This document is made available electronically by the Minnesota Legislative Reference Library as part of an ongoing digital archiving project. http://www.leg.state.mn.us/lrl/lrl.asp

NATURAL RESOURCES RESEARCH INSTITUTE

for the

Orderly Development of Minnesota's

Mineral, Biomass and Water Resources

April 1983

CONTENTS

I. A HISTORICAL PERSPECTIVE OF NATURAL RESOURCES AND NORTHERN MINNESOTA'S ECONOMY

Natural resources have always been the mainstay of northern Minnesota's economy. At first, these resources were relatively easy to extract and market. The great white pine forests of northern Minnesota provided millions of homes for the nation's burgeoning population; iron ore--then pure enough to be fed directly to smelters--built our factories and machines and made our country the most potent industrial force the world has ever known. Northern Minnesota's vast network of rivers and lakes carried timber to the mills. And Lake Superior--2900 cubic miles of fresh water--was a readymade highway for shipping iron ore to blast furnaces in the East.

The nation's appetite for northern Minnesota's natural resources eventually depleted the red ore and the white pine forests. But, commitment and ingenuity found new ways to use the region's resources. Development of the taconite process revived iron mining. Better forest management practices ensured a continuing supply of wood. Rivers and lakes which once carried only logs and occasional travelers began attracting tourists and sportsmen in increasing numbers. And the opening of the St. Lawrence Seaway expanded Lake Superior's water highway to destinations around the globe, making Duluth a first class world port. The region began to manage natural resources for the benefit of the entire state. By 1980, northern Minnesota was contributing $3.4 billion to the state's estimated $43 billion gross product. Of this total, taconite accounted for $1.3 billion, wood products $430 million, transportation (much of it moving natural resources) $400 million, tourism (based on the region's natural resources) $100 million.

II. NATURAL RESOURCES AND THE CURRENT STATE OF NORTHERN MINNESOTA'S ECONOMY

Just as northern Minnesota was beginning to enjoy stable prosperity, disaster struck in the form of world recession and rapidly changing trade patterns. Hardest hit was the taconite industry, backbone of the region's economy. Beseiged by lower-priced imported steel, the U.S. steel industry quickly lost sales. With a drop in demand for domestic steel, northern Minnesota's taconite facilities (which supply 64 percent of domestically mined ore) began slowing down and shutting down. The taconite industry's distress then rippled to other, supporting sectors of the region's economy. In 1980, the region employed 116,476 people who earned $1.6 billion in gross wage and salary income. By October 1982, employment in northern Minnesota fell to a yearly average of only 105,000. The unemployment rate rose to 20 percent of the regional labor force. The 11,000 lost jobs resulted in a $240 million loss in Gross Regional Product. Iron Range communities have been especially hard hit, leaving some Range communities with unemployment levels of more than 80 percent.

Other economic setbacks not directly related to mining have recently occurred. In Duluth, the United States Air Force closed the Duluth base, causing the loss of approximately 3,000 jobs with an annual payroll of $38 million. Jeno's Incorporated has relocated its frozen pizza-making operations from Duluth to Wellston, Ohio, adding 1,300 to the list of lost jobs.

Little imagination is needed to comprehend the serious impact of these economic ills on the region. Retail sales are down, new car sales are at their lowest level in 25 years, public services are being taxed to the limit, soup kitchens have reopened after having been closed since the depression, new home starts are almost non-existant, and the availability of existing homes for sale is at a monthly level equal to the total amount annually available in recent years past.

III. LOOKING TOWARD THE FUTURE: An Inventory of Natural Resource Potential

The minerals, forests and water of northern Minnesota have always been the basis for the region's economy. Despite current setbacks, these same natural resources will continue to play the most important role. The only question that remains is whether or not the state can marshal the cooperation and effort necessary to create new opportunities for natural resource development. Decades ago, when the red ore and the white pine forests were depleted, many wrote off the region's future. Ingenuity and commitment proved the cynics wrong then. This same ingenuity and commitment, coupled with development of new technologies, can prove them wrong again.

The natural resources which nutured northern Minnesota's communities and businesses are still plentiful. The inventory of potential is staggering: millions of board feet of timber; untapped minerals of copper, nickel, zinc, gold, silver, titanium, vanadium, and cobalt; seven million acres of peat lands totaling more than 50% of the U.S. supply; hundreds of millions of tons of taconite; billions of gallons of fresh, pure water.

Minerals--Private industry and public organizations (including the University) continue to look for new ways to extract and process northern Minnesota's vast mineral resources. Reserve Mining Company, to cite just one example, spent $123 million between 1977 and 1980 in a successful effort to become more competitive by improving pellet quality. Other private and public interests are conducting research and exploration programs on taconite and other minerals, but more work needs to be done to fully develop these resources.

Biomass Energy--Northern Minnesota contains extensive deposits of peat. Used extensively in Europe, the peat industry employs 100,000 people there. As one of Minnesota's most promising products, peat is now being studied by a number of private and public individuals and organizations. If properly developed, peat could be used as an energy source for existing and future energy-intensive natural resource industries, as well as for homes and factories. But peat production is also an environmentally sensitive process; therefore, more research is needed to assure sound development practices.

Several small companies in northern Minnesota are struggling to bring another biomass energy source--wood waste--onto the market. Utilizing chips and bark from forest harvesting operations, these entrepreneurs have sold wood waste in the form of pellets to 20 schools in the region, including the College of St. Scholastica. The City of Floodwood's school district changed from oil to wood products last year. With a $42,000 conversion investment, Floodwood saved $39,000 in heating costs the first year.

The Seaway Port Authority of Duluth recently commissioned a study which concluded that export of wood pellets to fuel-starved third world countries is feasible. In addition to these projects, substantial possibilities exist for developing biomass resources into higher value products such as solvents, adhesives and lubricants.

Water--One of northern Minnesota's most visible and distinctive natural resources is water. The abundance of lakes and rivers is generating substantial economic activity from tourists and sportsmen, and water is essential for the continuation of northern Minnesota's taconite, paper and other industrial activity. Water can play a key role in attracting new industry as companies based elsewhere face increasing shortages.

Forest Products--Northern Minnesota has had an active lumber and papermaking industry for many years. In recent years, however, research has led to new uses of our renewable forest. One relatively new forest product, waferboard, is emerging as an economical construction-grade substitute for more expensive western plywood. Several waferboard plants are now operating full-time in the region. Waferboard is made from previously scorned, but plentiful aspen trees. Industry research is continuing to look for ways to upgrade waferboard and produce it even more economically.

IV. RESEARCH AND ECONOMIC DEVELOPMENT

Despite tremendous potential, research activities on Minnesota's natural resources are largely uncoordinated, inadequate and, in some cases, nearly non-existant. If the State of Minnesota -- along with labor, industry and the University -- were to establish economic development of our natural resources as a top priority, both the state and region would benefit.

To illustrate the importance of research, we only need to review the effort undertaken by government, industry and labor and the University of Minnesota to develop the current taconite industry. During the 45-year period 1910-1955, industry, government and the University spent an average of $70,000 per year developing the taconite process. In 1982 dollars, accounting for inflation, this research represented an investment of $19.3 million. But what has the payoff been? This research eventually resulted in a whole new industry which annually produces $1.3 billion in gross state output. Each year, the rate of return on this cooperative endeavor is over 6,000 percent. By comparison, the steel industry, the State of Minnesota and the University have spent less than $500,000 in investigating the potential of a steel industry in Northeastern Minnesota.

If research can unlock the practical and economic blocks to the establishment of a steel industry in Minnesota, the use of biomass as an alternative energy source, or the use of other mineral or natural resources, the payoff may be as large, or greater than what the state has received from the taconite industry. For example, the establishment of a regional, mini-steel industry based in northern Minnesota would result in an annual increase in gross regional and state product of $2.8 billion, measured in 1977 prices. Current research in biomass shows that there may be an energy industry which could have a direct sale of $2.6 billion per year if current technological, market and economic problems can be solved. Our water resources also need to be studied more extensively. As the nation's aquifers dry up, and they are at an alarming rate, the country's thirsy eyes are converging on us and other water rich areas. Already, a proposal exists which calls for a pipeline between Lake Superior and Gillette, Wyoming, which, if realized, would draw 4 billion gallons of water per year. How should we respond? We must step up our research in this area so we can be in a strong position in what will surely be a national discussion.

The proposed Natural Resources Research Institute would strengthen and better organize these and other efforts to more effectively develop the abundant natural resources of northern Minnesota -- for the benefit of the region and the state.

V. THE NATURAL RESOURCES RESEARCH INSTITUTE

A. Objectives

The Natural Resources Research Institute will preserve and create new opportunities for developing the natural resource potential of northern Minnesota. Although the mainstays of the northern Minnesota economy will likely continue to be taconite and timber products, the Institute will create innovative programs to develop or expand the use of other resources as well; including copper, nickel, zinc, gold, silver, titanium, vanadium, cobalt, peat, biomass energy and water. All of these natural resources are under-utilized.

Although research is presently being conducted on these resources, it is geographically dispersed, essentially uncoordinated, and often the emphasis is upon basic rather than applied research and product development. The Institute will bring many of these now uncoordinated research activities together, in one facility, where the development of marketable products can be pursued close to the resources. In addition, the Institute will serve as a clearing house, compiling and indexing information concerning research which is being conducted by private and public parties in the region and elsewhere. The most critical objective of the Institute will be the creation of new jobs--for the region and the state.

B. Organization and Administration

The Natural Resources Research Institute will be divided into four major divisions which have been defined by the four most important classes of natural resources available in Minnesota: (1) minerals, (2) water, (3) biomass, and (4) energy. The organizational framework of the Institute is headed by a director who reports directly to the Provost of UMD. In addition, an advisory board will be established to provide input and consultation to the director regarding the plans of the Institute. The director will be responsible for administration, planning, fund raising, and overall efficient management of the Institute. Under the director will be one division chief for each of the four major resource areas. Each will be responsible for administration, planning, grant writing, and overall management of their respective divisions.

It is anticipated that the director will be a full-time administrator who has considerable research and management experience in a wide variety of resource areas. In contrast, the division chiefs will have responsibilities both in program administration and also will be in research activities. Considerable flexibility should be allowed in activities for both the director and division chiefs in order to attract some of the best people in these fields, and also to enable a variety of viable possible research lines to be explored. The director and division chiefs in consultation with UMD administration and the advisory board will develop the structure and personnel composition of the respective units.

The Natural Resources Research Institute will form a new unit within the University. However, both personnel and functions of the Institute will receive support from a variety of programs currently within the University. For instance, the Lake Superior Basin Studies Center (LSBSC) of UMD has water chemistry and geo-chemistry laboratories which can provide technical assistance and support capabilities to the Institute. Similarly, the Bureau of Business and Economic Research (BBER) at UMD can provide support in areas such as evaluation of the economic viability of products developed at the Institute. Furthermore, it is plausible that many of the personnel hired at the Institute will have capabilities which could foster an expansion of the teaching and research mission of the University.

The Institute staff is not expected to have any continuing instructional commitment at UMD, but the interaction between UMD faculty and students, and the Institute staff shall provide strong enrichment to both populations. Both undergraduate and graduate students from UMD create a trained or readily trainable source of research assistants for the Institute. In addition, the student assistants will gain invaluable research experienc which helps develop their capabilities and provides experience helpful in gaining employment. The professional level interactions with UMD research faculty consulting or even directly involved in projects and the corresponding resource support provided UMD by Institute staff will complement and enhance the effectiveness and productivity of both groups. In addition, the current UMD staff is available to develop research programs necessary to begin the Institute's research while Institute's staff is being recruited.

1. Minerals Division

This will be the largest unit within the Institute because it is associated with the resources that have greatest potential for economic benefit to Minnesota. Although the technologies associated with taconite development are relatively advance, it is anticipated that the Institute personnel will explore the possibilities for the use of low grade ores which are abundant, yet not economically feasible at the current time. Northern Minnesota is also known to have deposits of copper, nickel, zinc, gold, silver, titanium, vanadium, and cobalt which have obvious possibilities for development. In essence, the Minerals Division will be expected to work with private industry and University personnel to develop technology for extraction, reduction, production, and marketing of the most economically viable mineral products available in Northeastern Minnesota. The scope of the research activities will be to expand or refine existing operations to whatever extent possible and also to explore and develop other potential resourse possibilities.

Minerals Division Projects

Iron Ore

1. Investigate and develop innovative methods for taconite breakage.
   a. Crushing
   b. Grinding studies to reduce wear of grinding media and reduce energy costs. Major energy use in mining is for grinding the ore
2. Improve screening techniques. Development of screens for fine particle separation.
3. Improve pellet quality to meet foreign competition. Develop reliable testing methods to determine high temperature breakdown, low temperature breakdown and reducibility. Improve pellet quality.
4. Develop new and novel methods to utilize taconite tailings.
5. Develop new processes for recovery of iron from oxidized taconites.
6. Develop new processes for recovery of iron from lower grade crude ores than currently being mined.
7. Improve recovery of iron from taconites.

Other Minerals

1. Develop and investigate methods to recover copper, nickel and precious metals, such as symbiotic bacteria leaching, liquid ion exchange, base metal leaching for precious metals.

2. Investigate environmentally safe smelting of copper and nickel ores.

3. Develop and investigate methods to recover manganese from the Cuyuna Range manganiferrous ores.

4. Investigate the Duluth gabbros for potential recovery of olivine, ilmenite and feldspar.

5. Examine potential of Cook and western St. Louis Counties clay as a partial replacement for bentonite.

6. Examine potential of developing cobalt and uranium in Minnesota.

Other

1. There is a great need for a technical information center. Whereby information, reports and studies are filed from all sources. Retrieval of information by computer.

2. Electron microscopy for small particle identification.

3. Pilot plant facilities are required to test new processes, new equipment and verify basic research and bench-scale testwork.

4. To develop mineral deposits, effect changes to existing facilities, develop new products and processes it is essential that economic evaluations are conducted. We must be cognizant and up-to-date on freight charges, fuel costs, end use of new products and sensitivity of the markets for products, not only on a domestic basis but on the international scene.

5. Have the capability to study and review environmental effects of the industry from the technical standpoint.

6. Develop computer applications for process control.

2. Biomass Division

Northeastern Minnesota has extensive deposits of decayed organic matter (peat) and extensive areas of standing crops in the form of trees, shrubs, cattails, and a variety of other vegetational life forms. Although northeastern Minnesota has an active timber industry that produces lumber, construction materials, and paper products among other goods, the present forestry resources are under-utilized. In the National Forests, for instance, extensive stands of aspen are over-mature because of a lack of demand for this species of tree or because of access problems. A variety of potential uses for these biomass products have been identified but the development of technology for the expanded use of these products in northern Minnesota is limited. Among the most readily identifiable possibilities for exploration and expansion of the economic use of these resources are energy production such as in the gasification of biomass, the use of wood chips, and the production of liquid fuels. However, the opportunities for development of higher value products such as solvents, adhesives, and lubricants may be substantial.

Research within the biomass division of the Institute will focus on the areas listed below. However, the specific priorities in direction of research will be determined on the basis of (1) recommendations of an advisory committee comprised of local, state, and national experts in representative fields; (2) consideration of the economic feasibility and the environmental problems associated with the end-products of the research activities; (3) the technical expertise of the individuals subsequently employed in this division of the Institute; and (4) the availability of funds and extent of cooperation from private industries.

Biomass Division Projects

1. Energy production - the resources of northeastern Minnesota have the potential to produce energy from biomass like aspen, peat, and cattails;

    a. Gasification and the production of methane, including anaerobic digestion

    b. Pelletization and briquetting

    c. Direct combustion - bulk handling machinery

    d. Production of liquid fuels such as methanol and ethanol

2. Wood products - expand the use of existing timber products and develop uses for under-utilized species.

    a. Construction materials - fiberboard, particle board, veneers, and lumber

    b. Paper products

3. Feedstuffs

   a. Roughage food supplements

   b. Cattle feed - muka

   c. Steamed aspen

4. Horticultural and agricultural uses

   a. Soil conditioners, additives, sod, and fertilizers

   b. Landscape materials

5. Others - includes a wide variety of potential uses of the natural resources of northern Minnesota that could lead to the development of higher value products and multiple-product industries (e.g., from peat);

   a. Production of bitumens that are used to synthesize waxes, steroids, adhesives, paints, lubricants, and medicines

   b. Production of carbohydrates for yeast cultures

   c. Development of exudates from coniferous trees to produce petrochemicals and other by-products (e.g., turpentine and wood)

   d. Production of humic acids for use as root stimulants, pest controls, and fertilizer additives

   e. Production of peat coke for use as activated-carbons in steel manufacturing, peat tar, solvents, and grease

3. Water Division

Minnesota's lakes and rivers provide innumerable opportunities and support for the recreation and tourism industry. Therefore, the pressures for the protection of this resource are substantial. In contrast, the potential for the development of prudent schemes for use of the water resources of Minnesota is substantial, but has not been explored to a significant degree. The potential areas to be considered with respect to this resource include the use of water for irrigation or for consumption not only locally but also regionally or nationally. Other possibilities include the areas of aquaculture, fisheries development, and energy production.

Research will focus on several regional issues simultaneously. Within each research area, specific projects will address priority subjects as determined by local, regional and state advisors.

Water Division Projects

1. Economic Development and Utilization
    a. Slurry pipeline utilization and western coal
    b. Water export feasibility
    c. Industrial reuse of waste water
    d. Industrial cooling and reuse
    e. Trans-shipment of bulk commodities through the Twin Ports
2. Energy Production
    a. Atmospheric and aquatic pollution from coal-fired electric generation plants
    b. Reclamation and reuse of heated waters from power generation
    c. Water user conflict resolution associated with siting, constructing and generating energy conversion facilities and mining operations
    d. Hydropower and pump-back feasibility
3. Water Quality
    a. Sediment Transport processes
    b. Acid rain, public health and the aquatic environment
    c. Disposal of municipal and industrial wastes
    d. Land use drainage effects

4. Recreation and Tourism

   a. Development of public and private water-based recreational facilities in urban settings

   b. Regional integration of water-oriented activities and services

   c. Seasonal development of water and winter recreational activities

   d. Planning and development of the Duluth waterfront

5. Fish and Wildlife

   a. Functional and economic value of wetlands including ecological and hydrological mechanisms that influence their integrity

   b. Instream flow necessary, both quality and quantity to maintain an active and viable aquatic biota

   c. Fishing habitat evaluations oriented toward increased fish production for streams, rivers and lakes

   d. Potential for increased waterfowl production

4. Energy Division

The Energy Division is a necessity for the Natural Resources Research Institute because of the significant impact that energy has on the development of processing of many natural resources. In addition, several new sources of energy, particularly biomass and possibly water, require new technologies to transform these materials into usable energy forms. Also, the development of various minerals is energy intensive. The grinding and separation of the usable mineral from its tailings requires large amounts of cheap energy. The further processing of minerals into metals or chemicals requires more energy. Therefore, energy research is an integral part of the Natural Resources Research Institute.

C. Facilities and Location

The Natural Resources Research Institute would be housed in the Semi-Automatic Ground Environment building, located on the recently abandoned Duluth Air Force Base. The SAGE building is located approximately seven miles northwest of downtown Duluth, is readily accessible to the University of Minnesota-Duluth campus, and is adjacent to the commercial airport serving the area. It is important to note that a new building of comparable size would cost an estimated $6.5 million to construct.

The SAGE building was constructed in 1955-56. Considering its age, the building and equipment are in very good condition. The basic building structure consists of reinforced concrete floor slabs, columns, beams, and exterior walls. Exterior walls are constructed of 10 inch thick reinforced concrete with one inch rigid insulation, faced with 4 inch concrete block on the interior. Interior partitions are generally demountable type units with concrete block walls enclosing mechanical equipment rooms, stairways, elevator, toilet rooms, and special areas.

The building and grounds compound is enclosed with security cyclone fencing and electronic gates. The entire area within the compound is paved providing ample parking and storage of materials. The building has a loading dock at the elevator as well as overhead doors providing access to the building for vehicles. The building's elevator has a 16,000 pound capacity with a 10'x16' cab which has the capability to transport forklifts and other motor vehicles. The Power House portion of the building, first floor, has a rolling crane which runs the full length of the building. The clear floor to structural ceiling heights in the building are as follows:

22'0" at the Power House Area, First Floor
17'0" First Floor
13'0" Second Floor
19'0" Third Floor
16'0" Fourth Floor

The existing electrical systems are in very good condition and consist of: 500 kVA transformer, three generator switchgear units, power supply system, two power panels on each floor, and associated circuits for lighting panels and convenience outlets as well as electrical system supplying the refrigeration and air handling.

The existing mechanical systems were also found to be in good condition. They consist of building ventilation, water chiller, air conditioning, air distribution system, two oil-fired low pressure steam boilers, automatic temperature control, underground fuel oil storage tanks, plumbing and heating piping systems.

Reuse Conclusions

In appraising the SAGE building and site as a reuse facility for the proposed Natural Resources Research Institute, it is apparent that the building and site, including the electrical and mechanical systems, are very adaptable; and the implementation of this proposed reuse could be accomplished with minor renovations and modifications. The site is adjacent to a major trunk highway and routes to targeted resource areas as well as being in proximity to UMD, the airport, and other areas of the city.

The building would be renovated and modified, ready for implementation of laboratory equipment, pilot plants, and support facilities as follows:

Building Exterior

Would be wrapped in an envelope of two inch rigid insulation board faced with reinforced resin/portland cement and exposed aggregate finish.

Demolition of certain partition walls and related patching.

Patch and fill in existing duct openings in ceilings and floors.

New floor covering.

New suspended ceilings.

Minimal--new concrete walls, doors, frames, and hardware.

Painting and refinishing of interior surfaces. (All existing entrances, stairways, toilet rooms, janitors' rooms, and certain mechanical equipment rooms are to remain as they exist.)

Modification of ventilating, air conditioning, heating and plumbing systems.

Modification of electrical systems.

New lighting, electrical panels, and convenience outlets as required.

Assignment of Areas Within the Complex

First Floor: 42,548 gross sq. ft. 33,000 net renovated sq. ft.

Minerals and Biomass Handling Facilites
Bulk handling
Pilot plants
Energy conversion
Field laboratories
Storage
Heavy equipment
Power plant and electrical power source

Second Floor: 23,256 gross sq. ft. 21,000 net renovated sq. ft.

Applied Research and Experimental Laboratories
Minerals
Timber
Peat
Water

Third Floor: 23,256 gross sq. ft. 6,000 net renovated sq. ft.

Office and Clean Laboratories
Note: Most of the existing rooms and partitions on this floor will be used as they presently exist.

Fourth Floor: 23,256 gross sq. ft. 21,000 assignable sq. ft.

This floor is unassigned
Available for future related uses.
No renovation will be done on this floor at this time.

D. Budget

The proposed costs for converting the existing SAGE building on the former Air Force Base in Duluth into a Natural Resources Research Institute are estimated for the biennium. It is expected that costs will be highest during the first year when remodeling and laboratory development will occur. The progression of hiring personnel will first include the director, who will then develop the Institute in conjunction with the Provost and the Advisory Board. It is especially critical that the director have flexibility and authority to develop the most efficient operation that he/she sees fit. Therefore, the director will need to be hired in conjunction or preferably before most remodeling and laboratory development plans are finalized. Hiring of additional personnel will then lag behind the construction phase and likely will be primarily completed during the second year.

Fiscal Year 1983-84

Acquire and rehabilitate SAGE building (including fixed equipment)	$ 3,000,000
Purchase of additional equipment	2,000,000
Essential operating expenses for biennium.	3,000,000
TOTAL Fiscal Year 1983-84	$ 8,000,000

MINERALS DEVELOPMENT COMMISSION COMMITTEE

J. H. DeLuca - Chairman
Abe W. Mathews Engineering Co. - President
555 West 27th Street
Hibbing, Minnesota 55746
218-262-3465

Jack Rowe
Minnesota Power - President
30 West Superior Street
Duluth, Minnesota 55802
218-722-2641

Dick Maki
AFL-CIO-Local 1091 - Business Agent
2002 London Road
Duluth, Minnesota 55812
218-728-5151

Art Samuel
Reserve Mining Company - Assistant to the President
Silver Bay, Minnesota 55614
218-226-6200

Dennis Dunne
First National Bank - President
230 West Superior Street
Duluth, Minnesota 55802
218-723-2600

Robert Frans
The Hanna Mining Company
Research Lab - Director
Box 67
Nashwauk, Minnesota 55619
218-885-1951

Thomas A. Vecchi A.I.A.
Thomas & Vecchi, Inc. - President
1518 East Superior Street
Duluth, Minnesota 55812
218-724-8802

Tom Smrekar
Potlatch Corporation - Manager Wood Products Division
Box 510
Cloquet, Minnesota 55720
218-879-1011

Donald Grubich
IRRRB - Research Director
Post Office Box 441
Eveleth, Minnesota 55734
218-744-2993

Clifford Niemi
U. S. Steel Corporation - Engineering Research Director
Post Office Box 417
Mountain Iron, Minnesota 55768
218-749-7200

John Basso
Pickands Mather & Co. - Research Director
Post Office Box 278
Hibbing, Minnesota 55746
218-262-3461

Dr. Donald Harris
U.M.D. - Vice Provost
413 Administration Building
Duluth, Minnesota 55812
218-726-7578

Doug Johnson
State Senator
State Capitol
St. Paul, Minnesota 55155
612-296-8881

Sam Solon
State Senator
State Capitol
St. Paul, Minnesota 55155
612-296-4188

Judge Gerald W. Heaney
U. S. Circuit Court of Appeals
Federal Building
Duluth, Minnesota 55802
218-727-6922 Ex-Officio Member

Robert Heller
U.M.D. - Provost
Administration Building
Duluth, Minnesota 55812
218-726-7106 Ex-Officio Member

Charles Westin
NEMDA - Executive Director
800 Alworth Building
Duluth, Minnesota 55802
218-722-1484 Ex-Officio Member

Mike Jaros
Mineral Development Commission
Executive Secretary
400 City Hall
Duluth, Minnesota 55802
218-723-3400

ENDORSED BY: Minnesota Business Partnership
Minnesota Wellspring
Northeastern Minnesota Development Association
Lake Superior Industrial Bureau
Duluth Area Chamber of Commerce
Duluth AFL-CIO