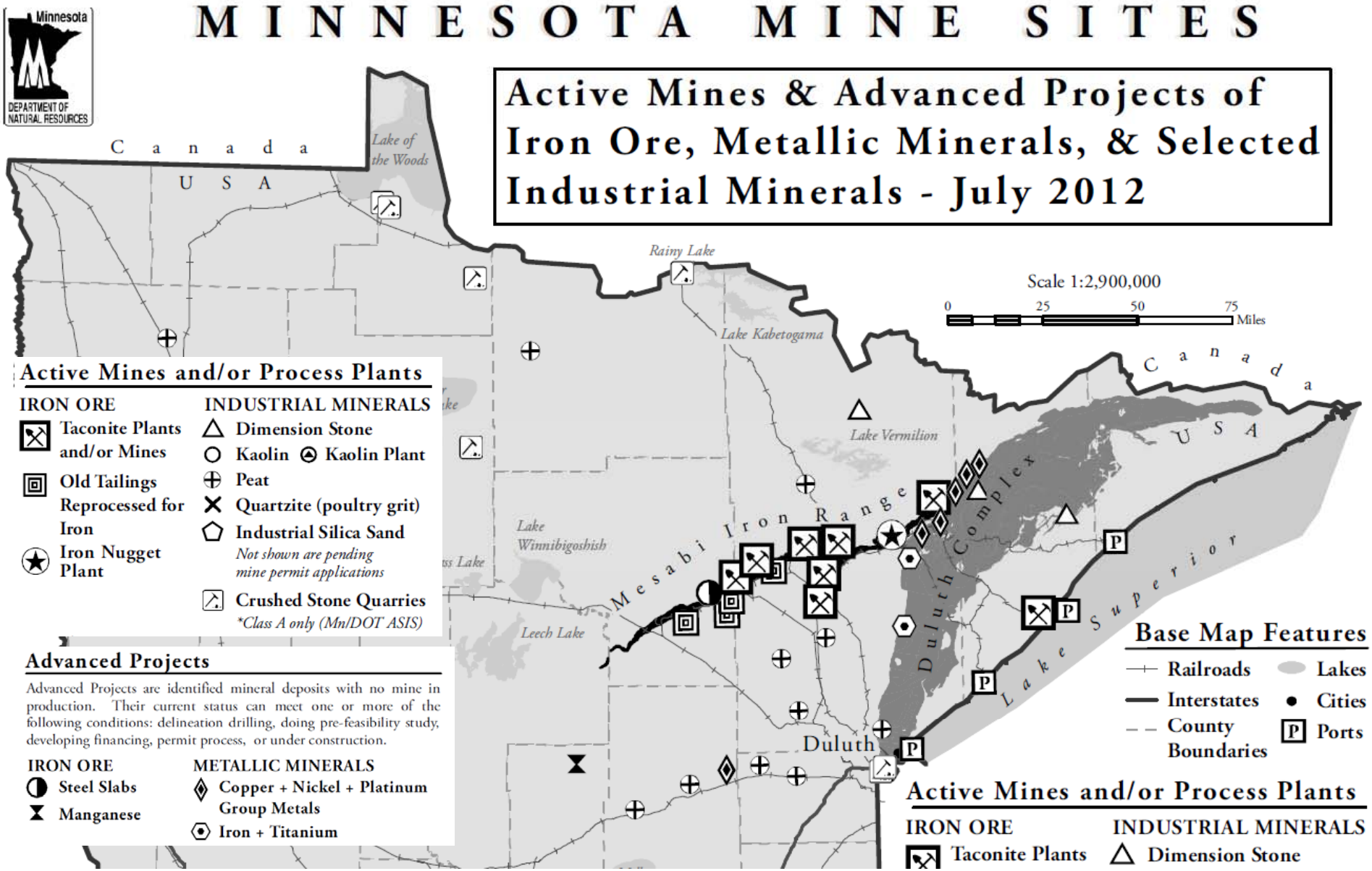
Mining in Minnesota:
Mineral Resource Activities in Northeastern Minnesota

October 24, 2012

Department of Natural Resources, Lands and Minerals Division
Dennis Martin

Northeast Minnesota –Active Mines and Advanced Projects



Classification of Mineral Resources:

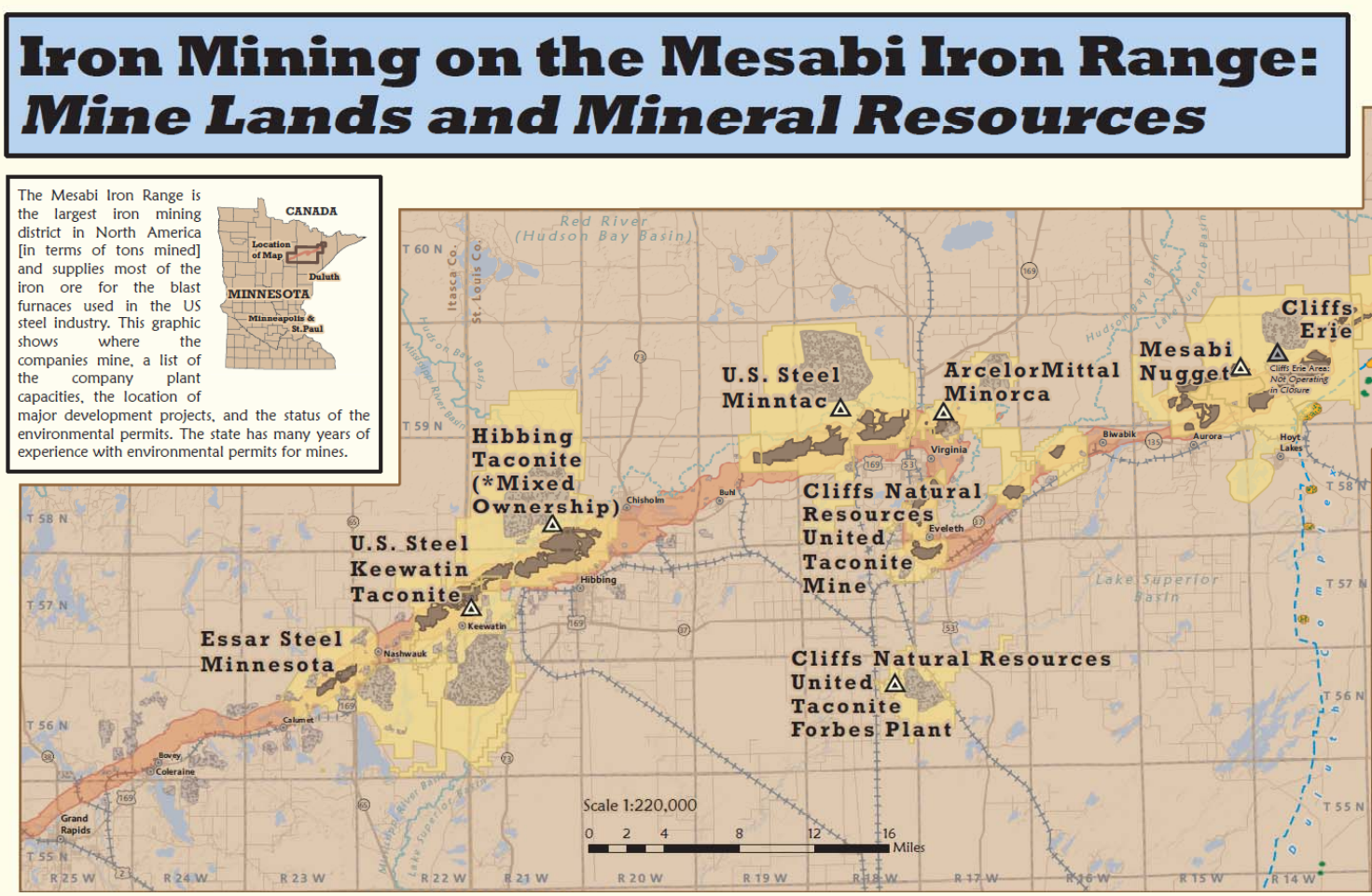
Three Groups with Different Economic Values, Laws, Rules, & Environmental Permits

There are <u>known deposits</u> in NE MN:

1. Iron Ores
2. Metallic Minerals
3. Industrial Minerals and Construction Aggregates

Iron Mining on the Mesabi Iron Range: *Mine Lands and Mineral Resources*

The Mesabi Iron Range is the largest iron mining district in North America [in terms of tons mined] and supplies most of the iron ore for the blast furnaces used in the US steel industry. This graphic shows where the companies mine, a list of the company plant capacities, the location of major development projects, and the status of the environmental permits. The state has many years of experience with environmental permits for mines.



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Current Mine Lands
- Taconite Pit
- Tailings Basin
- Permit to Mine Areas (Upper Map)
- Active Taconite Plant
- Inactive

Known Metallic Mineral Resources
- Cu+Ni+PGM Deposits
- TiO2 Deposits
- Cu+Ni+PGM & TiO2 Deposits

General Bedrock Geology
- Biwabik Iron Formation
- Contact of the Duluth Complex

Major Transit Features
- Railroads
- Lake Superior Ports
- Major Roads
- Minor Roads

Political Features
- County Boundaries
- Public Land Survey Townships
- Cities

Physical Features
- Lakes (USGS 100K)
- Major Watersheds (Level 1)

Minnesota Taconite Operations Table:

Total Annual Tons Mined

	Long Tons Crude	Long Tons Waste	Total Material
2009	57,681,000	31,431,000	89,112,000
2010	124,835,000	73,091,000	197,926,000
2011	139,563,000	99,234,000	238,797,000

Source: St. Louis County Mine Inspector. Data was rounded to nearest thousands. (2011)

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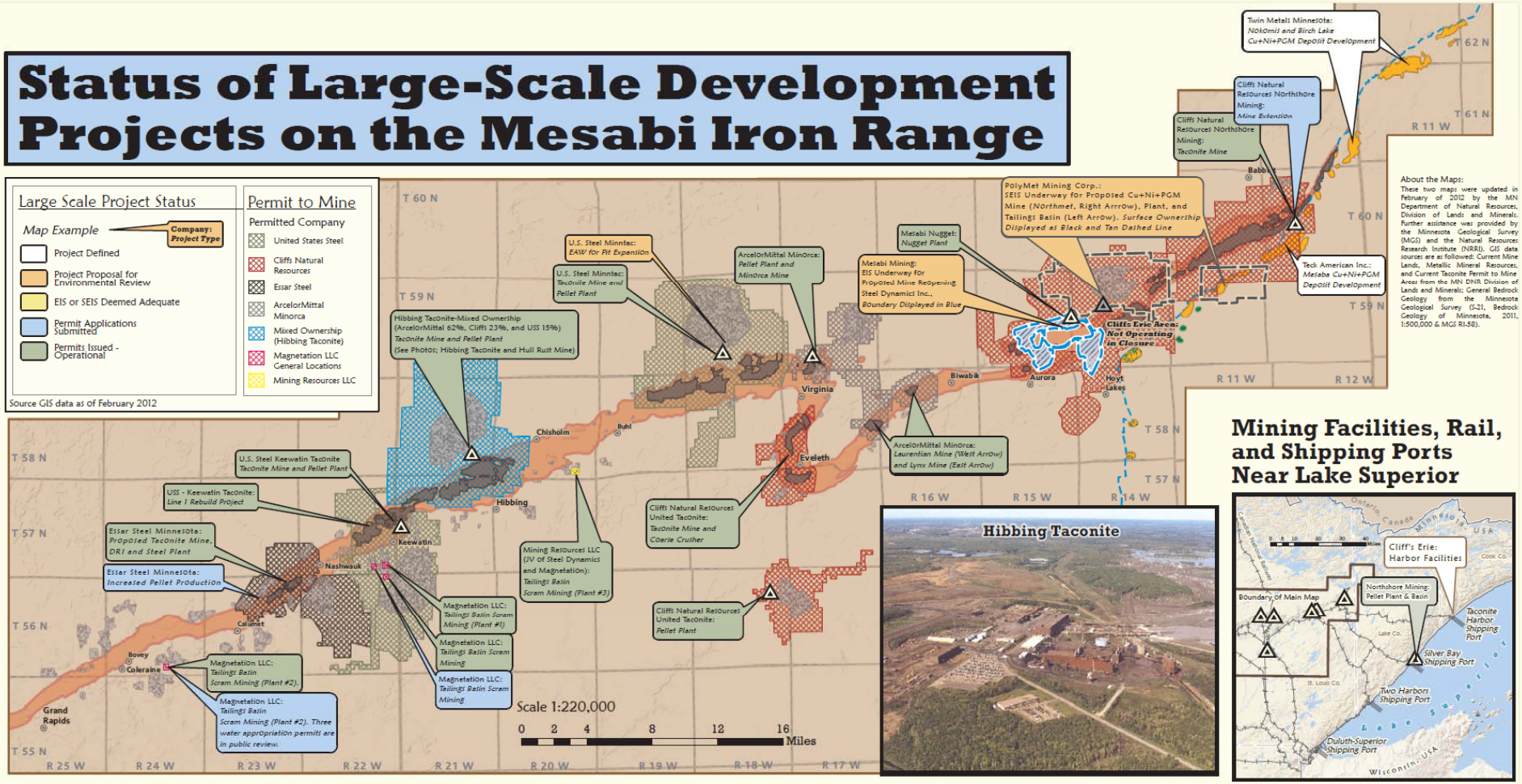
Status of Large-Scale Development Projects on the Mesabi Iron Range



About the Maps:
These two maps were updated in February of 2012 by the MN Department of Natural Resources, Division of Lands and Minerals. Further assistance was provided by the Minnesota Geological Survey (MGS) and the Natural Resources Research Institute (NRRI). GIS data sources are as followed: Current Mine Lands, Metallic Mineral Resources, and Current Taconite Permit to Mine Areas from the MN DNR Division of Lands and Minerals; General Bedrock Geology from the Minnesota Geological Survey (S-21, Bedrock Geology of Minnesota, 2011, 1:500,000 & MGS RI-58).

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New Iron Ore and Taconite Developments

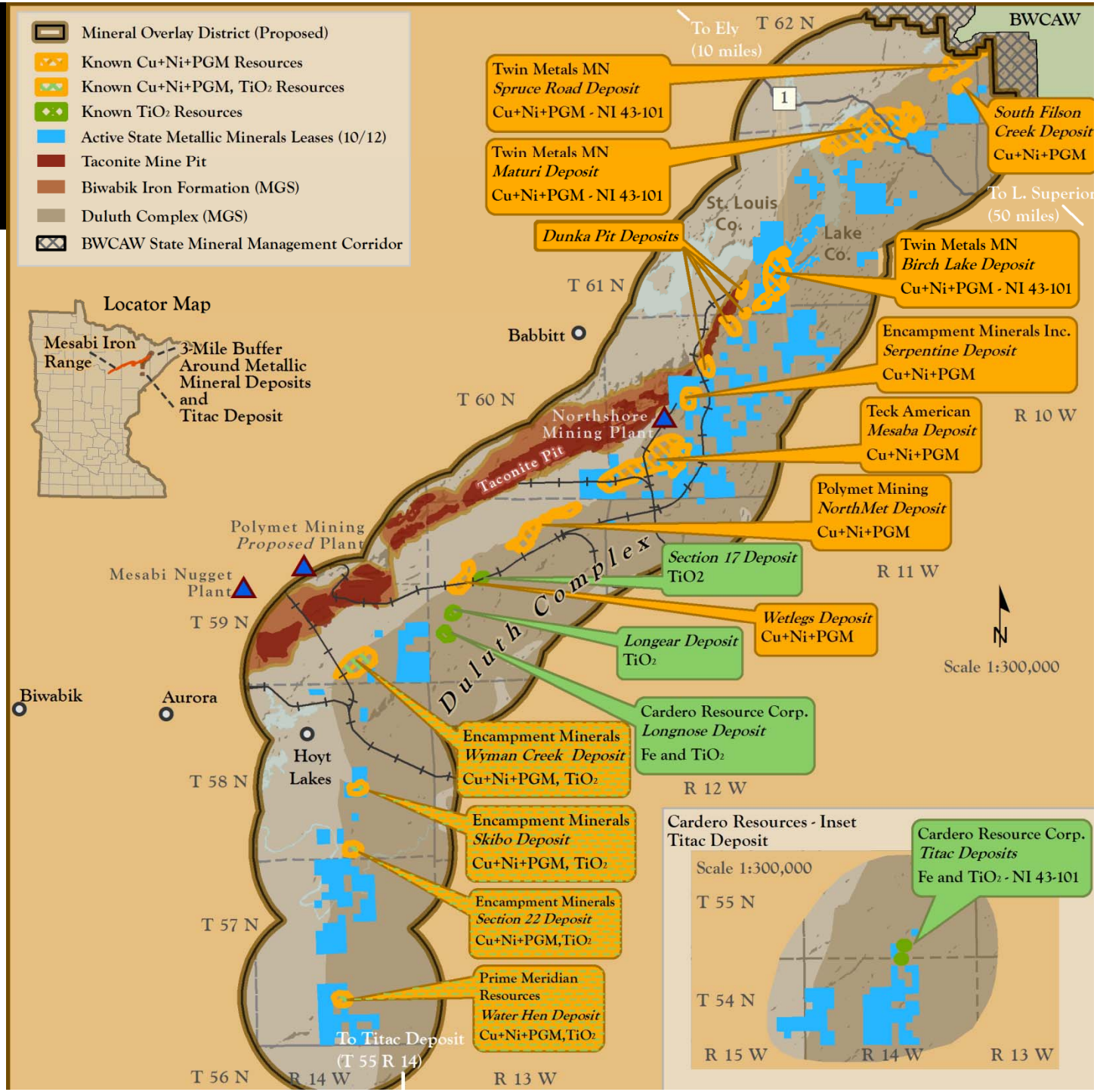
•United States Steel Corporation (U.S. Steel) completed environmental review to build a US$300M expansion to its Keewatin Taconite (Keetac) mine and pellet plant. U.S.Steel also began environmental review for an expansion of its permit to mine boundary at the Minntac facility.

• Essar Steel Minnesota, in the process of building a US$1.6B proposed taconite mine, pellet plant and steel mill, chose to pursue increasing the capacity of the mine and pellet plant, and completed environmental review for the increased capacity in December, 2011.

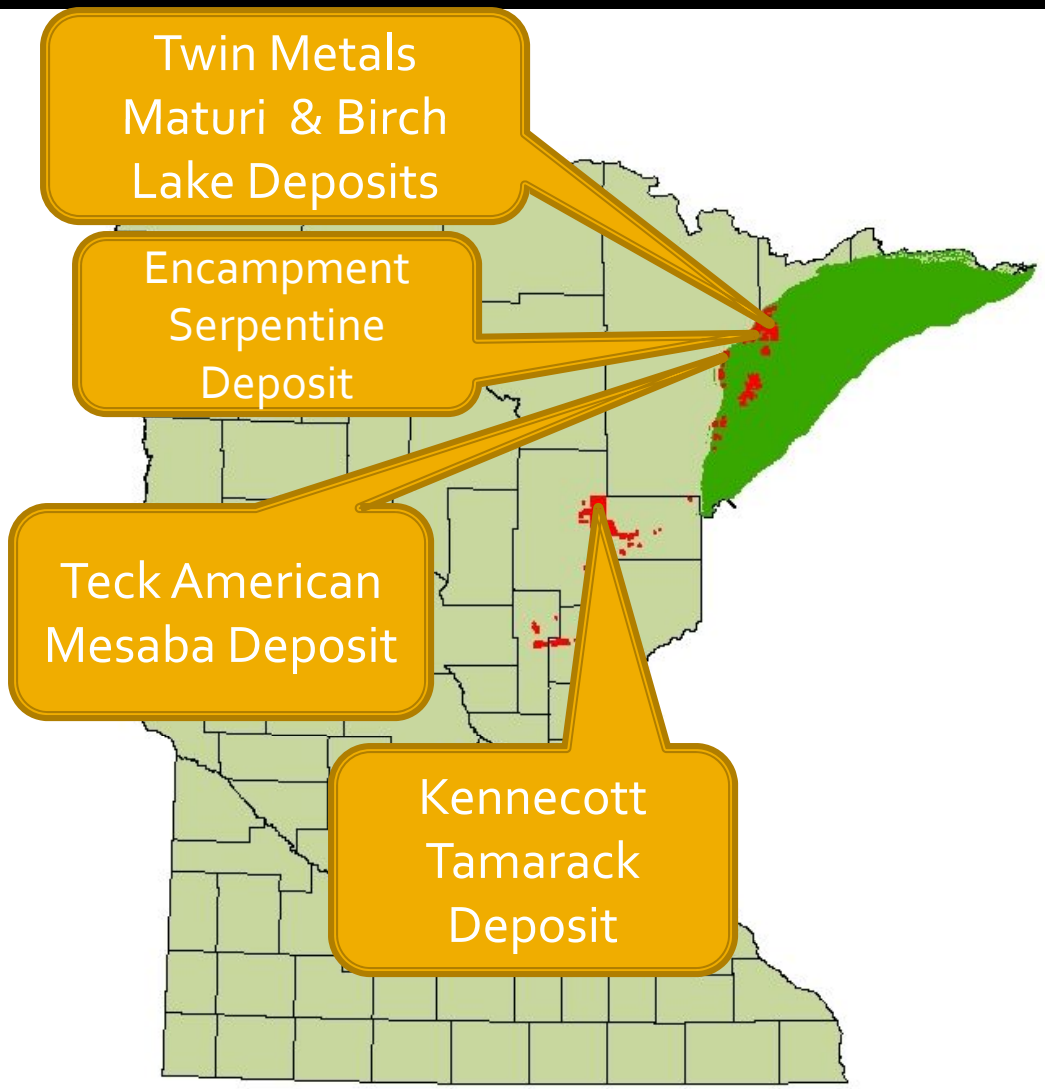
• Magnetation LLC formed a partnership with AK Steel Corporation. The steel producer's US$300M investment will boost production at Magnetation's two concentrators to 3.5 million tons per year by 2016, and support construction of a new pellet plant (location to be determined).

• Steel Dynamics, Inc. and Magnetation LLC formed a partnership called Mining Resources, LLC that will build a new processing facility at Chisholm to recover hematite from old iron ore tailings.

Known Metallic Mineral Deposits



Evaluation Phase for Copper + Nickel Projects on State Mineral Leases



Is Twin Metals Moving Forward?

Twin Metals has invested/committed on the order of $150 Million to get to this point.

This deposit appears to be important on a global scale of Cu+Ni+PGM deposits, because it has a relatively high grade of 1.5 wt.% copper-equivalent, <u>and</u> a large tonnage at 550 MT (2010). There is nothing to indicate a barrier to economic feasibility at this point in time.

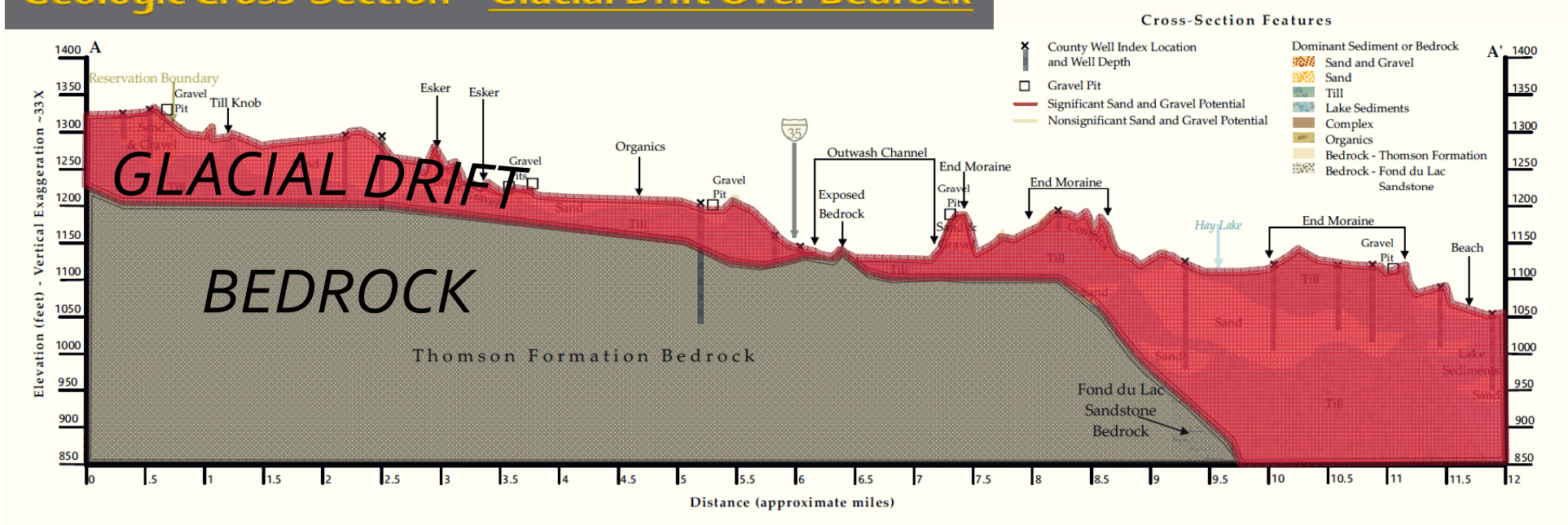
Dimension Stone

Further Classification: Potential Undiscovered Deposits

Future Potential for new deposits to be discovered for:

1. Copper + nickel + platinum group minerals
2. Gold
3. Titanium + iron
4. Copper + zinc + gold
5. Dimension stone
6. Construction aggregates

Geologic Cross-Section – Glacial Drift Over Bedrock



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Index Map to Mineral Exploration & Development in Northern Minnesota

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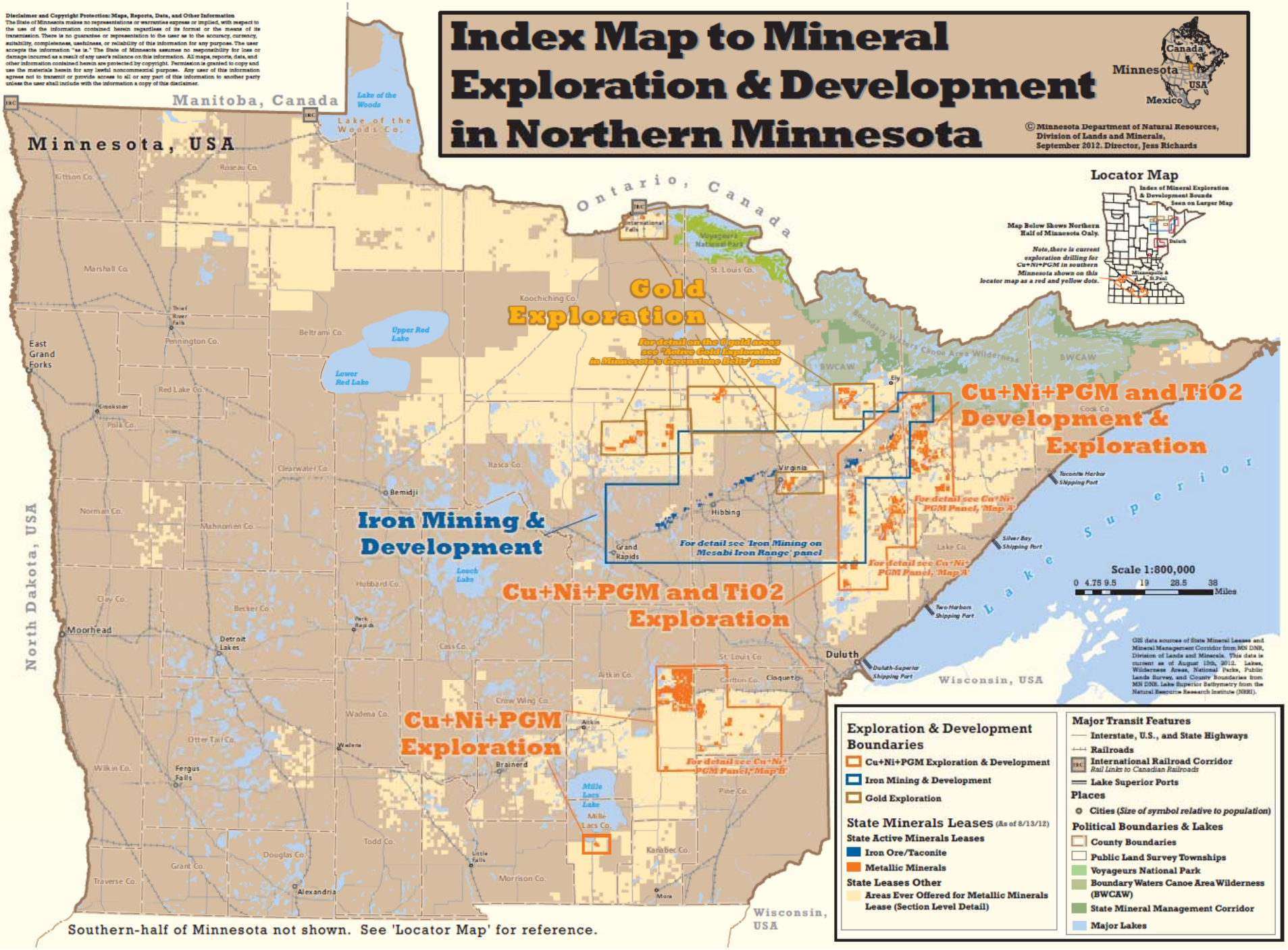


Southern-half of Minnesota not shown. See 'Locator Map' for reference.

Department of Natural Resources mission

Our mission is to work with citizens to **conserve and manage the state's natural resources**, to provide outdoor recreation opportunities, and to **provide for commercial uses of natural resources in a way that creates a sustainable quality of life**.

Managing School Trust Lands

It is the goal of the permanent school fund to secure the maximum long-term economic return from the school trust lands consistent with the fiduciary responsibilities imposed by the trust relationship established in the Minnesota Constitution, with sound natural resource conservation and management principles.

Foresters

Geologists

The State as Trustee

TRUST:

"A right of property, real or personal, held by one party, for the benefit of another".

-- Black's Law Dictionary

The Duties of a Trust Manager:

- To use reasonable care & skill in their actions
- To acquire assets of the trust
- To protect the property of the trust
- To invest trust assets properly
- To lease or sell trust property as directed
- To furnish information to the beneficiary
- To be loyal to the beneficiary

Why? Mineral Assets Value to the School Trust and other Trusts

- ***80% of Historic Net Revenue from >100 years to the Corpus of the School Trust comes from Mineral Revenue***

- Historic example: 160 acres of School Trust Minerals at an iron mine generated more revenue than the sale of 2 million acres of School Trust land

- Currently iron ore royalty is the main revenue source. Current example at MinnTac royalty value ~$80 million per 40 acre parcel

- Three Copper+Nickel Deposits moving toward development have significant School Trust mineral rights, -- projected to be an additional ~$2 Billion to the School Trust

Duties: Trust Mineral Assets

Conclusions

- DNR has a constitutional fiduciary obligation to manage the School Trust to enhance revenue [DNR Operational Order 121]
- Based upon the Historic Revenue data, mineral assets are the dominant value in the bundle of land rights
- Mineral assets should be managed to protect their future revenue

Duties

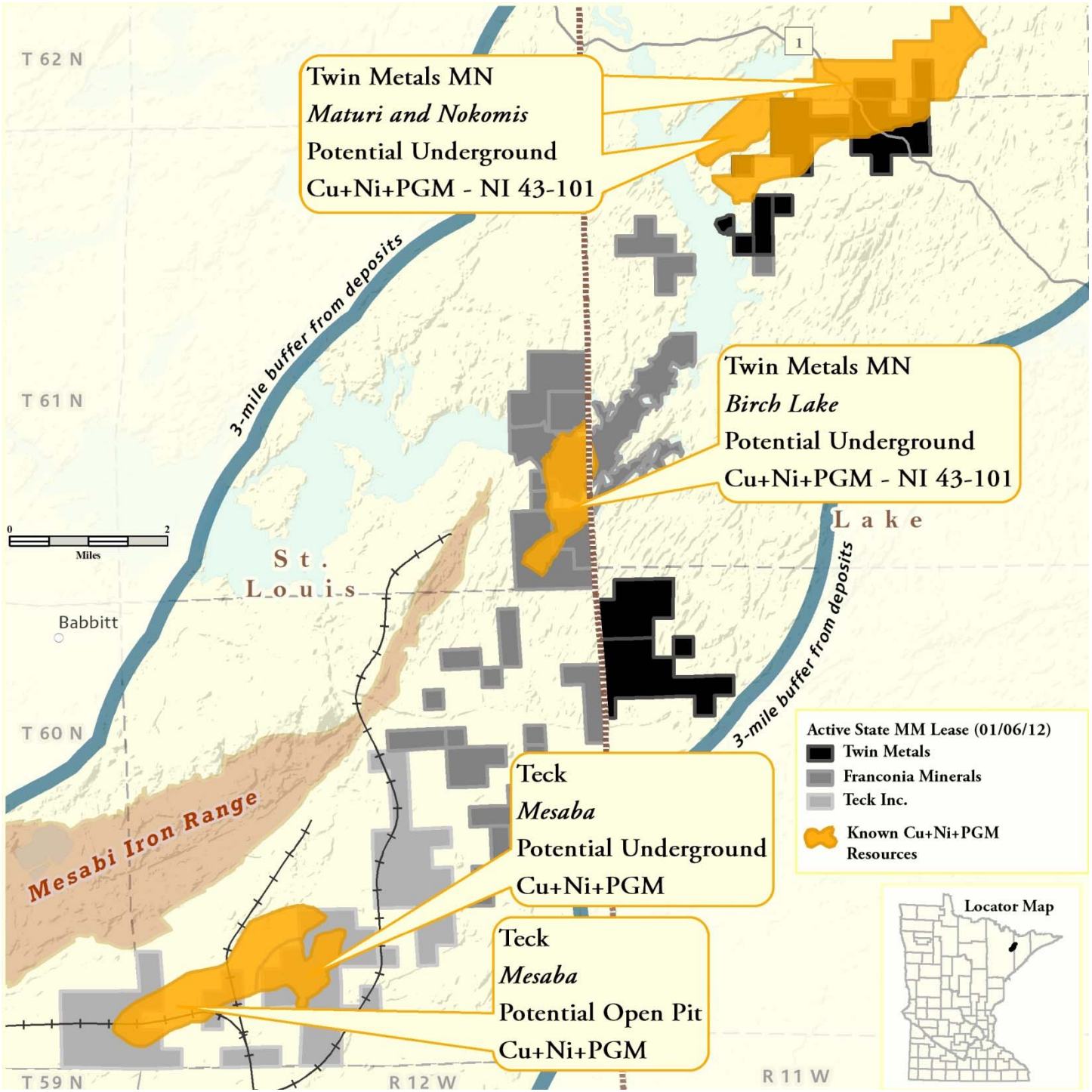
1. **Manage Known *Mineral Assets* for School Trust Mineral Lands**
2. **Perform State Mineral Lease Administration**
3. **Represent the Trusts to Protect Trust *Mineral Rights* During all DNR Land Transactions for Future Mineral Discoveries**

First Duty: Managing State Lands with Known Mineral Assets

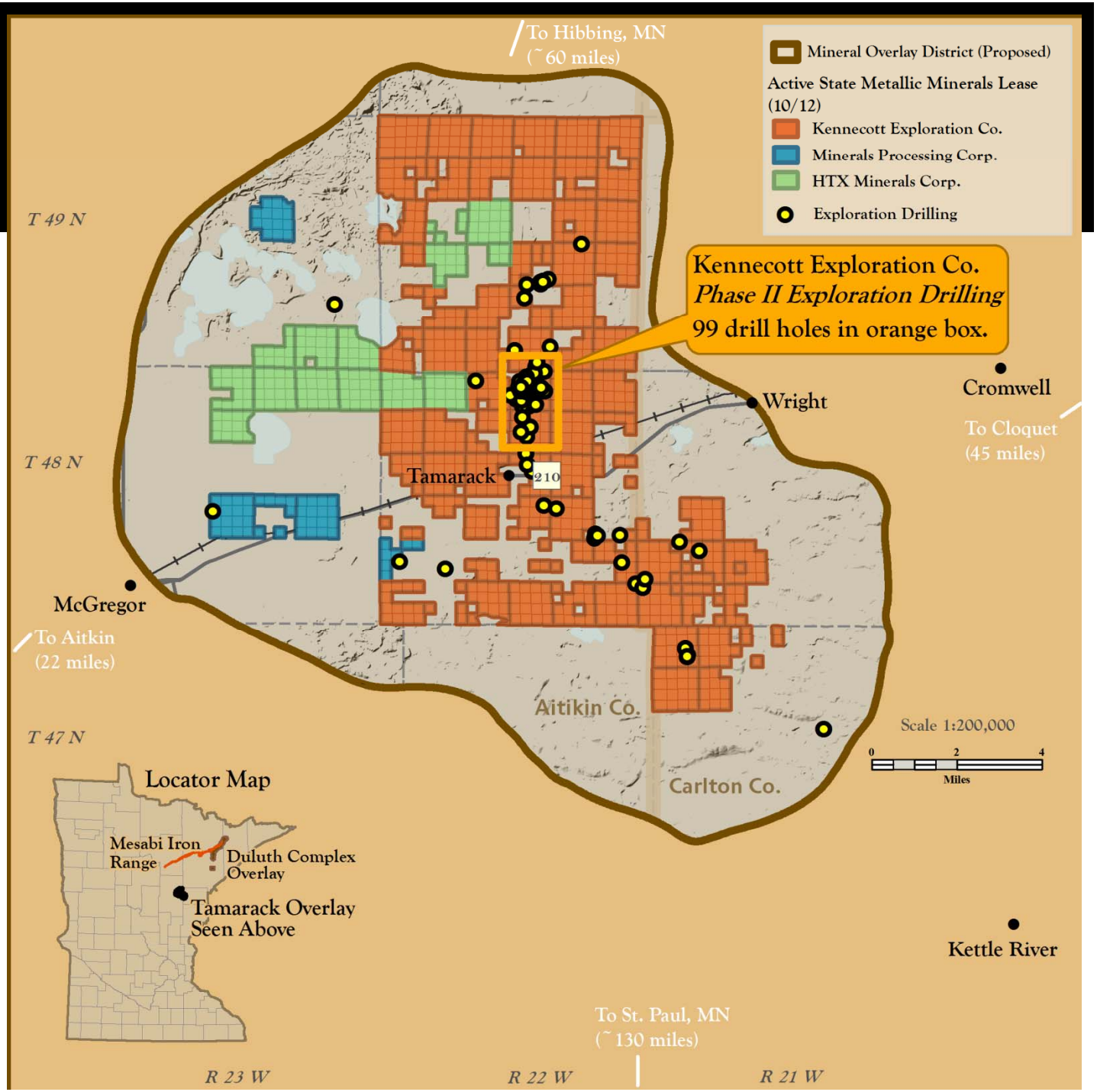
- A taconite mine
- More than 100 years of iron ore exploration and production data on hand to estimate reserves.

Known Deposits

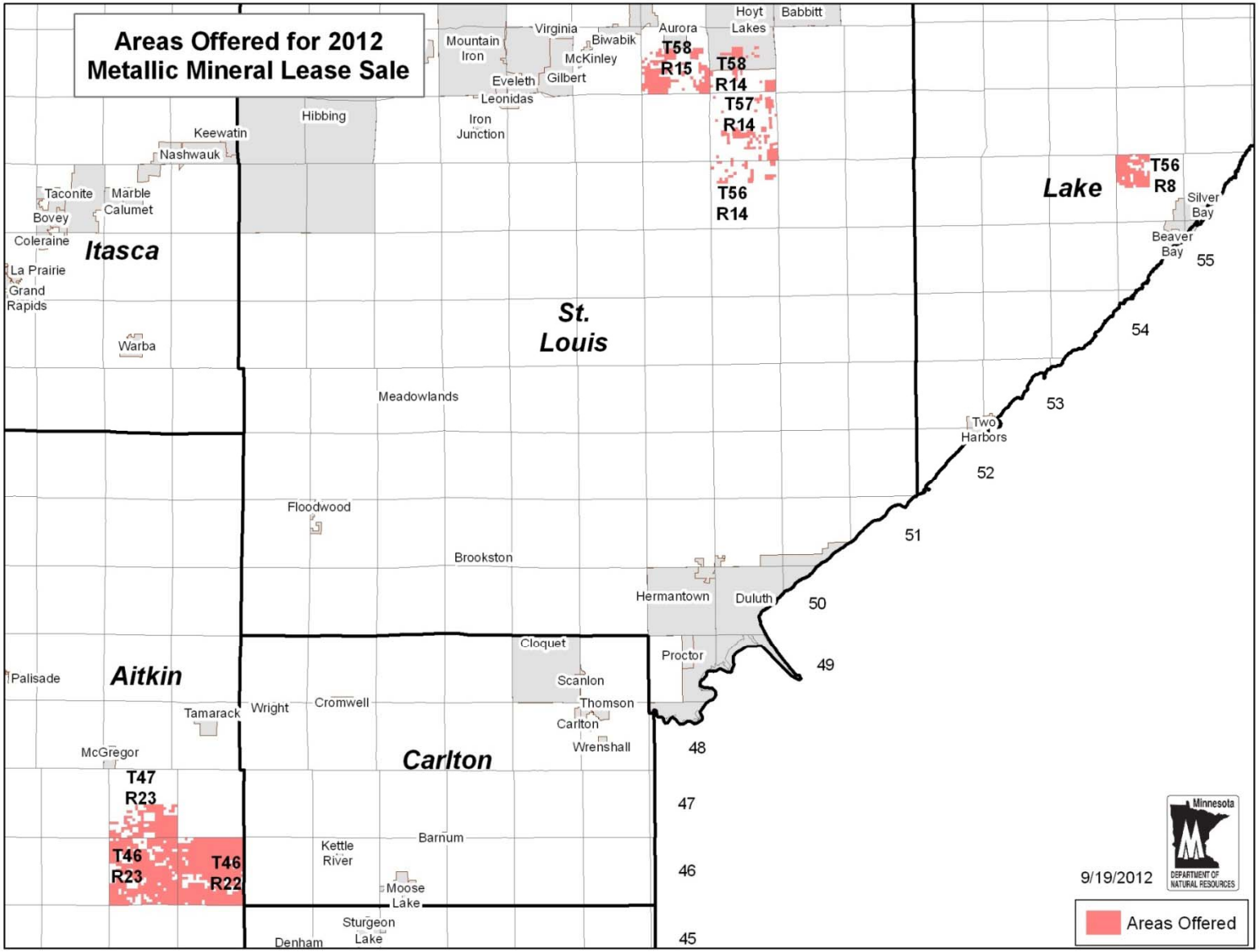
Three Major Known Metallic minerals Deposits (yellow) with active State Metallic Mineral Leases on School Trust



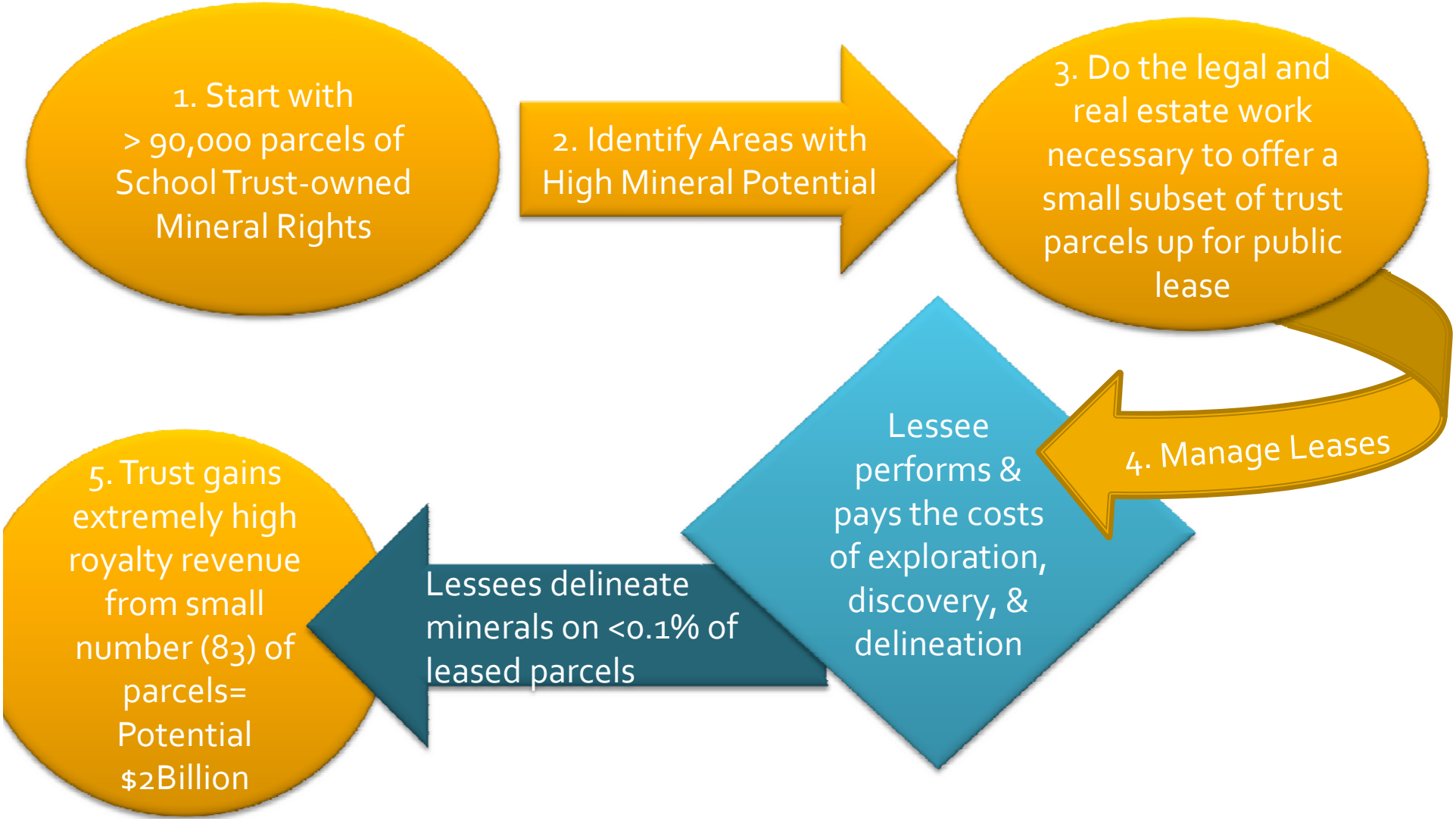
Known Metallic Mineral Deposit, Aitkin County



Second Duty: State Mineral Lease Administration



State's Mineral Management Process: School Trust Example

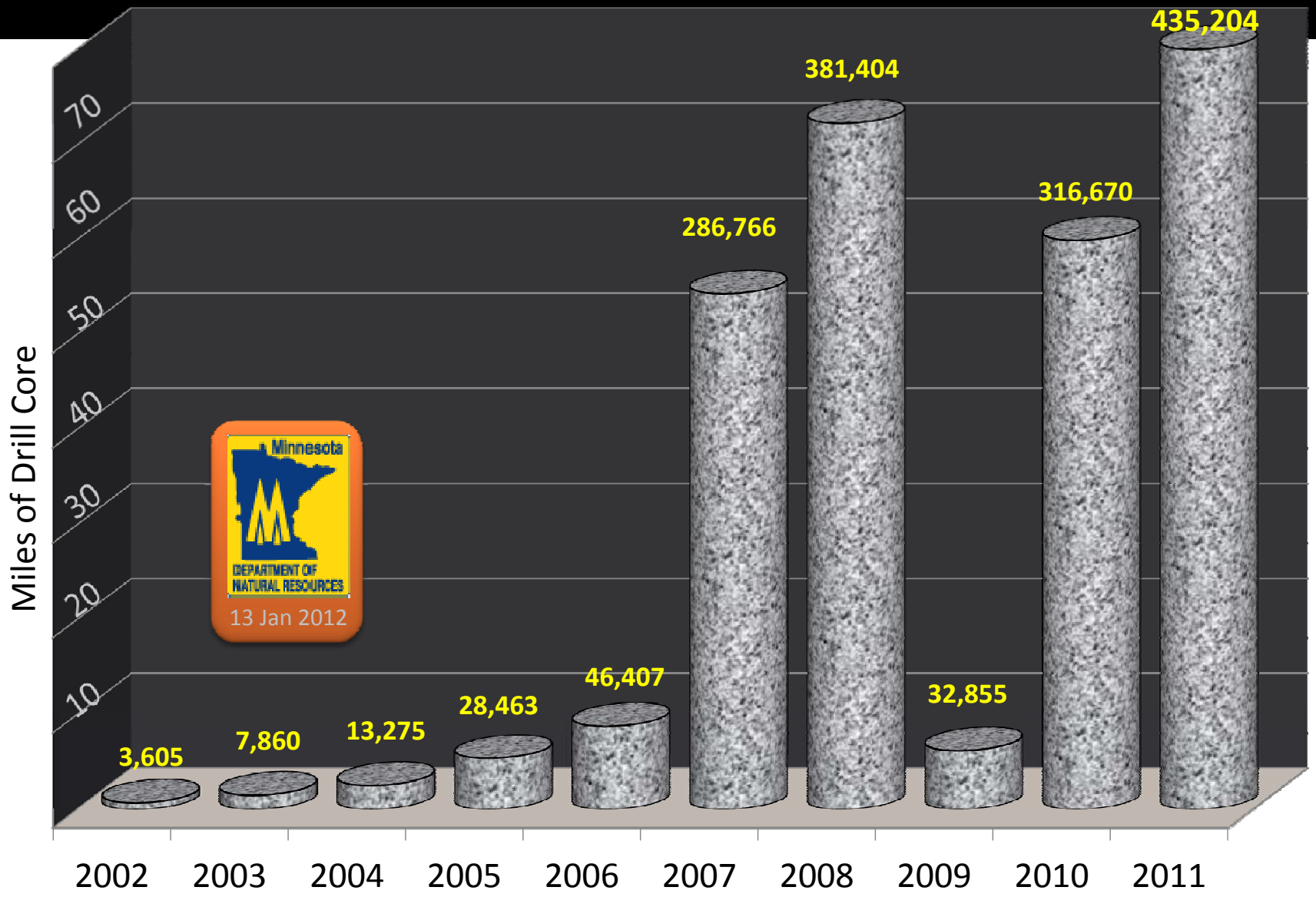


State's Business Model for Mineral Assets; Differs from Timber Inventory

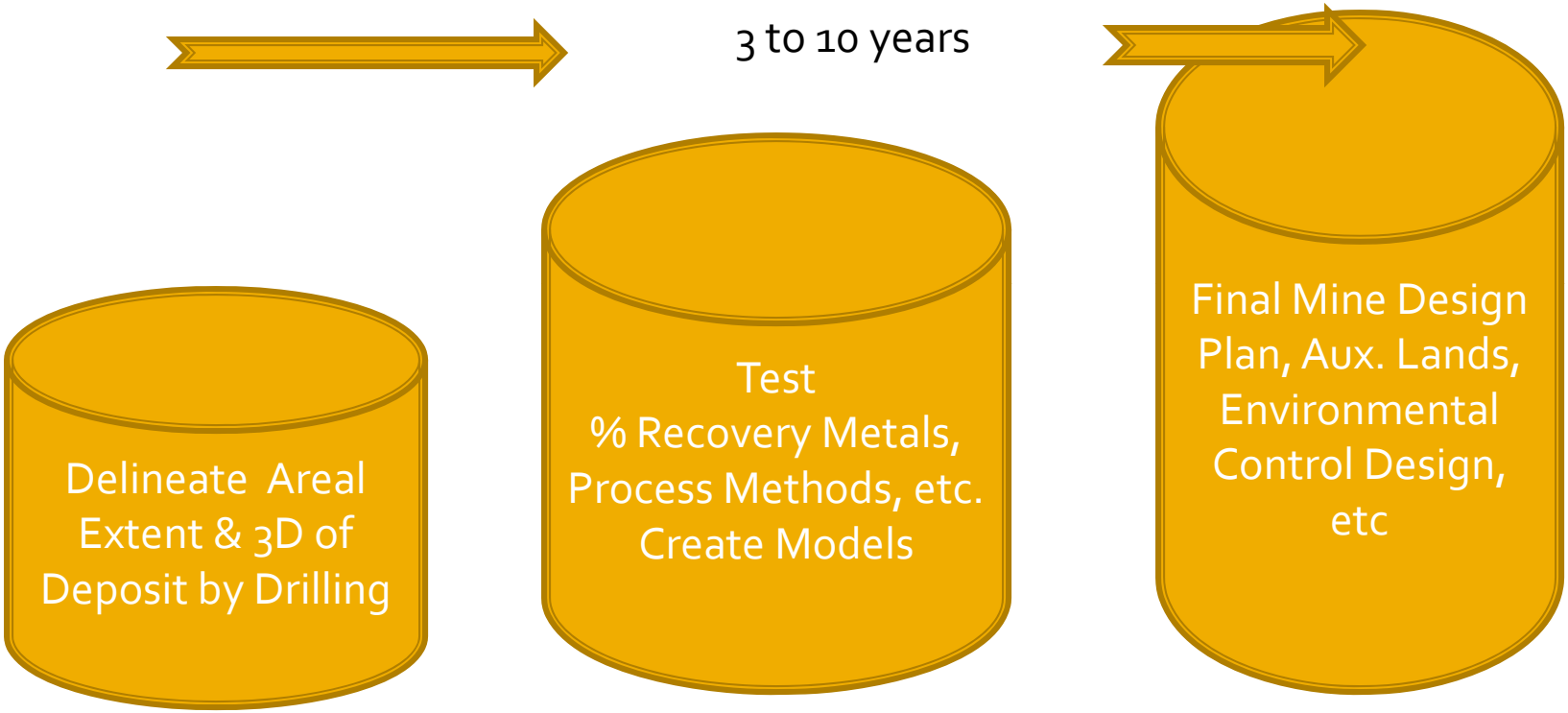
DNR Role:

- Manage the mineral rights *asset*, not the *natural resource*.
- Market opportunity for discovery of new mineral resources that are buried.
- Practice conservation of the mineral rights *asset*.
- Pay for minimal state expenditures and subsidies on mineral assets, such as "mineral inventory" work.
- State relies upon private investors to spend up to tens of millions of dollars per year to explore, discover, and develop (buried) mineral deposits.

Asset potential Trust royalty value too high to ignore in unknown areas: Taconite $80M/40 acres; Base Metals up to $500M/40 acres

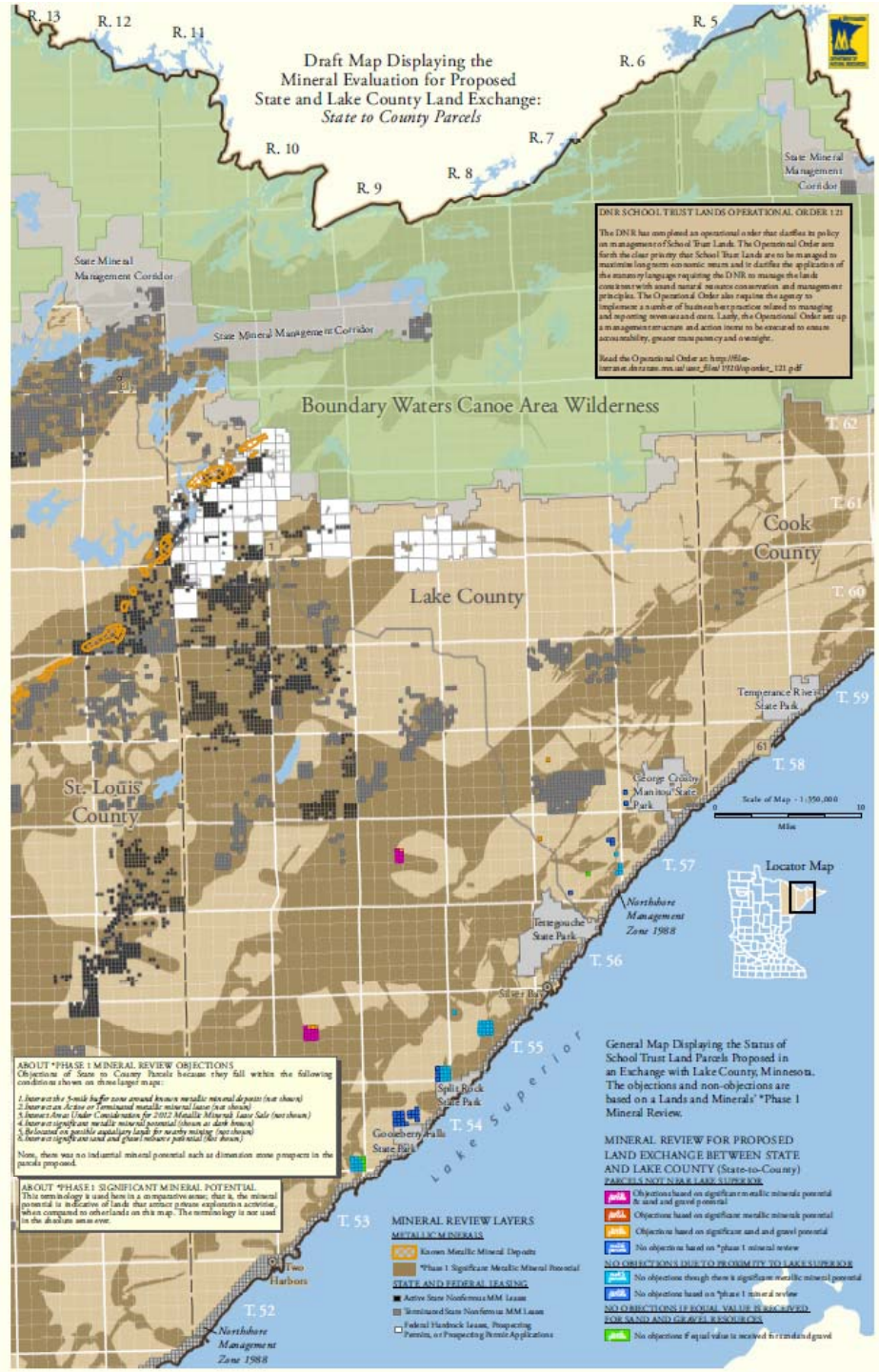

Miles of Drill Core
70
60
50
40
30
20
10
3,605
7,860
13,275
28,463
46,407
286,766
381,404
32,855
316,670
435,204
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
Minnesota
DEPARTMENT OF NATURAL RESOURCES
13 Jan 2012

Evaluation Phase
after Exploration and Discovery



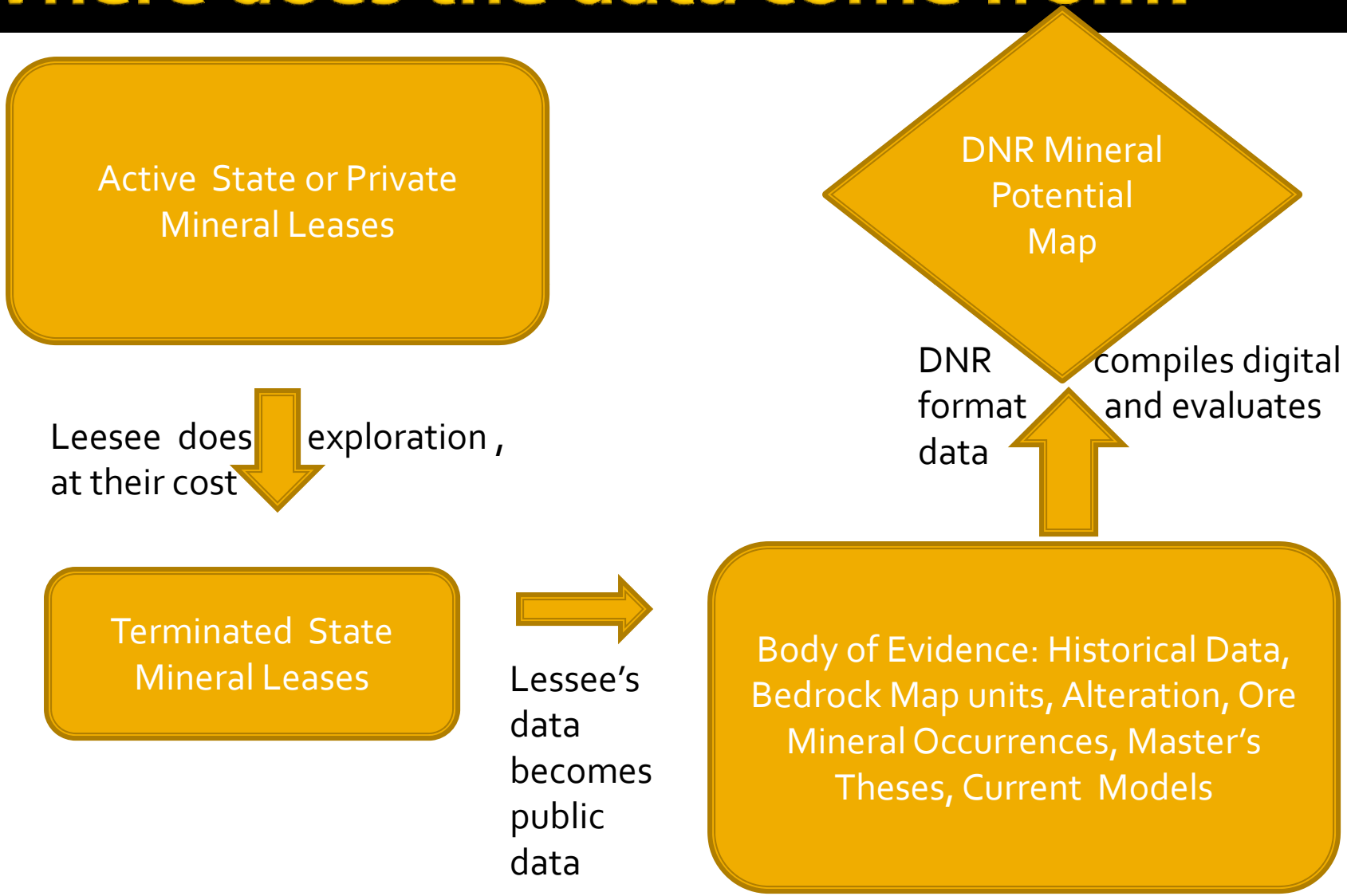
Metal price trends; cost of capital; energy supply; business partnerships & sale of future metal; technology improvements

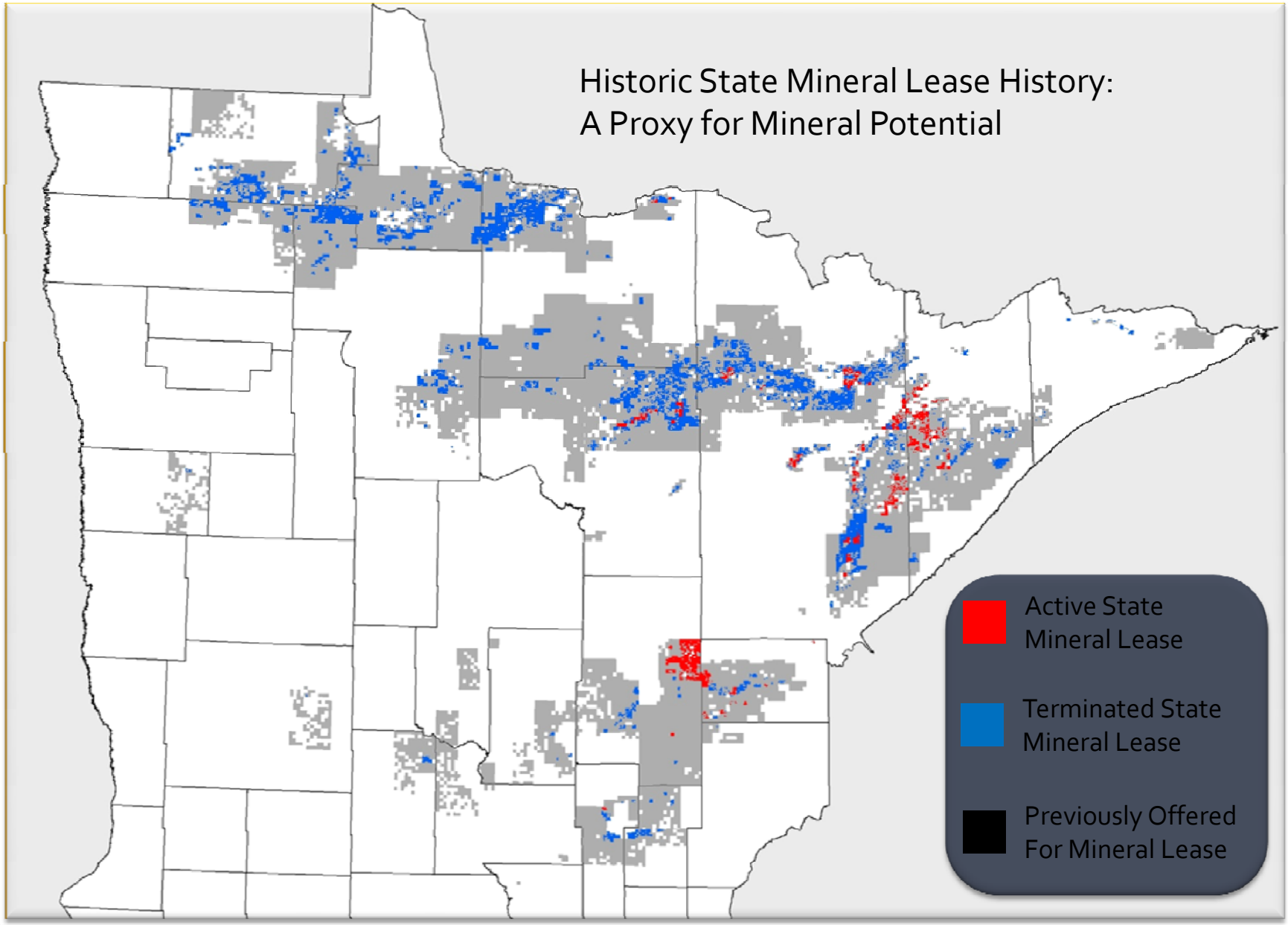
Third Duty: Lake County Mineral Potential Map (Phase I)



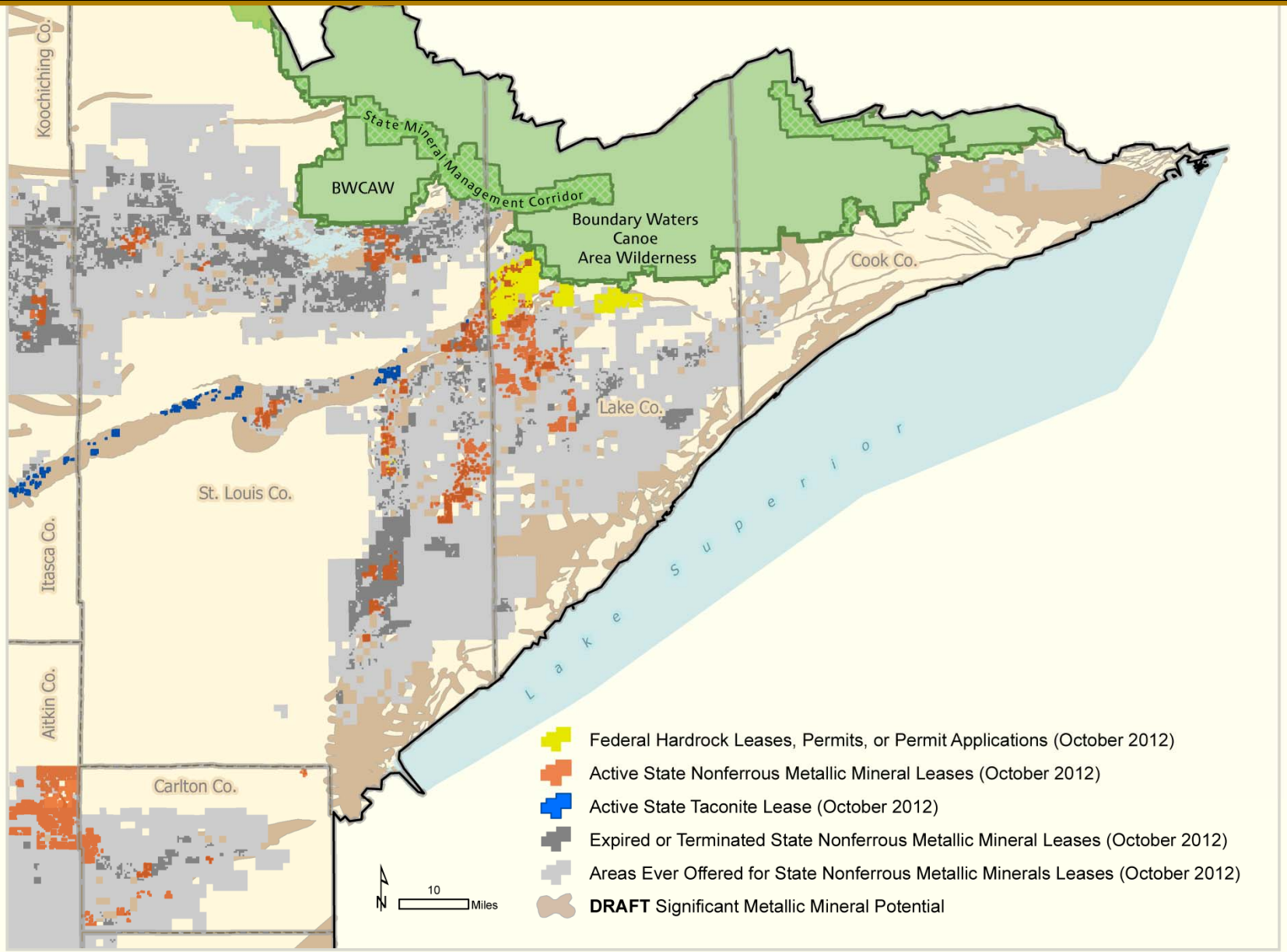
This county is the first major example of the DNR's recent changes in School Trust management.

Mineral Inventory & Potential Map: Where does the data come from?

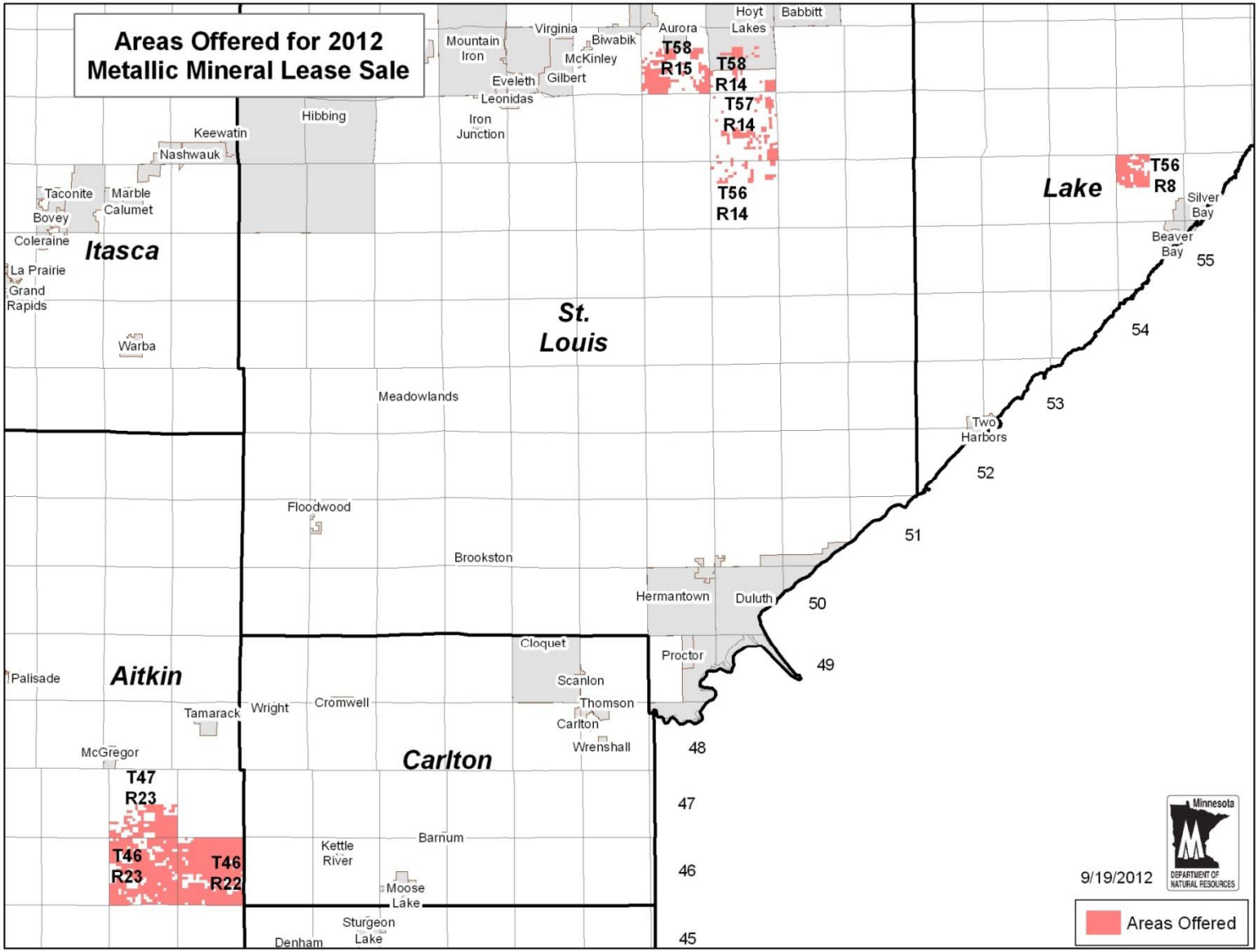



Historic State Mineral Lease History:
A Proxy for Mineral Potential
Active State Mineral Lease
Terminated State Mineral Lease
Previously Offered For Mineral Lease

Work in Progress: Draft Mineral Potential Map

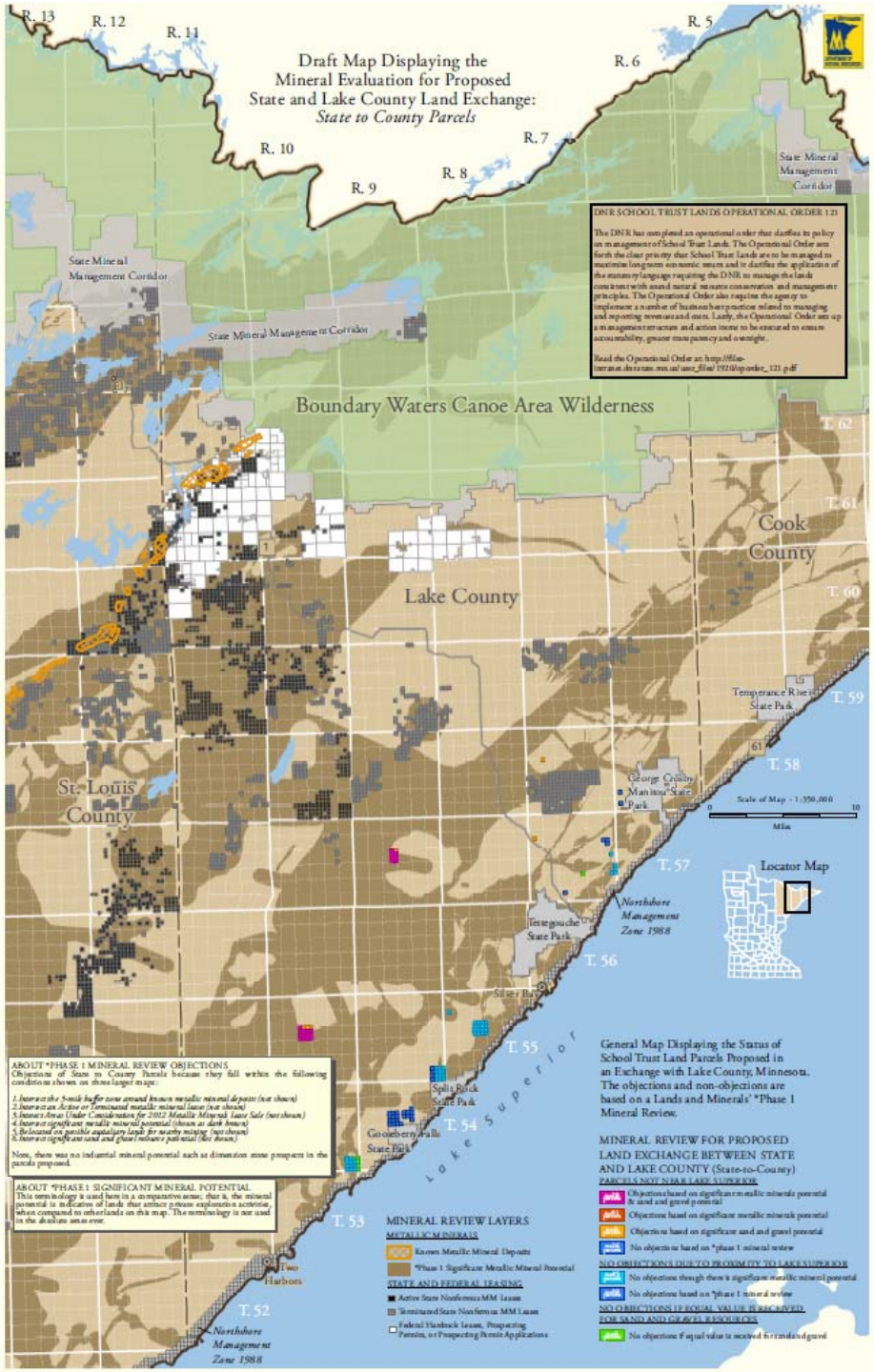


Second Duty: State Mineral Lease Administration



Mineral Potential Map of Lake County

Third Duty: Advocate in the Best Interest of the Trust – from perspective of Mineral Rights owner--- During DNR Land Transactions

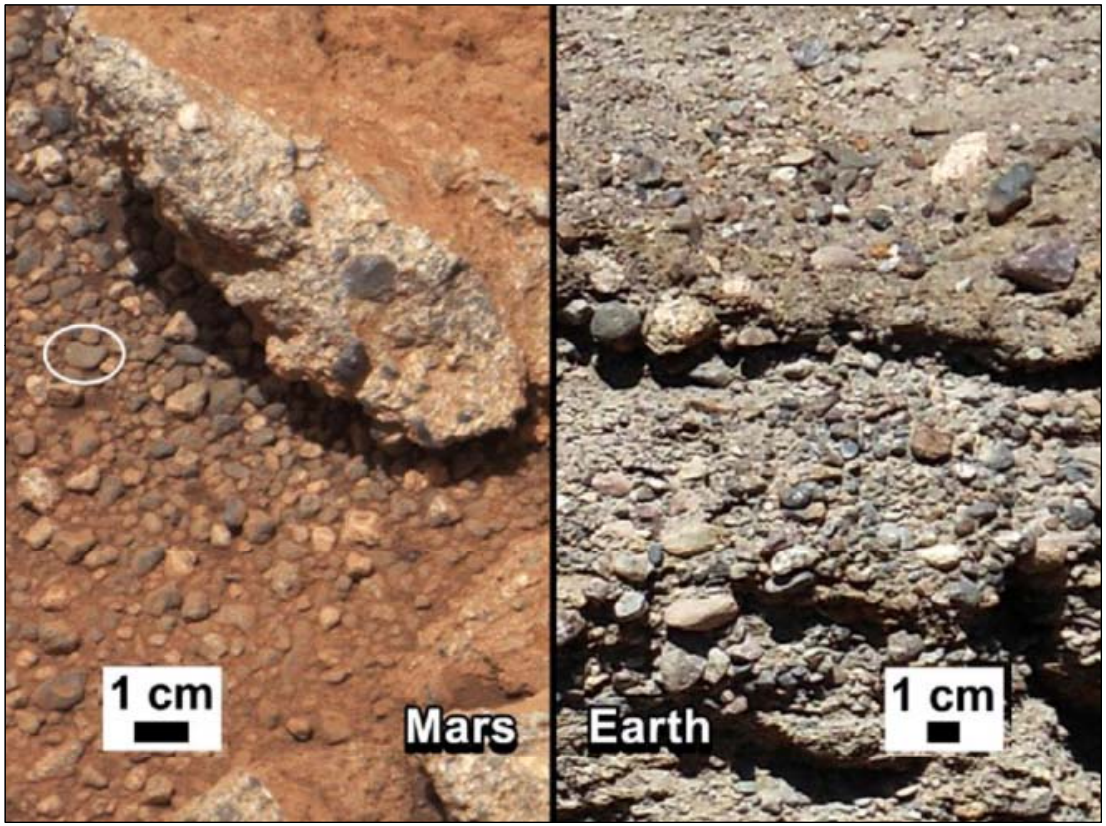


Rational Inference

A process of reasoning by which a fact or proposition sought to be established is deduced as a logical consequence from other facts, or a state of facts, already proved or admitted.

"NASA Rover Finds Old Streambed on Martian Surface"

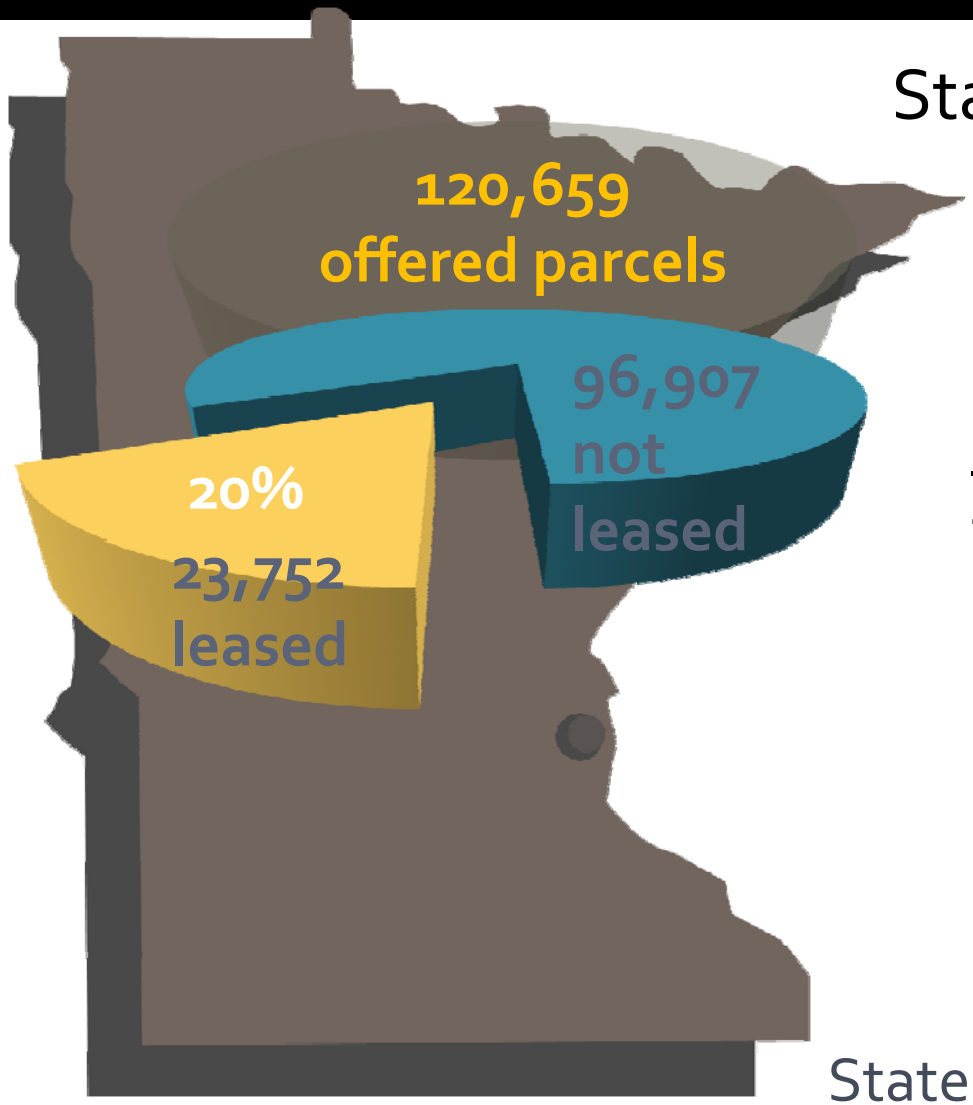
27 September, 2012



http://www.nasa.gov/mission_pages/msl/news
Image Credit: NASA/JPL-Caltech

.....we use rational inference to do the mineral potential evaluations, because the mineral resources are buried and not visible.

What Can We Learn from 46 years of State Mineral Lease Exploration Activity?



State mineral leases offered

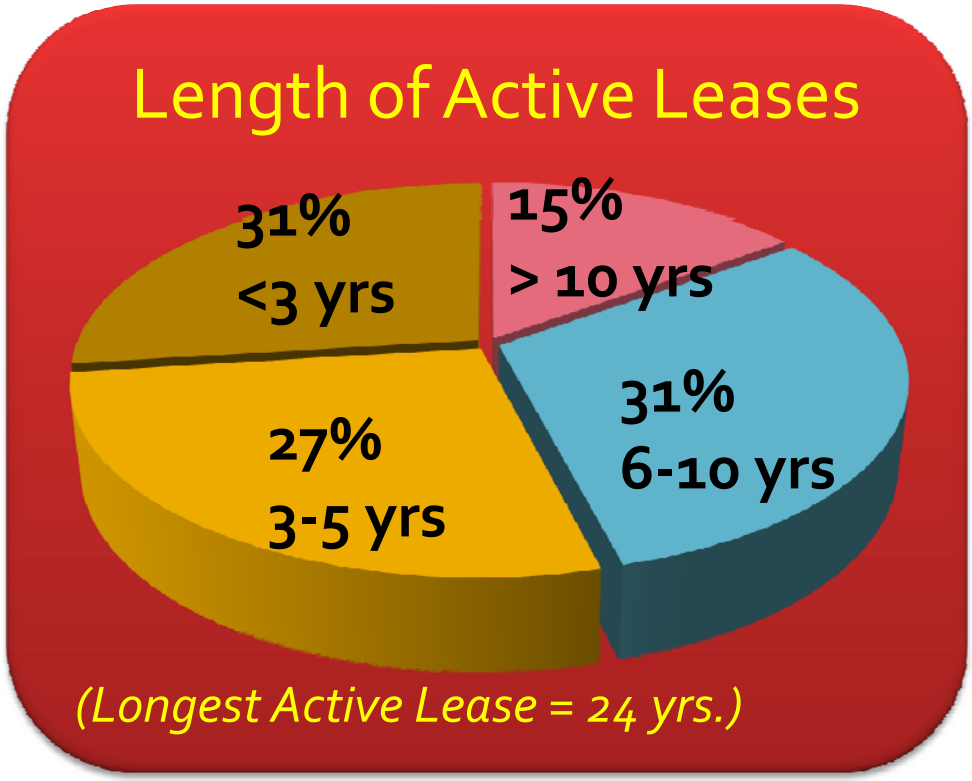
20% of <u>the forty-acre parcels offered</u> by the State for mineral exploration have been leased

All figures are the "40-acre parcel count" described in the notes. The 23,752 parcels are within 3,379 State leases.

State Mineral Leases, 1966-2012

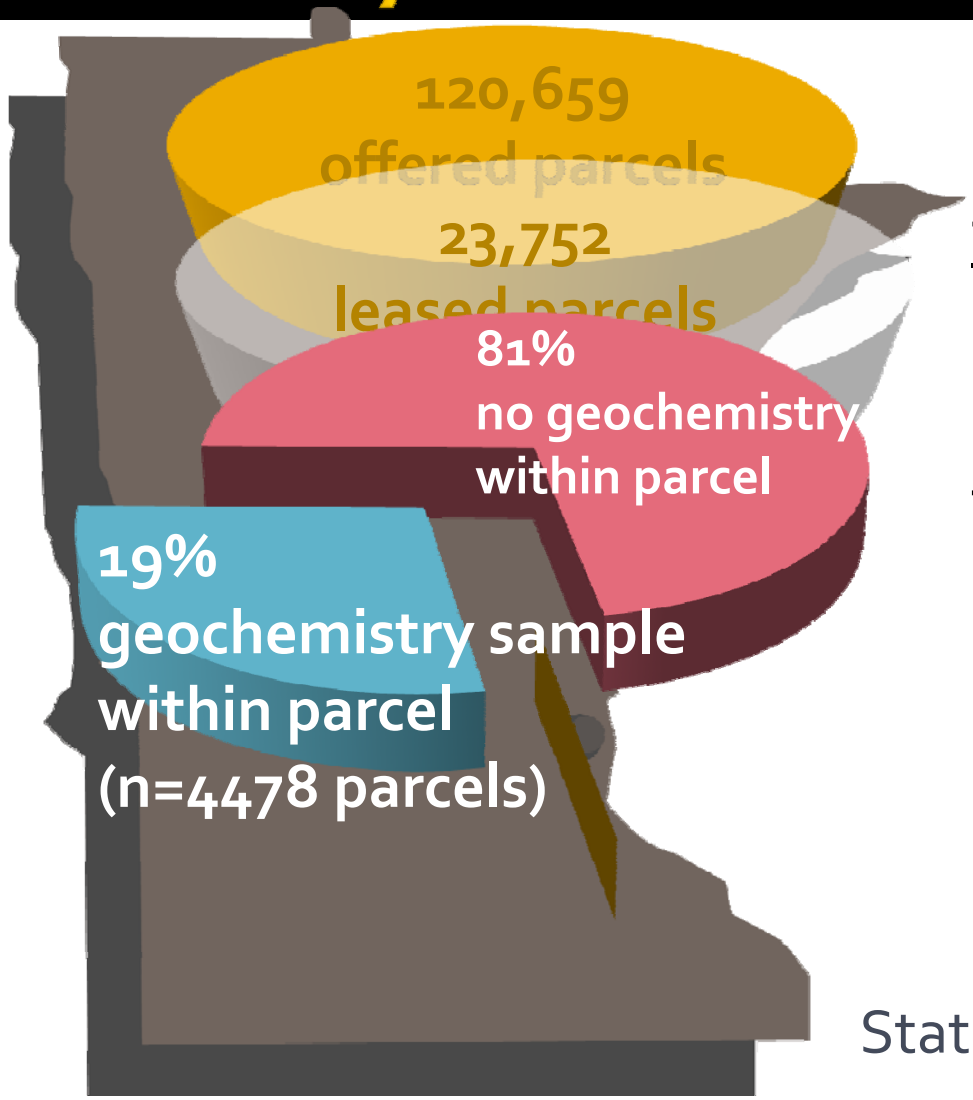
State Mineral Leases: 1966- 2012

- 387 active (11%)
- 2,992 terminated (89%)



Some active state leases are in the Exploration Phase, while others are in the Evaluation Phase.

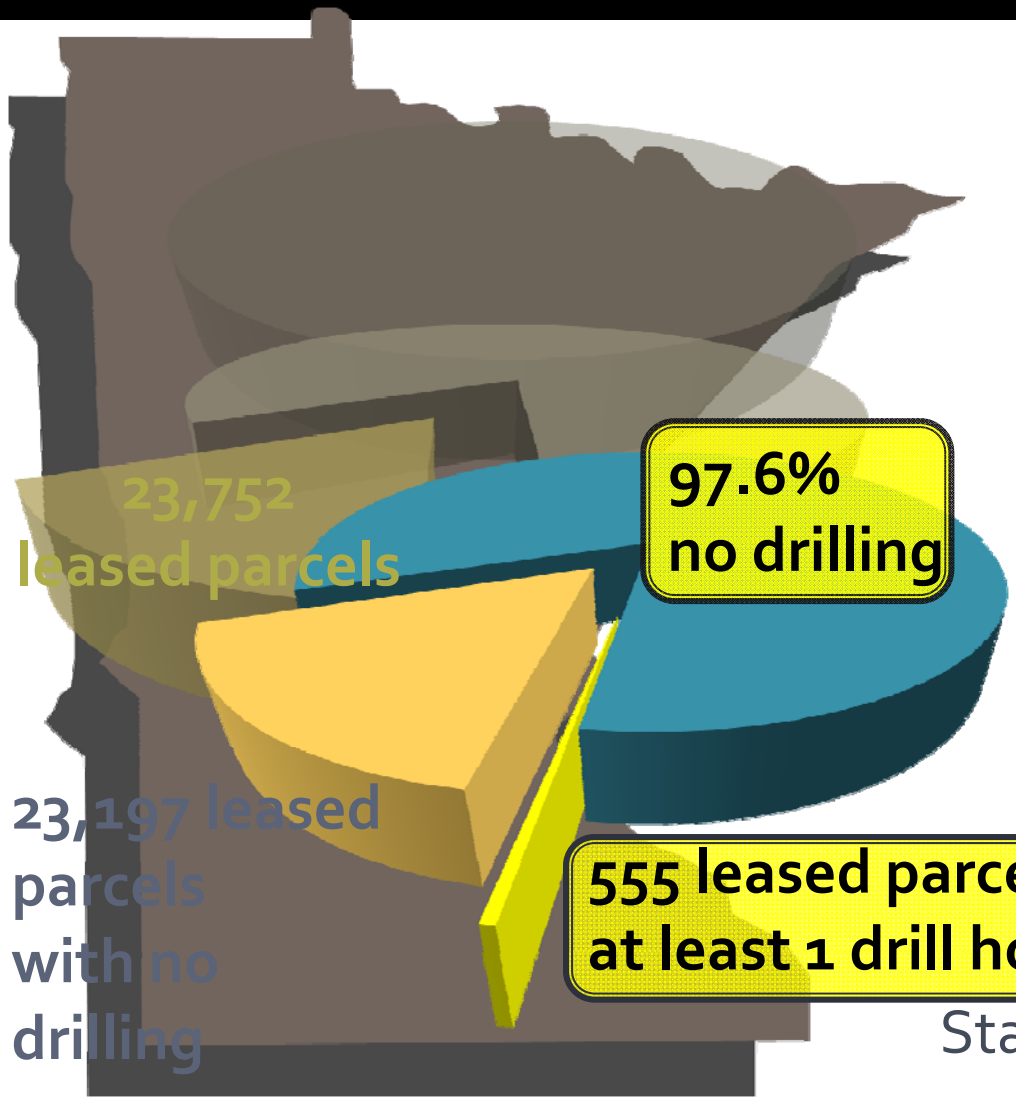
Exploration Phase
Activity: Geochemistry



Estimated 19**%** of the <u>forty-acre parcels leased</u> had at least one geochemical sample taken.

State Mineral Leases, 1966-2012

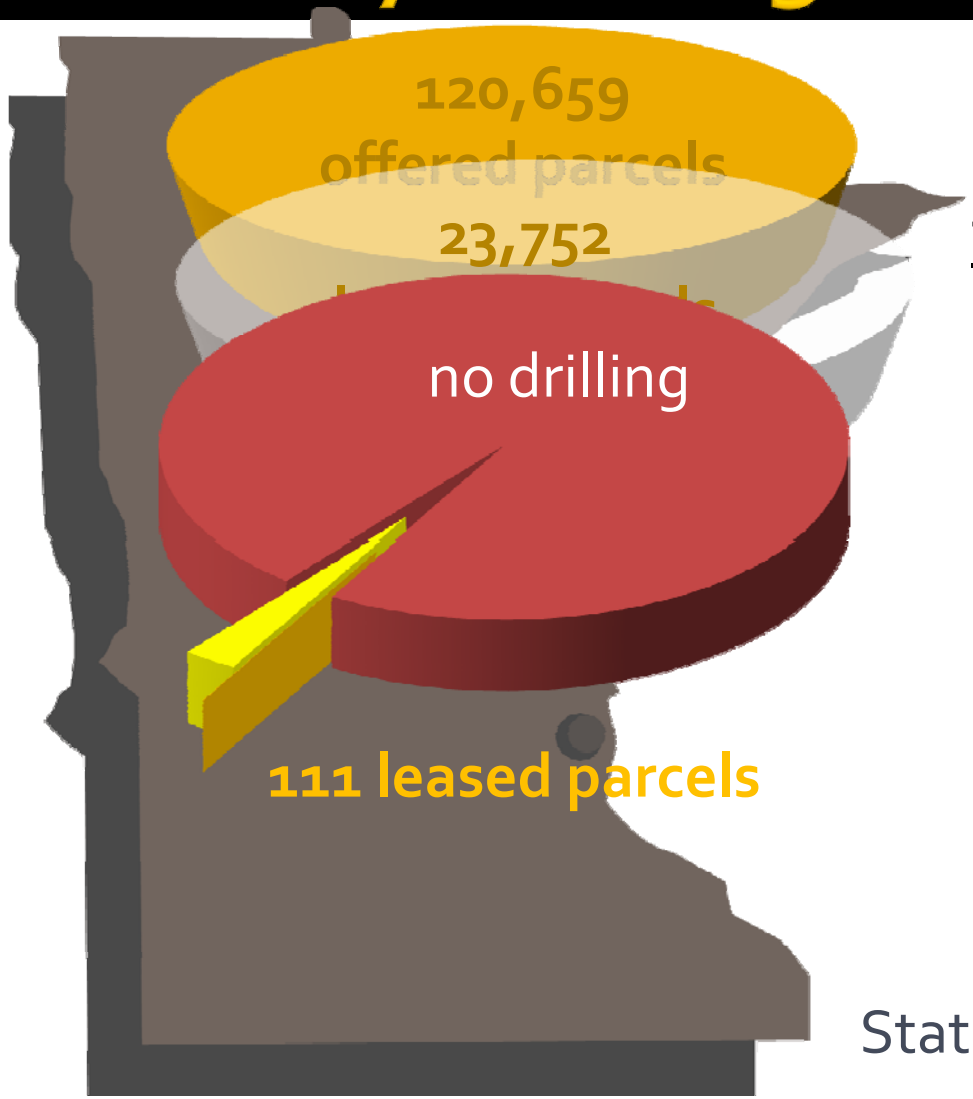
Combined Exploration & Evaluation Phases
Activity : All Drilling



2.4% of <u>the forty-acre parcels leased</u> had at least one drill hole on it during 46 years.

State Mineral Leases, 1966-2012

Evaluation Phase
Activity: Drilling



Estimated 0.5% of <u>the forty- acre parcels leased</u> had evaluation phase drilling.

State Mineral Leases, 1966-2012

DNR's fiduciary obligation

Minnesota Constitution, Article XI
Sec. 8. **Permanent school fund; source; investment; board of investment.**
The permanent school fund of the state consists of (a) the proceeds of lands granted by the United States for the use of schools within each township.....

The End