Aggregates and Industrial Minerals Mine Permitting:

A Multidisciplinary Approach

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Patrick Engineering, Inc.

Illinois Mining Institute
August 22, 2012

PATRICK
a family of companies

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SINCE 1913

Developing a mineral resource requires more than having access to the reserves…

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Bringing the resource to market requires careful planning…

…and the collaboration of a wide range of professionals

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Resource Development

- Greenfields
- Existing Facilities
- Expansions

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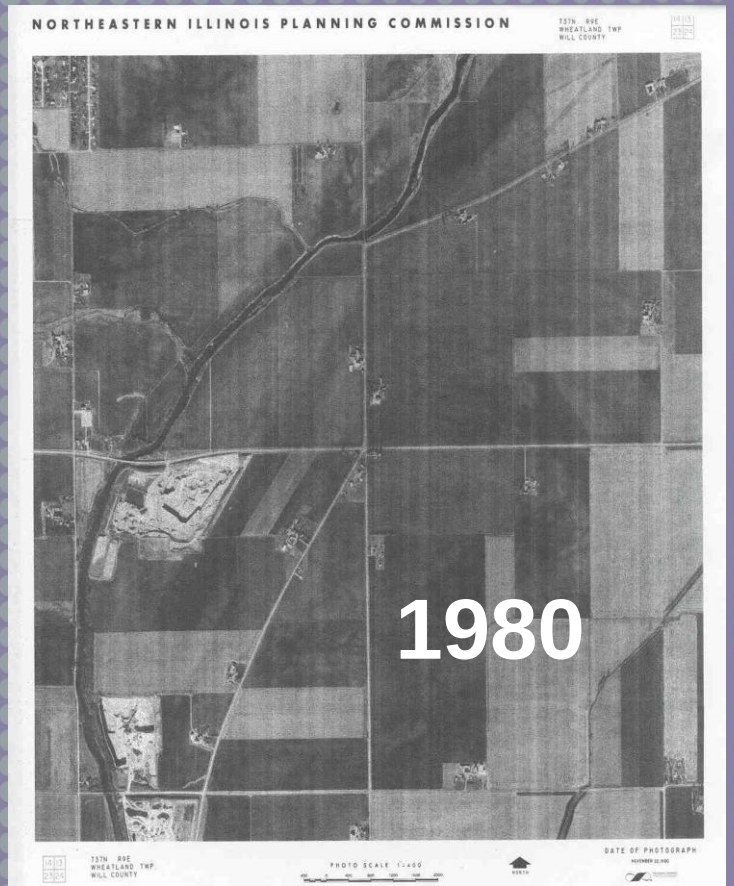
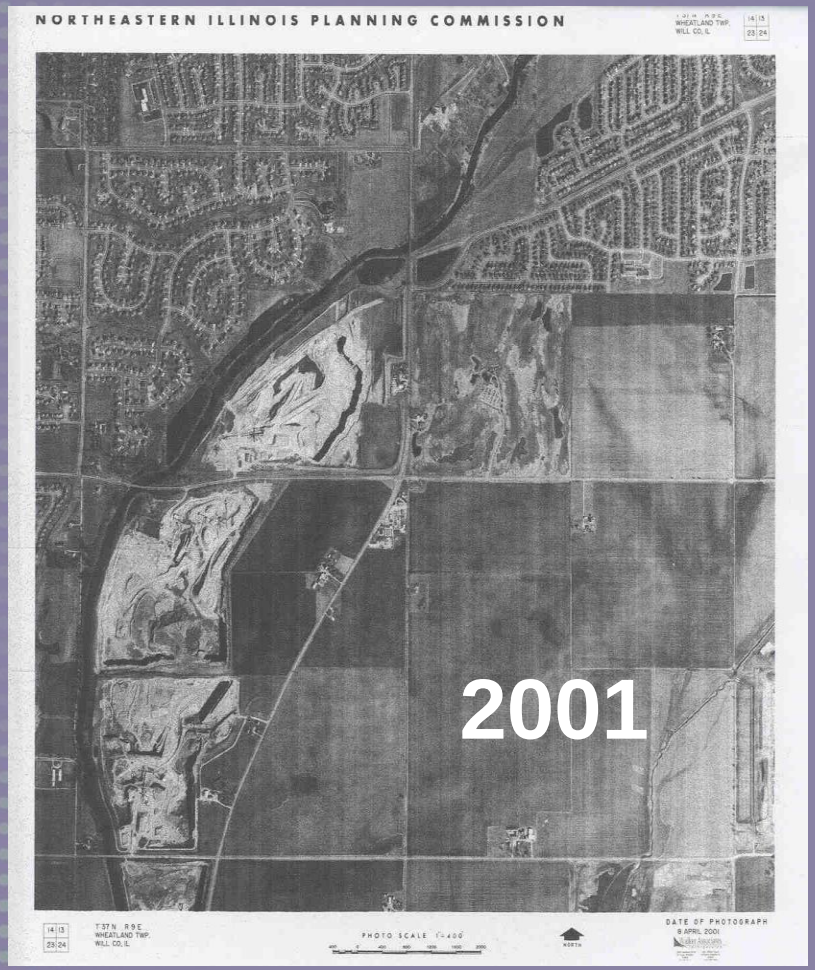
Planning

- Urban Sprawl





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Legal Framework

- Land Owner Rights/Justice
- Who Issues The Mining Permit?
- What is The Process?
- Who Might Be Impacted?
- Timing

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The Non-Strategic Approach

- Appraisers - Maybe
- Geologists - Maybe
- Mining Engineer -Probably

This approach worked in the good ‘ole days…with the good ‘ole boy networks

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The Strategic Approach

A truly multidisciplinary approach that works…

… and most of the time is required

in a modern, sophisticated world!

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Aggregate and Industrial Minerals Mine Permitting:

A Multidisciplinary Approach

The Multidisciplinary Approach

The First Wave…

- Law Team
- Public Relations
- Appraiser

Followed by a coordinated team of professionals to plan, design, educate…

…and Win!

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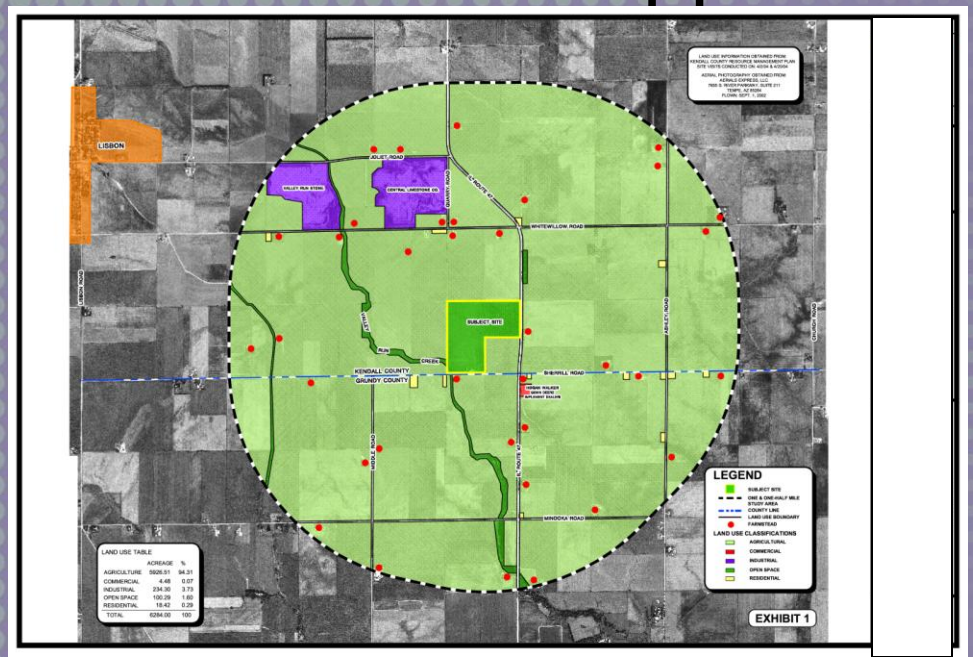
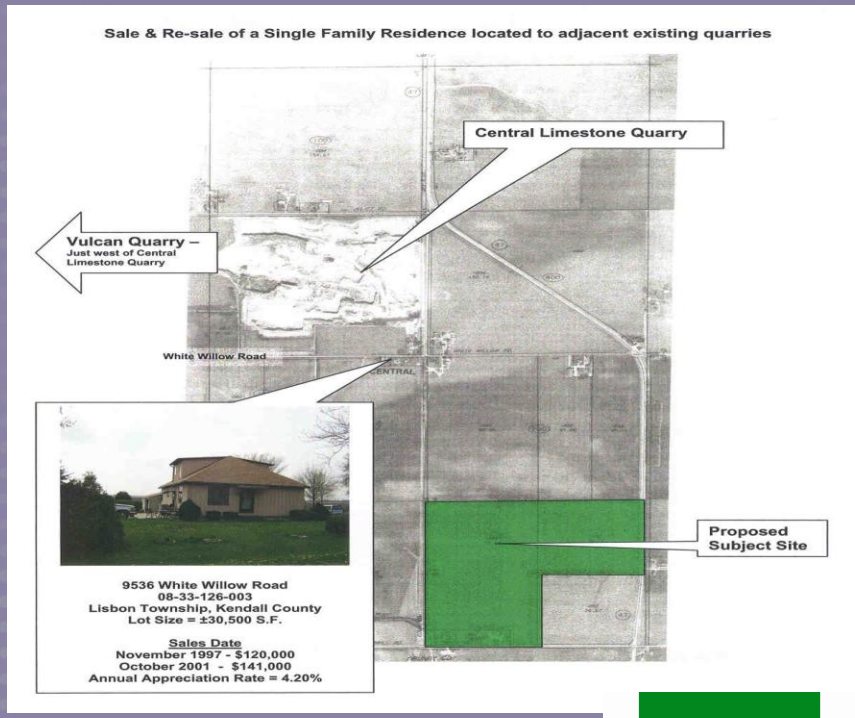
A Multidisciplinary Approach

The Multidisciplinary Approach

The Technical Team - The Planners

- Land Use Planners
- Real Estate Appraisers





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The Multidisciplinary Approach

The Technical Team - The Scientists

- Geologists
- Hydrogeologists
- Chemists
- Ecologists/Biologists
- Archeologists
- Meteorologists
- Industrial Hygienists/Toxicologists

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A Multidisciplinary Approach

The Multidisciplinary Approach

The Technical Team – The Engineers

- Mining Engineers/Civil Engineers
- Civil Engineers/Hydrologists
- Traffic/Transportation Engineers
- Blasting Experts/Engineers
- Landscape Architects

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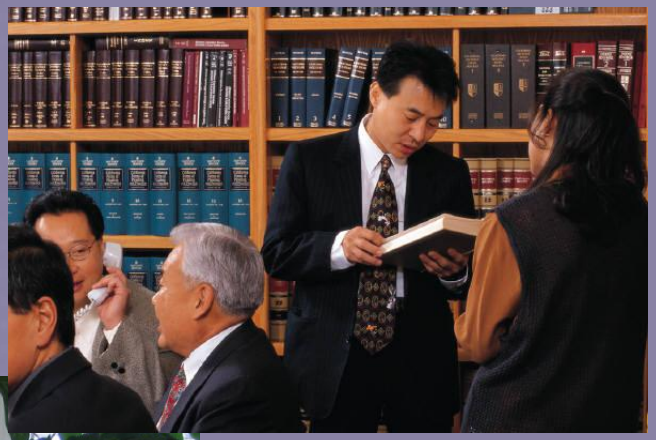
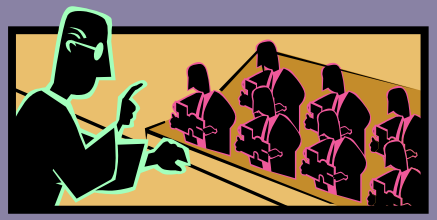
A Multidisciplinary Approach

Law Team

- Coordination
- Zoning Applications
- Hearings
- Litigation





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Public Relations

- Politics
- NIMBYs…
- …Mobs

A topic unto itself

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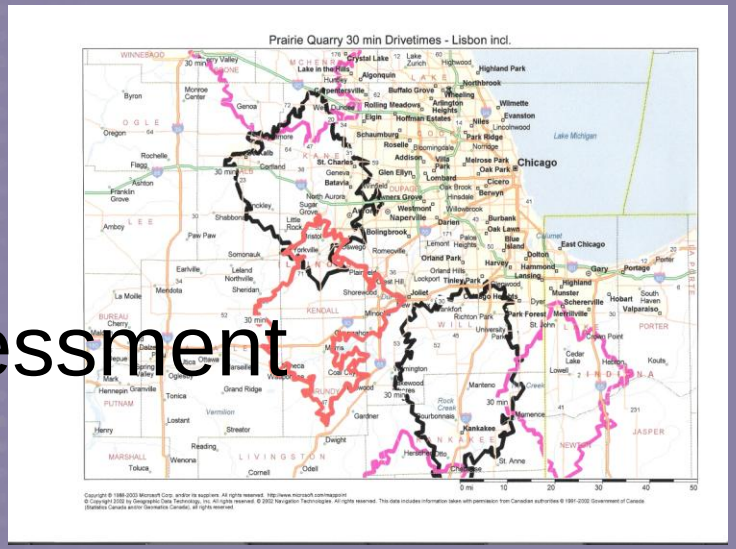
Appraisers

- Market Study
- Community Needs Assessment
- Projected Growth
- Current Values/Existing Facilities
- Highest and Best Use of Property



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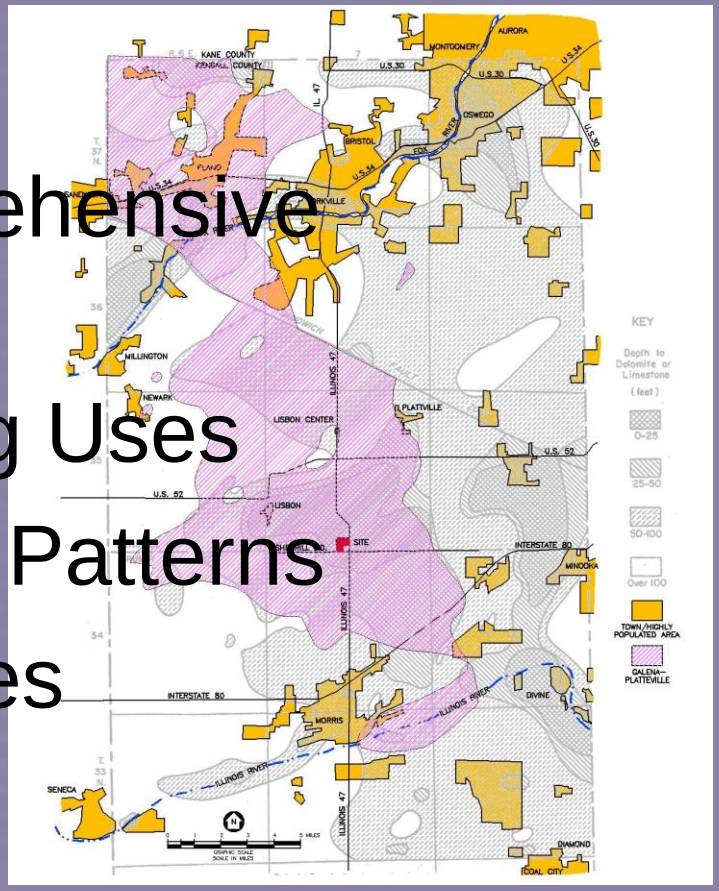
Land Use Planners

- Compatibility With Comprehensive Plan
- Compatibility With Existing Uses
- Compatibility With Zoning Patterns
- Local Zoning or Ordinances
- Development Trends



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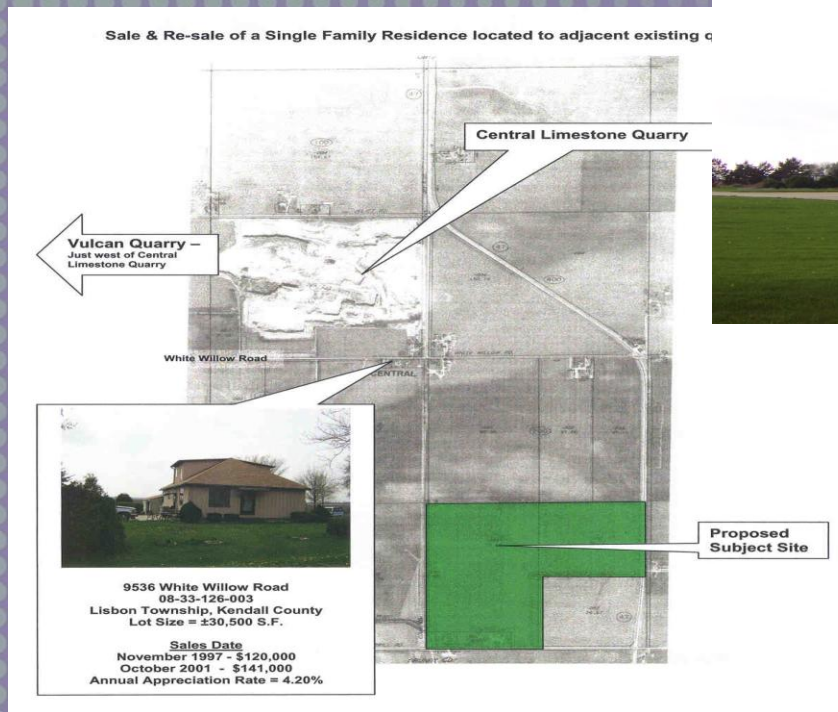
Real Estate Appraiser

- Impacts to Property Values
- Comparative Studies



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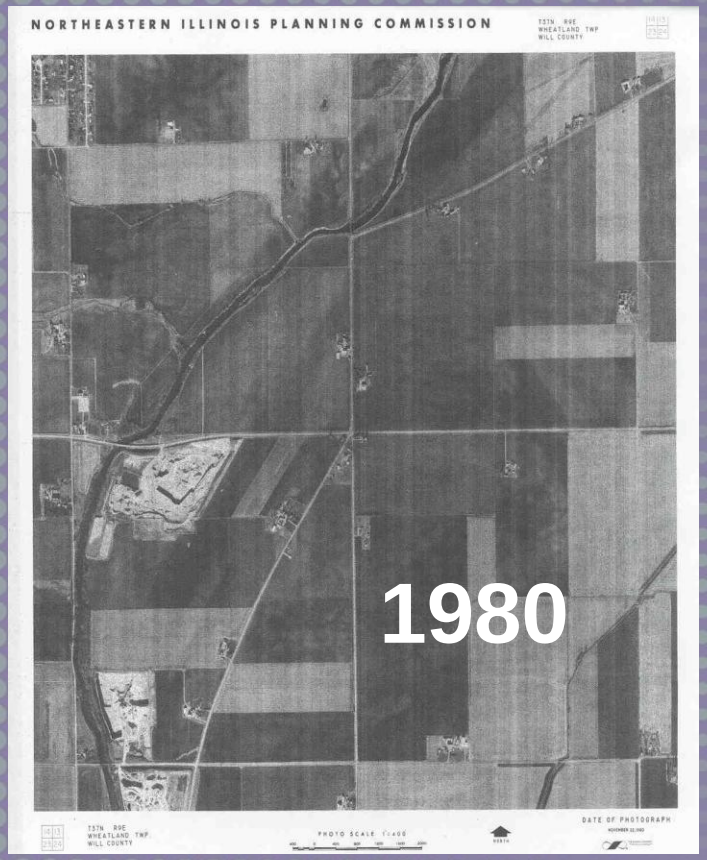
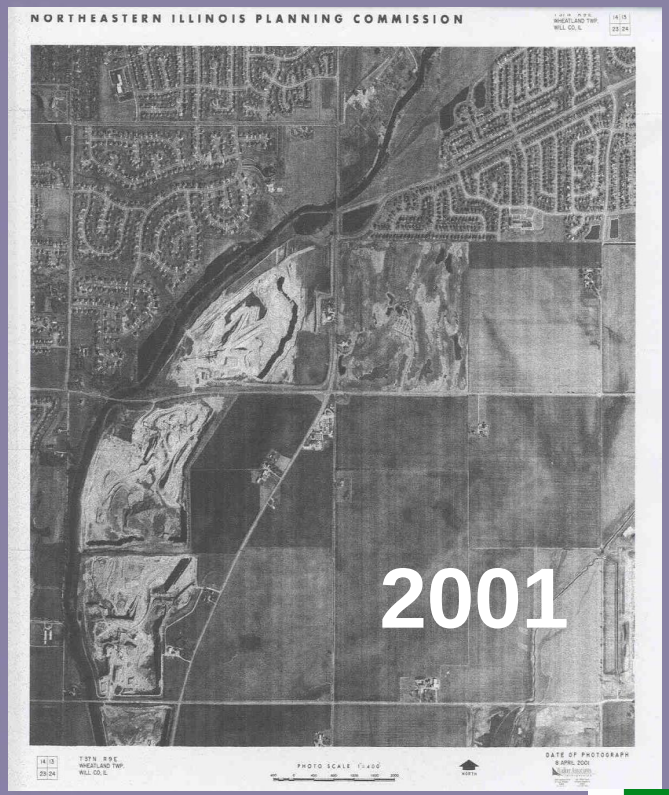
Real Estate Appraisers

- Comparative Studies





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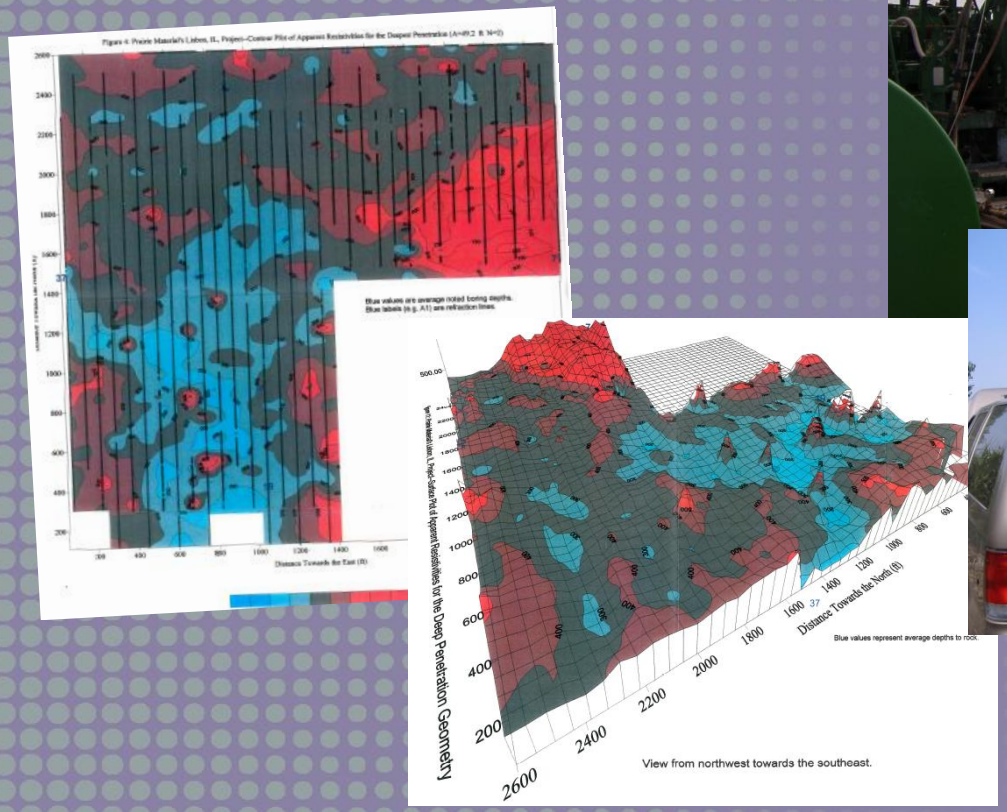
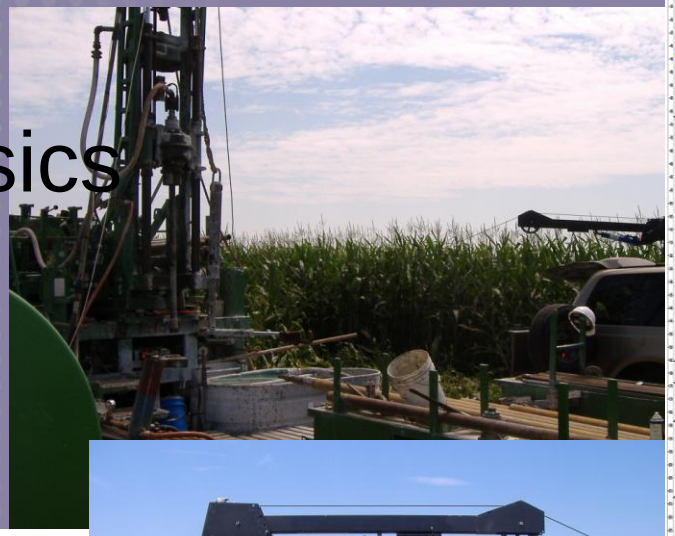
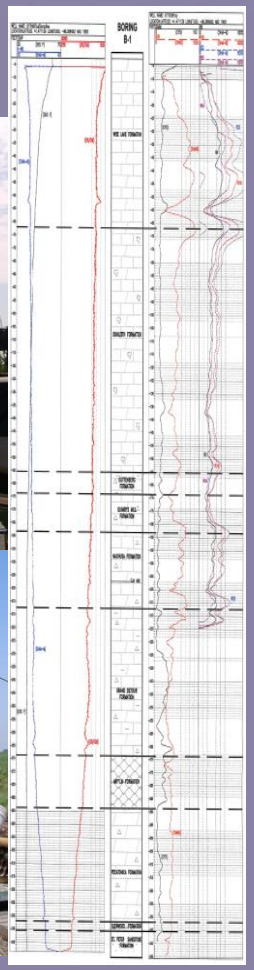
Geologists

- Exploration Geophysics







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Geologists

- Reserve Characterization

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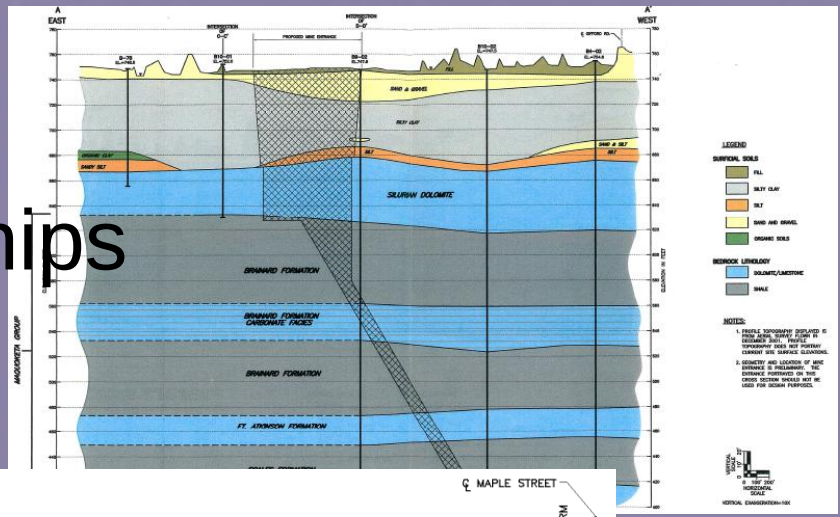
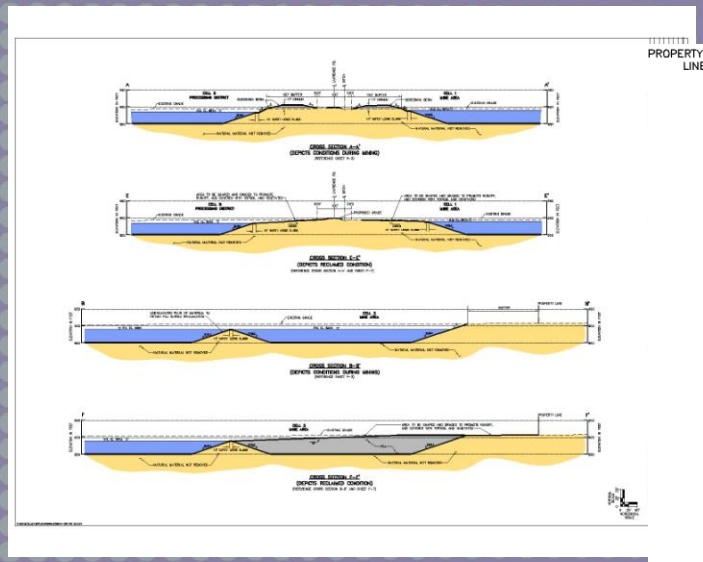
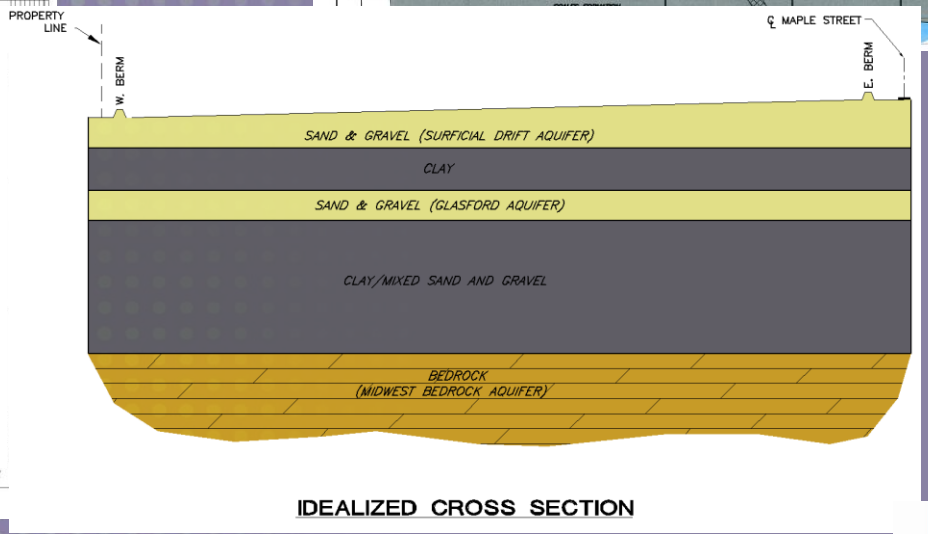
Geologists

- Stratigraphic Relationships







IDEALIZED CROSS SECTION

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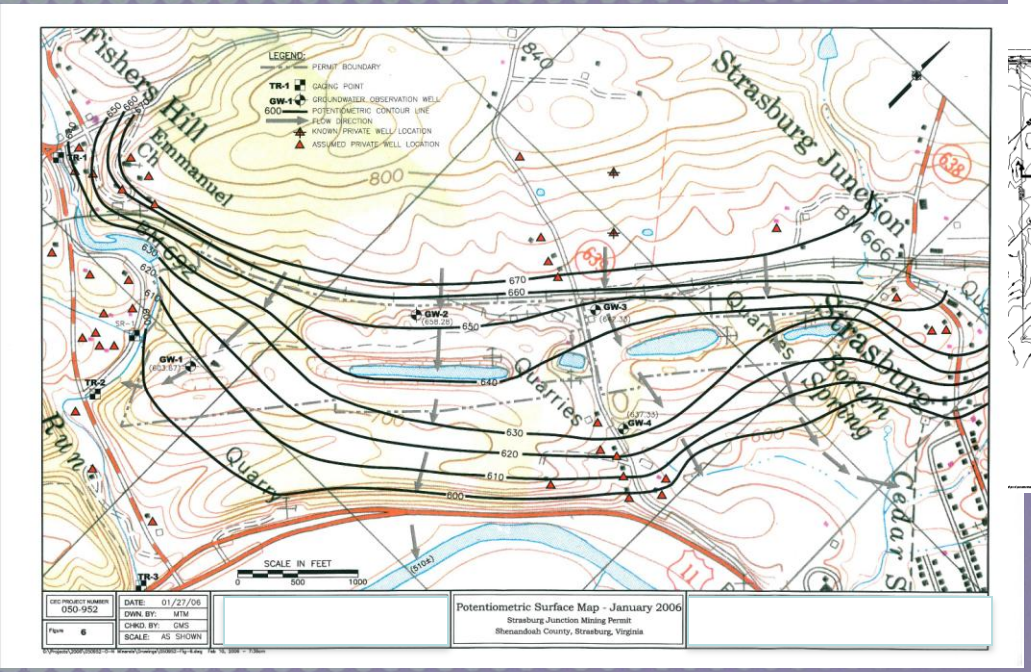
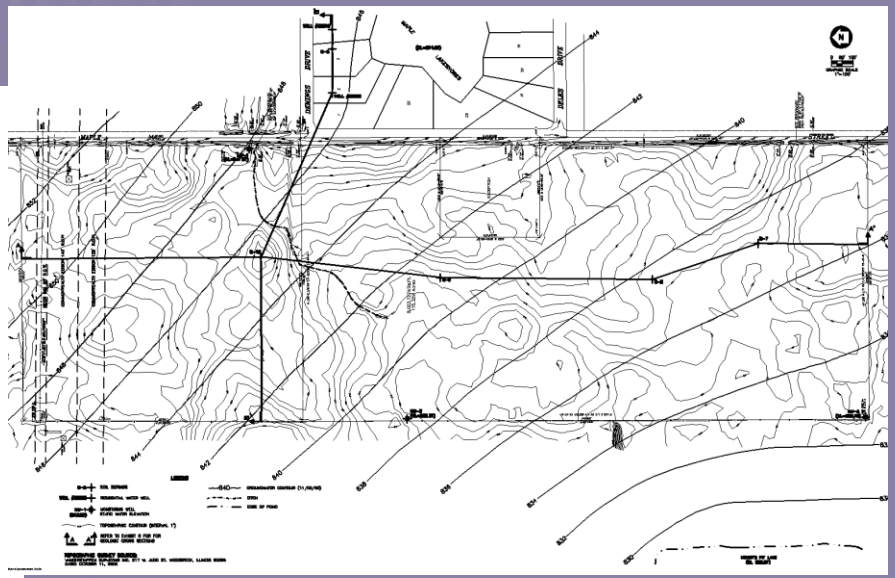
Hydrogeologists

- Existing Groundwater Conditions





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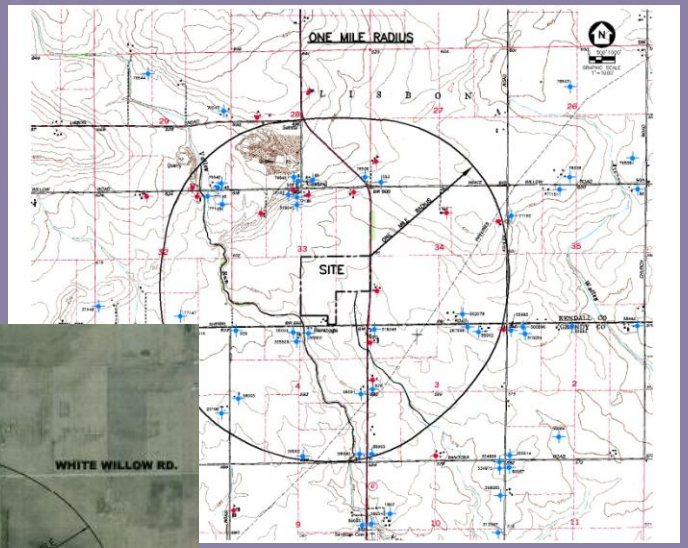
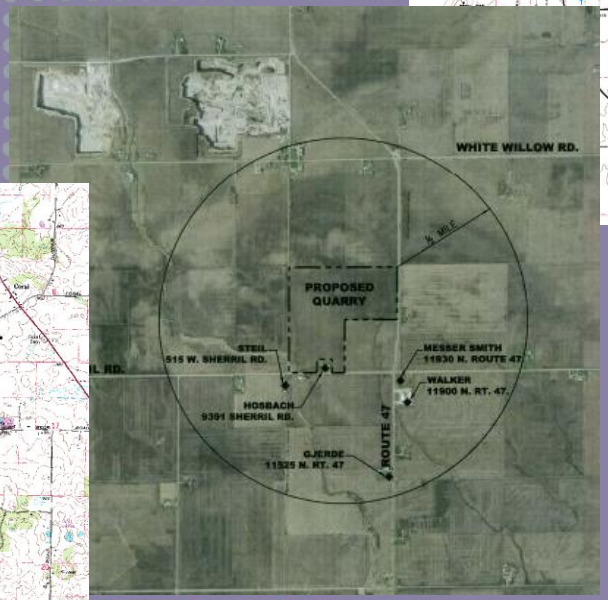
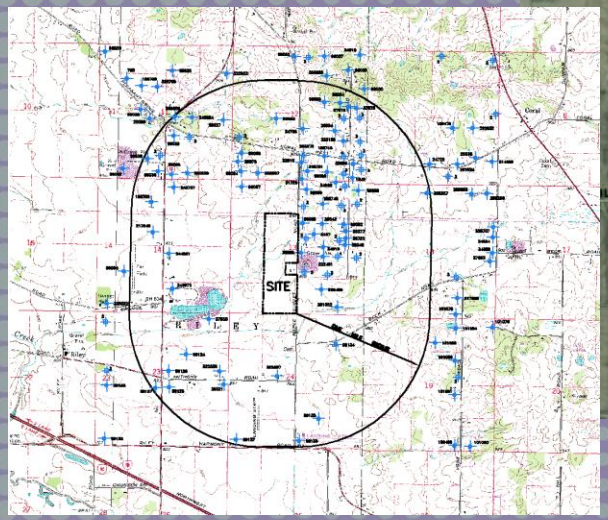
Hydrogeologists

- Water Well Surveys







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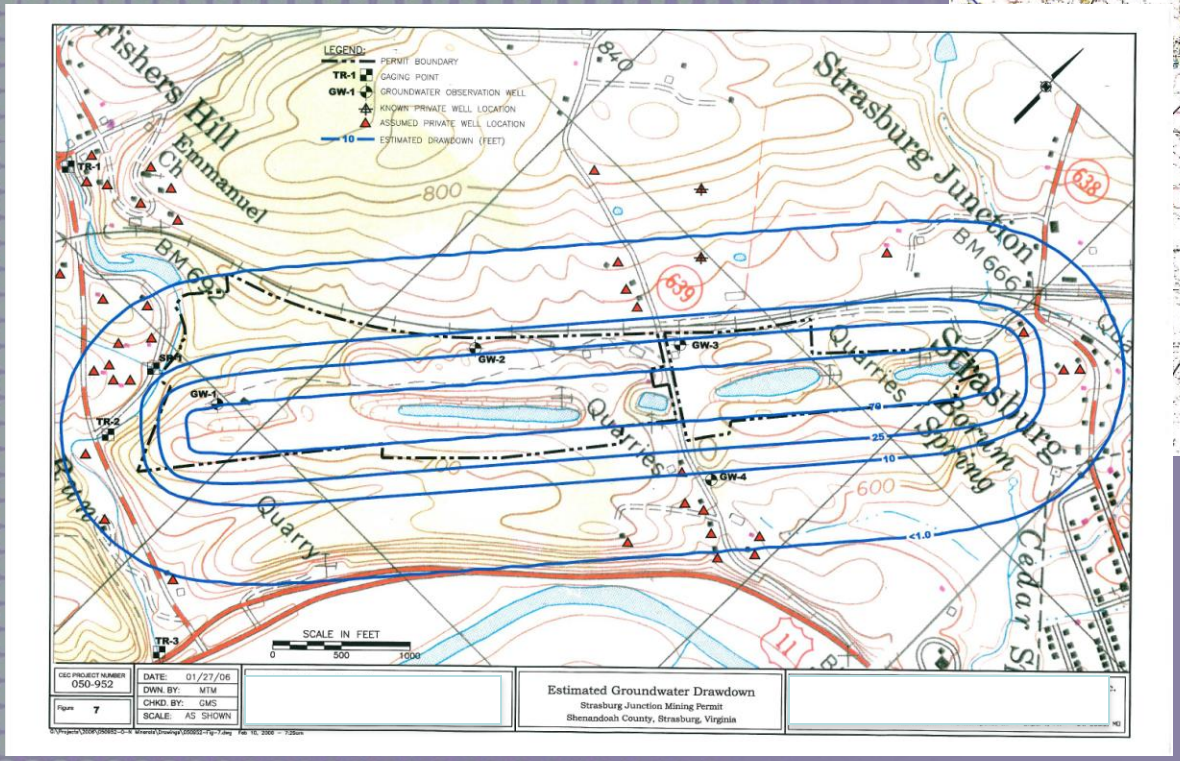
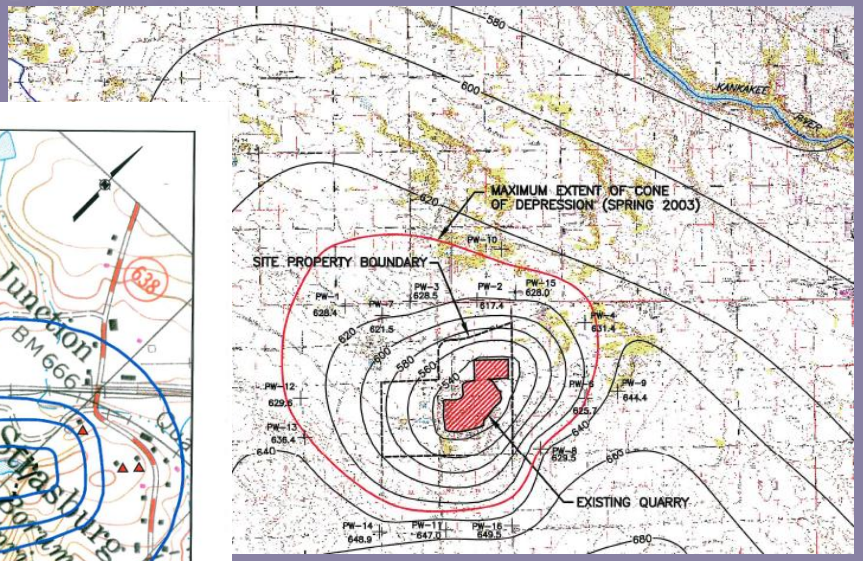
A Multidisciplinary Approach

Hydrogeologists

- Modeled Groundwater Impacts





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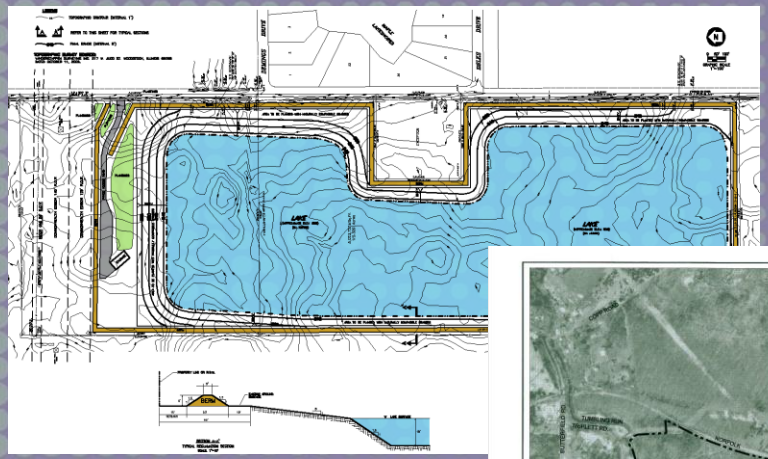
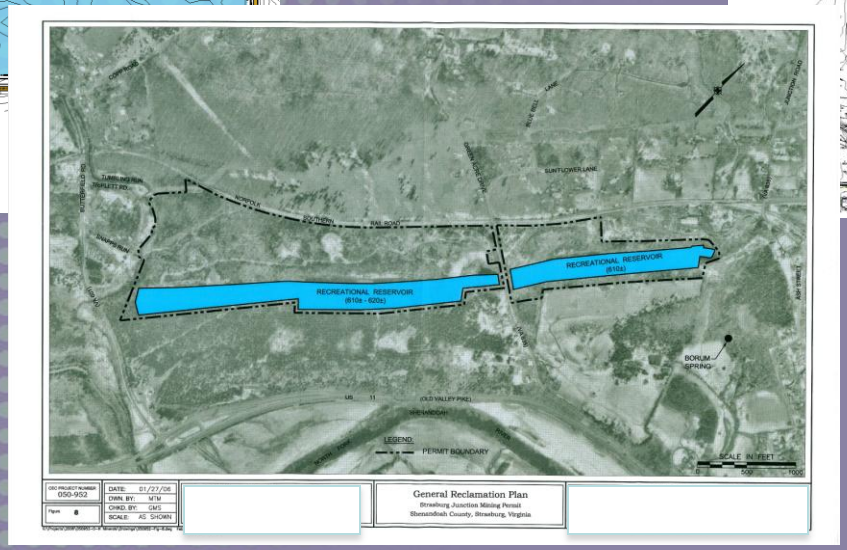
Hydrogeologists

- Final Groundwater Conditions





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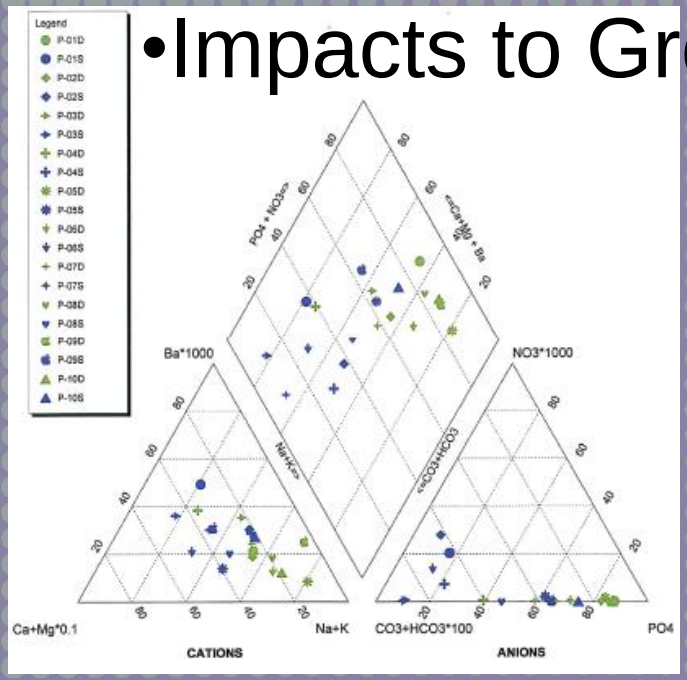
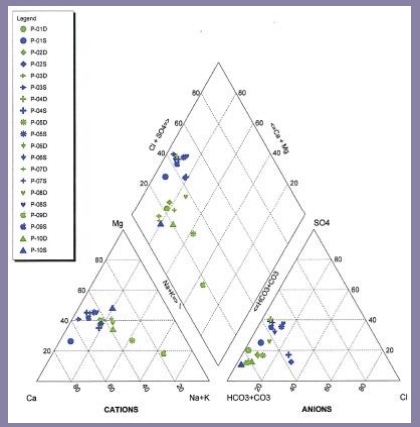
Chemists

- Rock Quality
- Rock Chemistry
- Impacts to Groundwater Quality





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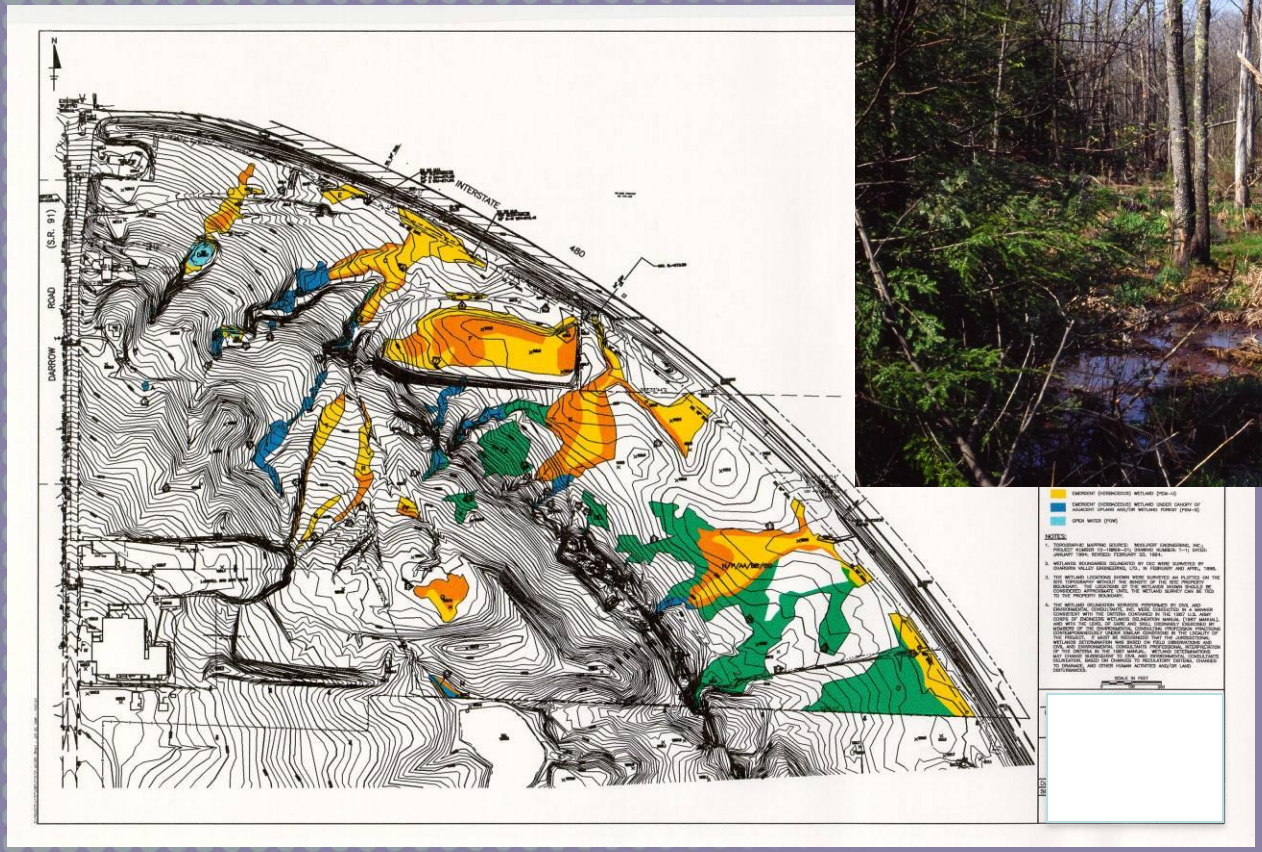
Ecologists/Biologists

- Wetland Delineation



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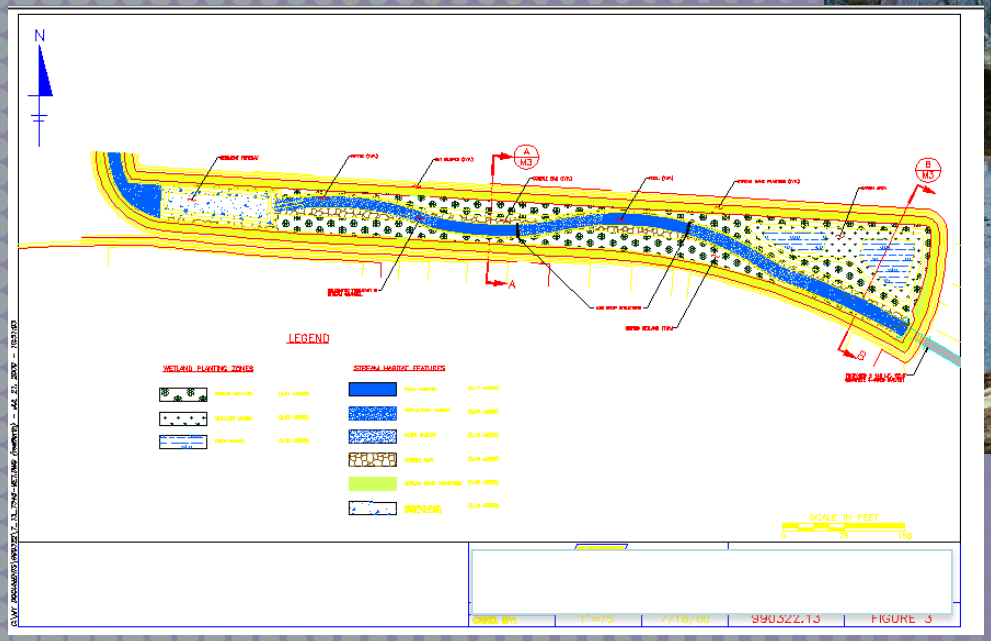
A Multidisciplinary Approach

Ecologists/Biologists

- Wetland Mitigation



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Ecologists/Biologists

- Endangered Species/Habitat

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Archaeologists

- Phase I Studies
- Historical Use
- Prehistoric Use

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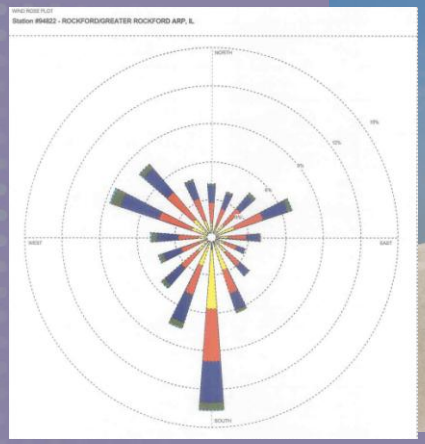
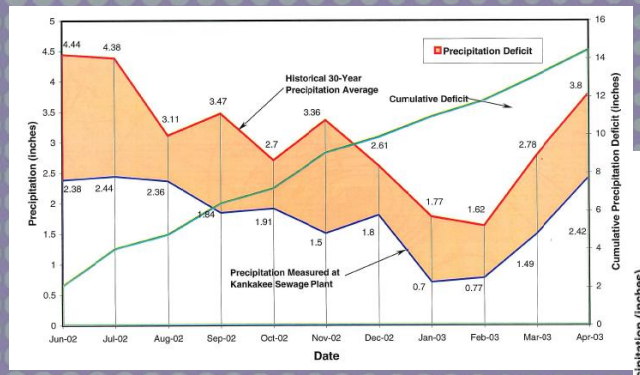
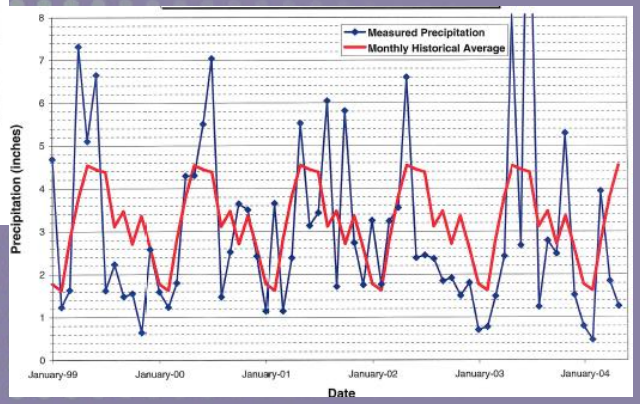
Meteorologists

- Weather Stations
- Precipitation Patterns
- Wind Directions







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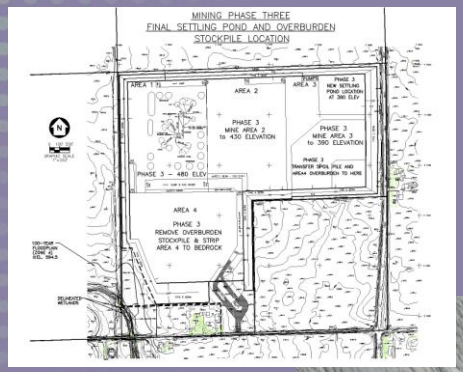
A Multidisciplinary Approach

Industrial Hygienists/Toxicologists

- Dust
- Noise
- Health Risks
- Control Features



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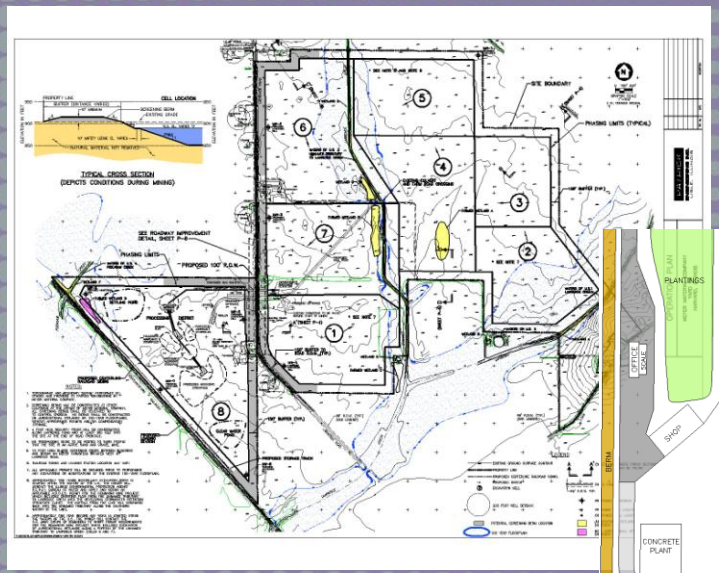
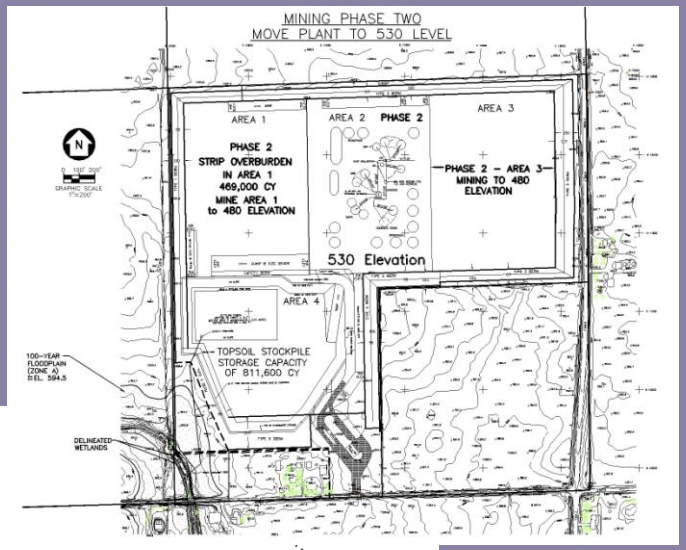
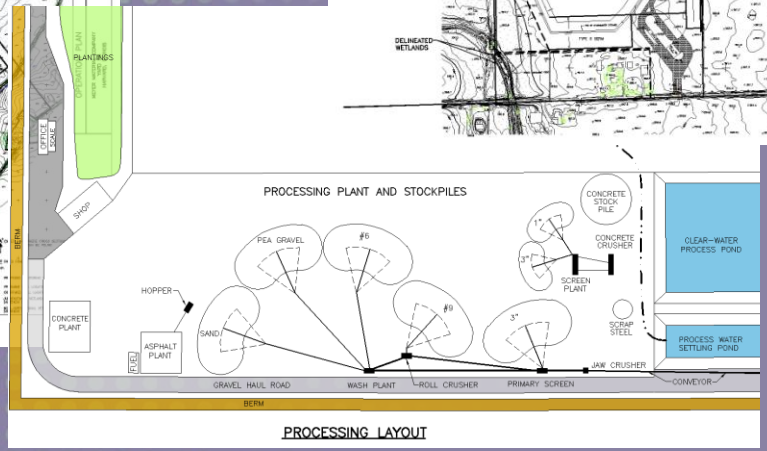
A Multidisciplinary Approach

Mining/Civil Engineers

- Mine Layout/ Design
- Infrastucture







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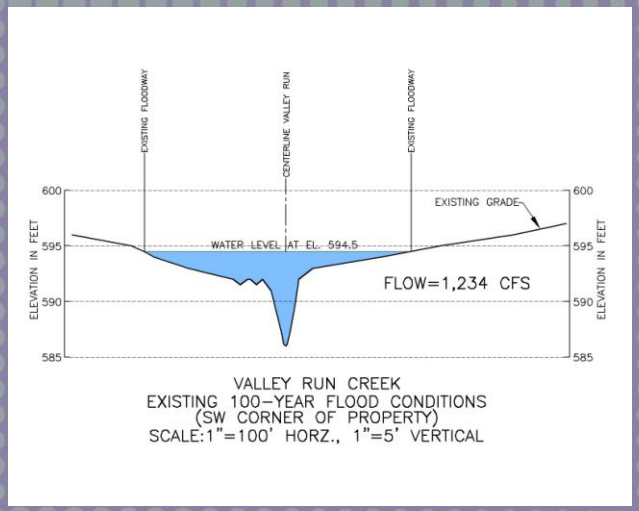
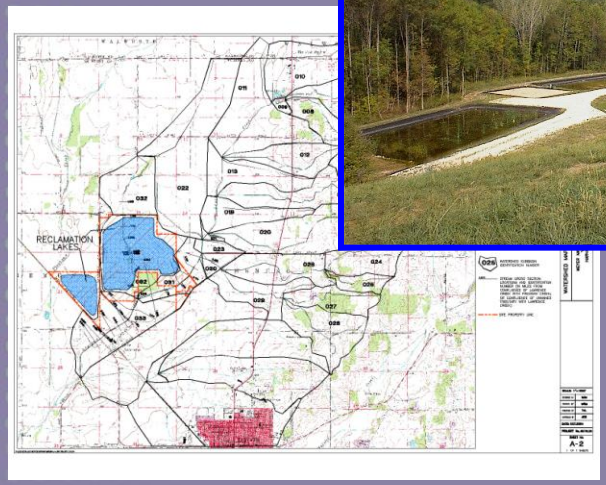
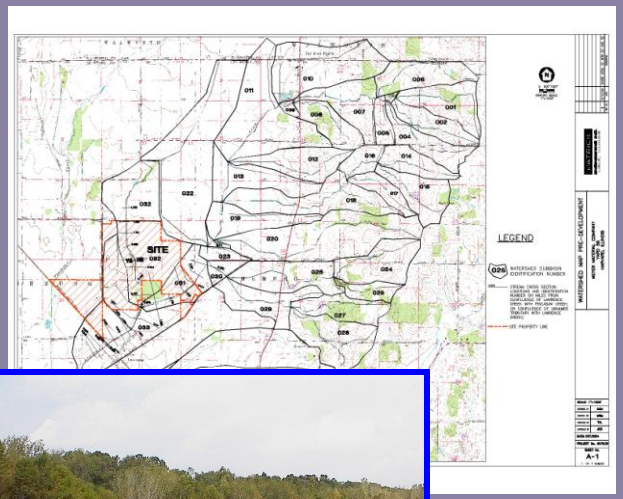
Hydrologists/Civil Engineers

- Watershed Management
- Storm Water
- Flood Plains
- NPDES Permitting







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Traffic/Transportation Engineers

- Haul Routes/Trips
- Traffic Counts
- Road Capacity Analysis
- Directional Distribution Analysis
- Intersection Capacity
- Gap Studies

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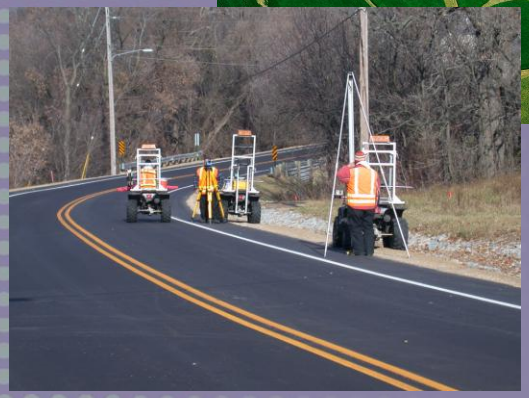
Traffic/Transportation Engineers

- Road Improvements
- Entrance Design/Permits
- Turn Lanes
- Control Devices
- Rail Spurs



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Blasting Expert

- Structures/Pipelines/Power Towers
- Pre-Blast Surveys
- Blast Design
- Notification/Reporting
- Education: Vibration -vs- Airblast

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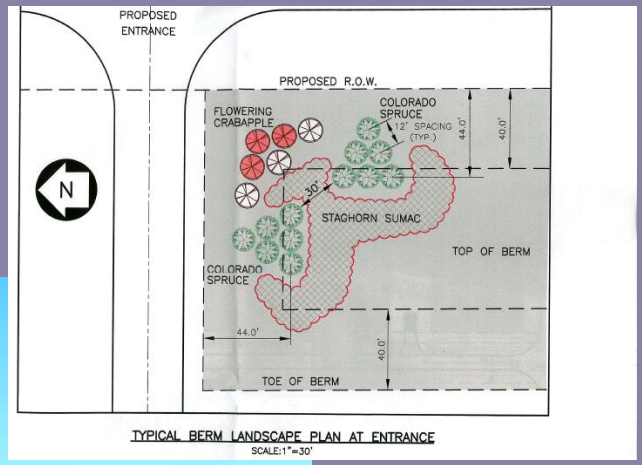
Landscape Architects

- Entrance Design
- Berm Layouts
- Model Views



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Developing a mineral resource requires more than having access to the reserves…

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Bringing the resource to market requires careful planning…

…and the collaboration of a wide range of professionals

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To successfully manage a mine development in this day and age…

…a multidisciplinary approach to resource planning is critical

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Questions?