Competition			
	A11		White birc	h -	Slight	Slight	Slight	Moderate		Red pine	
			Trembling .	aspen -	to	to				Jack pine	ν.
			White pine		severe	moderate				White spr	ice
-			Red pine		on steep	er					
			Whitespru	ce ·	slopes						

# RANGE

Phases of Series	Range Site Name	Climax Vegetation and Productivity of Air-Dry Herbage (lb./ac.)
L		

# WINDBREAK

Group	Adapted Trees to Plant	Tree Height Prediction at 20 Years Age	Relative Vigor

# OTHER

Low potential porductivity. Moderate to low natural feritility; no native plants suitable for grazing. Watershed - Deep to bedrock; mornumus; permeability 0.06-0.2"/hr.; moderate runoff; well drained.

<u>MLRA'S</u>

FOR INTERIM USE- Subject to change on completion of coordination between / Page 2 of 2 H-4

# U. S. DEPARTMENT OF AGRICHUTURE Sour Confermation Structs

SERIES <u>SR: CIB</u> STATE <u>Hundedia</u> MLRA <u>69,90</u>

# SOIL SURVEY INTERPRETATIONS 17

This series consists of slightly concave and nearly level, somewhat poorly and poorly drained soils formed in sandy loam glacial till under a mixed decideous-coniferous forest. Typically they have black loam surface horizons; mottled dark brown and brown loam subsurface horizons; mottled dark brown sandy loam subsoil horizons and dark brown sandy loam underlying material. A freegingen typically begins at 18 inches. Slopes are less than 2 percent. Mest areas are forceded.

#### ESTIMATED SOIL PROPERTIES SIGNIFICANT TO ENGINEERING

Major Soll	Clas	alfication		Ocaraa Frasts			na than Sieve Nr	3 inches			Permea-	Avall, Water	Soit Reac-	Shrink Ewoli
Horizons (inches)	USDA Texturø	Unified	AASHO	>3 in, %	4	10	40	ado	LL	PI	billig In./or.	Capas. In./in.	fion pH	Poton- tial
0-11	GR-L	ML-CL	A-11	0~5	30-200	<b>70-8</b> 0	60-75	55-65	25-30	0~10	0.6-2.0	.1618	5.1-5.9	Low
11-45	GR-SL	SM	A-2	0-5	85-95	70-20	55-65	20-30	10-20	0-1	0.2-0.6	.0813	5.1-6.0	A.TOM
45-60	GR-SL	SM	A-2	0-5	85-95	70-80	55-65	20-30	10-20	0-4	0.2-0.6	2/	5.1-6.0	V.Low
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Flooding	None				(				Hydrolog	tri Econ	5: C			
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TI Local Roads		<u>vere - V</u> ts	<u>et</u>											No. 1
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Potential F	røst Action	High												
Pro-spanning distribution from the	en janetala da da da territorio da territorio da territorio da territorio da territorio da territorio da territo		MAJ	OR SOI	L FEAT	URES	AFFEC	TING S	SELECT	TED UP	ES			
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		Blow pe		<del>tу</del>		(1993) - Name - S. (1998) - 1998								
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USDA-SCS-LINCOLI	N, #EDR. 1971		1/ Use								eets.	107	f	age 1 of 3 5,8-20,789

only the upper 2 ft. of these horizons supplies moisture to plants.

# DEGREE OF SOIL LIMITATION AND MAJOR FEATURES AFFECTING RECREATION USES

CTORE CONTRACTOR AND	
Camp Areas	
	Moderate to severe - wet
	Underste se percio - men
Picnic Areas	
	Moderate to severe - wet
NAMES OF TAXABLE PARTY AND ADDRESS OF TAXABLE PARTY.	J TAMOLENS FO FOVOLO
Playgrounds	
-	Moderate to severe - wet
Peths and Trails	
1	Moderate to gevere - wet
Programma and a state of the st	
	A DADITION LOOP DACTORS AND DOTENTIAL WITH DO (II) at lovel mention and)
	CAPABILITY, SOIL LOSS FACTORS, AND POTENTIAL YIELDS(High level management)

0/1	a neoratica a	- +2 e									
Phases of Series	Capability	Soll K	Lова Т								
All	IIIw										
PASTURELAND AND HAYLAND											

Phases of Series	Group	Species, Yield in AUMs for Dryland (Irrigated) Forage Production
	999-9979-1000 (California California Califor	
1		

# WILDLIFE HABITAT SUITABILITY

	Potential for						Potential for				
Phases of Series	Grain and Seed Cropa	Grasses, Legumes	Wild Herbaceous Plants	Hardwood Trees and Shrubs	Coniferous Plants	Wetland Food and Cover	Shallow Water Devel.	Openland Wildlife	Woodland Wiidlife	Wetland Wildlife	
A1.3	Poor	Fair	Fair	Fair	Fair	Good	Fair	Fair	Feir	Fair	

# WOODLAND SUITABILITY

				W000	GAND BULLA	1 JALJA L A				
Phases of	Ordi-	Potential P	roductivity		Woodland Mana	Suitable	Other			
Berles	nation	Important Trees	Site Index	Erosion Hazard	Equipment Limitations	Seeding Mortality	Plant Competition	To Favor	To Plant	
All	2₩	Aspen E. Wh. Pin N. Red Oak Red P ₁ ne		Slight	Moderate	Slight	Moderate to Severe	White P1 Aspen White Sp	Red Pi	

# RANGE

-		*****
Phases of Series	Range Site Name	Climax Vegetation and Productivity of Air - Dry Herbage (ib./ac.)

	WINDBREAK		
Group	Adapted Trees to Plant	Tree Height Prediction at 20 Years Age	Relativo Vigor
	OTHER		

FOR INTERIM USE Subject to change on completion of coordination between MLRA'S  $H\!-\!6$ 

58; 518

# U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE SOIL SURVEY INTERPRETATIONS 1/

SERIES 64; 7B	SERIES
STATE Minnesota	STATE
MLRA	MLRA

This series consists of deep excessively drained soils formed in loamy material over stratified sand and gravel under deciduous and conferous forest on plane and convex slopes of outwash plains, easkers, and kames. Typically, they have black, sandy loam surface layers 1 inch thick; dark grayish brown, sandy loam subsurface layers 2 inches thick; dark reddish brown and reddish brown, sandy loem subsoil 12 inches thick; and yellowish brown, gravelly very coarse sand underlying material. Slopes range from 1 to 60 percent. Most arces are forested.

Major Soll	Clas	sification	1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 - 1999 -	Coarse Fract.			ss than . Sleve No	3 Inches			Permea-	Avail. Water	Soll Reac-	Shrink Swell
Horizons (Inches)	USDA Texture	Unified	AASHO	>3 in. %	4	10	40	200	LL	PI	bility In./hr.	Capae. in./in.	tion pH	Poten- tial
0-15	SL	SM	A-4	0-5	90-100	80-95	55-75	35-50	er4 600	NP	0.6-2.0	.1824	4.5- 6.5	Low
15-60	GR-COS	GW, GP, SP	<u>A-1</u> .	0-10	40-85	35-75	10-45	0-5		NP	> 20	.0204	4.5-	V.Low
	, en stalet 1947 - L	141 - ¹												
	y la e La seconda de la seconda de													na na Ara Ara Maria
	None			<u> </u>					Hydrolog	de arou	D' B			
Flooding Depth to w		greater	than fi	ve feet	t						к: 40-120	inches		
		d steel: Lo							•		ncrete: Mc			
				SOURCE	OF SE	LECT	ED MA'	TERIAL	AND F	EATU	RES AFFI	ECTING	USE	<u></u>
Roadfill Go	SUITABILITY OF SOIL AS SOURCE OF SELECTED MATERIAL AND FEATURES AFFECTING USE Roadfill Good													
	od													
	od										· · · · · · · · · · · · · · · · · · ·			
Topsoll Poor: thin layer, small stones DEGREE AND KIND OF SOIL LIMITATION FOR SELECTED USES														
DEGREE AND KIND OF SOIL LIMITATION FOR SELECTED USES Septic Tank Filter Fields 0-0%; slight														
	8-15%: moderate-slope 154%: severe-slope													
Sewage Lag	Sewage Lagoons													
	Severe: веерадо													
Shallow Exc	avations													
Dwellings: With Bas Without I	iements Basements		modera ølight;							.ope			<u>er de la sec</u> ie	
Sanitary Lar	dfill	-												an a
(Trench Local Roads	and A.rea		е: веер	age										
Potential Fr	ost Action		alight:	8-15%:	_moder	ate-al	ope: ]	<u>і-%: ва</u>	vore-al	ope		ana a san ang ang ang ang ang ang ang ang ang a	1	
			MAJ	or sou	L FEAT	URES	AFFEC	TING S	ELECI	ED US	ES			
Pond Reserv	oir Areas	Seepar	(9											
Embankment	s, Dikes, a													
Drainage of	Cropland a													
Irrigation			вееред	Э										
Terraces and			too sa	ndy										
Grassed Wat	erways		drough	-										
provide the community of the provide statement of the		an and detailed filled of	un historia da da da di San de la come de la											
Excavated	Excavated Ponds Aquifer Fed: Deep to water													
Excavated	Ponds A		0	o to wa	ter				ĩ					

USDA-SCS-LINCOLH. NEBR. 1871

1 / Use in conjunction with Guide to Soil Survey Interpretation Sheets,

# DEGREE OF SOIL LIMITATION AND MAJOR FEATURES AFFECTING RECREATION USES

Camp Areas	0-8%: slight; 8-15%: moderate-slope; 15+%: severe-slope
Picnic Areas	0-8%; slight; 8-15%; moderate-slope; 15+%; severe-slope
Playgrounds	0-2%: slight; 2-6%: moderate-slope; 6+%: severe-slope.
Paths and Trails	0-15%: slight; 15-25%: moderate-slope; 25+%: severe-slope
	CAPABILITY, SOIL LOSS FACTORS, AND POTENTIAL YIELDS (High level management)

Cr.	IL RUIDINI	, 001		00 111010	2009 2211-0 E	9 a cont a ni i no	11-200 (11-Bit 101-01)	ana gomenty	
Phases of Series	Capability	Soll K	Loss T						
0–2% 2–6% 6–12% 12–18% 18–35%	38 3E 4E 6E 7E								
				PAS	TURELANI	O AND HAY	LAND		

Phases of Series	. Group	Species, Yield in AUMs for Dryland (Irrigated) Forage Production
and the second		

# WILDLIFE HABITAT SUITABILITY

			Pote		Potential for					
Phases of Series	Grain and Seed Crops	Grasses, Legumes	Wild Herbaccous Plants	Hardwood Trees and Shrubs	Confferous Plants	Wetland Food and Cover	Shallow Water Dovel.	Openland Wildlife	Woodland Wildlife	Wetland Wildlife
0-12%	Fair	Good	Good	Fair	Fair	V.Poor	V.Poor	Good	Good	V.Poor
12-35%	Poor	Poor	Good	Fair	Fair	V.Poor	V.Poor	Fair	Fair	V.Poor

#### WOODLAND SUITABILITY

Phases of	Ordi-	Potential P	roductivity	1	Woodland Man	agement Heza	rds	Suitable	Species	Other
Phases of Series	nation	Important Trees	Site Index	Erosion Hazard	Equipment Limitations	Seeding Mortality	Plant Competition	To Favor	To Plant	
0-12%	38	Red Pins E.Wh.Pine Jack Pine	55 55 60	Slight	Slight	Moderate	Slight		Red Pine Wh.Spruce	
12-35%	ЦS	Wh.Spruce Red Pine	60 55	Moderate	Moderate	Severe	Slight		Red Pine	
		E.Wh.Pine Jack Pine	60		RANGE				Jack Pine	
Phases of S	eries	Hangepensona,	ne p0	Cilr	nax Vegetation	and Product	ivity of Air-Dry	Herbage (1b	./ac.)	

	WINDEREAK		
Group	Adapted Trees to Plant	Tree Height Prediction at 20 Years Age	Relative Vigor
0-12%	Northern White-Cedar, Red Pine, Russian-Olive, White Spruce, Jack Pine, Siberian Grabapple, Eastern Red Cedar, Hackberry, Silver Buffaloberry Siberian Peashrub, Bur Oak, Tatarian Honeysuckle	11,20,15 18,20,12 15,18,12 10,18,10	

OTHER

FOR INTERIM USE Subject to change on completion of coordination between MLRA'S Page 3 of 3 5,11-29.789

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H-8

# U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

SERIES	6B	, 7/	<u> </u>
STATE	Minne	rota	
MLRA	89 &	90-2	
	D.P.	RL	2-72

# SOIL SURVEY INTERPRETATIONS 17

This series consists of nearly level to very steep, excessively drained soils formed in outwash material. These soils are on outwash eskers and ice-contact glacial deposits. Native vegetation was forest. The surface layer is dark reddish brown decomposed plant remains about 2 inches thick. The subsurface layer is gray very gravely coarse sandy loam about 5 inches thick. The subsoil is strong brown, gravely loamy sand about 10 inches thick. The underlying material is brown very gravely coarse sand. Permeability is very rapid. The available water capacity is very low and organic matter content is low. These soils contain many cobbles and boulders.

#### ESTIMATED SOIL PROPERTIES SIGNIFICANT TO ENGINEERING

Major	Class	ification	ESTIMAT	Coarse	Perces	ntage le	sa than	3 Inches			Permea-	Avail.	Soti	Shrink
Soil Horizons (inches)	USDA Texture	Unifled	AASHO	Fract. >3 in. %	4 4	t0	Sieve No 40	200	LL	PI	billity In./hr.	Water Capac. In./in.	Reac- tion pH	Swell Poten- tial
0-15	Very Gravelly loamy sand	GW, GP cr SP	A-1	0-10	20-60	10-50	4-30	0=5	NP	NP	Greater than 20.	0.03- 0.05	5.1- 6.5	Low
15-60	Very Gravelly loam	GW, GP or SP	I⊸A	520	20-60	10-50	4-30	0-5	NP	NP	Greater then 20,	0.02- 0.04	5.1- 6.5	Low
	sand	01												
Flooding	None								Hydrolo	gic grou	p: A			
Depth to w	ater table;	Greate	r than 5	feet					Depth 10	o hedroc	k: Norma	lly gre	ator th	an 6 feet
Corroslvity	- uncoated	d steel: L	WC						Corrost	ity - co	ncrete: Lo	W		
S	UITABIL	ITY OF S	OIL AS S	SOURCE	C OF SE	ELECT	ed ma'	TERIAL	, AND F	EATU	RES AFFI	ecting	USE	
	Good: h	igh shea	r streng	h: low	compre	ssibil	ity							ri _{stera}
		uantity o						****				1997 (N.).		1 - 17 - 17 - 17 - 17 - 17 - 17 - 17 -
		tones and oarse te:			and ho	ulders								
ropoon	1002.0		DEGREE					TION F	OR SEI	LECTE	D USES			
Septic Tank	Filter Fiel	lds g	Slight:								2 percent undergro			e on
Sewage Lago	ons	ŝ	Severe:	very i	capid p	ormeab	ility;	coarse	e textu	rød				
Shallow Exc	avations	Ş	Severe:	stones	e and b	oulder	e; ver	y grove	olly					
Dwellings: With Bas	ements :	Ş	Slight:		to 6 pe then 12				ate on	6 to :	12 percen	t slope	B; BOVC	re on
Sanitary Lan (trenc)			Gevere:	very i	rapid p	ormaab	ility;	COBIE	toxtu	red				
Local Roads		5	Slight:		to 6 pe than 12				ate on	6 to :	12 percen	t slope	8; 8eve	re on
Potential Fr	ost Action			MOXO (		201.00	110 D.LO	POD:						
			MAJ	or son	L FEAT	TURES	AFFE	CTING S	SELECT	red us	ES			
Pond Reserv	olr Areas	I	ligh com	pacted	permea	bility								
Embankment	s, Dikes, e							0.000000000	aihili	type ht.	ch abour	atmonat		
Drainage of	Cropland a	nes rubiule						CONFLAR	1111111	<u>, 111 (</u>	TI DIRING	o manke	м. <b>ц</b>	
Irrigation			lot need										and the first state of the stat	
Terraces and	Diversion	15	Jery low			and the second second second								<u> </u>
Grassed Wat	erwaya		Coarse t Coarse t									х. 		
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USDA-SCS-LINCOLN NEBR. 1971

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STATE OF MINNESOTA

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MN-SOILS-3 11-71 (F11e Code SOILS-12)

# DEGREE OF SOIL LIMITATION AND MAJOR FEATURES AFFECTING RECREATION USES

provide sector and a sector of the sector of	
Camp Areas	We target a many coorde fragments at the surface: () to 12 percent slopes: severe on more
Camp House	MODGLAPS: Waily COSTRA II SEMANDA AL AND DECISION A DAMA PARAMENT PROPERTY ACTION AND THE
	then 12 percent globes
Contraction of the second s	Moderate; many coarse fragments at the surface; 0 to 12 percent slopes; severe on more than 12 percent slopes
Picnic Areas	Moderate: many coarse fragments at the surface; 0 to 12 percent slopes; severe on more
, nonce to tot	SUCCERT CONTRACT
1	than 12 percent slopes
Contraction of the second s	
Playgrounds	
, 10, 800	Severe: many coarse fragments at the surface
	Severe: many coarse fragments at the surface
and the second sec	the second secon
Paths and Trails	Moderate: many coarse fragments at the surface; 0 to 25 percent slopes; severe more than
7 dente artarra	
1	25 percent alopea
Construction of the constr	L C 1 WALDBARD BAR WAR

# CAPABILITY, SOIL LOSS FACTORS, AND POTENTIAL YIELDS -- (High level management)

Phases of Series	Capability	Soii K	Loss T				
0 to 12% slopes	VIs	<b>.</b> 20	3	œ	6.03	-	
12-18% slopes	VIs			No inf	prmation a	this tim	
18-35% slopes	VIIs			NO THE	ormeeron e	0 011113 0.110	
PASTURELAND AND HAYLAND							

Phases of Series	Group	Species, Yield in AUMs for Dryland (Irrigated) Forage Production

# WILDLIFE HABITAT SUITABILITY

		in an	Potential for							
Phases of Series	Grain and Seed Crops	Grasses, Legumes	Wild Herbaceous Plants	Hardwood Trees and Shruba	Coniferous Plants	Wetland Food and Cover	Shallow Water Devel.	Openland Wildlife	Woodland Wildlife	Wetland Wildlife
All	very poor	poor	poor	very poor	very poor	very poo	r very poor	poor	very poor	very poor

# WOODLAND SUITABILITY

Phases of	Ordi-	Potential F	Productivity		Woodiand Mana	Suitable	Other			
Series	nation	Important Trees	Site Index	Erosion Hazard	Equipment Limitations	Seeding Mortality	Plant Competition	To Favor	To Plant	
All	Цø		50 or less	increases with stee	Moderate O- 12% slopes p increases with steep slopes	to	Low	Jack Pine	Jack Pine	

#### RANGE

Phases of Series	Range Site Name	Climax Vegetation and Productivity of Air-Dry Herbage (ib./ac.)

	WINDBREAK	۵. پر ۲۵۵ میلی در ۲۵۵ میلی در ۲۵۵ میلی میلی میلی میلی با در میلی میلی میلی میلی میلی میلی میلی میل	an a
Group	Adapted Trees to Plant	Tree Height Prediction at 20 Years Age	Relative Vigor
			L

OTHER

FOR INTERIM USE Subject to change on completion of coordination between MLRA'S  $\rm H{-}10$ 

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#### U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

SERIES 7C; 43A; 44A; 46A; 47A

# STATE Minnesota

# SOIL SURVEY INTERPRETATIONS 1/

MLRA <u>90</u> Revised Draft DP-RRL 12-72

This series consists of nearly level to steep, excessively drained soils formed in 1 to 2 feet of loany material over stratified and and gravel. These soils are on plane and convex slopes of outwash plains, eskers and kames. Native vegetation was forest. In a representative profile the surface layer is black sandy loan about 1 inch thick. The subsoil is dark brown, very friable, sandy loam about 13 inches thick. The underlying material is reddish brown gravelly coarse sand. Permeability is moderate in the upper part of the profile and very rapid in the lower part of the profile. The available water capacity is low and organic matter content is low. The availability of phosphorue is low, and of potassium is low.

	O ENGINEERING

Major Soll	Class	ification		Coarse Fract,		ntage les nasing f		3 inches	LL	PI	Permea- bility	Avail. Water	Soil Reac-	Shrink Swell
Horizons (inches)	USDA Texture	Unifled	AASHO	>3 in, %	4	10	40	200	1.5	F1	In./hr.	Capac. In./In.	tion pH	Poten- tiol
08	sandy loam	SM	A-Li	0-1	90-100	80-95	55-75	35 -50	NP	MP	0.6-2.0	0.22- 0.24	4.5-6.0	10W -
8-14	sandy loam	SM	А-Ц	0-1	90-100	80-95	55-75	35 –50	NP	NP	0.6-2.0	0.18-	4.5-6.0	low
14-60	gravelly coarse send,	GW,GP or SP	A-1	0-10	40-85	35-79	10-45	0-5	ΝÞ	NP	Greater than 20	0.02- 0.04	5.6-6.5	low
Flooding	None		l						Hydrolog	gic grou	р: В			
	vater table;	More th	en 6 fee	.+					Depth to	bedroc	k: More t	hen 6 f	'eet	
	y « uncoate										ncrete: Mc			
signation to an internet show on the state	SUITABIL	and the second sec	and the second is when a second	OURCE	OF SE	LECTI	ED MA'	nia mandre se substation	aleman services and the services of the service of		in a second state of the second s	CONTRACTOR CONTRACTOR	USE	
Roadfill	Good: hi		82798-00-4000-00-09	e en la sub 1949 de la sectementad	DER DONALD VIOLENNED	Constantino anticipante de las		And a state of the state of the state	وبعديوني والمحملي		agennes og gefölde ander sinne som			
land	Fair: mi										ck.			
iravel	Cood: st	ratified	eand ar	d frave	1; 805	e ston	bra ae	houlde	roj va	tor te	ble is de	өр		
opsoil	Fair: up	· margaret and a second s		The Task of Mandalan Provide Products	an Barran (1992), (Parris), a star	Service and the service of the servi	concerning the second second		shapsetermine Tarb	Service and rear work of	fragment	.8.		anana mini mini mini mang mang mang mang mini mang mang mang mang mang mang mang mang
	F. (1) (7) I 1		DEGREE			o sate -reactostro	The second s		No. Company and Provide Street	NAME OF BUILDING	como trativileria menedialentella	alitika ana ana ang kata ang k	37	
eptic lans	Filter Fiel	SI	i <i>g</i> ht: v vere: c	ery raj n more	id per than l	meabil 2 perc	ity =' ont sl	opes 2/	Moder	ato: 6	-12 porce	nt slop	99 ^{~~/}	
jewage Lag	0003	Se	vere: v	ery raj	id per	meabil	ity; c	oarse t	exture	d mate	rial	4		
Shallow Exc	avations	Se	vere: s	iany coa	rse fr	agment	8					General de la companya da la construidada		900-00-00-00-00-00-00-00-00-00-00-00-00-
Owellings: With Ba	eamants	S1	ight: }	ui <i>c</i> h she	ar str	ength:	lov B	hrink-a	wall:	low co	mpressibi	likv: 0	xcessive	lv drai
WILL DB	sements		derate:								r then 12			v
anitery Le	ndfill	00000000000000000000000000000000000000												
(Trench	type)	Se	vero: v	ery rap	id per	meebil	ity 2/							
Jocal Road	e and Street	Se									e; low eu nt elopee		0	frost beaving
Potential F	rost Action		PLE CONTRACTOR	and the second		i. Anis i tarrer				- 1. in 2 min.	an ann an Araicean a' Araic			MANAT BENG
	an an falsan an Albanders Antonio an		Contraction and Contraction and	OR SOU	, FEAD	UEES	AFFE	CTING S	ELECT	ED US	ES			
Pond Reser	voir Areas	va	ry rapid	กลาซอล	bilitv	The and if with platform (4)	and the second	unter and the second state of t		Self The Constant of Second				andra ang Panalan Salah Sa
Embankmen	ts, Dikes, e		High		trongt						ics; high	compac	ted perm	eabilit
rainage of	Cropland a	nd Pasture	9	ally no						ئە			*** **********************************	2017 March 1997 Aug 2017
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Perraces ar	d Diversior	18	Coare	<u>vailaba</u> o toxtu					of 1 1	to 2 f	eet; low	availab	le water	holdin
'specod Wo	من مدين مريوسوسور سري م مدين مريوسور سريو	n haan an al an	CODOO	ity										

 $\pm$  ' Use in conjunction with Guide to Soll Survey Interpretation Sheets. ,

2/ Pollution is hazard to water supplies.

V2

Grassed Waterways

Goarse Fextured material below depths of 1 to 2 feet; low available water holding

	DEGREE OF SOIL LIMITATION AND MAJOR FEATURES AFFECTING RECREATION USES
Camp Areas	Slight: 0-6 percent slopes Moderate: over 6 percent slopes
Picnic Areas	Slight: 0-12 percent slopes Moderate: over 12 percent slopes
Pieygrounds	Slight: 0-2 percent slopes 'Moderate: 2-6 percent slopes Severe: over 6 percent slopes
Paths and Trails	Slight: 0-6 percent slopes Moderate: slopes over 6 percent

# CAPABILITY, SOIL LOSS FACTORS, AND POTENTIAL YIELDS -- (High level management)

Phases of Series	Capability	Soll K	Loss T	Oats	Corn Silago	Bluegrass Pasturs	Lagumo-	And the second se	
0-2% slopes 2-6% slopes 6-12% slopes	IIIs IIIe IVe	•24	2.2	Bu/Ao。 70 70 60	Ton/Ao 8 8 7	алт 4.0 4.0 4.0	Ton/Ac. 3.5 3.5 3.5	AUM 5.0 5.0	
2-12% slopes 12-18% slopes 18-25% slopes	IVe VIe VIIe			60-70	7-8 mm	4.0 4.0 4.0	3.5	5.0	
12-25 % slopes 25-35% slopes	VIIO			PAS	TURELANI	4.0 D AND HAY	LAND		

# Phases of Series Group Species, Yield in AUMs for Dryland (Irrigated) Forage Production

			WIL	JULIE E. MF	ABITAT SU	TABILITY				
			Pote	ntial for					Potential for	40
Phases of Series	Grain and Seed Crops	Grasses, Legumes	Wild Herbaceous Plants	Herdwood Trees and Shrubs	Conlforous Plants	Wetland Food and Cover	Shailow Water Devel.	Openland Wildlife	Woodland Wildlife	Tetland Wildlife
0-12%	Fair	Good	Good	Fair	Fair	ery Poor	Very poor	Good	Good	ery poor
12-35%	Poor	Poor	Good	Bair WOODLAP	Fair ID SUITAB	Course of the co	Very poor	Fair	Good	Very poor

WIT DI TEE HADITAT CUITADIT ITV

#### Woodland Management Hazarda Equipment Seeding **Potential Productivity** Suitable Species Other Phases of Ordi-Site Erosion Plant Important nation To Favor To Plant Series Trees Index Hazard Limitations Mortality Competfilon 55 55 Red Pine Slight:0 Slight Moderate Slight to Red Pins Red Pins 0-12% Jeck Pine Jack Pine White Pine White Pine -12% Moderate 60 Moderate Jack Pine 38 White to Moderate Moderate 50 toSevere Spruce 12-35 % Savara

han in the children in the company of the second	FANGE
Phases of Series   Range Site Name	Climaz Vegetation and Productivity of Air-Dry Herbage (lb./ac.)

#### WINDBREAK

Group	Adapted Trees to Plant	Tree Height Prediction at 20 Years Age	Relative Vigor
Construction of the second	Long C1 C1 C1 C1 C1 C C	1	

OTHER

FOR INTERENT USE Subject to change on completion of coordination between MLRA'S

USDA-SCS-LINCOLN, NEBR, 1973

H - 12

# H, S, DEPARTMENT OF AGRICULTURE SOU, CONSERVATION SERVICE

# SOIL SURVEY INTERPRETATIONS 1/

 SERIES
 9A; 40A

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 11/71

This series consists of gently sloping to steep well drained soils formed in 20 to 40 inches of dark brown, medium acid, gravelly sandy loam glacial till that is underlain by bedrock. The dominated bedrock is gabbro and granife. Surface stones typically occupy less than 5 percent of surface and varies locally to 30 percent. Subsurface coarse fragment content typically is 25 percent. These soils occur on sloping to hilly terrain in the Laurentian Shield country of cortheastern Minnesota.

ESTIMATED SOIL PROPERTIES SIGNIFICANT TO ENGINEERING

#### Percentage lean than 3 inches Avail. Soll Coarse Shrink Maior Classification Permea-Soil Fract. Passing Slove No.22 Water Reac-Swell LL ΡI bility Capac. Horizons USDA >3 in. t!on Poten-Unified AASHO 10 40 200 in./hr. 3 In./in. рH tial (inches) Texture % 0 to 28 Gravelly SM A-2 50-85 40-75 30-55 25-35 20-20 0 - 42.0 to 0.10 to 5.1 to Low sandv 6.3 0.14 6.0 loam Hydrologic group; C Flooding None Depth to water toble: 20 to 40 inches Depth to bedrock: 20 to 40 inches Corrosivity - concrete: moderate to high Corrosivity - uncoated steel; Low SUITABILITY OF SOIL AS SOURCE OF SELECTED MATERIAL AND FEATURES AFFECTING USE Roadfill Fair: limited volume of material, poor on slopes over 18 percept Poor Sand Gravel Poor Poor: low natural fertility; 25% coarse fragments Topsoll DEGREE AND KIND OF SOIL LIMITATION FOR SELECTED USES Septic Tank Filter Fields Severe: bedrock at 20 to 40 inches, sloping to hilly terrain Sewage Lagoons Severe: bedrock at 20 to 40 inches, sloping to hilly terrain Shallow Excavations Severe: bedrock at 20 to 40 inches Dwellings. With Basements Severe: bedrock at 20 to 40 inches; sloping to hilly terrain Without Basements Sanitary Landfill Severe: bedrock at 20 to 40 inches; sloping to hilly terrain Local Roads and Streets Severe: bedrock at 20 to 40 inches, sloping to hilly terrain Potential Frost Action Low MAJOR SOIL FEATURES AFFECTING SELECTED USES Pond Reservoir Areas Bedrock at 20 to 40 inches, no or very few available sites Embankments, Dikes, and Levees Bedrock at 20 to 40 inches, high content of coarse fragments Drainage of Cropland and Pasture Irrigation Terraces and Diversions Grassed Waterways

1/ Use in conjunction with Guide to Soil Survey Interpretation Sheets.

Page 1 of 2

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DEGREE OF SOIL LIMITATION AND MAJOR FEATURES AFFECTING RECREATION USES

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Comp Areas	Moderate to sloping to hilly terrain
Picnic Areas	Moderate to severe; sloping to hilly terrain
Flaygrounds	Severe: sloping to hilly terrain
Paths and Trails	Slight to moderate: sloping to hilly terrain

CAPABILITY, SOIL LOSS FACTORS, AND POTENTIAL YIELDS .- (High level management)

Phases of Series	Capability	Soil K	Loss T			
2 to 18 percent slopes	VIe	.37	2,2			
18 to 35 percent slopes	VIIe					

PASTURELAND AND HAYLAND

Phases of Series	Group	Species, Yield in AUMs for Dryland (Irrigated) Forage Production

# WILDLIFE HABITAT SUITABILITY

			Pote	ntial for					Potential for-		Ĺ
Phases of Series	Grain and Seed Crops	Grasses, Legumes	Wild Herbaceous Plants	Hardwood Trees and Shrubs	Coniferous Plants	Wetland Food and Cover	Shallow Water Devel.	Openland Wildlife	Woodland Wildlife	Wetland Wildlife	
All	V.Poor	Fair	Fair	Fair	Fair	V. Poor	V. Poor	Poor	Fair	Very poor	
											Ĺ

# WOODLAND SUITABILITY

Phases of	Ordi-	Potential F	Productivity		Woodland Mana	gement Haza	rds	Suitable	Species	Other
Series	nation	Important Trees	Site Index	Erosion Hazard	Equipment Limitations	Seeding Mortality	Plant Competition	To Favor	To Plant	
A11		Jack pine Trembling a White pine White sprue Red pine	-	Slight to severe on steeper slopes	Slight to severe on steeper slopes	Slight	Moderate		Jack pine Red pine White spro	

RANGE

hases of Series	Range Site Name	Climax Vegetation and Productivity of Air-Dry Herbage (lb./ac.)

#### WINDBREAK

Group	Adapted Trees to Plant	Tree Height Prediction at 20 Years Age	Relative Vigor

OTHER

Potential productivity is low. Moderate to low natural fertility; no native plants suitable for grazing. Watershed - Shallow to bedrock; erodibility class III; mor humus; *infiltration 0.15-0.3"/hr. permeability 2-6.3"/hr; moderate runoff; well drained. * Infiltration rates need further consideration.

USDA-SCS-LINCOLN, NEBR. 1972

FOR INTERIM USE Subject to change on completion of coordination between MLRA'S Page 2 of 2

H - 14

# U. S. DEPARTMENT OF AGRICULTURE SOLL CONSERVATION SERVICE SOIL SURVEY INTERPRETATIONS 1/

SERIES 9D; 40B
STATE Misnesota
MLRA 89,00
Bey. DHP-FLB 11/71

This series consists of gently sloping to steep well drained soils formed in 8 to 20 inches of brownish and reddish gravelly coarse sandy loam, glacial till underlain by bedrock. Coarse fragment content typically is about 20 percent. Soils are subject to seasonal drouthiness. These soils occur on sloping to hilly terrain in the Laurentian Shield country of northeastern Minnesota.

# LISTIMATED SOIL PROPERTIES SIGNIFICANT TO ENGINEERING

Major	Class	ification		Coarse Fract.			ss than Sleve No	inches			Permea-	Avail. Water	Soll Reac-	Shrink Swell
Soll Horizons (inches)	USDA Texture	Unified	AASHO	>3 in. %	4	10	40	200	LL	PI	billty in./hr.	Capac. in./in.	tion pH	Poten- tial
0=15	Gravelly coarse sandy loam	SM	A-2		50-85	40-75	30-44	25-35	10-20	0=4	2.0 to 6.3	0.10 tc 0.14		Low
15+	Bedrock													
														*
The allow	Flooding None Hydrologic group: B													
	Flooding None     Hydrologic group: B       Depth to water table: 5 feet     Depth to bedrock: 8 to 20 inches													
									Corrosiv			20 inche Moderate		h
Contrasta Angular Providence	y - uncoate SUITABIL			SOURCE	OFSI	ELECT	ED MA'							
Non-sector and the sector sect							100.a. 777 100.00.000 000.000							
- Constant														
	Unsuited		6										annalise kan ann gut heferen	
Topsoil	Poor; low		DEGREE	Andrew Street Street Street Street				TION F	OR SEI	ECTE	D USES		<i>6</i>	:
Septic Tank	Filter Fie.	lda Sev	ere; sh	allow t	o bedi	ock		Den entreten er det tekning	andread and a subsection of a		inger Sungar für sächt i Can keynig där S	tanang ng mga tanang na ang mga tang ng tang ng mga tang ng tan		
Sewage Lag	oons	Sev	ere: sh	allow t	to bed	oek; n	noderat	ely rap	oid por	meabil	ity; slo	ping to	hilly t	errain
Shellow Exc	cavations	Sev	ere: sh	allow t	o bedi	ock, e	loping	to hil	ly ter	rain				
Dwellings; With Ba Without	sements Basements	Sev	ere: sh	allow t	to bedr	ock, s	loping	to hil	ly ter	rain				
Sanitary La	ndfill	Seve	re: sha	illow to	bedro	ock, sl	oping	to hill	y terr	ain				
Local Road	s and Street		ere: sh	allow t	o bedi	ock, s	loping	to hil	ly ter	rain				
Potential F	rost Action	Low	2											
			MAJ	OR SOII	L FEA	TURES	AFFE	CTING S	SELECT	ED US	ES		· · · · · · · · · · · · · · · · · · ·	<u>National</u>
Pond Reser	voir Areas	Shallow	to bedr	ock, no	or ve	ry few	suita	ble sit	es				e suited	
Em. ankmen	ts, Dikes, a	and Levees	Modera	tely ra	npid pe	rmeabi	lity,	shallow	to be	drock				
Drainage of	Cropland a	nd Pasture	•										n an Start an Start	
Irrigation														
Terraces an	d Diversion	15										A		andreas and a second
Grassed Wa	terways												<del>a antina di</del> Milanggari	
		9997. <del></del>	1											
		The same bound and a second second second second												i de la composición d Composición de la composición de la comp
		an an the sector of the sector	n, aga, daana gan Pathinan naa						1					
· · · ·			1/ Use	in conjur	nction w	ith Guid	e to Soil	Survey	Interpret	ation Sh	eets.		Pao	e 1 of 2

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9B; 40B

# DEGREE OF SOIL LIMITATION AND MAJOR FEATURES AFFECTING RECREATION USES

Camp Areas	Moderate or severe on slopes over 18%; shallow to bedrock; low natural fertility; subject to compaction; low natural carrying capacity for intensive use
	Moderate, severe on slopes over 18 percent, shallow to bedrock; sloping to hilly terrain; low natural fertility
1 m , groundo	Severe: sloping to hilly terrain; subject to compaction; low natural carrying capacity for intensive use
Paths and Trails	Slight, moderate on slopes over 18 percent: sloping to hilly terrain

#### CAPABILITY, SOIL LOSS FACTORS, AND POTENTIAL YIELDS -- (High level management)

								-			
Phases of Series	Capability	Soil K	Loss T								
2 to 18% slope	VIe	.37	2,2							-	
18-35% slope	VIIe								•		
		ł									
PASTURELAND AND HAYLAND											

Phases of Series	Group	Species, Yield in AUMs for Dryland (Irrigated) Forage Production							
	أمارك المراجع معالم مراجع معالمون جرامعا	WILDLIFE HABITAT SUITABILITY	and the second						

#### Potential for --Potential for--Phases of Wild Hardwood Trees and Wetland Shallow Coniferous Grain and Grasses, Openland Woodland Wetland Herbaceous Series Food and Weter Seed Crops Legumes Plants Wildlife Wildlife Wildlife Shrubs Plants Cover Devel. A11 V. Poor Fair Fair Fair Very · Poor Fair V. Poor Fair Poor poor

WOODLAND SUITABILITY											
Phases of	Ordi-	Potential P	roductivity		Woodland Mane	Suitable	Other				
Series	nation	Important Trees	Site Index	Erosion Hazard	Equipment Limitations	Seeding Mortality	Plant Competition	To Favor	To Plant		
A11		Jack pine Trembling	50 50	Moderate to	Slight to	Slight	Slight		Jack pine Red pine		
:		aspen White sprud	e 45	severe on steepe slopes	severe on r steeper slopes						

-				
R	A	N	G	E

Phases of Series	Range Site Name	Climax Vegetation and Productivity of Air-Dry Herbage (lb./ac.)										
WINDBREAK												

# Group Adapted Trees to Plant Tree Height Prediction at 20 Years Age Relative Vigor

OTHER

Potential productivity is low. Low natural fertility. No native plants suitable for grazing. Watershed - shallow to bedrock; erodibility class III; morhumus; *infiltration 0.15 to 0.3"/hr.; permeability 2 to 6.3"/hr.; moderate runoff; well drained. *Infiltration rate needs further consideration.

USDA-SCS-LINCOLN, NEBR. 1972

FOR INTERIM USE Subject to change on completion of coordination between MLRA'S

Page 2 of 2

# U. S. DEPARTMENT OF AGRICULTURE SOLL CONSERVATION SERVICE

# SOIL SURVEY INTERPRETATIONS 1/

SUBIES 25; 100; 11A; 400 Minnesota

This ceries consists of somewhat excessively drained soils formed in 4 to 8 inches of dark brown and strong brown, strongly and very strongly apid loam over bedrock. Bedrock outcroopings are common. The terrain is broken, irregular and sloping to hilly. These soils occur within the Laurentian Shield country of northeastern Minnesota.

# ESTIMATED SOIL PROPERTIES SIGNIFICANT TO ENGINEERING

Major	Classification			Coorse Percentage less that Sicelina Fract. Passing Sieve Signer							Permea-	Avall, Water	Shilak Swell	
Soil Horizons (inches)	USDA Texture	Unified	AASHO	>3 In. %	4	10	40	200	LL	Ы	5 ¹¹¹¹ y In./lir.	Capac. In./In.	Reac- tion pH	Poten- tiat
0 to 8	Loam	ML-CL	A-4		75-95	70-90	60-20	55~70	10-30	5-10	0.63 to 2.0	0.15 to 0.20	4.5 to 5.5	Low
8*	Bedrock													
		-												
Flooding	Flooding None Hydrologic group; D													
Depth to w	ater table:	Over 5	feet						Depth to	n hedroc	k: 8 inc	hes or	less	
Corrosivit	y = uncoate	d steet:	Low						Corrosi	vity = co	ncreto: Mo	derate	to high	
1	SUITABIL	ATY OF S	OIL AS S	SOURCE	OF SE	ELECT	ED MA'	TERIAL	AND F	PEATUR	RES AFF	ECTING	USE	elle aufarter elle time in all'Add
Roadfill Po		llow soi	l, outer	ops of	bedror	k are	common			an a				
Sand Ur	suited													
	suited				100 - 100 June - 10 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 -					and the second because			and the second	
Topsoil Po	or: ext	remely s												]
DEGREE AND KIND OF SOUL LIMITATION FOR SELECTED USES														
Septic Tank	pilter pie	ias Sev	ere; ex	tremely	r shall	ov to	bedroc	k; alor	ing to	hilly	terrain			
Sewage Lag	oons	Sev	ere: ex	tremely	ohall	ow to	bedroc	k; slop	ing to	hilly	terrain		99))******	
Shellow Excavations Severe: extremely shallow to bedrock; sloping to hilly terrain														
Dwellings: With Bas Without	sements Basements		ere: ex 1 draine		shall	ow to	bedroc	k; slop	ing to	hilly	terrain;	low cla	ay conte	ent;
Sanltury La	ndfill	Sev	ere: ex	tremely	' s'iall	ou to	bedron	k; slop	ing to	hilly	terrain			
Local Road	and Stree		ere: ex	tremely	shall	ow to	bodroc	k; slop	ing to	hilly	terrain			
Potential F	rost Action	Low		na an a			******						COTS - Conversion Calling Symposium,	
L			MAT	OR SOL	L FEA'	TURPS	AFFE	CTING S	SFLEC	CED US	ES			]
Pond Reser	voir Areas	Shalle	a to bed											
Embankmen	ts, Dikes, i	and the first state of the stat	energia de la construction de la construcción de la construcción de la construcción de la construcción de la co		manual services and	annual community		une of	materi				on and a close of the second	
Drainage of								and or	und cos 7					
Irrigation	Irrigation													
Terraces an	Terraces and Diversions													
Grassed Wat	erways													
					a ha , annais d'ann _a agu _n t _a sao ag									
									ì					

 $\underline{1} \neq$  . Use in conjunction with Guide to Soi' Survey Interpretation Sheets.

9C; 10C; 11A; 40C

DEGREE OF SOIL LIMITATION AND MAJOR FEATURES AFFECTING RECREATION USES

Camp Areas	Severe: irregular, broken sloping to hilly terrain; extremely shallow soils; boils subject to compaction; low natural fertility
Picnic Areas	Severe: irregular, broken, sloping to hilly terrain
Playgrounds	Severe: irregular, broken, sloping to hilly terrain; extremely shallow soils
Paths and Trails	Moderate on 5 to 18 percent slopes and severe on slopes over 18 percent; irregular broken, sloping to hilly terrain

CAPABILITY, SOIL LOSS FACTORS, AND POTENTIAL YIELDS--(High level management)

1	Phases of Series	Capability	Soi1 K	Loss						
	5 to 18 percent slopes	VIIs	•							
	18 to 35 perceni slopes	VIIs								
						an ta Roman				
Ĩ			l		PAS	TURELAN	L D AND HAY	LAND	an a shipir dha baan dha a bhinne any na canana cangang	

Phases of Series	Group	Species, Yield in AUMs for Dryland (Irrigated) Forage Production					
WILDLIFE HABITAT SUITABILITY							

					Carles and a	n mar				
			Potential for							
Phases of Series	Grain and Seed Crops	Grasses, Legumes	Wild Herbaceous Plants	Hardwood Trees and Shrubs	Coniferous Plants	Wetland Food and Cover	Shallow Water Devel.	Openland Wildlife	Woodland Wildlife	Wetland . Wildlife
	V. Poor	Poor	Poor	Poor	Poor	V. Poor	V.Poor	Poor	Ροοτ	Very poor
1	1		5							

# WOODLAND SUITABILITY Potential Productivity Woodland Management Hazards Suitable Species Important Site Erosion Equipment Seeding Plant To Favor To Plant Trees Index Hazard Limitations Mortality Competition To Favor To Plant

A11	Jack pine	<40	Moderate	Moderate	Slight	.Slight	Jack pine	
			to	to				
			severe	severe				
The summaries and the summaries and the summaries	 	Construction of the Construction of Management Statements of the Construction of the C					 	

RANGE

		aver a second a secon	
Phases of Series	Range Site Name	Climax Vegetation and Productivity of Air-Dry Herbage (Ib./ac.)	]
			]
			ļ
			1

#### WINDBREAK

Group	Adapted Trees to Plant	Tree Height Prediction at 20 Years Age	Relative Vigor

OTHER

Watershed - Extremely shallow to bedrock; morhumus; permeability 0.63-2.0"/hr.; rapid runoff; low storage; somewhat excessively drained.

USDA-SCS-LINCOLN, NEBR. 1972

Phases of

Series

Ordi-

nation

FOR INTERIM USE Subject to change on completion of coordination between MLRA'S

Page 2 of 2

Other

H-18

Contraction of the

Conversion of the second

#### U. S. DEPARTMENT OF AGRICULTURE SOLL CONSERVATION SERVICE

SERIES 28A; 29A STATE Minnesota MLRA 88, 99

# SOIL SURVEY INTERPRETATIONS 1/

This series consists of deep excessively drained soils formed in glacial outwash under conferents forest on outwash plains and valley trains. Typically they have black and very dark grayish brown loamy coarse sand by inches thick; dark brown, dark yellowish brown and brown coarse sand subsoils 20 inches thick; and pale brown coarse sand underlying material. Slopes range from 0 to 12 percent. Most areas are forested, a few cropped or pastured.

### ESTIMATED SOIL PROPERTIES SIGNIFICANT TO ENGINEERING

Major Soil	Class	ification		Coarse Fract,			os than Slevo Nr	2 inches			Permea-	Avail. Water	Soil Reac-	Shrink Swell
Horizons (inches)	USDA Texture	Unified	AASHO	>3 in.	4	10	40	200		PI	bility 'in./hr.	Capac. in./in.	tion FII	Poten- tial
0-4	LCOS	SM	A-2		95-100	85-100	60-80	10-30	-		6.0-20	0.10- 0.12	4.5-6.0	Low
4-60	cos, s	SP	A-3		95-100	85-100	50-75	0-10		-	6.0-20	0.05- 0.07	4.5-6.0	Low
Flooding	Noze		L						Hydrolog	gic grou	р: <u>А</u>			
Depth to w	ater table:	greater	than 6	feet					Depth to	bedroc	k: great	er than	60 inche	35
	y ~ uncoate								Corrosiv	i^y − co	ncrete: M	oderate		
COLUMN ADDRESS OF THE OWNER OF THE OWNER OF	SUITABIL			SOURCE	OF SE	ELECT	ED MAT	rerial	AND F	EATU	RES AFF	ECTING	USE	ninen an and a star game day
Roadfill G	oed				an a			ulan ulati kurat uni "Wala Balla"						
Sand G	ood													
	nsuited													
Topscil P	00r - 100													
Septic Tank	Eilter Eig		DEGREE			SOIL		TION F	OR SEI	LECTE	D USES		ginan ang ang ang ang ang ang ang ang ang	Tilen, sjagijek (gelik komen
O-8%: s		1000 20 60	rd of po oderate											
Sewage Lag	and the second s	and a second	rd of po	Wiring and a getting and a first state		na na managana ang ang ang ang ang ang ang ang	ana a successive a successive success		galanin mining ay according			,		
	- seepag		an wa pr	7352 G C 2 C 2	4									
Shallow Exc														******
Severa	- cutban	ks cave												
Dwellings: With Bas Without	ements Basements	0-8%:	slight	84	%: E00	lerato	- alop	ତ						
Sanitary Lar	ndfill	Hazard o	f pollut	lon		100 <b>4 - 11</b> - 11 - 11 - 11 - 11 - 11 - 11 -								******
Severe	- seepag		E											
Local Roads	and Street	8							9					
0-8%1 8	light	8+%: mo	derate -	slope										
Potential F	rost Action	Low												
	ang		MAJ	or son	J FEAT	FURES	AFFEC	CTING S	ELECI	ED US	ES			17842234.89427844294234-0428484444
Pond Reserv	voir Areas	Seepage												
Embankment	s, Dikes, e	ind Levees	Seepa	re										25.000 million and an
Drainage of	Gropiand a	nd Pasture									****	1999 - T BOLLON, N. P C C C C C C C.		*******
Irrigation			Droughty	, seeps	ge						an a sub-sector and a sub-			
Terraces and	d Diversion	c	s easily							a ann an a	De CORPort Canadaman armada a Cola		ale fan Leit i Aldryk - Leit yn mer yn y	-
Grassed Wat	erways	Droug												
	transformation and an													
nand de las aconseres deservando	a an												D#9964-4	
									······································			anan dalam terden dalam yang yang y		
USDA-SCS-LINCOLS	N. NEBR. 1971		<u>1</u> / Use	in conjun	ction wi	ith Guide	e to Soil	Survey ]	nterprete	ntlon Sh	eets,		P	age 1 of 3 5,N-29,789

# DEGREE OF SOIL LIMITATION AND MAJOR FEATURES AFFECTING RECREATION USES

Camp Areas	Moderate - too sandy	
Picnic Areas	Moderate ~ too sandy	
	0-6%: moderate - too sandy 6+%: severe - slope	
 Paths and Trails	Moderate - too sandy	

# CAPABILITY, SOIL LOSS FACTORS, AND POTENTIAL YIELDS--(High Jevel management)

Phases Serie	Capabili	ty K	I Lose	Silage	Cats	Hey .	and becay muchanass	
				(tons)	(Bu)	(tons)	(AUM)	
0-12%	45	.21	5	8	40	2.5	1.2	
				1				
l	 <u> </u>			L		1	1	
				PAS	STURELAN	d and haylani	0	_

Phases of Series	Group	Species, Yield in AUMs for Dryland (Irrigated) Forage Production

# WILDLIFE HABITAT SUITABILITY

					Potential for-a						
	Phases of Scries	Grain and Seed Crops	Grasses, Legumes	Wild Herbaceous Plents	Hardwood Trees and Shrubs	Coniferous Planto	Wetland Food and Cover	Shallow Water Devel.	Openland Wildlife	Woodland Wildlife	Wetland Wildlife
	AJJ	Poor	Poor	Fair	Poor	Poor	V. Poor	V. Poor	Poor	Poor	V. Peor
1											

# WOODLAND SUITABILITY

hases of	Ordi-	Potential F	roductivity		Woodland Mane	Suitable	Other			
Series	nation	Important Trees	Site Index	Erosion Hezard	Equipment Limitations	Seeding Mortality	Plant Competition	To Favor	To Plant	
A11	38	Red Pine White Pine Jack Pine White Spruce	56 54 60 59			×			Red Pine White Spruce	

# RANGE

Phases of Series	Range Site Name	Climax Vegetation and Productivity of Air-Dry Herbage (15, /ac.)
Thuben of Octreo		China vegetation and Fronteevity of Alf "Dily Aeroage (15./ac.)
1 1		

 
 WINDEREAK

 Group
 Adapted Trees to Plant
 Tree Height Prediction at 20 Years Age
 Relative Vigor

 Group 6
 Eastern Red Cedar Red Pine Jack Pine Ponderosa Pine
 20 20
 20

OTHER

FOR INTERIM USE Subject to change on completion of coordination between MLRA'S

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H-20

# U. S. DEPARTMENT OF AGRICULTURE SOLL CONSERVATION SERVICE SOLL SURVEY INTERPRETATIONS 1/

SERIES 208: 298 STATE Minnesota MLRA CO PRCN, RTH

This series consists of deep excessively drained soils formed in sandy outwash under coniferous and deciduous forest on smooth and pitted plains. Typically they have organic layers 2 inches thick; very dark gray and dark grayish brown loamy sand surface layers 2 to  $\beta$  inches thick; dark brown loamy sand subsurface layers 10 inches thick; layered brown and yellowish brown coarse cand and dark brown loamy coarse cand subsoil 27 inches thick; and pale brown or brown sand or coarse cand underlying material. Slopes are  $\beta$  to 25 percent. The main use is for forestry.

ESTIMATED SOIL	PROPERTIES	SIGNIFICANT	TO	ENGINEERING
----------------	------------	-------------	----	-------------

promotion		-2			1					·	r	<b>T</b>		
Major Soil Horizons	Class	sification Unified	AASHO	Coarse Fract. >3 in.		atage ie Paneing   10		3 Inches 200	LL	PI	Permea- bility in./hr.	Avall, Water Capac,	Soil Reac- tion	Shrink Swell Poten-
(inches)	Texture	Unitied	AASHO	70	4	2.0		200			1	∫n./in.	рН ·	ttal
0-13	$\mathbf{LS}$	SM	A-1,A-2	0-2	95-100	90-100	50-75	15-30		NP	5.0-20	.1012	5.1- 6.0	V. Low
13-40	COS	SP,SM	A-1	0-5	80-100	75-100	Ļ0-70	0-10	69 TO -	NP	> 20	.0305		V. Low
28-30	COS	SM,SP	<u>A</u> -1	0-5	80-100	75-100	<b>40~</b> 70	10-20		NP	6.0-20	.0507		V. Low
<u></u> цо-60	S.	SP,SM	A-1	0-5	80-100	75-100	40-70	0-10	642 đã.	MP	≥20	.02 <b>0</b> !,		V. Low
Floeding	ng None Hydrologic group: A													
Depth to w	ater table;	≽6 fee	t						Depth to			inches		
Corrosivity	and the second	Contraction of the Party of the P									ncrets:Med			.OW
procession and the second s	SUITABIL	ATY OF S	OIL AS S	OURCE	OF SE	SLECT	ED MA.	PERIAL.	AND I	EATU	CES AFFI	ECTING	USE	
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Sand Go Gravel Do			_	10000-2179-0-0-00000	and the second secon	*****	n an an an Arian <u>Corra</u> do an Ari	alan kanangan sakarangan						
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Shallow Exc	avations													
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eq$  Use in conjunction with Guide to Soil Survey Interpretation Sheets.

# DEGREE OF SOIL LIMITATION AND MAJOR FEATURES AFFECTING RECREATION USES

. 1	Camp Areas		
1		0-15%; moderate-too mandy; 15+%; mevere-mlope.	Į.
	Picnic Areas		
1		0-15%: moderate-too sandy; 15+%: severe-slope.	1
Ì	Playgrounds		
		0-6%: moderatetoo sandy. 6+%: severe-slope.	
1	Paths and Trails		
	1	0-25%: moderate-too sandy; 25+%: severe-slope	

# CAPABILITY, SOIL LOSS FACTORS, AND POTENTIAL YIELDS-(High level management)

Phases of Series	Capability	Soll K	Loss T	CORN SILAGE	OATS	GRASS- LEGUME HA	PROMEGRASS Y ALFALFA	GRASS- CLOVER	KENTUCKY BLUFGRASS
				(Tons)	(Bu)	(Tons)	(AUM)	(AUM)	(лпм)
0-3% 3-12% 12-35%	45  45 75			8 7.5 	45 40 <del></del>	2.2 2.0	4.0 4.0 3.0	3.1 3.1 2.0	2.0 2.0 1.5

# PASTURELAND AND HAYLAND

Phases of Series	Group	Species, Yield in AUMs for Dryland (Irrigated) Forage Production

#### WILDLIFE HABITAT SUITABILITY Potential for --Potential for- -Wild Shallow Hardwood Wetland Phases of Grain and Grasses, Confferous Openiand Woodland Wetland Herbaceous Trees and Food and Water Series Seed Crops Wildlife Wildlife Legumes Plants Wildlife Plants Shrubs Cover Devel. 0-15% V.Poor V.Poor $\operatorname{Poor}$ $\operatorname{Poor}$ Fair $\operatorname{Poor}$ Poor Poor $\mathbf{Poor}$ V.Poor 15-35% V.Poor V.Poor Fair $\operatorname{Poor}$ PoorV.Poor V.Poor Poor Poor V.Foor

# WOODLAND SUITABILITY

Phases of	Ordi-	Potential P	roductivity		Woodland Mana	gement Huzu	rds	Suitable	Other	
Series	nation	Important Trees	Site Index	Erosion Hazard	Equipment Limitations	Seeding Mortality	Plant Competition	To Favor	To Plant	
0-12%	35	RedPine E.Wh.Pine Jack Pine	56 50	Slight	Slight	Severe	Slight		Red Pine Wh.Spruce Jack Pine	
12-35%	ЦЗ	Wh.Spruce Red Pine E.Wh.Pine Jack Pine	592	Moderate	Moderate	Severe	Slight		Jack Pine Red Pine Jack Pine	
		Wh.Spruce	54		RANGE					

	-	
Phases of Series	Range Site Name	Climax Vegetation and Productivity of Air-Dry Herbage (lb./ac.)

### WINDBREAK

Group	Adapted Trees to Plan:	Tree Height Prediction at 20 Years Age	Relative Vigor
12-35% North facing	E.RedCedar,N.Wh.Cedar,Wh.Spruce,RedPine,E.Wh.Pine, Russian-Olive,SiberianCrabapple,TatarianHoneysuckle, Siberian Pea Shrub E.RedCedar,Wh.Spruce,RedPine,Siberian Pea Shrub E.RedCedar,Wh.Spruce, Red Pine, Siberian Pea Shrub	15,11,18,20,20, 15,12,10, 10 18,22,25,12 12,0,15,10	

OTHER

B 0 to 12 percent slopes: windbreak suitability group 6. 12 to 35 percent slopes: windbreak suitability group 7.

FOR INTERIM USE ONLY Subject to change upon completion of coordination between MLRA's.  $\frac{H-ZZ}{H-ZZ}$ 

Page 3 of 3 5,8-29,789 M-SOLLS-3 (File Code SOILS-12)

# U.S. PEPARTMENT OF AGRICULTURE 501. CONPERVATION PERVICE

SERIES 544; 558 STATE Miner Hoto MLRA ____

# SOIL SURVEY INTEDPRETATIONS 17

This series consists of deep, screwhat poorly and poorly drained soils formed in meddish brown clayey glacial till under a decidious and confforces formet on nearly level till plains and good moraire. Typically they have grayish brown, leam surface layers 9 inches thick; reddish brown clay subsoil layers 25 inches thick; reddish brown silty clay underlying material. Slopes range from 0 to 2 percent.

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(Inches)	Texture	Unifie-1	A.AOUTO	e , ۲	· · · ·	ι,		· · · ·			Li. Turi	in./in.	P?1	tial
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9 <del>~3</del> 6	Clay	CL MH~CH	A='/	0	i i i	500 En C	r - 7	:: /:::-::	40~60	2035	.06-9.2	.1014	5.1-8.l	Mcd.
36-60	Silty Clay	CL SH-CH	A-7	ġ.	K. Mig	n.,**\}f	1 80- P	5 65-90	40-60	20-35	.06-0.2	.0915	7.1;-8.1	Mod.
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Corrosivity	y - uncoate	d steel: j	Moderate			. marine englase	alat mananagan	an and the state of the state o	Corrosi	vity - co	ncroto: Mc	norato	adalar y Die Laura na approximation	tant attactively days
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1/ Use in conjunction with Guide to Soil Survey Interpretation Sheets.

DEGREE OF SOIL LIMITATION AND MAJOR FEATURES AFFECTING RECREATION USES

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Camp Areas	
	Savere: perce glowly. Wet
Picnic Areas	
	Severe: wet
Playgrounds	
	Severe: wat. floods
Paths and Trails	
	Moderate: floods, wet
	CAPABILITY, SOIL LOSS FACTORS, AND POTENTIAL VIELDS (High level management)

Phases of Series	Capability	Soll Lost K T	) (BU)	Corn SilageT/A	Bluegrass Pasture	Lagume-Graes Hay (T/A)	. Pasture (AUM)
All	IIIw		80	14	(AUM) 5.0	4.5	6.5
		beranna an breasann w	PAS	TURELAN	D AND HAY	LAND	

Phases of	Group	Species, Yield in AUMs for Dryland (Irrigated) Forage Production
Series	Group	operies, riek in some to oryand (ingeres) roage Production
	and the second sec	

#### WILDLIFE HABITAT SUITABILITY

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Phases of Series	Grain and Seed Crops	Grasses, Logumes	Wild Herbaceous Plenis	Hardwood Trees and Shrubs	Coniferous Plants	Wetland Food and Cover	Shallow Water Devel,	Openland Wildlife	Woodland Wildlife	Wetland Wildlife
<u>A</u> 11	Poor	Fair	Good	Fair	Good	Good	Good	Fair	Good	Good

# WOODLAND SUITABILITY

Phases of	Ordi-	Potential S	Productivity	1	Woodland Mana	gement Haza	irda	Suitable	Species	Other
Series	nation	Important Trees	Site Index	Erosion Hazard	Equipment Limitations	Seeding Mortality	Plant Competition	To Favor	To Plant	
All		Red Pine E.Wh.Pine Wh.Spruce Northern Hardwoods	60 60 60 60-70	Slight	Moderate	Moderate	to Severe	Wh. Spruc E.Wh.Pine Northern Hardwoods	Northern	

#### RANGE

Phases of Series	Range Site Name	Climax Vegetation and Productivity of Air-Dry Herbage (ib./sc.)

hannan terretari kan barran yang mana kan dar dan barran terretari kan dari kan barran bertari kan barran berta	WINDBREAK	ᡊᡊᡊᡊᡊᡊᠧᠿᢗᢦᡦᡆᡄᡕ᠆ᠳᡄᡄᡣᢦᠻᠹᠥᡣᠧᢒᡭᢜᡊᡶᡭᡚᡠᢦ᠊ᡄᡠ᠂ᡄᡬᡳᠴᡆᡘᢛᢦ᠆᠑ᢗᡬᡆᠮᢗᡦᡣᡷᡣᡄᠯᡳᢛᡄ᠆᠆᠆ᢩᠸᡬᡭᡬᡱᢂᢆᠶᢏᢤ᠇ᡱᠿᢦᠧᠭᠧᢘᡄᢩᡔ <u>ᠧᠧᠧᡘ</u> ᡆᡘ	
Group	Adapted Trees to Plant	Tree Height Prediction at 20 Years Age	Relative Vigor

OTHER

Page 3 of 3 5,8-29.789

FOR INTERIM USE Subject to change on completion of coordination between MLEA'S  $\mathrm{H}{-}24$ 

MN-SOILS-3 11-71 (plin Code SOULS-12)

# 11, S. DEPARTMENT OF AGRICULTURE SOUL CONCERNATION SERVICE SOIL SURVEY INTERPRETATIONS 1/

54B; 55% SERIES

Minnecota STATE 90 MI.PA

Rov. GDN, RBL 2-72

This series consists of nearly level to hilly, woll and moderately well drained soils formed in reddish brown clayey material. These soils are on moraines and lake plains. Native vegetation is forest. The surface layer is dark gray loam about 2 inches thick. The subsurface layer is grayish brown loam about 6 inches thick. The subsoil is reddish brown clay about 26 inches thick. The underlying material is reddish brown clay. Permeability is slow. The available water capacity is moderate and organic matter content is low. The availability of phosphorous is low, and of potassium is low.

### ESTIMATED SOIL PROPERTIES SIGNIFICANT TO ENGINEERING

Major Soll	Cles	sification		Coarse Fract.			as then Bleve N	3 Inches 1972	LL	PI	Permea-	Avall. Water	Soil Reac-	Shrink Swell
Herizons (inches)	USDA Texture	Unified	AASHO	>3 in, "3	1	10	40	200			In./hr.	Capac. In./In.	tion pH	Poten- tial
0-8	Loam	ML ML-CL	A-lı	0	95-1.00	90-1.00	80-85	65-90	15-25	0-4	0.6-2.0	2022	4.5- 6.0	Iow
8-3h	Clay	CL or MH-CH	A-7	0	95-100	90-100	80-95	65-90	40-60	20-35	0.05-0.2	0.1- 0.24	5.1- 8.4	Moderate
34-60	Clay	CL or MH-CH	A-7	0	95-100	90-100	80-95	65-90	40-60	20~35	0.06-0.2	0.1- 0.14	7.4- 8.4	foderate
Flooding	Nono		   					an a	Hydrolo	gic group	o: C			L.,
Depth to w		Greater	than 5	feet						bedrock	0	ter than	.10 fee	et
Corroslyity									Corrosty	∕ity ∝ cor	ncroto: Ma	derate		
		ITY OF S			OF SE	ELECT	ED MAT	TERIAL	AND F	EATUR	RES AFFI	ECTING	USE	
Roadfill F	Fair: lo	ow to med	lium shea	ir strei	ngth; n	nedium	compre	ssibili	ty; fa	ir to p	good wort	ability		
1	lot suita			an a			1	and a first of the state of the s	and set and a second			the end of the second	10 No. 10 Prov. 6 4 4 10	
and the second second	lot suita	ble derately	thick ]	CONT IN	torial	1 3 014	organi	e matte	ar cont	on‡	a manana ang ang ang ang ang ang ang ang an		That is shared in a	
ropson r	all: m		DEGREE				a na su a	and the second			D USES	and a second	1020	Ball Balance and an an an an an
eptic Tank	Filter Fie	lds		100-00-00 (110-0-1-000)	*****************	100 1020-00-000-0004 <u>0-0</u>	nanananan (* 25. mili	. Fa ca a secondaria		zuzena Arienia da	anant catrices, in the sector that the sector	ul II Colest bio Curta pada		
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With Bas	ements Rangania	Modera	te: mod	lerate s	hrink.	-swell:	Sever	e: ove	ar 12 n	ercent	ടിന്നുട			
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		Severe	: moder	rate to	high s	inscept	ibilit	y to fi	ost ac	tion				
Potential Fr	ost Action	Mødera	te to hi	.gh								-Carrier 10- 20- 40- 40- 40- 40- 40-	****	
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Pond Reserv	olr Areas	Slow p	ermeabil	.1*y										
Embankment	s. Dikes, (	and Levees	Medium	to low	shear	streas	th: me	dium er	moresa	ibilita	r			
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# DEGREE OF SOIL LIMITATION AND MAJOR FEATURES AFFECTING RECREATION USES

Camp Areas	
	Moderate: slow permeability: Severe: on slopes over 12 percent
Picnic Areas	Slight: on nearly level slopes; Moderate: on slopes 6-12 percent; Severe: on slopes 12
Playgrounds	Moderate: slow permeability; Severe: on slopes over 6 percent
Paths and Trails	ogola
	Slight, 0-12 percent alones: Moderate: on alones 12-25 percent slopes; Severe: over 25 perce

CAPABILITY, SOIL LOSS FACTORS, AND POTENTIAL YIELDS -- (High level management)

Phases of Series	Capability	Sol1 I K	Loss T	Oats	Corn Silage	Bluegrass Pasture	Legume-Grass	ı
0-2% вlopes 2-6% slopes 6-12% вlopes 2-11% slopes 12=25% slopes	IIC IIE III0 III0 VI0	.43	3.2	Bu. 80 80 70 70–80 –	14 14 10 10–14 –	АЩ 5.0 5.0 5.0 5.0 5.0 4.0	т 4.5 4.5 4.5 4.5 -	АЛМ 6.5 6.5 6.5 6.5 

# PASTURELAND AND HAYLAND

Phases of Series	Group	Species, Yield in AUMs for Dryland (Irrigated) Forage Production
A description of the second seco		

### WILDLIFE HABITAT SUITABILITY

			Pote	ntial for					Potential for	
Phases of Series	Grain and Seed Crops	Grasses, Legumes	Wild Herbaceous Plants	Hardwood Trees and Shrubs	Coniferous Plants	Wetland Food and Cover	Shallow Water Devel.	Openfand Wildlife	Woodland Wildlife	Wetland Wildlife
0-12%	Good	Good	Good	Good	Good	Poor	Very Poor	Good	Good	Very Poor
12-25	Poor	Fair	Good	Good	Good	Very poor	Very po	r Fair	Good	Very poor

# WOODLAND SUITABILITY

Phases of	Ordi-	Potential P	roductivity	3	Woodland Mann	gement Hazi	ards	Suitable	Species	Other
Series	nation	Important Trees	Site Index	Erosion Hazard	Equipment Limitations	Seeding Mortality	Plant Competition	To Favor	To Plant	
0-12%		Aspen Red Pine White Pine	70 60 50	Slight	Slight	Slight	Moderate to Slight		Hed Pine Black Spr White Spr	ice
12-25%		Jack Pine Northern	60	Moderate	Moderate	Slight	Moderate Severe	White Pine White Spru		ç
		Hardwoods	60		RANGE			Aspen		

Range Site Name	Climax Vegetation and Productivity of Air - Dry Herbage (Ib. /ac.)
	Range Site Name

# WINDBREAK Tree Height Prediction at 20 Years Age Group Relative Adapted Trees to Plant Vigor

OTHER

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FOR INTERIM USE Subject to change on completion of coordination between MLRA'S

# U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE

Series - <u>GA</u>

# STATE Minnesota

SOIL SURVEY INTERPRETATIONS  $^{1/}$ 

MLRA 88-90 Revised Draft GDN, REL 2-72

These are extremely to very strongly acid deep organic soils. They consist of moderately decomposed dark brown or dark reddish brown herbaceous material throughout most of the layers from 12 to 51 inches. Normally these soils occupy bogs ranging from 10 to more than 600 acres in size. Hack spruce along with a few tamarack are the major trees growing on these soils. The permeability is moderate to moderately rapid. The available water capacity is very high.

# ESTIMATED SOIL PROPERTIES SIGNIFICANT TO ENGINEERING

Herizons       USDA (inclusie)       United (inclusie)       AASHO       23.0. 20.70       4       10       40       200       In. Arr.       Capes. In. Arr.       Capes. (inclusie)       Comparison (inclusie)       Percent (inclusie)       A.SHO       Not suitable for bigines/ring seive gnalysis         6-20*       0.58- 0.70       3.5- 0.50       High bigs         20-70       Peat (hemic)       PT       A-B       0       Not suitable for bigs seive gnalysis         6-20*       0.58- 0.50       3.5- 0.50       High bigs         20-70       Peat (hemic)       PT       A-B       0       Not suitable for bigs seive gnalysis         0.6-6.0       0.48- 0.50       10.0- 0.50	Major Soll	Class	ification	ESTIMAT	Coarse Fract.	Percei	ntage le	se than Sieve No	3 inches	LL	PI	Permea- bility	Avail. Water	Soll Reac-	Shrink Swell
(fibric)       Peat (fibric)       PT       A-B       0       bngineering selve shalysis       0.0.06.0       0.70       h.5       Hgh         20-70       Peat (herdo)       PT       A-B       0       non-one selection of the selec	Horizons (inches)		Unified	AASHO	>3 in. %	4	10	40	200				Capac. in./in.	tion PH	Poten- tial
(hendo)         0.58         5.0           Floating None         Hydrologic group: D           Floating None         Hydrologic group: D           Depth to water table: Wear surface during most of growing generating         Depth to bedrock: Greater than 5 feet           Cornerbity - uncested steel: High         Cornerbity - concerts: High           SUITABLITY OF SOLL AS SOURCE OF SELECTED MATERIAL AND FEATURES AFFECTING USE           Section 10 at attable           condition           condition           Mot suitable           condition           Great Not autiable           condition           Beevers: high water table; very poorly drained           DECREE AND KIND OF SOIL LANDAR FLOATER DURING           Severe: high water table; very poorly drained           Severe: high water table; wery poorly drained           Severe: high water table; boor side plops stability           welling:::::::::::::::::::::::::::::::::::	0-20		PT	A-8	-					1	10 64	6-20+			High
<pre>Finding Hole Provide Test Files Plan surface during most of growing bears Correstvity - uncosted steel: High Correstvity - concrete High SUITABLITY OF SOLL AS SOURCE OF SELECTED MATERIAL AND FEATURES AFFECTING USE and Not suitable or organic soils; let bearing canacity and Not suitable careed Not suitable Not subtained Not subtained Not subtained not applicable; nearly Level Major Soil, FEATURES AFFECTING SELECTED USES mainter Careed Not subtained N</pre>	20-70		PT	8-A	0							0.6-6.0			High
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Processes         Severe:         very poorly drained; high water table           sattary LendfUll         (trench type)         Severe:         very poorly drained; high water table           occal Roads and Streets         Severe:         high water table; high susceptibility to frost action; high shrink-swell           potential more than 30 percent organic matter         organic matter           otential Frest Action         High           MAJOR SOIL FEATURES AFFECTING SELECTED USES           ond Reservoir Areas         High water table;           mbantments, Dikes, and Leves         High water table; low compacted Loaded permeability; poor stability more than 30 percent organic matter           reinage of Cropiend and Pesture         High water table; subsidence is common after drainage           rigation         High water table; very poorly drained           eraces and Diversions         Not applicable; nearly level           reased Waterways         Not applicable; nearly level           i         i	Dwellings:		Mandod Mora and Anagora da Anago	na an an an Aran an Ar	er mittearten, metabete		L'errore come		a the construct	ana	ananioni, ngeroardiken ngendari tu		10.71.9494-14045-40-41.949-294		o dženano princano mne sanoji vista
Iteration       Iteration         (trench type)       Severe: very poorly drained; high water table         ocal Roads and Streets       Severe: high water table; high susceptibility to frost action; high shrink-swell         potential more than 30 percent organic matter         intervential Freet Action       High         MAJOR SOIL FEATURES AFFECTING SELECTED USES         ond Reservet Areas       High water table;         mbantments, Dikes, and Leves       High water table; low compacted loaded permeability; poor stability more         than 30 percent organic matter         reinage of Cropland and Peature         High water table; subsidence is common after drainage         rigation         High water table; nearly level         reased Waterwaya         Not applicable; nearly level         i         i			Corman			al es a d es a	. ب	-h							
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ocal Roads and Streets Severe: high water table; high susceptibility to frost action; high shrink-swell potential more than 30 percent organic matter  totentist Frost Action High  MAJOR SOIL FEATURES AFFECTING SELECTED USES  ond Reservoir Areas High water table mbantments, Dikes, and Levees High water table; low compacted loaded permeability; poor stability more than 30 percent organic matter  restage of Croptend and Pesture High water table; subsidence is common after drainage  rigation High water table; vory poorly drained  erraces and Diversions Not applicable; nearly level  i	(trench	type)	Severe	: very	poorly	draine	d: his	zh wate	r table						
otentisl Frost Action       High         MAJOR SOIL FEATURES AFFECTING SELECTED USES         ond Reservoir Areas         High water table       High water table; low compacted loaded permeability; poor stability more than 30 percent organic matter         reinage of Cropiend and Pesture         High water table; subsidence is common after drainage         rigation       High water table; very poorly drained         erraces and Diversions         Not applicable; nearly level         reased Waterwaya       Not applicable; nearly level         i       i			⁸ Severe	: high	water t	able;	high s	uscopt	ibility	to fr		ion; hig	h shrinl	(-swell	
ond Reservoir Areas       High water table         mbankments, Dikes, and Levees       High water table; low compacted loaded permeability; poor stability more         than 30 percent organic matter         reinage of Cropland and Pesture         High water table; subsidence is common after drainage         rigation         High water table; very poorly drained         etraces and Diversions         Not applicable; nearly level         i         i         i	Potential F	rost Action	High	an a	egyleniara (dal - i terrationeri			and the second				949000-0070000-0070700000-09000	5+8++**********************************	a an	im zorde szeneneketetetetetetetetetetetetetetetetet
High water table mbankments, Dikes, and Levees High water table; low compacted loaded permeability; poor stability more than 30 percent organic matter reinage of Cropland and Pasture High water table; subsidence is common after drainage rigation High water table; very poorly drained erraces and Diversions Not applicable; nearly level reased Waterways Not applicable; nearly level i L / Use in conjunction with Guide to Sait Super Interpretation Shorts				MAJ	OR SOII	FEAT	TURES	AFFEC	CTING S	ELECI	ED US	ES			**************************************
mbankments, Dikes, and Levees High water table; low compacted loaded permeability; poor stability more than 30 percent organic matter reinage of Cropland and Pesture High water table; subsidence is common after drainage rigation High water table; very poorly drained erraces and Diversions Not applicable; nearly level rassed Waterways Not applicable; nearly level i	Pond Reser	volt Areas	High w	ater tab	la		falaniar Handdille Heidan		anta data Kunada nas						00%,000%,000%,000%,000%,000%,000%,000%
reinage of Cropland and Peature High water table; subsidence is common after drainage rigation High water table; very poorly drained erraces and Diversions Not applicable; nearly level reased Waterways Not applicable; nearly level i i i i i i i i i i i i i	Embankment	ts, Dikes, s	nd Levees	High w	ater ta	ble; 1 mt ors	ew con	pacted	loaded	parma	ability	r; poor s	tability	more	in the first of the second
High water table; very poorly drained erraces and Diversions Not applicable; nearly level reseed Waterways Not applicable; nearly level i i i i i i i i i i i i i		Cropland a	nd Pasture	9											
Not applicable; nearly level ressed Waterways Not applicable; nearly level	Irrigation		CONTRACTOR OF THE PARTY OF THE	ater tat	le; ver	y poor	ly dra	dned							
Not applicable; nearly level	ferraces an	d Diversion	Not ap	plicable	; near]	y leve	1								_
i L / Use in conjunction with Guide to Soil Survey Interpretation Sheets	Grassed Wat	erwaya	Not ap	plicable	; nearl	y leve	1	19 ann an 19 an Ann an Ann	n de ser a sécurio a maso e mayangé	****	-				
1.7. Use in conjunction with Guide to Soil Survey Interpretation Sheets	handrad ann rodd ff agel is 100 a diwron		**************************************			anna a chainn ann an thainn ann a		an a	ann a she an			and and a state of the state of	1		a kongress van de standarde sta
1.7 Use in conjunction with Guide to Soil Survey Interpretation Sheets										ì	80. ***** (******************************			1979) and 1999 and 1	
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MN-SOILS-3 11-71

(File Code SOILS-12)

Greenwood

DEGREE OF SOIL LIMITATION AND MAJOR FEATURES AFFECTING RECREATION USES

		THE OWNER WAS ADDRESS OF THE OWNER W	Contraction of the Contraction of the		
Camp Areas	,				1
Camp Areas	Severe:	high water tal	ole: poor	r trafficability	
Plenic Areas	Severe:	high water ta	ole; poor	or trafficability	
Playgrounds	CARLON PARTY DESCRIPTION OF THE PARTY OF THE		LAND, TO MALENT CROMMEND		
1 10 9 8	Severe:	high water tal	le; poor	or trafficability	
Paths and Trails			-		į
	Severe:	high water ta	le; poor	or trafficability	

# CAPABILITY, SOIL LOSS FACTORS, AND POTENTIAL YIELDS -- (High level management)

Phases of	Capability	Soil	Loss		Corn		[		Bluegrass
Series	Capability	K	T	Oats	Silage		Legume	- Grass	Pastura
All	IVW	ca fit	~ =	<b>B/A</b> 60	T/A 12		Hay T/A h.5	Pasture. AUM 6.7	AUM 5.3
	PASTURELAND AND HAYLAND								

Phases of Series	Group	Species, Yield in AUMs for Dryland (Irrigated) Forage Production
	1	
Language of the second s	1	
		WILDLIFE HABITAT SUITABILITY

		Potential for								
Phases of Series	Grain and Seed Crops	Grasses, Legumes	Wild Herbaceous Plants	Hardwood Trees and Shrubs	Coniferous Plants	Wetland Food and Cover	Shallow Water Devel.	Openland Wildlife	Woodland Wildlife	Wetland Wildlife
530S	Very Poor	Very Poor	Poor	Very Poor	Poor	Poor	Good	Very Poor	Very Poor	Fair
530	Very Poor	Poor	Poor	Poor	Poor	Good	Good	Very Poor	. Very Poor	Good

# WOODLAND SUITABILITY

1	Phases of	Ordi-	Potential F	roductivity		Woodland Mana	gement Haza	rds	Suitable	Species	Other
ļ	Series	nation	Important Trees			Equipment Limitations	Seeding Mortality	Plant Competition	To Favor	To Plant	
	All	Sw	Black Spruce Tamarack	15-40	Slight	Severe	Severe	Severe	filack Spruce Tamarack	Elack Spruce Tamarack	

#### RANGE

Phases of Series	Range Site Name	Climax Vegetation and Productivity of Air - Dry Herbage (lb./ac.)
1		
)		
ļ		
		WINDBREAK

# Group Adapted Trees to Plant Tree Height Prediction at 20 Years Age Relative Vigor . . . . . CROPLAND OTHER . .

Potential yields are moderate for the commonly cultivated crops. The choice of crops is limited by climate, low fertility, and a high water table. Crops that can withstand light frost and have a short growing season are best suited. These include carrots, cabbage, cauliflower, celery, potatoes, cultured sod, radishes, onions and the like. Wind erosion and fire are special hazards.

FOR INTERIM USE Subject to change on completion of coordination between MLRA'S Page 3 of 3 5,8-29,789

H-28

GA

U.S. DEPARTMENT OF AGRICULTURE FOIL CONSERVATION SERVICE

SERIES 19B; PA STATE Minnesota

# SOIL SURVEY INTERPRETATIONS 1/

MLRA 89-90

Revised Draft GDN-RRL 1-73 These are medium to slightly acid deep very poorly drained organic soils. They consist of moderately decomposed dark reddish brown woody materials throughout most of the layers from 12 to 51 inches. Normally these soils oc-cupy bogs ranging from 10 to more than 600 acres in size. White cedar, tamarack, black spruce and in places black ash are the major trees growing on these soils. Some areas are nearly treeless and have chiefly lowland brush. These soils have a high inherent fertility.

#### ESTIMATED SOIL PROPERTIES SIGNIFICANT TO ENGINEERING

Major Soil	Class	sification		Coarse Fract,			ss than Sleve Ni	3 Inches			Permea-	Avail. Water	Soil Reac-	Shrink Swell
5011 Horizons (inches)	USDA Texture	Unifled	AASHO	>3 in. %	4	10	40	200	LL	PI	bility in./hr.	Capac. in./in.	tion pH	Poten- tial
060	Mucky Peat (hemic)	PT	A-B	0		3	le for g seiv	e anal;		473276	10-20	°78−°28	5.1-6.	5 High
Flooding Depth to w	None ater table:	Near a	urface d	luring r	nost o:	f growi	ing Bea			gic group	Ð	r then 5	feet	
Corrosivity	/~uncoate			0		0	0				ncrete: M			
S	SUITABIL	ITY OF S	OIL AS S	SOURCE	OF SE	LECT	ED MA'	FERIAL	AND F	FEATUR	RES AFF	ECTING	USE	1000-00100-0000-0000-0000-0000-0000-00
	Poor:or		ila; lo	a hearin	ng_can	city;	high_	mter t	able	n anas surgedities in				
	Not suite Not suite							eren e consiste en gej W	an Children an Anna an	- Martin Charles Barton				
e conservation and processing and a second processing	Poor when		one. Fa	air to (	good w	nen mis	ced wit	h mine	ral soi	1; hie	h water	table.		
		Ĩ	DEGREE	AND KI	ND OF	SOIL	LIMITA	TION F	OR SEI	LECTE	D USES			
Septic Tank	Filter Fiel	lds												
		Severe	: high	water	table;	very J	poorly	draine	1	64 Million de alemania	1 •******	a de la rechender d'alla de endera	1.14.000 co.co.co.co.co.co.co.co.co.co.co.co.co.c	
Sewage Lag	oons	Severe	: high	water '	table;	mora t	then 30	) perce	nt orga	nic ma	ttor.			
Shallow Exc	avations	Comoro	e him	wator	tobles	3001927 7		danino	de low	rosist	ance to	sloughin	ce	
Dwellings; With Bas	ements	Severe		water :						200200		0.00 0011213	3	
Sanitary Lar	dfill	Laudater ("Wer" weinerschweiser vo				1447) (#) ( = 447) (514 ()467	*****		in 11 minute receiver and					
(Trench	n type)	Severe	: very	poorly	drain	ed; hie	gh wate	er table	9					
Local Roads	and Street	s Severe	~			-			y to fr	ost ao	tion; hi	gh shrin	k-swall	potentia
Potential Fr	ost Action	High	more	than 30	) parce	<u>ana or</u> y	59170 0	REG DEE						
		Name	MAJ	OR SOII	FEAT	TURES	AFFE	CTING 8	SELECT	TED US	ES		and an american specific and an an and a second second	ananan kanan ka
Pond Reserv	oir Areas	Hi	gh water	c table										
Embankment	s, Dikes, c	and Levees	High 1	ater ta	able; :	lov oh	er str	ength	1020-1000 (nort-/1020-2	and and an an an and an and an			and and and and an and an	
Drainage of	Cropland a	nd Pasture		water to	nhle: 1		ordan d	Insing	• 077 (79)	to sol	1.	ana an		
Irrigation								11. <u>0211 714</u>	<u>a 01. press</u>	LLU PUL	ch.9	**************************************	*******	
Terraces and	i Diversion	18	ater tab plicable				linad				The Person of the State of the	ang gang tertering and an	in billio na successive and an	
Grassed Wat	erways			the second second second second	24 marganetic constraints and	et el tot - company a			9-17-9-16-16-16-16-16-16-16-16-16-16-16-16-16-			ويناورونكو وتشاهد المتحد بالمتحد والمحدومات		
		Not ar	plicable	et near	Ly lave	al bog								
	ag fellet an an Digital Statistican dear				Note-alast West Press		in management	0					10105101000000000000000000	
1-12-17-18-18-18-18-18-18-18-18-18-18-18-18-18-	20000-010-0000-0-040-000		nar Adalasta Angelana ang Kabula	- Ohn flor tage of demonstration								andre 17800000 dividiane come	endeter and an	
						101 ⁻¹ -1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-			t-man de la composition de la compositi	tin - main an tao philip a		anantal manana alim ana ana	1. Mile Summingerstree Tran	

Use in conjunction with Guide to Soll Survey Interpretation Sheets. 11

Shrinkage is very high, but the pressure exerted upon swelling is rather low. 21

19B; PA

DEGREE OF SOIL LIMITATION AND MAJOR FEATURES AFFECTING RECREATION USES

and the second manifold and the second se	
Camp Areas	Severe: high water table; poor trafficability
Lang and a second second second	L. PARES. HER FOR FOR FOR CONTRACTOR
Ficnic Areas	
	Severe: high water table; poor trafficability
Playgrounds	Severe: high water table; poor trafficability
	Develo: HEAI HEVEL deskey pool dichingtonilley
Paths and Trails	
	Severe: high water table; poor trafficability

#### CAPABILITY, SOIL LOSS FACTORS, AND POTENTIAL VIELDS -- (High Jevel management)

C	APABILITY	, sor	LLO	SS FACTO	RS, AND P	OTENTIAL	TELDS(High level m	lanagement)
Phases of Series	Capability	Soit K	Loss T	Biz. Oats	Tons-Cor Silage	n AUM Pasture	Tons Legume-grass	AUM
All	IVW	entena		60	12	Bluégras: 5.0	4.5	6.5
оно с на село со		[]		PAS	TURELANI	D AND HAY	LAND	
Phases of Series	Group			Spec	ies, Yleid in	AUMs for Dr	ryland (Irrigated) Forage F	Production

# WILDLIFE HABITAT SUITABILITY

			Pote	ntial for					Potential for-	• •
Phases of Series	Grain and Seed Crops	Grasses, Legumes	Wild Herbaceous Plants	Hardwood Trees and Shrubs	Coniferous Planta	Wetland Food and Cover	Shallow Water Devel,	Openland Wildlife	Woodland Wildlife	Wetland Wildlife
All	Very Poor	Poor	Good	Fair	Fair	Good	Good	Poor	Poor	Good

# WOODLAND SUITABILITY

	Phases of	Ordi-	Potential F	roductivity		Woodland Mana	gement Haza	rds	Suiteble	Species	Other
	Series	nation	Important	Site	Erosion	Equipment	Seeding	Plant	To Favor	To Plant	
	Seriea	nation	Trees	Index	Hazard	Limitations	Mortality	Competition	10 Pavor	to Plant	
-	A11	5w	Black	30-40	Slight	Severe	Severe	Severe	Black	Black	
			Spruce				•		Spruce	Spruce	Í
			Tamarack						Tamarack	Temarack	
- }			White						Phite	White	s
1			Ceder						Cedar	Cedar	

	RANGE							
Phases of Series	Range Site Name	Climax Vegetation and Productivity of Air-Dry Herbage (Jb./ac.)						

#### WINDBREAK

Group	Adapted Trees to Plant	Tree Height Prediction at 29 Years Age	Relative Vigor
a con esta de la construcción de la		n and a second	<u>`````````````````````````````````</u>

# CROPLAND

GEDA-SCI-LINCOLN, NEBR, 1973

Potential yields are moderate for the commonly cultivated crops. The choice of crops is limited by climate, and a high water table. Grops that can withstand light frost and have a short growing season are best suited. These include carrots, cabbage, cauliflower, celery, potatoes, cultured sod, redishes, cnions and the like. Soil blowing and fire are special bazards.

FOR INTERIM USE Subject to change on completion of coordination between MLRA'S

H-30

MRTSC Trial Form File Code Soils=12 Rev. 9=10=71

# U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE SOIL SURVEY INTERPRETATIONS $1^{/}$

SERIES SPA
STATE MINNESOTA
MLRA 88, 89
REV. RRL 8-18-71

These soils are extremely acid, deep organic soils. They consist of slightly decomposed, reddish brown sphagnum fibers throughout most of the upper 5 feet. Normally they occupy areas within large bogs that have slightly convex surfaces. Mapped areas are usually circular or oblong and range from about 100 to more than 600 acres in size. Black spruce along with a few tamarack are the major trees growing on these soils.

# ESTIMATED SOIL PROPERTIES SIGNIFICANT TO ENGINEERING

Major Soll	Class	sification		Coarse Fract.			es than Sieve No	3 inches		- D.	Permea-	Avail. Water	Soil Reac-	Shrink Swell
Horizons (inches)	USDA Texture	Unified	AASHO	>3 in. %	4	10	40	200	LL	PI	bility in./hr.	Capac. in./in.	tion pH	Poten- tial
0-60"	Fibric	Pt	619			uitabl analy		nginee	ring	80	12-20	0.55- 0.65	3.5-4.9	High
Flooding	None			<u> </u>	L		<u> </u>	[	Hydrolog	dic grou	p: D	<u> </u>	<u> </u>	
Depth to w		0 to 2 1	Get.						Depth to	bedroci	k: 5 to m	any fee	٤.	
	Corrosivity - uncoated steel: Very high. Corrosivity - concrete: High													
[	SUITABIL	ITY OF S	OIL AS S	SOURCE	OF SE	ELECT	ED MA'	<b>FERIAL</b>	AND F	EATUI	RES AFF	ECTING	USE.	
Roadfill Po	or; organ t suitab	2710410417474040041074540745	s; very	low bea	ring c	apacit	у.			anan alaan kara kara ala	alan di suku tarin dan militik kasima	international and a subscription of the subscription of		
COLUMN TRANSPORT	t suitab		azze en de la companya de la company	nda ny mpany ara na daoina			1 Process Server (C) - 2 - 948 (C - 2019 A	n-artingan adapted ar					an balan da kana sa ka	
1 5		used alor	ne. Fair	r to go	od whe	n mike	d with	minera	1 soil;	needs	lima, H	igh wate	er table	ę
			DEGREE						OR SEI	ECTE	D USES	2020-025-000-000-000-000-000-000-000-000	Group in the state of the state	
Septic Tank	Filter Fie	lds 56V6	re: Higi	n Water	cable	, organ	nic mai	erial.						
Sewage Lag	oons	Seve	re: High	n water	table	; more	than 3	0% orga	anic ma	tter.	<u>, , ,                                </u>			
Shallow Exc	avations	Seve	re: Hig	gh wate:	r table	e, orga	snic me	terial	•					
Dwellings: With Bas Without	sements Basements		re: High ressibil					-	ı; high	shrin	k-swell	potentis	l high	108-058 (K. 1949)
Sanitary Lar	dfill	Seve	re: High	water	table	, poor	traffi	cabilit	y.					
Local Roads	and Stree	is Seve pote	re: High ntial; m	water Nore the	teble an 30%	; high organi	suscep lc matt	tibilin er.	y to f	rost a	ction; h	igh shri	nk-swe l	1
Potential F	rost Action	High							•					
			MAJ	OR SOI	L FEA'	FURES	AFFE	CTING 8	SELECT	red us	ES			
Pond Reser	volr Areas	Orga	nic soil	., high	water	table.								
Embankmeni	is, Dikes,	and Levees	High w	ater ta	ıble; p	oor st	abilit	y; more	than	30% or	ganic mai	tter.		
Drainage of	Cropland a	and Pasture		table and by or			ce or w	ithin )	l-2 fee	t duri	ng the g	rowing a	eason;	usually
Irrigation														
Terraces an		ns												
Grassed Wat	lerways					metana atticulati nimi b								
														19-10-1-10-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1
	angan kalendar di Kuma di Kabu								-					
	e - a marcella de la dese de la deve					ter ver um sancto dirigitoriae					· .			
Longary Brit of Manager Statements									1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1					

USDA-SCS-LINCOLN, MEBR, 1971

 $\underline{1}/$  Use in conjunction with Guide to Soil Survey Interpretation Sheets.

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# DEGREE OF SOLL LIMITATION AND MAJOR FEATURES AFFECTING RECREATION USES

Camp Areas	Severe: High water table; poor trafficability.
	Severe: High water table; poor trafficability.
Playgrounds	Severa: High water table; poor trafficability.
Paths and Trails	Severe: High water table; poor trafficability.

# CAPABILITY, SOIL LOSS FACTORS, AND POTENTIAL YIELDS--(High level management)

Phases of Series	Capability	Soll L	7 T	м. М		
O to 2% slope	AIIA	-	-			

#### PASTURELAND AND HAYLAND

Phases of Series	Group	Species, Yield in AUMs for Dryland (Irrigated) Forage Production
	Second and a second and a second s	

#### WILDLIFE HABITAT SUITABILITY

1.2				1						
Phases of Series	Grain and Seed Crops	Grasses, Legumes	Wild Herbaceous Plants	Hardwood Trees and Shrubs	Coniferous Plants	Wetland Food and Cover	Shallow Water Devel.	Openland Wildlife	Woodland Wildlife	Wetland Wildlifo
A11	Very Poor	Very Poor	Very Poor	Very Poon	Very Poor	Good	Good	Very Poor	Very Poor	Fair
									veri V	

# WOODLAND SUITABILITY

Ī	Phases of	Ordi-	Potential P	roductivity		Woodland Mana	gement Haza	rds	Suitable	Other	
	Series	nation	Important	Site	Erosion	Equipment	Seeding	Plant	To Favor	To Plant	
			Trees	Index	Hazard	Limitations	Mortality	Competition			
	A11	5w	Black spruc	e 20-30	Slight	Severe ,	Severe	Severe		Black Spru	ce
	ar.										

#### RANGE

Phases of Series	Range Site Name	Climax Vegetation and Productivity of Air-Dry Herbage (lb./ac.)	
$g_{\rm eff} = 0$			
		WINDBREAK	

Group	Adapted Trees to Plant	Tree Height Prediction at 20 Years Age	Relative Vigor

# OTHER

Potential yields are poor for the commonly cultivated crops. The choice of crops is limited by climate, low fertility, and a high water table. Crops that can withstand light frost and have a short growing season are best suited. These include carrots, cabbage, couliflower, celery, potatoes, cultured sod, radishes, onlong and the like. These peaks are well suited for commercial peat harvesting.

FOR INTERIM USE

Subject to change on completion of coordination between MLRA'S

Page 2 of 2

MRTSC Trial Form File Code Soils-12 Rev. 9-10-71

# U. S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE SOIL SURVEY INTERPRETATIONS 1/

SERIES	SPB
STATE	MINNESOTA
MLBA	88, 89, 90
pev.	10-71

These are extremely acid, deep organic soils. They consist of slightly decomposed reddish brown sphagnum material throughout the upper three to four feet. Below this is moderately decomposed, dark reddish brown herbaceous material. These soils occur in relatively marrow bands around the outer edge of large raised bogs, and in circular or oblong areas in small bogs.

# ESTIMATED SOIL PROPERTIES SIGNIFICANT TO ENGINEERING

Major	Clas	sification		Coarse Fract,			ss then Sleve No	3 inches			Pormea-	Avail. Water	Soil Reac-	Shrink Swell
Soll Horizons (inches)	USDA Texture	Unified	AASHO	>3 in. %	4	10	40	200		PI .	bility in./hr.	Capac. In./In.	tion pH	Poten- tiol
0-38	Fibric	Pt	æ			uitab enal		engine	ring -		6-20	0.55- 0.65	3.4-	High
38-60	Hemic	Pt	50						6.6	4	2.0-6.3	0.45- 0.55	4.0- 4.5	High
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Flooding	None	<u>.</u>	1					J	Hydrolog	ic grou	p: D	l	L	
		0 60 7 6	ant						Depth to	hedroc	k:5 to m	anv feat		
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Sanitery Lo	ndfill	Severe:	High wat	er tabl	le; poc	or graś	Elcabi	lity.						
Local Road	s and Stree	ts Sever poter	e; High tial; mo	water t	able; 302;	high s organic	uscept matte	ibility r.	y to fr	ost ac	tion; hi	gh shrin	k-avell	
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# DEGREE OF SOIL LIMITATION AND MAJOR FEATURES AFFECTING RECREATION USES

Camp Areas	Severe: High water table; poor trafficability.
Picnic Areas	Severe: High water table; poor trafficability.
Playgrounds	Severe: High water table; poor trafficability.
Paths and Trails	Severe: High water table; poor trafficability.

# CAPABILITY, SOIL LOSS FACTORS, AND POTENTIAL YIELDS--(High level management) Phases of Series Capability Soil Loss K T 0 to 2% slopes VIIw - - - - - - - Phases of Series - - - - 0 to 2% slopes VIIw - - - - - - - PASTURELAND AND HAYLAND - - -

Phases of Series	Group	Species, Yield in AUMs for Dryland (Irrigated) Forage Production
and the second		

#### WILDLIFE HABITAT SUITABILITY

	Potential for							Potential for		
Phases of Series	Grain and Seed Crops	Grasses, Legumes	Wild Herbaceous Plants	Hardwood Trees and Shrubs	Conifèrous Piants	Wetland Food and Cover	Shallow Water Devel,	Openland Wildlife	Woodland Wildlife	Wetland Wildlife
A11	Very poor	Very poor	: Very poor	Very poor	Very poot	Good	Good	Very poor	Very poor	Fair

# WOODLAND SUITABILITY

1	Phases of Series	Ordi- nation	Potential Productivity		Woodland Management Hazarda				Suitable Species		Other
			Important Trees	Site Index	Erosion Hazard	Equipment Limitations	Seeding Mortality	Plant Competition	To Favor	To Plant	
	A11	5W	Black Spru	ce 20-40	Slight	Severe	Severè	Severe		Black Spr	uce

RANGE

Phases of Series	Range Site Name	Climax Vegetation and Productivity of Air - Dry Herbage (lb. /ac.)
		WINDDOFAV

	WINDBREAK		
Group	Adapted Trees to Piant	Tree Height Prediction at 20 Years Age	Relative Vigor
	OTHER		

OTHER

Potential yields are poor for the commonly cultivated crops. The choice of crops is limited by climate, low fertility, and a high water table. Crops that can withstand light frost and have a short growing are best suited. These include carrots, cabbage, cauliflower, cranberries, celery, potatoes, cultured sod, radishes, onions and the like.

FOR INTERIM USE

Page 2 of 2

Subject to change on completion of coordination between MLRA'S

H - 34

#### Appendix I - Statistical Check

## Introduction

The MINESITE study is dependent on a data inventory representing various parameters (variables) which can be displayed Transforming data from base maps into computerin map form. generated map representations of these base maps is the principal task to be completed before analysis stages can begin. There is a chance for the introduction of error throughout this transformation process. These errors would eventually show up on the final computer maps. A statistical sampling procedure was established to estimate this error on maps having the most complex distribution of data levels. Data base maps for the variables are assumed correct; hence, the statistical check is an estimate of error introduced somewhere between the time data was taken from the base maps and the time this data appeared on a final computer map.

# Background

Variables included in the study differ drastically in nature. For some variables, each of the 145,000 cells in the study area must be represented by a symbol, an example being the elevation variable (V09). In others, only a fraction of the total cells have a symbol, an example being the transportation variable (V25).

On a map such as V25, it is quite simple to check the accuracy of the computer map by comparing it with base maps; either USGS topographic maps, Superior National Forest maps, or others which

1 - 1

might show additional transportation systems. Obvious errors, such as a gap in a string of cells representing a continuous road, are easy to detect.

In cases where the majority of the study area is coded and mapped, finding errors by such direct comparison methods usually would be difficult and time consuming. Exceptions, however, include variables such as bedrock geology (VO4) that contain large blocks of fairly uniform data computer-coded with the same symbol. A cellby-cell check of such variables is often reasonable despite the large number of cells involved, primarily because it involves linear boundary checks such as those used with the transportation variable.

However, most variables covering a large proportion of the study area, such as the elevation variable (VO9), have symbols that, in part, seem to be arranged in a random manner, here due to the changes in elevation between cells. To error check each cell on such maps would require that each cell be reinterpreted, consuming probably as much time as did the original coding. It was for this type of variable that statistical sampling procedures were designed, to replace the cell-by-cell verification used on the other maps.

#### Types of Error

Several types of error can be introduced during various stages of the transformation process, and are discussed below.

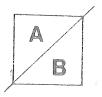
- 1. Misinterpretation error originates when the coder simply does not understand correctly the information represented within a cell on the original data map and codes the wrong data level.
- 2. Misplacement error originates when (a) the coding grid is mistakenly placed in the wrong position on the base

map during coding, or (b) in filling out the coding form, the symbol from the data map is not placed in the corresponding cell on the form, or (c) grid lines are drawn on the base maps in the wrong position.

3. Transfer errors occur when the data symbols placed on coding forms are transferred incorrectly to the keypunch form from which computer input cards are keypunched. The keypunch form was designed so that the "shorthand coding" system could be used. This coding system reduces the number of cards required to be keypunched and the number of entries made on each card. The format of this keypunch form and the procedure in which it is filled out are somewhat involved, making this step of the procedure particularly susceptible to error. Some gross transfer errors are easily recognized on the computer maps, but others can go unnoticed. Since the keypunched cards are a direct link to the computer map, an error made on a card appears as an error on the map.

- 4. Errors made in keypunching computer cards are another explanation for incorrect symbols showing up on a computer map. This could occur when transfer forms are punched, or when cards are corrected to change data on data maps.
- 5. Another type of error can be introduced when correcting either line printer or dot plot data maps. When errors are found on a map and a new computer card is punched to show correct data, the cell or cells corrected sometimes do not show up changed on the updated maps. This could be due to an error of omitting an entry on a card, or to the wrong cell being changed. If the wrong cells are changed on a line printer map, it is often impossible to find the location of those cells because previous cards are disposed of when new ones are keypunched. When changes are made on a dot plot map but do not show up on an updated map, the card deck can be checked to explain why.

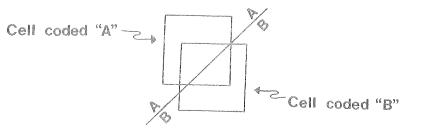
Not to be confused with errors, are the contradictions in data level selection that can arise when personal judgment is called upon to make decisions. These may show up when a coder, in selecting a symbol for a particular cell, may be uncertain of his choice, or may not have a clear choice. As a hypothetical example, when a coder placed the coding grid over the base map, the following cell configuration resulted. FIGURE 1



The letters in the diagram represent different data levels, each occupying what appears to be about half of the cell. In this case the coder must decide which letter to use. Either letter (A or B) would be equally correct, and a person checking the coding at a later date may choose the alternate and equally correct letter. Both choices would be correct.

Similar contradictions may also be caused by a poorly fitting grid overlay, the alignment of which is, again, based upon an individual's judgment. The following example shows how grid alignment could result in different symbols being chosen by coders. If a coder were not to apply a consistent rule in aligning a grid, it is conceivable that the same coder, checking the coding of the same cell at a later time, could make an alternate choice.

FIGURE 2



#### Statistical Check

1. Theory

The statistical check is initiated by taking a random sample of the "population" (total cells on a map). Once the percent of wrong cells in this sample is determined, the percent of wrong cells in the "population" can be estimated with a specified degree of certainty. The statistical method used is the method of "confidence limits".

The check begins with the random selection of 200 cells, the calculated minimum number required for an "upper one-sided confidence limit" of 90%. This means that the chances are 90% that the "true percentage" of wrong cells in the population will fall within a range from zero to a calculated upper limit. This range is known as a "confidence range". The percentage of wrong cells in the sample is used to determine the upper limit of the "confidence range", calculated here on the basis of a sample size of 200. Table 1 shows this relationship.

> D  $L_{2}(\pi)$ 1% 2.1% 2%3.4% 3% 4.8% 4%5.9% 5% 7.1% 6% 8.3% 7% 9.4% 8% 10.6%

TABLE 1

P = percent of wrong cells among a random sample of 200 cells.  $\pi$  = the true percentage of wrong cells among all the cells.  $L_2(\pi)$  = the upper one-sided 90% confidence limit for  $\pi$ .

For example, a sample of 200 cells is taken and six wrong cells

are discovered. This results in:

$$b = \frac{500}{2} \times 100\% = 3\%$$

Looking at Table 1 for P = 3%, we find that the upper one-sided 90% confidence limit  $L_2(\pi)$  is 4.8%. What this means, simply, is that the chances are 90% that  $\pi$  (the true percent of wrong cells among all the cells) will fall within the range 0 - 4.8%. Another way this might be stated is that the chances are 10% that  $\pi$  will be greater than 4.8%.

There is nothing unique about the selection of a confidence coefficient of 90%. Any other value could have been chosen, but a change in the confidence limit  $L_2(\pi)$  and the sample size would within a given range would increase the upper confidence limit, pothetical example, assume a 95% confidence coefficient is adopted in the example shove; then the value of  $L_2(\pi)$  for P = 3%the same time a sample size of about 400 would be required. The 90% was suggested because it seemed to be a satisfactory trade-off between the length of the confidence range and the trade-off between the length of the confidence range and the trade-off between the percentage of wrong cells would fall outside of the confidence range  $0 - L_2(\pi)$ , and kept the random sample of the confidence range  $0 - L_2(\pi)$ , and kept the random sample of the confidence range  $0 - L_2(\pi)$ , and kept the random sample of the confidence range  $0 - L_2(\pi)$ , and kept the random sample

suitable. Referring to Table 1, a value of P for  $L_2(\pi) = 10\%$ is interpolated to equal 7.5%. This means that, among a sample

size at a reasonable number of 200, rather than 400, or greater.

For the MINESITE study, a confidence limit of 10% was deemed

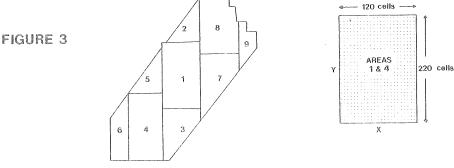
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of 200 cells, 7.5%, or 15 wrong cells would represent  $L_2(\pi)$ . Again, simply stated, this means that the chances are 90% that the true percent of wrong cells among the total of all cells will fall within the range of 0 - 10%.

# 2. Random Sample Selection

Two methods were applied for selecting a random sample of 200 cells from line printer maps of the nine MINESITE areas. One method was used for areas 1 and 4, and the other for the remaining seven areas.

Areas 1 and 4 are unlike the others in that they are rectangular in shape, both having cells arranged 120 columns wide and 220 rows long. The other seven areas have various geometric shapes, hence various column widths and row lengths (Figure 3).



A. Sampling for Areas 1 and 4

For areas 1 and 4, the procedure for selecting the sample was to select x (column) and y (row) cell coordinates using a 3-digit random number table, which gives numbers in the range 000 - 999.

Since we would be interested only in numbers 001 - 120 for columns, all other numbers chosen greater than 120 would become wasted, for instance the numbers 313, 678, 505, 825, 450, and 918.

1 - 7

To reduce this waste, the following scheme was adopted:

- When the first digit is <u>EVEN</u>, turn it into a <u>NERO</u>.

Using this scheme, the above numbers are changed as shown below,

8 T T	8.8	8T6
020	8.8	09Þ
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ETT	səwoəəq	313

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A similar scheme was devised to select the rows among the numbers 001 - 220, converting larger random numbers 518, 680, within this range. Suppose the numbers 375, 443, 518, 680,

- When a number starts with 3, 4, or 5 subtract 300. - When a number starts with 6, 7, or 8 subtract 600.

Any number starting with a 9 becomes useless, as well as the following sets:

221-300, 521-600, and 821-899.

sre converted to useful numbers:

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and then serve to identify columns.

SMOJ

Because of wasted numbers, in order to obtain the 200-cell sample, useful numbers representing columns (x) and rows (y) are chosen from among an average of 340 numbers when selecting columns, and from among more than 275 numbers when selecting

8-I

Here the 200 valid numbers for columns can be chosen first, followed by the 200 numbers for rows, because all cells printed on the map are "on-site". Each cell is then located and circled on the line printer data map. In a case where there is a repetition of selected cells, additional coordinate numbers are chosen so that the sample represents 200 individual cells.

B. Sampling for Areas 2, 3, and 5 - 9.

These areas each have a unique shape and contain a different number of cells as shown earlier in Figure 3. These facts, for the most part, prohibit the efficient use of the cell selection procedure described above.

As an example, the line printer map for Area 2 is the same 120 columns wide, but only 160 rows long. In addition, the border of the cells within this areas forms a diagonal across the map, rather than a rectangle, as shown in Figure 4.

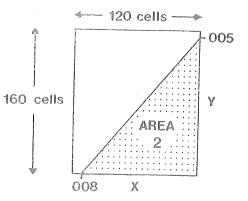


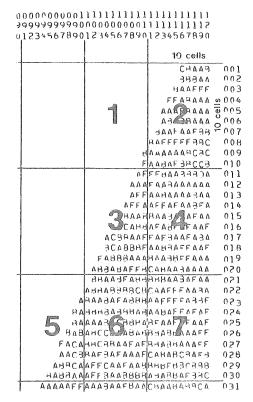
FIGURE 4

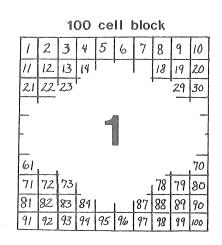
Notice that the first column containing a cell is 008, the first row is 005, and that greater than half the map is void of cells. Selection of cells falling within this void would add to the waste in choosing random numbers for coordinates of cells to be included in the sample. It is at this point that a caution must be given to avoid improper sampling techniques. A basic requirement in random sampling is to insure that each potential sampling unit in a population has an equal chance of being in the sample. An illustration of how this requirement could be violated can be given using Area 2 as an example. The wrong way to proceed here would be to first select a column in the range 008 - 120 and then look for a new random number in the range 005 - 160 until a row is found that gives an on-site cell. Though it would decrease the number of wasted numbers, such a procedure would not provide an equal chance to all cells in the population for inclusion in the sample.

The proper procedure might be to select pairs of random numbers until the required 200 are found, rejecting pairs that fall outside the area. This would be almost the same method used for Areas 1 and 4. This is a rather inefficient procedure for Area 2 since so many numbers are wasted, but for areas where much of the map is on-site (such as Area 8), it would be most efficient to select the sample using this method.

A more efficient and equally correct procedure has been devised for Area 2 and other areas containing numerous off-site cells. This procedure involves dividing the map up into blocks of 100 cells, 10 cells on each side. Complete blocks are drawn even if only one cell in enclosed. Figure 5 shows a portion of a map as an example of these blocks and how they are numbered.

FIGURE 5





As an illustration, suppose the area is divided into 85 blocks, each containing 100 cells. Three-digit random numbers are then selected for numbers in the range 1 - 85 to identify a block. These random numbers are paired with 3-digit random numbers from the 1 - 100 range which identify individual cells within the 100-cell blocks. This is repeated until a 200-cell sample is compiled. Pairs falling outside of the area are rejected during the selection process so some numbers are still wasted, although not nearly as many as would be under the procedure described earlier. The same conversion scheme adopted in (A) above is applied in selecting useable numbers.

It would be advantageous if the number of blocks were to number 100, or at least near but lower then 100, to minimize the waste of 3-digit random numbers. If the number of blocks,

for instance totals 35 or 105, then there may be no advantage in using this method. Perhaps then it would be just as easy to use the selection method used for Areas 1 and 4 described earlier.

The 100-cell block is handy because there is no waste of 3-digit numbers if the first digit is converted to zero. Conversion of numbers over 100 is as follows:

becomes	012
ę ș	074
\$ \$	054
۴ î	100
¥ Y	100
	9 P P P

3. Use of Sample

When the 200-cell sample is chosen for a particular variable, each sample cell is compared with the corresponding cell on the original data base map from which the computer mapping originated. The percent of error in the sample is calculated and the map is accepted if the error does not exceed 7.5% of the sample (15 cells wrong in 200), as explained above. If the sample error exceeds 7.5%, the sample is rejected. This requires that every cell on the computer map be checked against corresponding cells on the base maps, and those found to be in error corrected. Erroneous cells on accepted maps must also be corrected. If a sampler notices errors not included in the 200-cell sample, these must also be corrected but they do not count toward the percent error in the random sample. Because of these corrections, the map may be somewhat more accurate than the % infers if they occur in multi-cell arrangements, rather than in individual, ran-

domly distributed cells.

When comparing the computer map against the data map, some leeway is given for several variables when a cell seems to be in error. The cell may not really be in error at all but, rather, a checker may not agree with the original coder as the result of a judgment decision, as described earlier. A one data level difference (above or below) is allowed for VO2 - Percent Slope (levels 1-6), VO3 - Slope Orientation (levels 1-9), and VO9 -Elevation (levels 1-34) in cases where there is no clear choice of data level. An example on each variable is given.

Variable	Level Chosen	Level Acceptable (above & below)
V02 V03 V09	2 (4-6%) 3 (East) 10 (1520's & 30's)	1 (1-3%) or 3 (7-9%) 2 (NE) or 4 (SE) 9 (1500's & 10's) or 11 (1540's & 50's)

These variances are not counted as errors in this case, and the cells remain as originally coded.

Once the 200-cell sample is chosen for the first computer map in each of the nine areas, other variables can be tested using those same cells if the variables have no dependence between one another. Areas 1 and 4 are identical in shape, the other seven are not, so there are initially eight different 200-cell samples used. For example, the data levels coded for V02 - Percent Slope taken from a USGS topographic base map have no direct connection with the data coded for V09 - Elevation, other than that the same base map is used for both. In contrast, the data for the vegetation variables V16, V18, V19, and V20 were interpreted as a group on base maps and then later separated into four variables during coding. Therefore, there is an interde-

pendence between them requiring that a different 200-cell sample be chosen for each. If any one of these four variables were to fail the check, then all cells on all these maps would require comparison with the base maps.

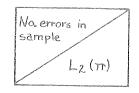
# Results of Statistical Check

The chart below lists the mapped variables that were statistically checked along with, 1) the number of errors found and 2) the confidence limit corresponding to the percentage of sample error.

TABL	Ε 2	)
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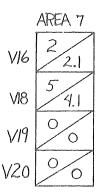
	AREA	1	2	3	4	5	6	7	8	9
V02	% Slope	2/2.1	12 8.3	00	11	8	11	5	8	13 8.9
V03	Slope Orientation	15 10	11 7.7	23 #	19 9.4	22/*	7 5.4	3 2.8	4 3.4	13 8.9
V09	Elevation	11	20	%	%	%	%	26	%	3 2.8
V10	Soil Landscape Units	221	3 2.8	4 3.9	4 3.4	6 4.8	4 3.4	1	18 *	11
V16	Vegetation	1	11	2/2.1	32.8	6 4.8	2/2.1	+	%	14 9.4
V18	Crown Density	11	6 4.8	%	11	%	3/2.8	+	3/2.8	15 10
V19	Size Class	%	11	2/2.1	2/2.1	1	%	/+	%	13
V20	Height Class	20	4 3.4	1	2/2.1	1	5 4.1	16+	1	10 7.1
V24	Soil Associations	2 2.1	1	3 2.8	2/2.1	3 2.8	5 4.1	2/2.1	1	11

*Upper one-sided 90% confidence limit of 10% exceeded; all cells subsequently error checked.



### TABLE 2 CONT'D

+V20 Area 7 rejected; V16, V18, V19 and V20 recoded and rechecked with the following results:



Variable 03 - Slope Orientation for Areas 3 and 5, and V10 - Soil Landscape Units for Area 8 failed by exceeding the 15 errors allowed in the sample, so each cell had to be checked and corrected when necessary.

Variable 16, V18, V19, and V20 for Area 7 were rejected based upon the failure of V20 because of the interdependent nature of these variables. It was then discovered that UTM grid lines were misaligned when originally coded. These variables were recoded and were again statistically checked, with all passing, as shown at the bottom of Table 2.

# REFERENCES

- 1. Written and verbal communication with Leonard Wroblewski, Research Analyst, Environment Section, Division of Fish and Wildlife, March 1975 to present.
- 2. Guttman and Wilks, <u>Introductory Engineering Statistics</u>, John Wiley & Sons, 1965, 340 pp.