

Sulfide Mining In Michigan

 **Wolfpack** Research Findings

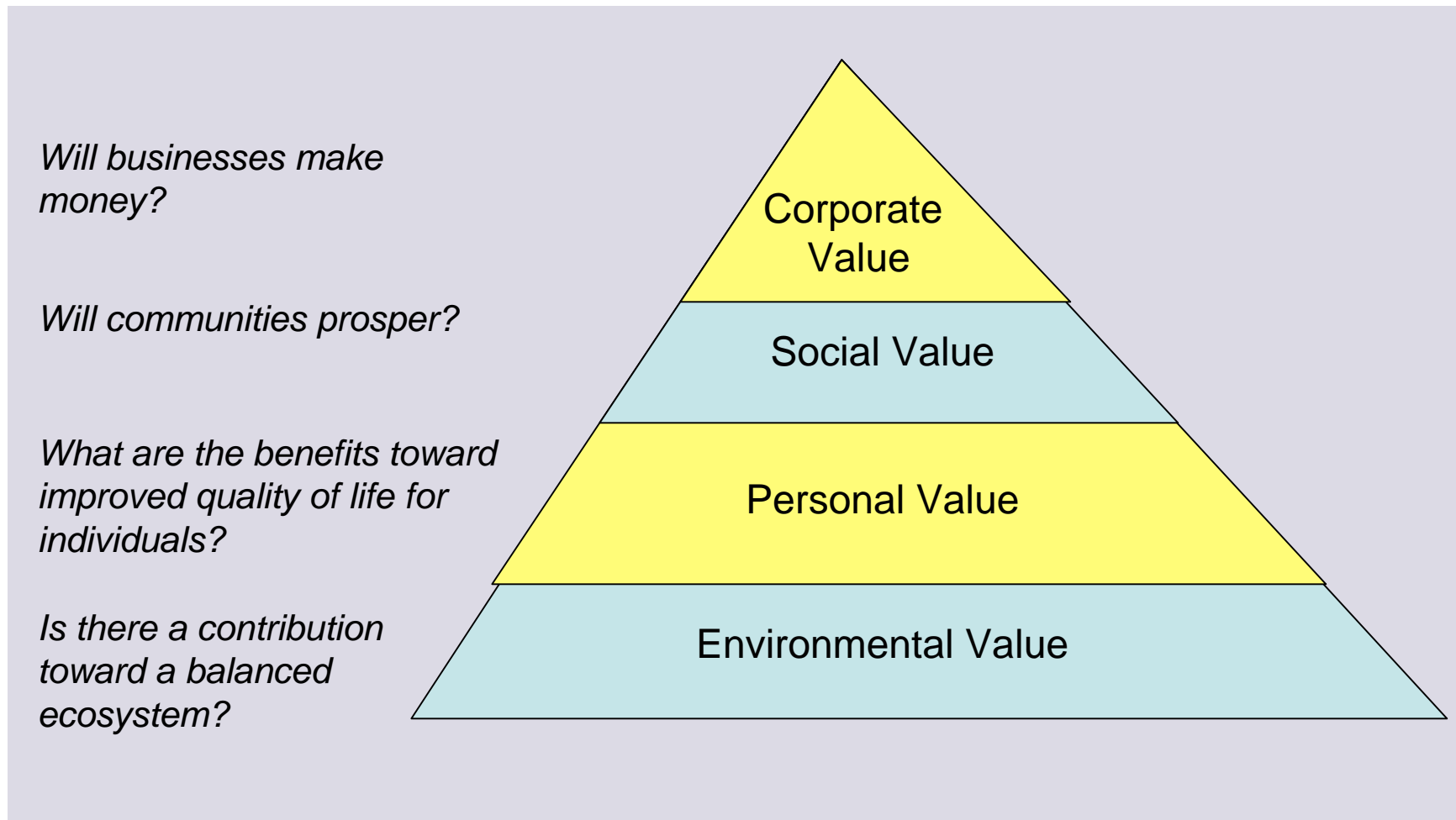


*Assessing the Value of Sulfide Mining in Michigan's Upper
Penninsula.*

Guiding Principle: Value Creation

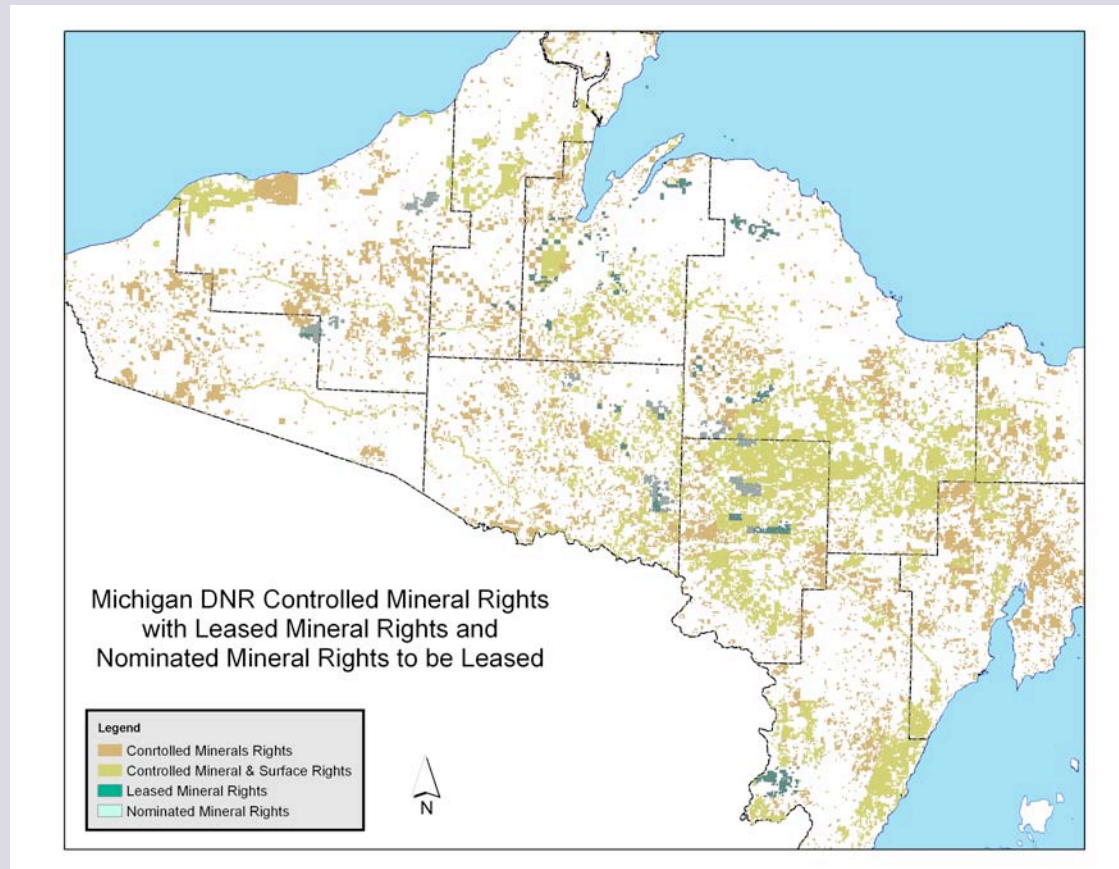
Businesses, community leaders, environmentalists, and personal activists will judge an issue from their own set of values. We look across value models.

Value Balanced Scorecard



Why Is WP Interested in Eagle

Sulfide Mining is on the short list of Michigan's environmental challenges due to the risk of acid mine drainage and the size of the impacted areas.



Seven Mines Studied

We selected seven mines to study based on 1) those that had many characteristics of a “21st Century Mine” and 2) those with similarities to what we assume to be the characteristics of Eagle.

	<i>Eagle</i>	<i>Flambeau</i>	<i>Gr Creek</i>	<i>Ridgeview</i>	<i>Cranston</i>	<i>Voisey's</i>	<i>Raglan</i>	<i>Louvicourt</i>
Mining Site	N. woods; near rivers, Upper Michigan	N. woods; near river, Wisconsin	Temperate rain forest; sea water inlet, SE Alaska	Temperate forest, numerous streams, South Carolina	N. woods; near river, streams, lakes, Wisconsin	Sub-arctic, northern Labrador, near rivers, lakes	Sub-arctic, northern Quebec, near rivers, lakes	N. woods; near river, streams, lakes, Quebec
Mining Operation	Underground/Cut & Fill (proposed)	Open Pit/DB (reclamation stage)	Underground/Cut & Fill (operational)	Open Pit/DB (reclamation stage)	Underground (inactive proposal)	Open Pit/DB; Underground/Cut & Fill (proposed, construction started)	Open Pit/ST; Underground/Cut & Fill	Underground/Cut & Fill (operational, expected to close in 2005)
Minerabgy	Nickel, Copper, low buffering capacity	Copper, Silver, Gold, limited buffering	Zinc, Lead, Silver, Gold, significant buffering capacity	Gold	Zinc, low buffering capacity (?)	Nickel, Copper, Cobalt	Nickel, Copper, Cobalt Plat. Grp., Palladium	Copper, Zinc, Gold, Silver
Hydrology	Close proximity to headwaters of two low flow drainages	Close proximity to high flow river	Close proximity to moderate river, treated discharge to sea water outfall, very dry mine	Pit lake is filling with water, wetlands mitigation in progress, bedrock at surface	Close proximity to numerous lakes and rivers	Close proximity to numerous lakes and rivers, permafrost.	Permafrost setting	Close proximity to numerous lakes and rivers



Strong Fit with Eagle



Moderate Fit with Eagle



Weak Fit With Eagle

Key Finding #1: Financial Inequities

Our first key finding is that our case mines resulted in a great inequity between those that benefit from mining and those that bear the cost of it's inherently invasive nature.



What Is the Payout?

What we can say about the losers is that they are in greater numbers than the winners and they are nine times more likely than the winners to live in Michigan.

Value Creation Calculation

	Total	Per Annum	
Net smelter returns	4.7B	782M	
Operating costs	.8B	133M	
Operating Margin	3.9B	649M	
Depreciation, Royalties		.525B	90M
EBIT	3.375B	559M	
EVA	3.3B	500M	
NPV	2.885B		

Typical Value Distribution

Kennecott Shareholders	1,875M	73	%	*
Feds	470M	18	%	
State Taxing Authority	166M	6.5	%	
Royalty Owners	50M	2	%	
Municipalities	19M	0.7	%	
Employees	125M	6	%	**

* Really, these are Rio Tinto shareholders

** Less than half of employee wages are likely to go to local people

*** Adds up to 106% because the six percent that represents wages is not part of earnings, but is an expense

Key Finding #2: Socio-Economic Failings

Our second finding is that the evidence shows growing negative impacts on income, unemployment and poverty, especially in the Great Lakes region.

Freudenberg and Wilson study of 301 mining-dependent communities

- Mines often “sold” to communities based on **improvements** in **income, unemployment rates, and poverty rates**.
- Actual findings that most had **worsened income, unemployment rates, and poverty rates** at time of closing:
 - More than **60%** of **all** communities
 - more than **85%** in the **great lakes region**,
 - more than **70%** of **those that have closed since 1982**

Key Finding #3: Site Sensitivity

Permits are set at a level of damage that someone determines a location can handle. The due diligence in setting those levels predetermines how much damage there will actually be.

Meeting Permitted Levels Does Not Mean There Is No Pollution



Permit levels must be appropriate for a particular site

Key Finding #4: High Risk Technology

Our fourth key finding is that sulfid mining technology is not mature. There is no reusable “21st Century Mining Technology”.

21st Century Mining Defects

Unable to predict outcomes with high degree of precision

- significantly higher levels of metals and significantly lower PH than predicted at Flambeau

Release of toxic chemicals (may be within permit rules”)

- 59 million pounds of toxic chemicals released in 2000 and 15,000 pounds of persistent bioaccumulative toxins (PBTs) released per year at Greens Creek
- Permitted releases of cyanide to the air in Ridgeway lead to local residents testing positive for cyanide in their blood

Ruptured lines and liners

- Failure of Berm around High Sulfide Waste Rock Pile at Flambeau
- 134 reported problems with waste rock liners at Flambeau

Key Finding #5: High Risk Management

Our fifth and final key finding is that the mines we studied all had significant defects and many of those defects were caused by failures of management vs failures of technology. Quality programs are not yet prominent in this industry.

Flambeau Management Defects:

Defect

1. 1997 two waste rock liner holes undetected for two years
2. Offsite Stream "C" found with elevated copper up to 30 ug
3. Discharge from abandoned rail spur sent up to 500 ug of copper sulfide into bio-filter pond and then to Stream "C"

Root Cause

Liner damaged by equipment and inspections not made

No monitoring plan for streams just off mine site – pre, during, and after mining

Improper initial remediation of rail spur where ore was crushed and loaded for transport

Progress To Date

The State of Michigan is moving in the right direction with current draft legislation, but the real test has been deferred to rulemaking.

Draft Legislation:

- A permit shall be required for sulfide mining.
- Sulfide mines shall be bonded prior to receiving a permit.
- The permitting process will have ample opportunity for public input and public access to the application and supplementary documents.
- An Environmental Impact Assessment shall accompany all applications.



Need: Broad Value Model

There is not enough data available to conclude that Eagle is anything but a very high risk investment. We are not ready to process permit requests in Michigan.

You Cannot Manage What You Do Not Measure

- What is the track record of the **technology**?
- What is the **process** competency of the operator?
- What are the **financial** needs and sourcesability to remediate a site and reconcile potential damages?
- What are the measures of the **location's sensitivity** to expected by-products of mining?
- What are the likely **socio-economic** effects on an area?
- What is the value of **recreational opportunities** lost?

How Much Degradation of Quality of Life is Expected? How Much Is Justifiable?



Need: Broad Site Evaluation

The costs of mining can be very large or relatively small, based on characteristics of the location.



Health & Fitness

- Proximity, volume, flow, and baseline purity of streams and aquifers affect quality of water



Lifestyle

- Lowers desirability as a place to live and visit



Nature

- Risk of losing endangered or environmentally sensitive species



Jobs

- Transient nature of work can raise unemployment in smaller, less diverse local economies



Education

- Unemployment places strain on community services, like education.



Crime Control

- Crime follows blight



Agriculture

- Competition with existing land-use based industry

Need: Quality Certification Requirements

The costs of mining can also be very large or relatively small, based on the management, process, and technical capabilities of the operator.

Michigan Sulfide Mine Operators Must:

- Certify Processes against ISO14001 standards
- Achieve “6 Sigma” improvements
- Meet EIS Requirements
- Utilize Best Practices
- Demonstrate Financial Ability to fund restitution, reclamation, and remediation
- Ensure standards of processes are maintained by continuous review and monitoring studies

Need: Access to World Class Expertise

The only way that we can improve our picture of value creation/destruction is to tap the most qualified sources of objectivity and expertise.

Improve Sources of Expertise

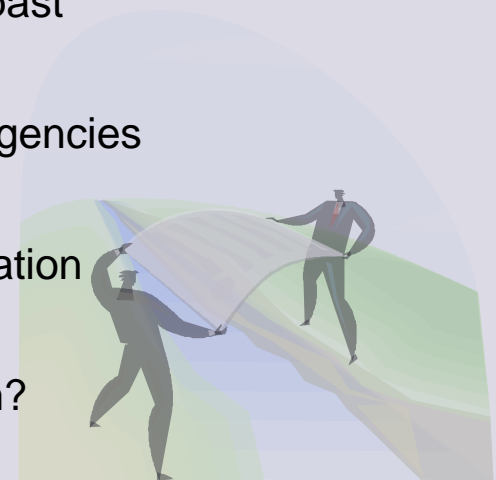
- Obtain full environmental baseline from neutral sources such as the USGS for full Hydrogeologic Assessments of the affected areas
- Leverage expertise from informed sources such as the EPA, Mining Industry consultants, Economic Assessment consultants, etc.
- Socio-Economic expertise from Academia
- Develop in-depth analyses of operators that fully disclose financials, past performance, technological expertise, etc.



Rulemaking Challenge

Value to the public will be created or destroyed by sulfide mining based on whether rulemaking provides adequate controls. How will the state respond to these needs?

1. How will a long term value prospect of a mine be determined?
2. What will be done to ensure that complete baseline data is gathered on a site before any activity is permitted?
3. How will socio-economic effects be forecast?
4. How will it be determined whether a location is suitable or not suitable for mining based on science?
5. How will operators be certified as responsible based on past performance to standards?
6. From what internal and external sources will regulating agencies acquire, develop, and retain deep, objective expertise?
7. How will we ensure that there is adequate public participation and understanding to ensure transparency of operation?
8. Who is going to cover the cost to administer this program?
9. How can recycling be made more economical?



What Can You Do?

Don't assume that someone else will protect the interest of the communities and individuals affected. Our research shows that an active community is mandatory (though not sufficient) for a fair outcome.

Active Communities:

- Educate themselves
- Seek objective, expert involvement
- Challenge assumptions
- Think long term
- Make use of public input opportunities

Be An Active Community:

1. *Support proposed legislation*
2. *Be Active in the rulemaking process!*
3. *Be Active in the permitting process!*



Wolfpack