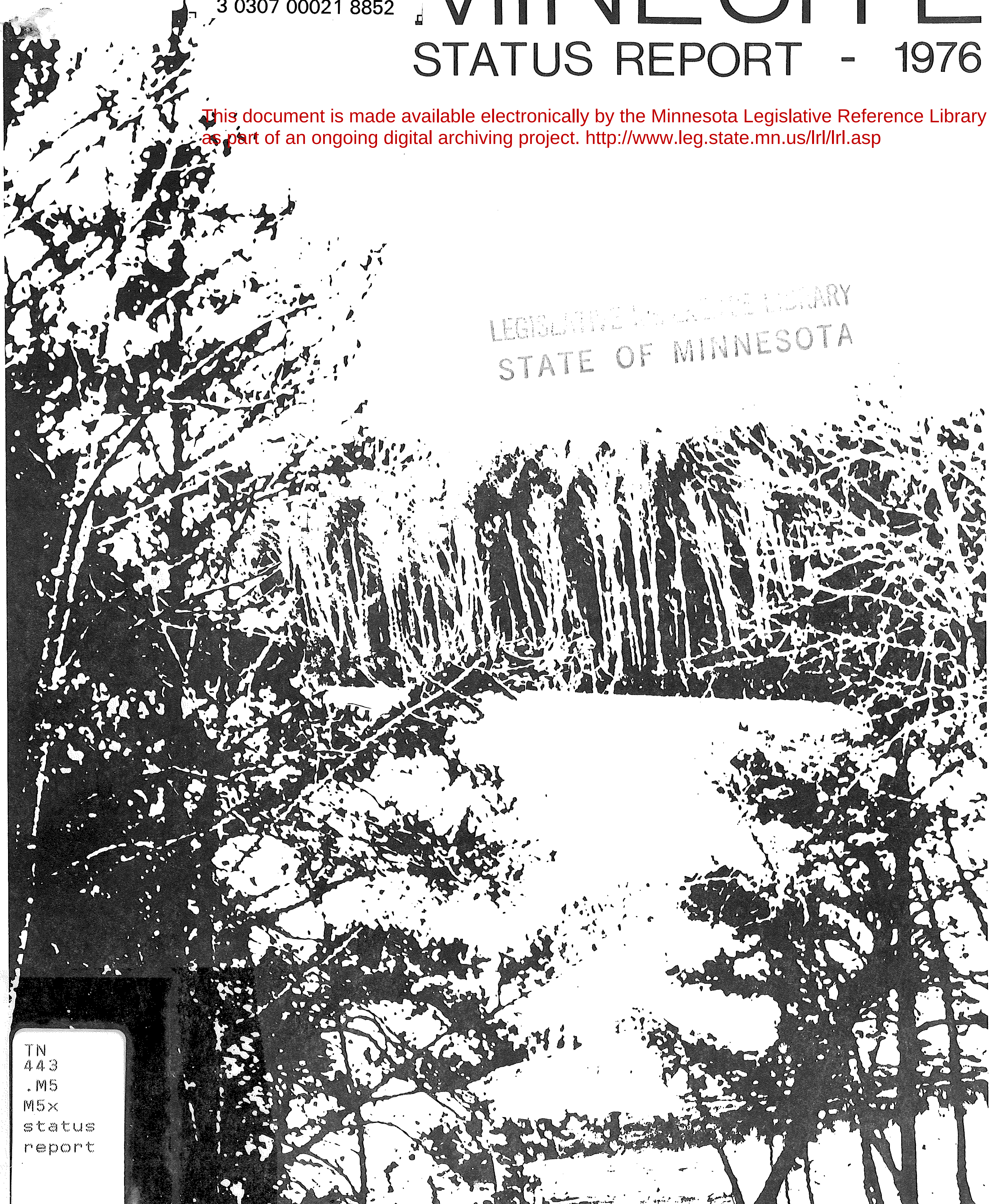
MINESITE

STATUS REPORT - 1976



INTRODUCTION

MINESITE PROJECT

Copper-nickel resources are known to exist in an area of Northeastern Minnesota that is in a relatively natural condition and where mineral development has not been widespread. MINESITE utilizes a resource inventory and computer modeling techniques that combine the existing environmental resources and sensitivities into a framework for evaluating the environmental trade-offs, on the regional scale, of potential copper-nickel development.

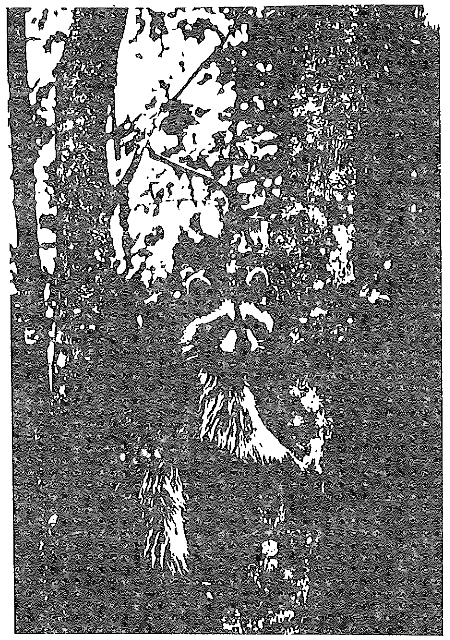
The purpose of this report is to explain and illustrate the MINESITE study. MINESITE is a concept that makes use of a resource inventory to interrelate the knowledge of diverse resource specialists with planning techniques, through the use of computer modeling.

COPPER–NICKEL

The Duluth Complex, the geological formation containing this copper-nickel mineralization, is considered one of this country's largest nickel resources. The United States presently imports most of its nickel. If copper-nickel is developed, a variety of mining and processing facilities would be required, including open pit or underground mines, processing plants, and waste disposal areas. Through the MINESITE study, a series of alternative facility sites will be identified for comparative evaluation. MINESITE is not a regional EIS, but it will provide valuable resource data, alternative facility sites, and an organized evaluation system useful in any EIS. As such, MINESITE provides a resource management tool to help guide future development alternatives for copper-nickel in Northeastern Minnesota.

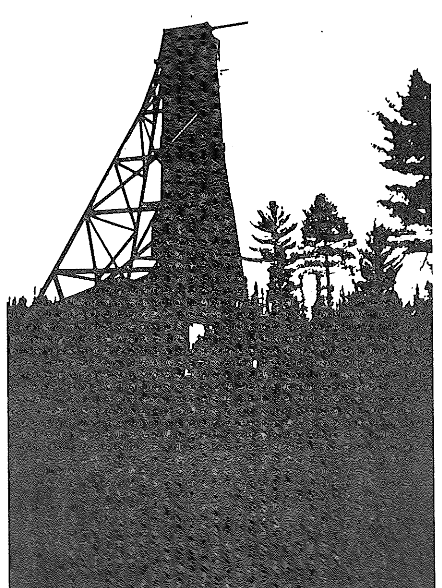
DNR

The study was initiated in 1973 by the Division of Minerals of the Minnesota Department of Natural Resources. Interdisciplinary techniques are used to evaluate environmental values and resource development potential. These techniques can then be used with existing economic and social systems to develop resource management plans.



PEOPLE & DECISION MAKING

Concern over potential copper-nickel development has been expressed due to the variety of possible impacts. An acceptable policy can be reached only by using a public decision making process involving such representation as citizens and citizen scientists, public interest groups, exploration and mining companies, regulatory and planning agencies, and legislative committees. MINESITE can serve as a valuable resource planning document and as a tool for evaluating mineral management alternatives.



ENVIRONMENT

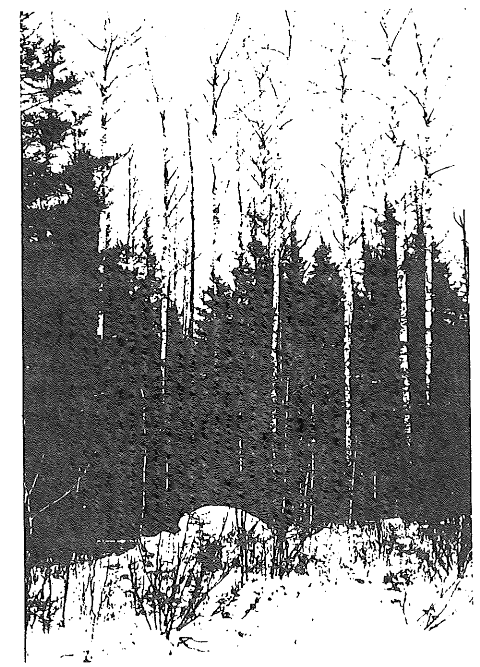
The environment of the MINESITE area is strongly natural resource orientated. The majority of the employment in the area is derived from forest, recreation, and mineral resource industries. MINESITE will provide a means for identifying land use priorities based on resource capabilities and environmental sensitivities.

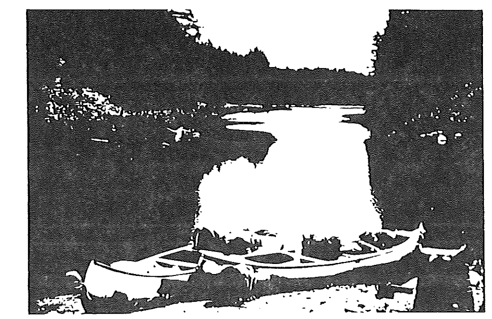
MINING

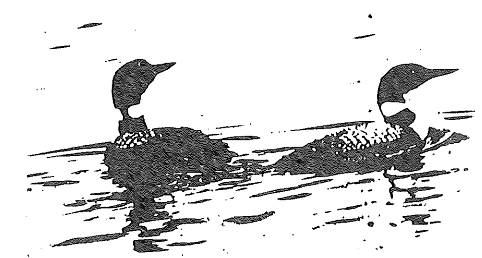
Mining activities require large tracts of land that must be modified significantly. Mining operations also cause secondary impacts in the periphery adjacent to facilities. MINESITE will provide a series of alternative facility sites that can be evaluated objectively prior to heavy development pressures.

OBJECTIVES

MINESITE has three important objectives.
1. Determine natural resource management capability.
2. Assess environmentally sensitive areas.
3. Establish a mineral resource planning program. This includes an evaluation of mineral potential, and locates a series of mineral facility site alternatives. These evaluations will be used for land use management and evaluation of specific proposed projects.







LAND USE CAPABILITY

Resource capability models will be developed for the major land use types in the study area. These land types include wildlife habitat, recreation, aesthetics, forest production, and urban development. Minerals are included as a separate category. Within each category, a series of indicator models will be used to express land use capability. For example, wildlife habitat could include models on upland grouse and deer, wetland furbearer, and fisheries habitat and spawning. These can then be combined to express regional wildlife habitat potential.

ENVIRONMENTAL SENSITIVITY

Models expressing environmentally sensitive areas will be grouped into three types of impacts: air and noise; water; and land. Within each category, a series of models will be developed that indicate environmental sensitivities such as erodability, water availability, and revegetation potential.

MINERAL RESOURCE PLANNING

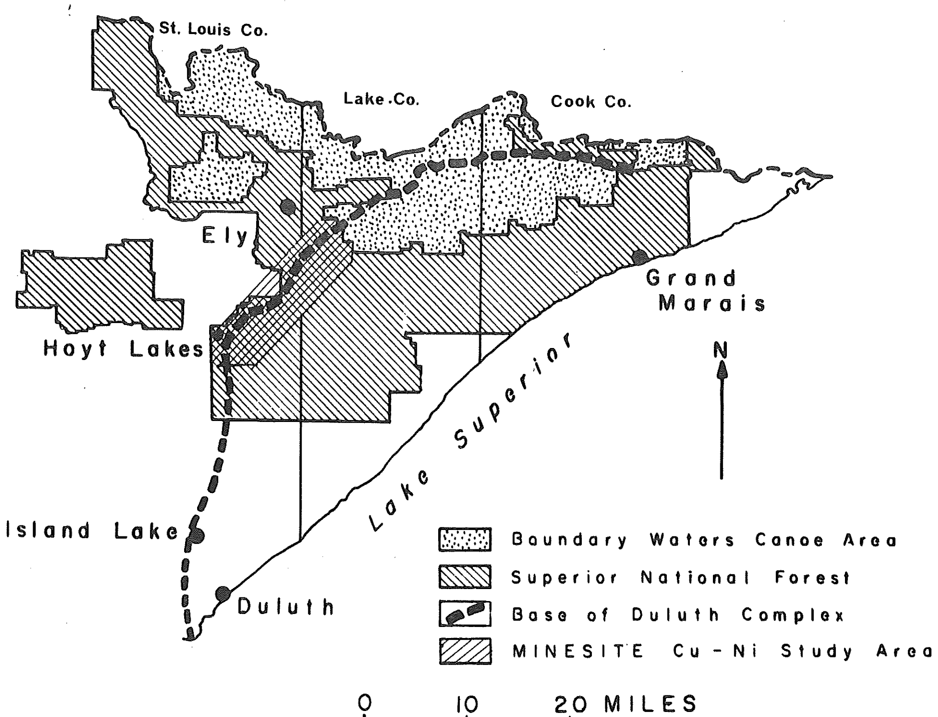
This phase of the study is divided into two categories, mineral potential and mine facility site alternatives. The mineral potential aspect will include an evaluation of taconite and potential copper-nickel resources that could be available through open pit and underground mining techniques. The mine facility alternatives will include a series of models using engineering and environmental standards to locate mine facility sites such as tailings disposal basins, stockpiles, and water reservoirs.

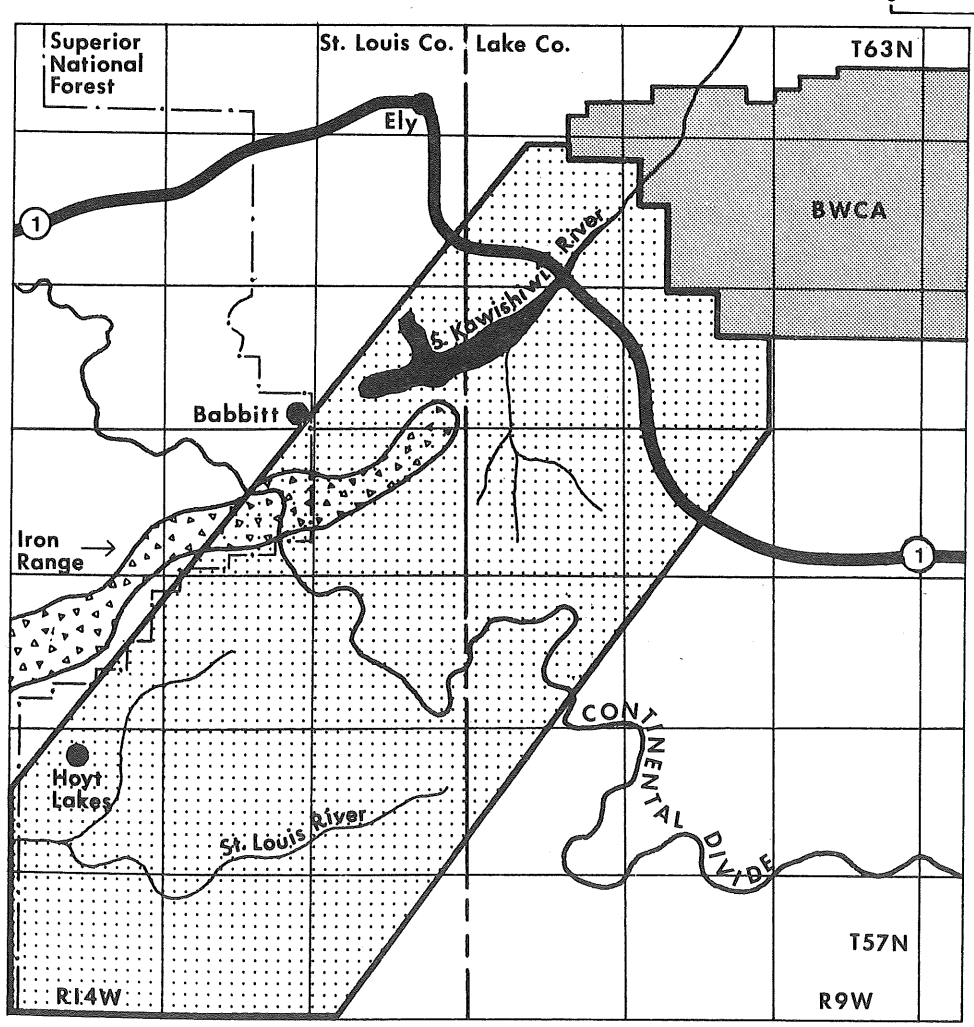
OBJECTIVES

SETTING

REGIONAL SETTING

The MINESITE study area is located in Northeastern Minnesota and includes the area of highest copper-nickel potential. Exploration interest has been concentrated along the base of the Duluth Complex where it is in contact with, and overlays, older rock formations. Important management units in or near the study area include the Boundary Waters Canoe Area (BWCA), Superior National Forest, and State forests and parks.



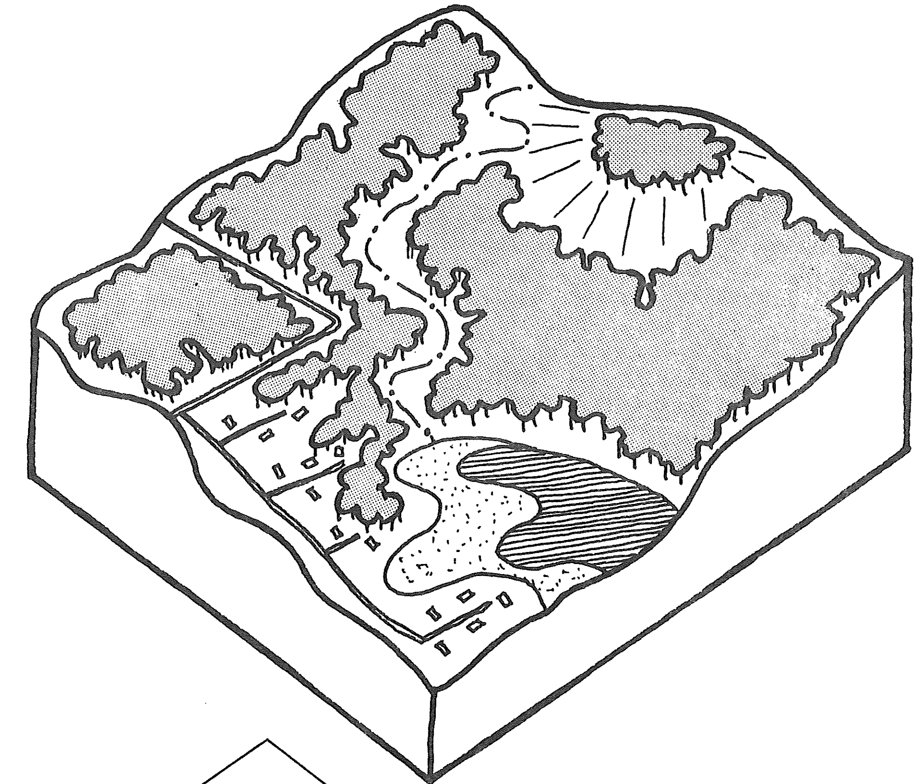


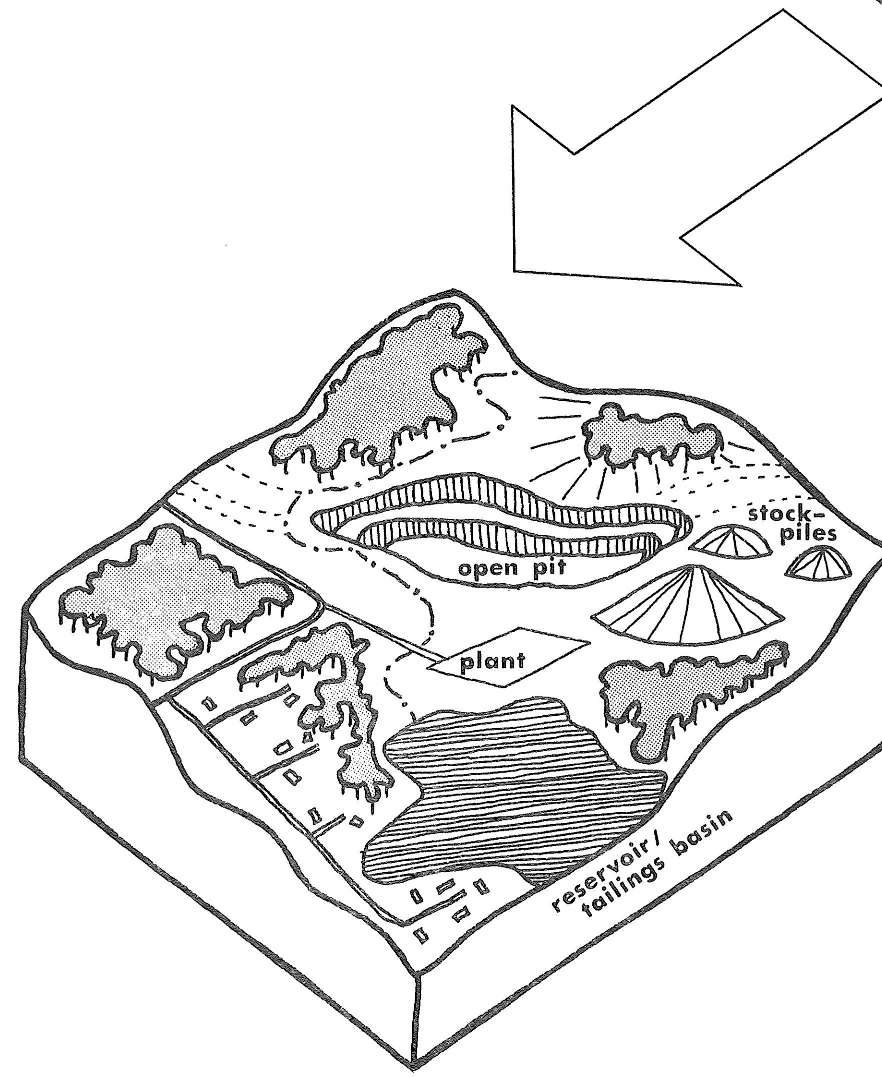
MINESITE SETTING

The study area is composed of portions of 23 townships and contains approximately 560 square miles. The area, located in St. Louis and Lake Counties, is bordered on the northeast by the BWCA and a portion borders the Mesabi Iron Range. Waters in the northeast flow through the BWCA into Hudson Bay; waters in the southwest flow into Lake Superior through the St. Louis River system.

ENVIRONMENTAL VALUES

The area of Northeastern Minnesota in which potential mining operations may take place, is characterized by a natural landscape with little human modification. Natural features include a large variation in topography, extensive forest cover, productive wildlife habitat, highly sensitive water systems, and very localized urban development. The MINESITE study defines these factors in a descriptive and quantified manner, facilitating environmental evaluation and providing a basis for future policies and decisions regarding copper-nickel development.

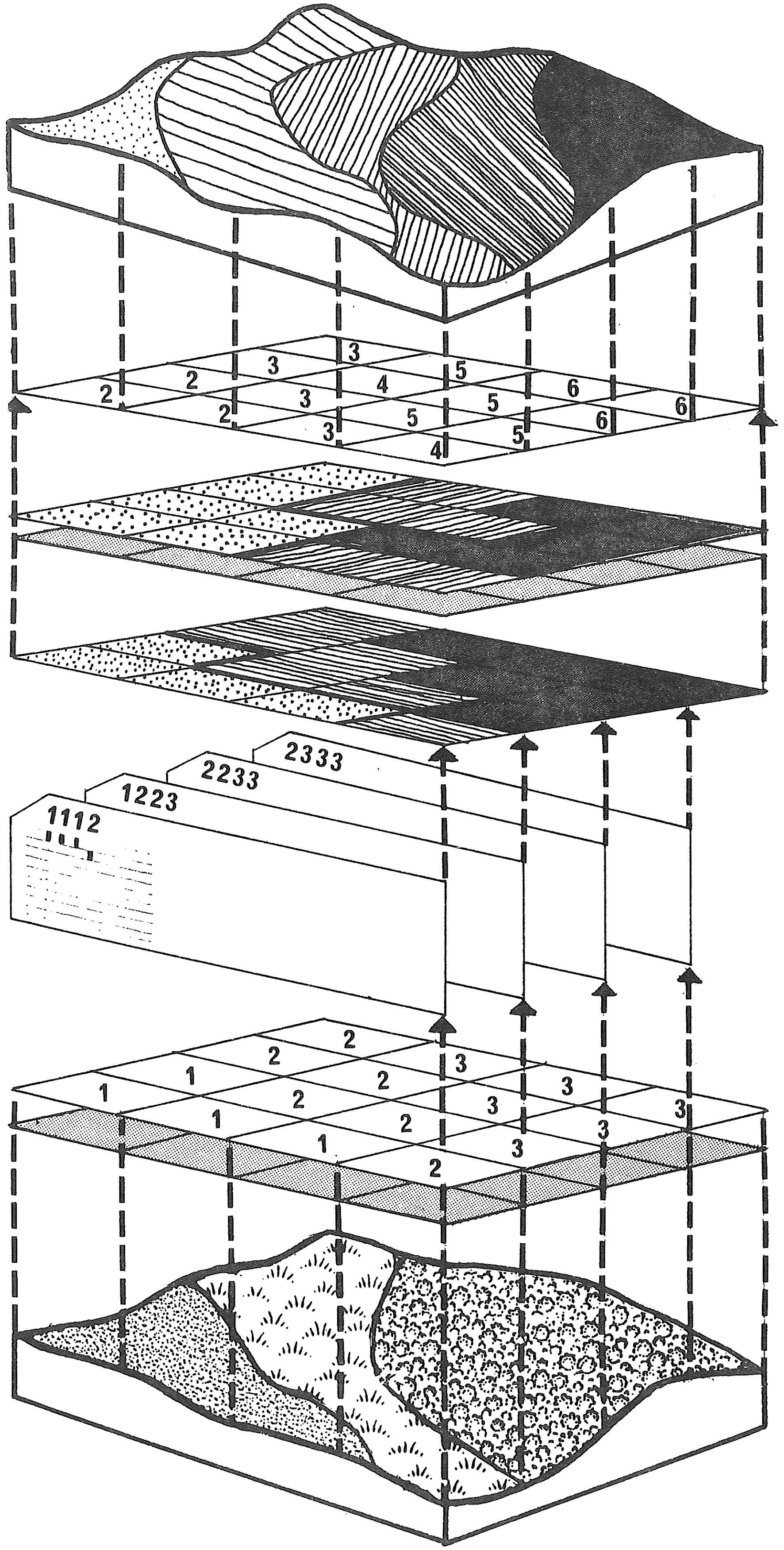




POTENTIAL MINING FACILITIES

Mining operations consume large areas of land and alter the landscape, at times to an extreme degree. These operations involve excavation, processing, waste disposal, and water management. Impacts include on-site displacement of natural features as well as remote environmental effects. The objective in the MINESITE study is to find alternative facility sites which minimize these impacts.

ISSUES



8. RESULTANT LAND PATTERN

Site capacities from analysis maps can be easily visualized using a gradation of tones from dark to light.

7. ANALYSIS MAP

As the data is combined, descriptions of the site's capacity can be determined, mapped, and quantified. The diagram shows a hypothetical case of timber productivity with "6" showing high timber productivity and "2" showing low productivity.

6. OTHER DATA MAPS

Information on many resource variables is known for each grid cell and each is stored as a separate data file.

5. COMPUTER DATA DISPLAY MAP

Data can be displayed on computer printed maps as symbols or grey tones.

4. COMPUTER CARDS

Coded data is keypunched onto computer cards. Positions on computer cards correspond to those on the coding sheets.

3. DATA CODING

The coding process involves the determination of the predominant resource class within each grid cell and recording it with a numerical symbol. The example in the diagram shows: 1 = grassland; 2 = marsh; and 3 = forest.

2. GRID

The scale of the base map and the size of the grid cell are established according to the detail of the data available, and the detail of desired results. Thus, cell size could range from one acre to one square mile.

1. SITE

A site is composed of many natural land features including soil, water, and vegetation. Each of these is identified and recorded on a base map.

COMPUTER

PROCESS

PLANNING PROCESS

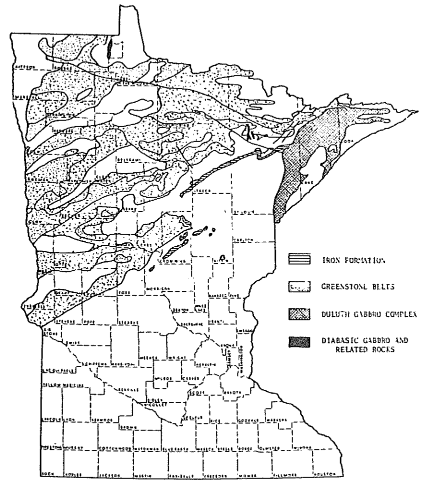
The MINESITE Project utilizes a systematic process based on resource information, and planning judgements determined by resource specialists. Planning judgements are decisions and values that the interdisciplinary planning team must provide throughout the planning process. These judgements are used to develop components in the form of maps and tabulated land coverage.

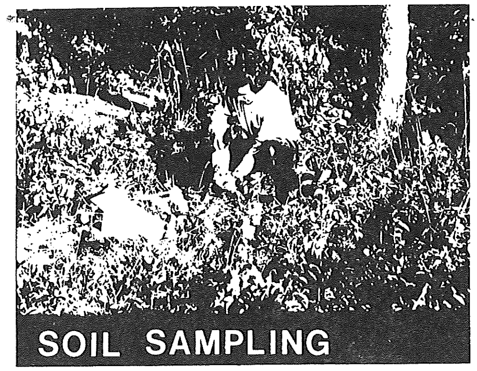
The process follows a sequence of phases. A resource inventory is prepared which is used to develop a regional assessment. This assessment is then used to generate mine facility and land use alternatives. Evaluation is carried out by comparing specific proposals against the alternatives and regional assessment factors.

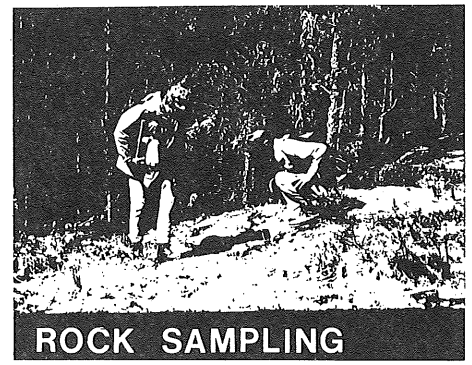
PLANNING JUDGEMENTS	COMPONENTS	PHASES
RESOURCE CLASSIFICATION INVENTORY MAPPING PRODUCTIVITY RATINGS	NATURAL RESOURCES CULTURAL RESOURCES ADMINISTRATIVE PATTERNS	1. RESOURCE INVENTORY Development of an information base for the region.
ENVIRONMENTAL MEASURES LAND USE CAPABILITY RATINGS LEGAL/ADMINISTRATION INTERPRETATIONS MINERAL POTENTIAL RATINGS MINING FACILITY CRITERIA	ENVIRONMENTAL SENSITIVITIES LAND USE CAPABILITY OWNERSHIP/LEASING MINERAL RESOURCES MINING FACILITIES	2. REGIONAL ASSESSMENT A framework for assessing the requirements and effects of mining.
MINERAL RESOURCE PREDICTION SITE SELECTION CRITERIA LAND USE CAPABILITY RATINGS	MINERAL RESOURCES MINING FACILITIES LAND USE PLAN	3. ALTERNATIVES Integration of factors into a workable set of future choices for action.
IMPACT MODELS LAND USE COMPATIBILITY ADMINISTRATIVE REQUIREMENTS MINING OPERATIONS STRATEGY	ENVIRONMENTAL EFFECTS LAND USE CONFLICTS IMPLEMENTATION/CONTROL PROBLEMS MINERAL LAND USE CONFLICTS	4. EVALUATION Comparison of alternatives and critical review of proposed mining projects.

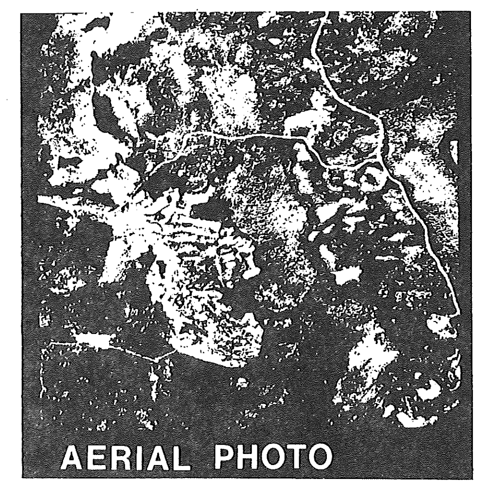
RESOURCE INVENTORY

The initial and most important aspect of the study is the resource inventory. Twenty-four data variables have been developed for the MINESITE project. They describe both natural and cultural resources. The variables are coded using a standard metric grid (Universal Transverse Mercator). Individuals cells are 100 meters square and represent areas of approximately 2.5 acres.




SOIL SAMPLING


ROCK SAMPLING


AERIAL PHOTO

USE OF THE RESOURCE INVENTORY

The resource inventory is the most important aspect of the study because all future evaluations rely on the information as being an accurate and reliable description of environmental conditions. To achieve this goal, each variable includes a description of its use, source of the data, and date and technique of verification. By computerizing data variables, complex computer models can be developed to help assess the complicated environmental relationships in the study area.

ROLE OF RESOURCE SPECIALISTS

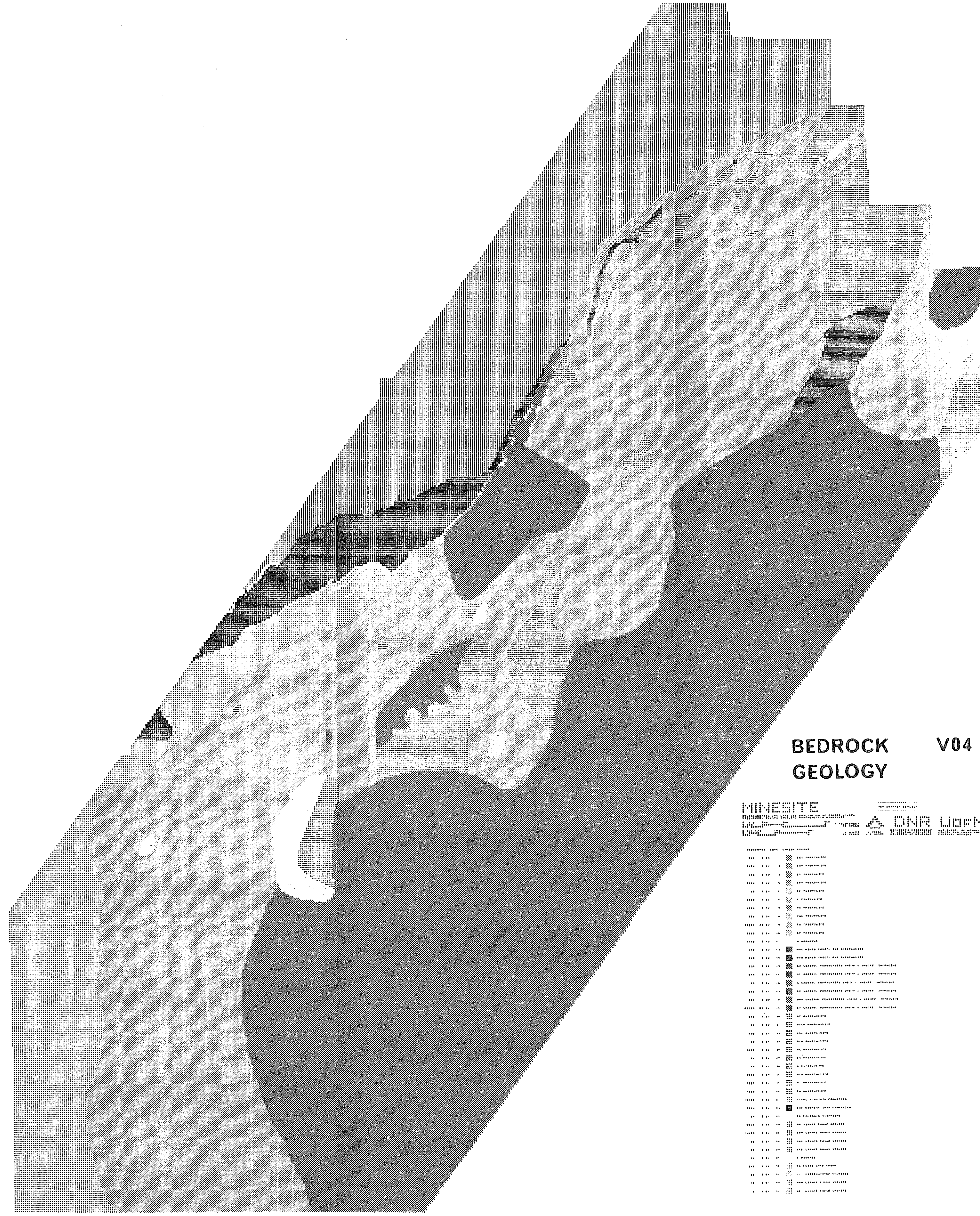
Resource specialists first become involved by recommending the types of variables required and techniques for collecting them. Later, they develop analysis models simulating environmental conditions. Using specialists assures the responsible use of the data and that models will best represent the actual field conditions in the study area.

DATA VARIABLES

- V01 Site Map
- V02 Percent Slope
- V03 Slope Orientation
- V04 Bedrock Geology
- V05 Surface Hydrology
- V06 Watersheds
- V08 Surface Ownership
- V09 Elevation
- V10 Soil Landscape Units
- V11 Depth to Duluth Complex Contact
- V12 Land Use
- V13 Shipstead Newton Nolan-Superior National Forest Areas
- V14 Recreation-Historical-Archeological Sites
- V15 Taconite Reserves and Potential Resources
- V16 Vegetation
- V17 Timber Cutting History
- V18 Crown Density
- V19 Forest Size Classes
- V20 Forest Height Classes
- V22 Lake and Stream Surveys (Fish Habitat)
- V23 Mineral Leasing
- V24 Soil Associations
- V25 Transportation
- V26 Railroads and Utilities

COMPUTER DISPLAY MAP

With the resource information collected, classified, and coded into computer format, it is possible to prepare graphic displays of the data. Maps are produced by a computerized printer which represents each of the cells in a resource class with its corresponding symbol or tone. An example is the bedrock geology map on the facing page. Bedrock geology (V04) includes 41 rock types (resource classes). These have been condensed for display into 11 groups based on economic mineralization potential. Maps include a legend giving total cell counts for each resource class.



REGIONAL

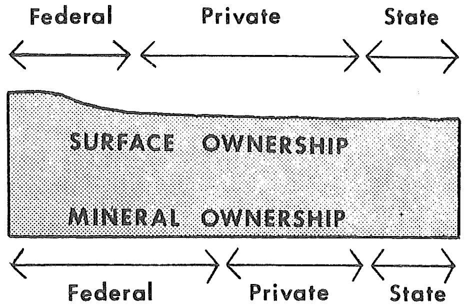
Northeastern Minnesota is well known for its Mesabi Iron Range, a past and present major source of iron ore and taconite for this nation's steel industry. In the last two decades, extensive copper-nickel resources have been discovered in the Duluth Complex. Exploration interest is continuing and further discovery is likely to occur.

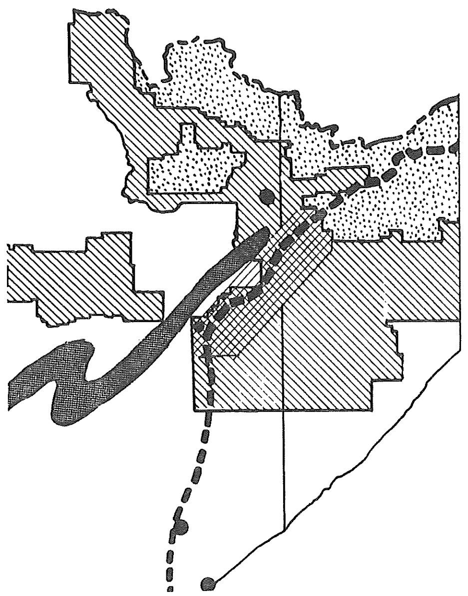
COPPER–NICKEL POTENTIAL

An estimate of copper-nickel resource potential is based upon a combination of factors. These are: bedrock geology; depth to mineralization; and mineral leasing interest. Mineralization seems to be limited to a specific portion of the Duluth Complex, and long-term mineral leasing interest reinforces this. Depth to mineralization is a major limiting factor in copper-nickel mining due to available mining techniques.

TACONITE RESOURCES

Today, magnetic taconite is being mined only by open pit methods in certain intervals of the Biwabik Iron Formation. An advance in technology may someday allow vast underground taconite resources to be mined. This advance may also include a process whereby, for the first time, nonmagnetic taconite resources could be developed.





Mineral Potential Class	TACONITE			COPPER-NICKEL		
	Thickness	Dip Angle (degrees)	Depth (feet)		Geology	Exploration Activity
OP Highest	UC only, UC & LC[1]	-	<1000	0-1000	Troctolitic	High
↓				"	"	Moderate
				"	"	Low[2]
OP Lowest				"	Any D.C. other than troctolitic	Low to High
UG Highest	UC only, UC & LC	<10	≤3000	1000-3000	Any D.C.	High
	"	<10	>3000-<5000	"	"	Moderate
↓	"	>10	≤3000	"	"	Low
UG Lowest	"	>10	>3000-<5000	>3000	"	Low to High

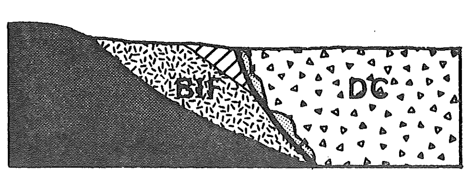
OP = Open pit
UG = Underground

UC, LC = Upper and lower cherty members of the Biwabik Iron Formation.
D.C. = Duluth Complex

[1]Includes present OP areas.
[2]Low includes "none" and terminated leases.

BEDROCK GEOLOGY

Taconite resources are limited to the Biwabik Iron Formation (BIF). In the Hoyt Lakes to Ely area, copper-nickel bearing mineralization is restricted to the base of the Duluth Complex (DC). Mineralization is of a disseminated nature, low in grade, but large in volume. Combined copper and nickel percentages typically may average around one percent, and copper is three or more times as abundant as nickel. Mining development is likely to occur in the base of the Duluth Complex, with open pit limits reaching a depth of nearly 1,000 feet. Underground limits initially may be in the range of 1,000 to 3,000 feet.



LAND OWNERSHIP

Because the separation of surface and mineral ownership is possible, many conflicts in land use have resulted. Surface and mineral ownership patterns do not necessarily coincide, and often do not. Land use conflicts occur when surface and mineral owners are at odds over the compatibility of uses.

Surface – Land in Northeastern Minnesota is used in a variety of ways. A large proportion is owned and managed by Federal and State government for recreational, iron mining, and forestry management uses.

Minerals – Two large areas of federally administered lands, the BWCA and the Superior National Forest (SNF), are managed in distinctly different manners. Mineral exploration, mining, and timber harvesting are prohibited within the BWCA because of its protection as a wilderness recreational area. In contrast, the SNF is host to a diversity of land uses including iron mining, timber harvesting, urban development, industry, and recreation. Even so, it is clear management policy that future land use commitments shall be compatible with environmental concerns.

MINERAL LEASING

Federal and State agencies have the authority to grant permits for exploration and mining on lands under their jurisdiction.

Federal – Prospecting permits allow exploration to be conducted. Preferential rights applications and mineral leases can follow, if eventual mining is contemplated.

State – Adoption of copper-nickel and associated minerals rules and regulations in 1966 made State lands available for exploration and subsequent mining. Since the adoption of these regulations, Minnesota has had one of the most active leasing programs of any area in the country. More than 1,000 State leases have been awarded to date, and over $1,000,000 collected in rental fees. It has been estimated that about $15,000,000 have been spent in exploration on these lands.

MINE FACILITY SITING

Mining facility site alternatives are determined on the basis of accessibility, proximity to the resource, and minimization of land use conflicts and environmental effects. Analytical models combine specific data variables to produce a map of alternative sites for mining facilities.

MINING FACILITIES

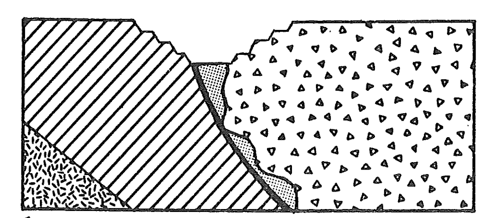
The location of surface facilities is flexible to a certain degree. Through a planning process, one can locate alternatives for the following mining facility components.

1. Processing plant
2. Overburden stockpiles
3. Waste rock stockpiles
4. Lean ore stockpiles
5. Tailings basin/water reservoir

MINING TYPES

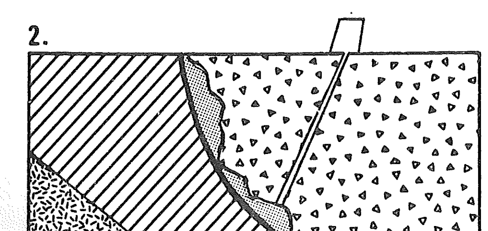
Methods for the mining of copper-nickel ore can be classified into two broad categories:

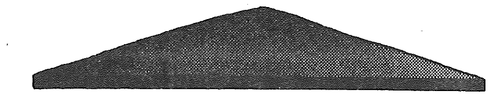
1. OPEN PIT methods, where mineralization occurs in sufficient quantity and grade near the surface.
2. UNDERGROUND MINING systems, where the orebody is too far below the surface to be mined by an open pit method.



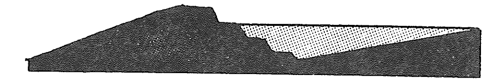
1.

2.

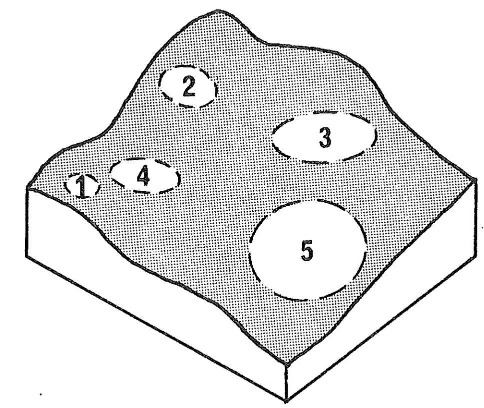




STOCKPILES



TAILINGS BASIN / RESERVOIR



PROCESSING PLANT

A milling process is required to separate the copper-nickel minerals from their host rock and form a concentrate suitable for refinement. The gangue material (waste) is pumped to the tailings basin, while the concentrate is shipped to a smelter. The different phases associated with a processing plant are:

- Secondary crushing of the ore by rotary or small cone crushers (assumes primary crushing at the mine site).
- Tertiary crushing by rod and ball mills to reduce size sufficiently to liberate the copper-nickel minerals from the gangue minerals.
- Flotation of the crushed product to separate the copper-nickel and gangue minerals.
- Removing water from the flotation product by using a concentrate thickener.
- Filtering and drying of the concentrate for storage until time of delivery to a smelter.

SURPLUS MATERIAL STORAGE

Storage of surplus material is required throughout the mining process. Land requirements for the storage of the following materials are often extensive and are strongly dependent on the mining type:

- Overburden is stripped in advance of the hard rock mining and stockpiled for future use in reclamation as a medium for revegetation.
- Waste rock containing minimal or no copper-nickel mineralization requires stockpiling in areas adjacent to potential open pit expansion.
- Lean ore containing submarginal concentrations of copper-nickel is stockpiled for future use.
- Tailings basins serve as a disposal site for the waste material produced during the mineral processing phase.
- Water reservoir storage is used to augment make-up water for the mining and milling processes. A reservoir may be part of a tailings impoundment or a separate unit.

MAGNITUDE OF SURFACE FACILITIES

By assuming production levels for the mining methods, the approximate area requirements of the surface facilities can be estimated. Assuming the average life of a mining operation to be 40 years for open pit operations and 20 years for underground operations, and an average production of 35,000 tons/day for open pit and 20,000 tons/day for underground, the approximate area requirements of the surface facilities for a single operation are as follows (in acres):

	OPEN PIT	UNDERGROUND Type 1	UNDERGROUND Type 2
Processing Plant	80	60	60
Overburden	130	—	—
Wasterock	1,660	20	70
Lean Ore	1,300	—	—
Tailings	4,100	1,170	560

Type 1 = Block caving
Type 2 = Open stoping with backfill

CAPABILITY / IMPACT ANALYSIS

LAND USE CAPABILITY

Land use capability analysis is the determination of development potential for various activities that compete with mining. Included are aesthetics, recreation, wildlife, forestry, and urban development. For each of these activities a model that simulates the land use capability is designed using the resource inventory data. Land use maps can then be produced from the models describing the location and extent of areas most suited for a given land use.

Aesthetics
1. Scenically attractive areas, as defined by landform, vegetation cover, and shoreline of lakes and rivers.
2. Views from major roads and navigable waterways.
3. Existing recreational, historical, and archeological sites.
4. Existing natural features, including unique landforms, virgin areas, etc.

Recreation
1. Existing recreation areas and management plans.
2. Potential camping and picnicking areas.
3. Potential trail areas.
4. Potential canoeing areas.
5. Potential hunting and fishing areas.

Wildlife Habitat
1. Grouse habitat.
2. Deer habitat.
3. Wetland furbearer habitat.
4. Warm and cold water fish habitat and spawning areas.

Forestry
1. Existing harvestable timber volume.
2. Sustained yield.

Urban Development
1. Seasonal recreational housing potential.
2. Urban growth potential.

EXAMPLE: FOREST PRODUCTIVITY

Development of copper-nickel resources could transform large amounts of land from forest production use to mineral extraction. Direct displacement of forest resources by mining and ancillary facilities would remove these forest lands for an indefinite period. The intent of the forest capability analysis is to determine the relative effects mining would have on forest production.

Loss of Short-term Productivity
With a knowledge of the existing forest cover (specie, density, and height) along with forest volume tables, a determination can be made of the volume that could currently be harvested if mining were to occur. This could then be compared to the volume if allowed to grow to maturity. The difference between these two would be the loss of short-term productivity.

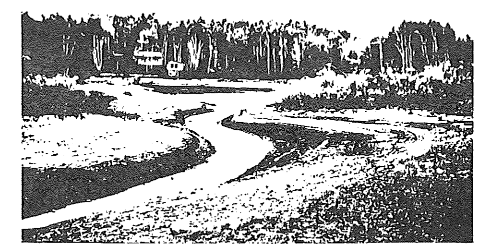
Loss of Long-term Productivity
In order to project productivity, some forest management practices must be assumed. If the ideal forest specie for each soil type is planted or the current specie is assumed, a projection of future forest volumes can be made. A map of long-term productivity would aid in siting and evaluating mining facilities.

Relative Regional Productivity
The regional context for MINESITE considers the forest productivity within the study area compared to the regional productivity. This is done by using MLMIS statewide data with forty-acre grid cell resolution. This analysis puts the detailed forest capability into a larger geographic perspective.

EXISTING HARVESTABLE TIMBER VOLUME

VALUE	MAP SYMBOL	% OF SITE	NO. OF CELLS	NO. OF ACRES	CU. FT. X 10^6	CORDS X 10^3 PULP	CORDS X 10^3 SAW	MBF X 10^3 SAW
HIGH		27.8	40266	99577	158	307	923	462
MEDIUM		16.9	24546	60702	64	442	59	30
LOW		30.9	44881	110990	82	639	X	X
NONE		22.8	33045	81720	X	X	X	X
NO DATA		1.6	2259	5587	X	X	X	X

Low = 550 - 925 CuFt/Acre Medium = 926 - 1300 CuFt/Acre
High = 1301 - 1675 CuFt/Acre
Cords (Saw) = only trees >50 ft. in height
Mbf = only trees >50 ft. in height
128 cubic feet = 1 cord 2 cords = 1,000 board feet (Mbf)
Mbf = thousand board ft. No Data = no data on CuFt/Acre



POTENTIAL ENVIRONMENTAL IMPACT

Impact analysis is a method of predicting the effects of mining activities on environmental systems. Each of the environmental systems can be rated for sensitivity to pollution or disruption by mining activity. Models develop the relationships between the intensity of mining operations and the sensitivity of air, water, and land systems.

Air
1. Air pollutant sensitivity.
2. Noise and vibrations.

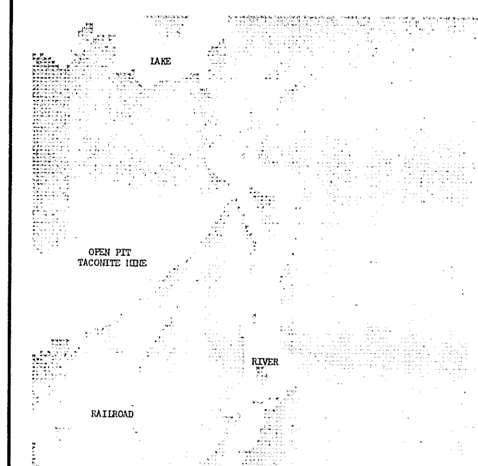
Water
1. Water availability.
2. Discharges into surface and ground water.
3. Effect on water level fluctuations.
4. Sedimentation and critical slopes.
5. Off-stream storage capacities.

Land
1. Slope stability.
2. Erosion potential.
3. Revegetation potential.
4. Runoff sensitivity.
5. Subsidence.

EXAMPLE: WATERSHED MANAGEMENT

The quality/quantity of water is altered when used in ore processing. This example comments on water availability, which is the potential for withdrawal from lakes and streams, either directly or by watershed reduction, to provide make-up water in mineral processing.

Tailings Basins/Storage Reservoirs
A single facility can serve tailings disposal and water supply. The site selection phase for such facilities is a screening process to identify eligible and technically feasible sites. The impact evaluation phase is the measure of environmental effects of each of the alternatives.



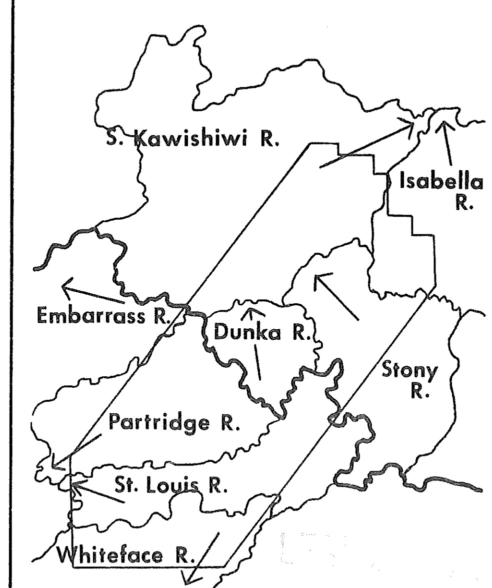
SITE SELECTION

Step 1 — Areas unable to accomodate tailings basins/reservoirs are identified. Among the factors considered are urban areas, certain streams and lakes, areas with administrative restrictions, and areas with high potential for open pit taconite or copper-nickel mining.

Step 2 — Eligible areas are further screened, based on desired area, volume, and perimeter ratio, to determine alternatives that are technically feasible.

IMPACT EVALUATION

Tailings basins/reservoirs are evaluated against each of the impact models as well as the land capability results. In each of these impact evaluations a model of sensitivity is prepared for the entire study area. As an example, water availability is assessed for each watershed in terms of land area, low flow, average flow, and (a worst case condition) percentage of water to be withdrawn relative to low flow. From this analysis it is apparent that there is an excess of water throughout the study area, although some of the headwater areas are more susceptible to impact. If no other water source is available, these sites would require storage reservoirs for collecting water during high periods of runoff to moderate the effects of withdrawal in low flow seasons.



Watershed / Characteristics	Dunka	Stony	S. Kawishiwi	Birch Lake Total	Partridge	Upper St. Louis	St. Louis @ Hoyt Lakes
Area (sq. mi.)	53	180	250	483	140	138	378
12 mo. low flow (cfs)	18	63	339	420	49	97	146
Avg. flow (cfs)	37	127	437	601	100	99	199
% make up water vs. low flow	50.0	14.4	2.7	2.1	18.3	9.3	6.2

ALTERNATIVES

One function of the MINESITE Project is to develop a framework plan which sets forth a set of alternatives for mineral development. The plan attempts to minimize environmental effects, ownership problems, and land use conflicts, while at the same time maximizing the utilization of mineral resources and location of mining facilities.

MINERAL RESOURCES AND MINING FACILITY REQUIREMENTS

Sites are rated for their mineral potential as well as their suitability for mining facilities.

ENVIRONMENTAL SENSITIVITIES

Sites are rated according to their sensitivities to pollution or disruption of air, water, or land systems.

LAND USE CAPABILITIES

Sites are rated according to their capability for other land uses including aesthetics, recreation, wildlife, forestry, and urban development.

FRAMEWORK PLAN

MINERAL RESOURCES

Prediction of mineral potential areas for underground and open pit mining.

MINING FACILITIES

Identify site alternatives for plants, tailings basins, reservoirs, and stockpiles.

LAND USE PLAN

A compatible land use and resource management plan.

A second function of the MINESITE Project is to evaluate specific mining proposals. The proposed mining facility plans could be checked against the framework plan as well as the four decision factors that were used to develop it. The results of this evaluation become useful when preparing environmental impact statements or reviewing permit applications.

PROPOSED MINING PROJECT

Anticipated projects or industry-initiated plans including excavation, processing, waste disposal, and water management can be reviewed.

MINERAL LAND USE CONFLICTS

Locational conflicts between the proposed mining facilities and areas of potential mineral resources can be identified and resolved.

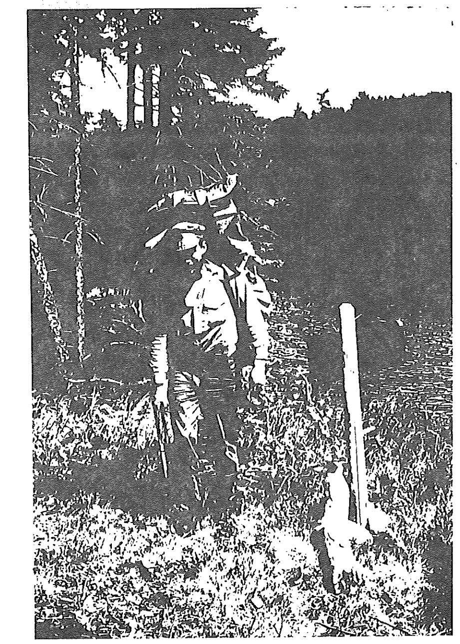
ENVIRONMENTAL EFFECTS

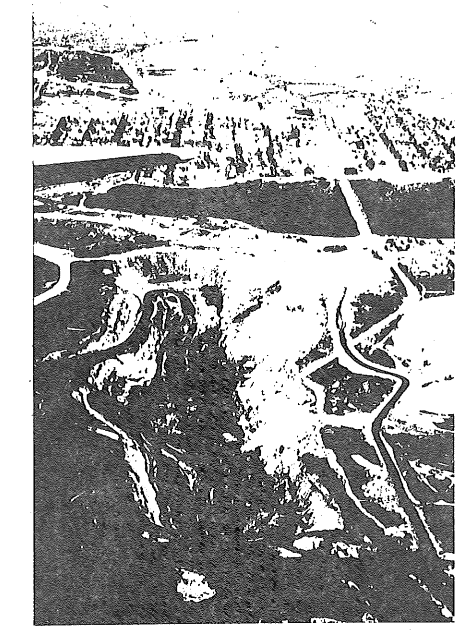
Impacts of specific proposals can be located and quantified so that plans can be modified, if necessary, to minimize effects.

LAND USE CONFLICTS

Competition with other land uses and the resource management issues on public land must be reviewed.

EVALUATION





RESOURCE INVENTORY

Information is compiled from maps, topographic surveys, aerial photographs, and land records. A series of maps describe the geographic location and extent of natural and cultural resources. This data is coded into computer format by assigning numeric codes within grid cells. This data is then stored in a computer and can be combined, manipulated, and displayed by a printer as symbols or tones.

CAPABILITY/IMPACT

Land use capability analysis is the determination of development potential for activities that compete with mining. Included are aesthetics, recreation, wildlife, forestry, and urban development. Impact analysis is a prediction of the effects of mining activities on environmental systems. Models develop the relationships between the intensity of mining operations and the sensitivity of air, water, and land systems.

ALTERNATIVES/EVALUATION

One function of the MINESITE Project is to develop a framework plan which sets forth a set of alternatives for mineral development. The plan attempts to minimize environmental effects, ownership problems, and land use conflicts, while at the same time maximizing the potential of mineral resources and location of mining facilities.

A second function of the MINESITE Project is to evaluate specific mining proposals. The proposed mining facility plans can be checked against the framework plan as well as the four decision factors that were used to develop it. The results of this evaluation become useful when preparing environmental impact statements or reviewing permit applications.

SUMMARY

MINESITE STAFF

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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

U.S. Forest Service
Department of Agriculture

OTHER ORGANIZATIONS ACTIVE IN COPPER–NICKEL STUDIES

Copper-Nickel Project
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Department of Natural Resources
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Minnesota Geological Survey
University of Minnesota

Superior National Forest
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U.S. Bureau of Mines
Department of the Interior

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