The Nelsonville Bypass:

A Hitchhiker's Journey through the Galaxy of Mine Hazards

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Geohazards in Transportation
Appalachian Region Technical Forum
August 1-2, 2007

Agenda

I. Project Introduction/Background
II. Exploration of Geohazards
III. Results of Exploration
IV. Mitigation of Geohazards
V. Questions/Answers

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I. Project Introduction/Background

Nelsonville, Ohio

General Project Information

- Owner: ODOT
- Designer: District 10
- County: Athens/Hocking
- Limited Access Highway from Columbus, Ohio to Charleston, WV

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Project Location

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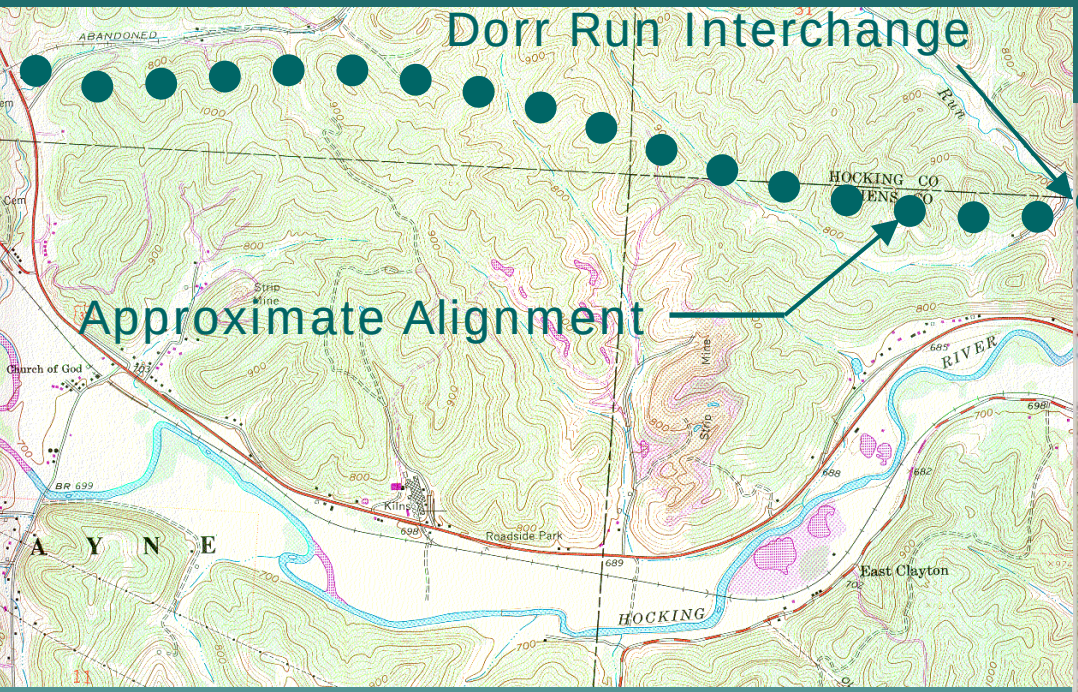
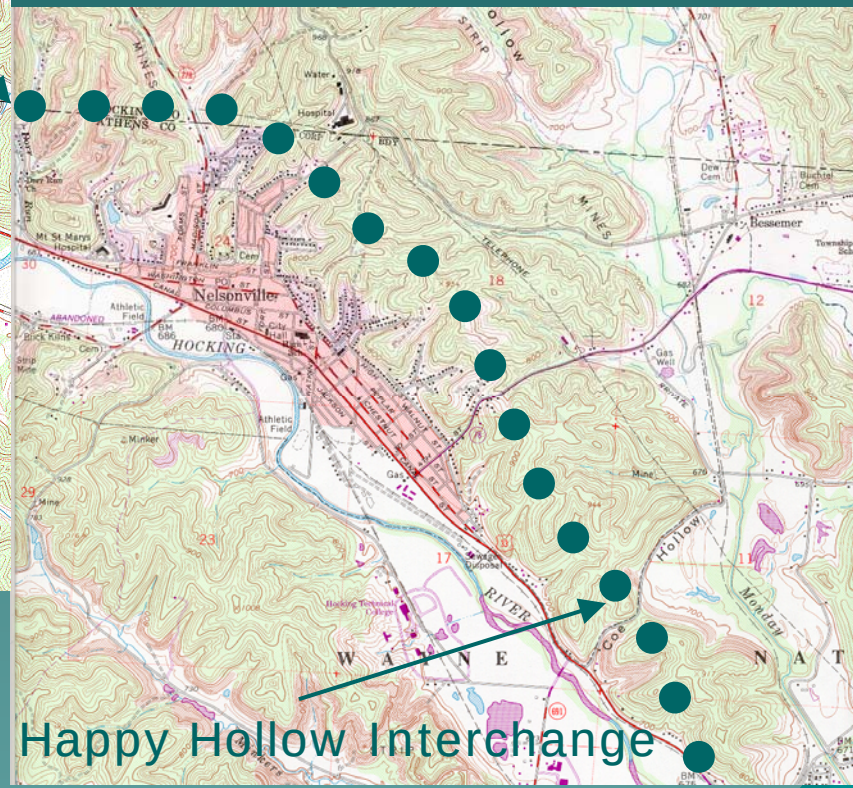
Bypass Alignment



8.5 Miles Long



10 Bridges Along Alignment

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Project Challenges

- Large-scale roadway project with tight schedule
- Appalachian terrain meaning deep cuts and fills
- Alignment underlain by abandoned coal mines
- Roughly half of the alignment on Wayne National Forest property

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Geohazards

- Abandoned Underground Mines
  - Mine Water Quantity/Quality
  - Subsidence
  - Drift Entries, Shafts
- Abandoned Surface Mines
  - Mine Spoil
  - Highwalls
  - Mine Sediment Ponds
- Uncontrolled Man-Made Fills
- Landslide-Prone Soils and Bedrock
- Soft Foundation Soils

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Mining History

- Started Mid-1800's in Nelsonville
- Both Surface and Underground
- No. 7 (Upper Freeport) Coal
- No. 6 (Middle Kittanning) Coal
- Lower Kittanning Coal/Clay

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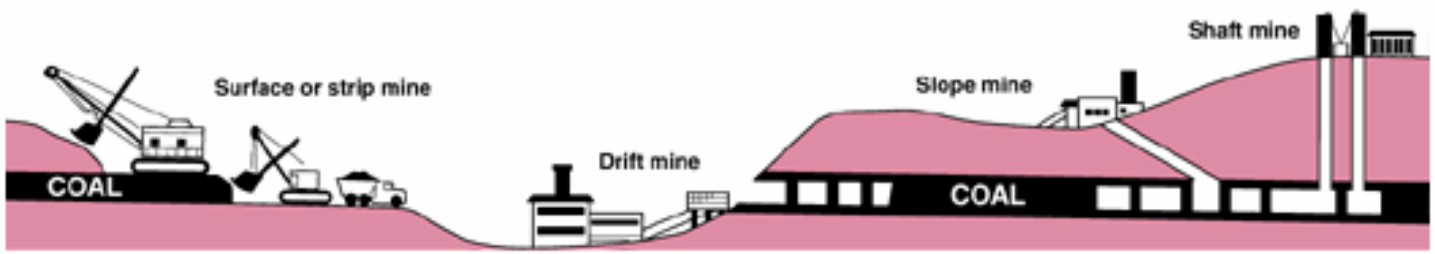
Ohio Coal Mining

- Coal Production Since 1800:
  - 1.4 billion tons from surface mines
  - 2.2 billion tons from underground mines
- Principal Means of Coal Mining
  - 1800-1948: Underground Mining
  - 1948-1995: Surface Mining
  - 1995-present: Underground Mining



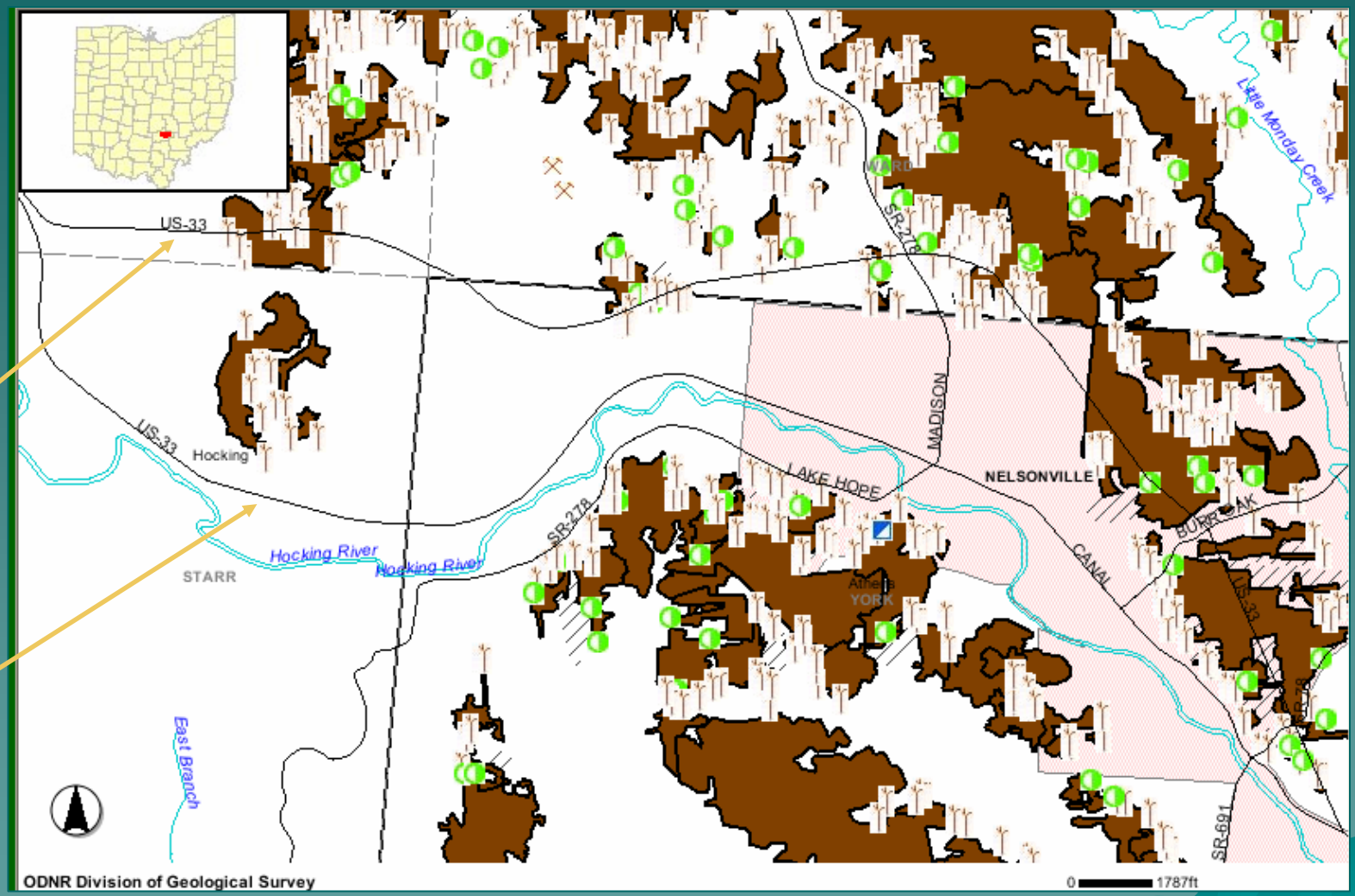
UNDERGROUND MINING

Geofacts No. 15, ODNR Division of Geological Survey

Mapped Mines in Project Vicinity

Proposed Alignment

Existing Alignment



State of Ohio - Abandoned Underground Mine Locator (ODNR)

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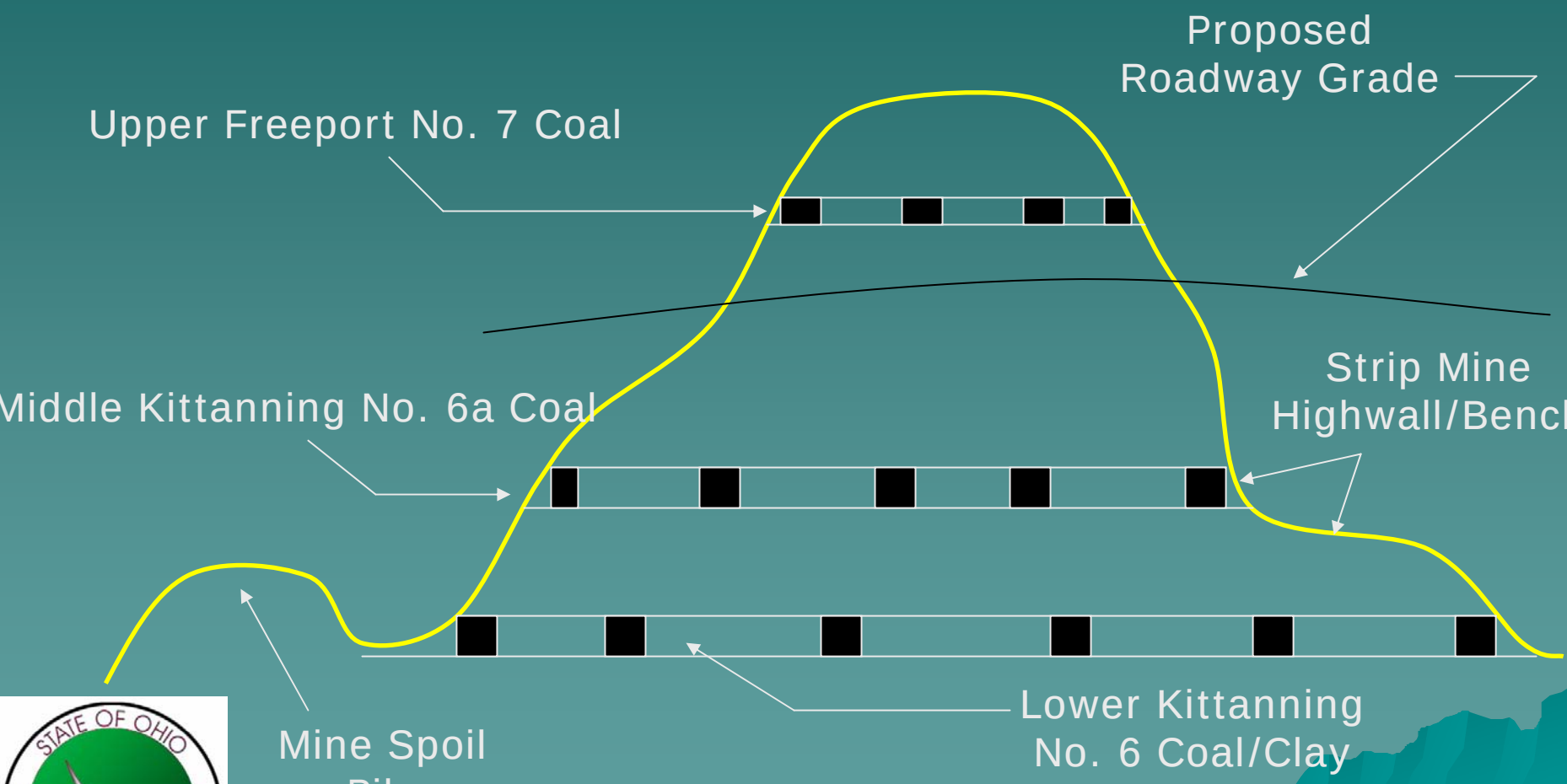
Typical Profile of Mining Geohazards



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II. Exploration of Geohazards

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Exploration Planning

- Geologic Mapping Review
  - Bedrock Geology
  - Soil Survey
- Abandoned Mine Mapping Review
  - Review of abandoned mine quadrangle
  - Review of individual mine maps
  - Superimposed mine maps on roadway plans
- Use Preliminary Exploration Results
- Prepare Final Boring Plan

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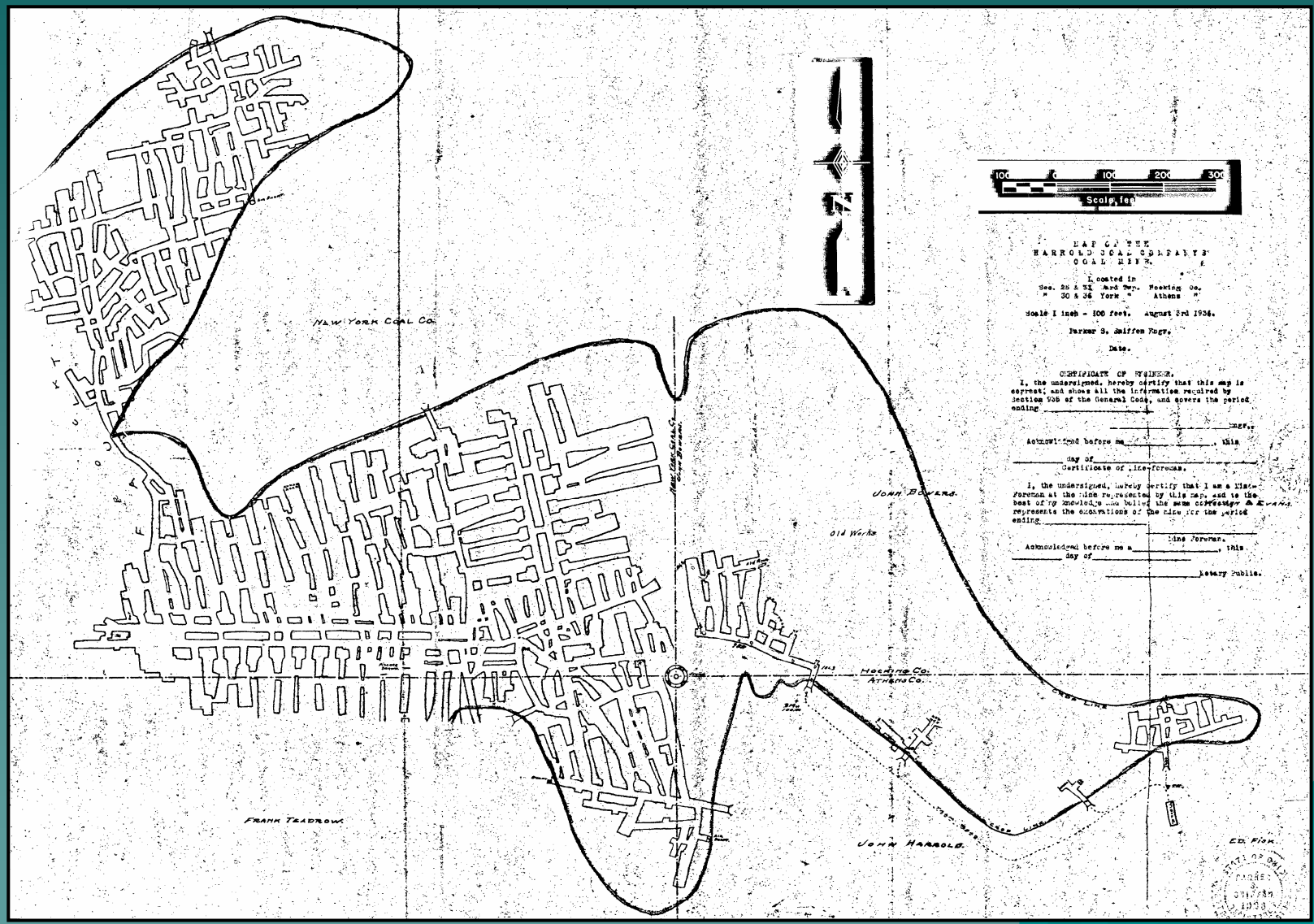
Exploration Planning - Mine Maps



Harrold Coal Company Mine - 1934

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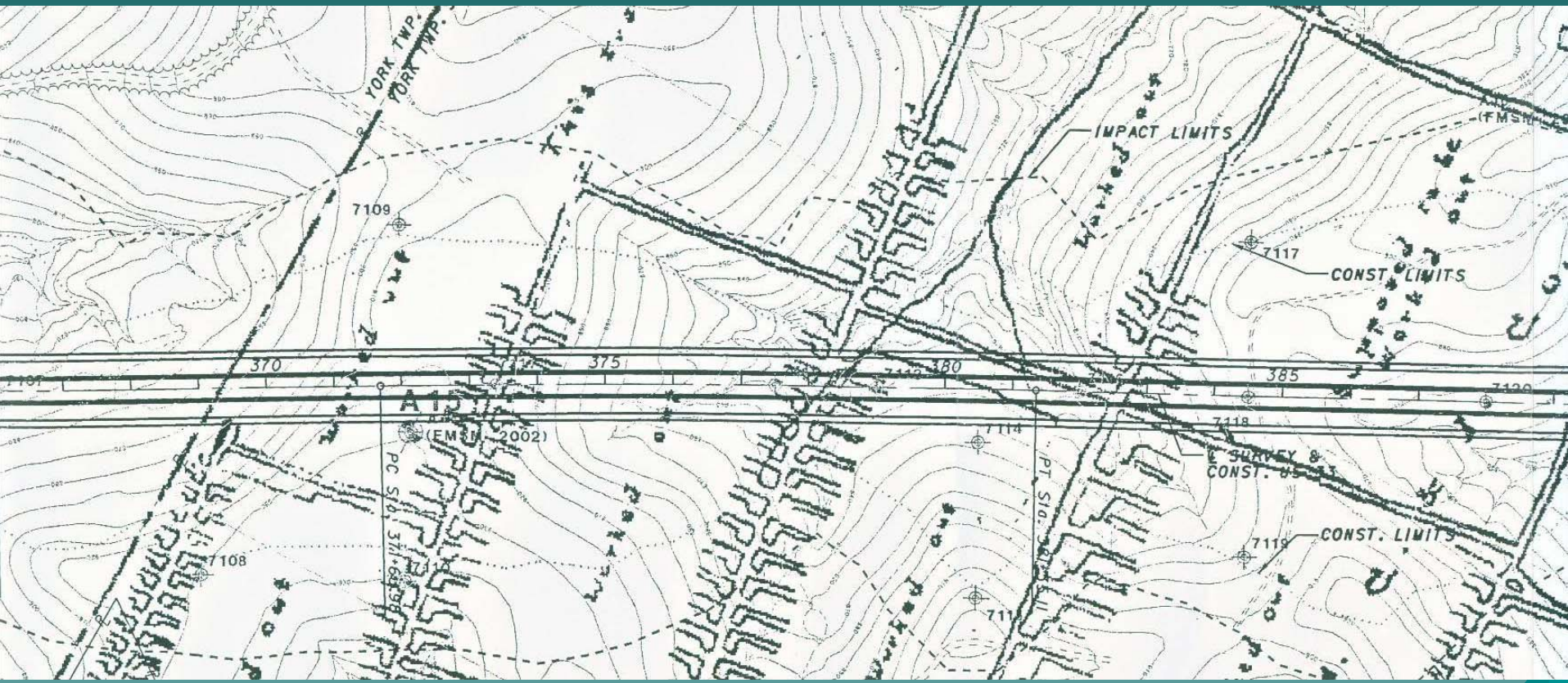
Mine Maps Superimposed on Roadway Plans



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Sample/Core Borings

- Three Stages of Drilling
- Approximately 265 Borings
- Over 22,000 Feet of Drilling
- Average Depth per Boring About 80 Feet

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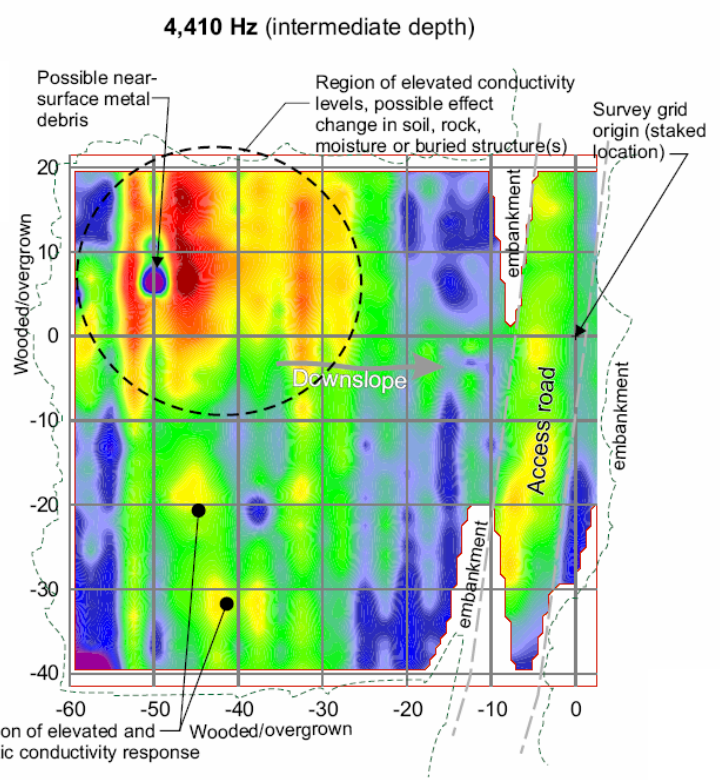
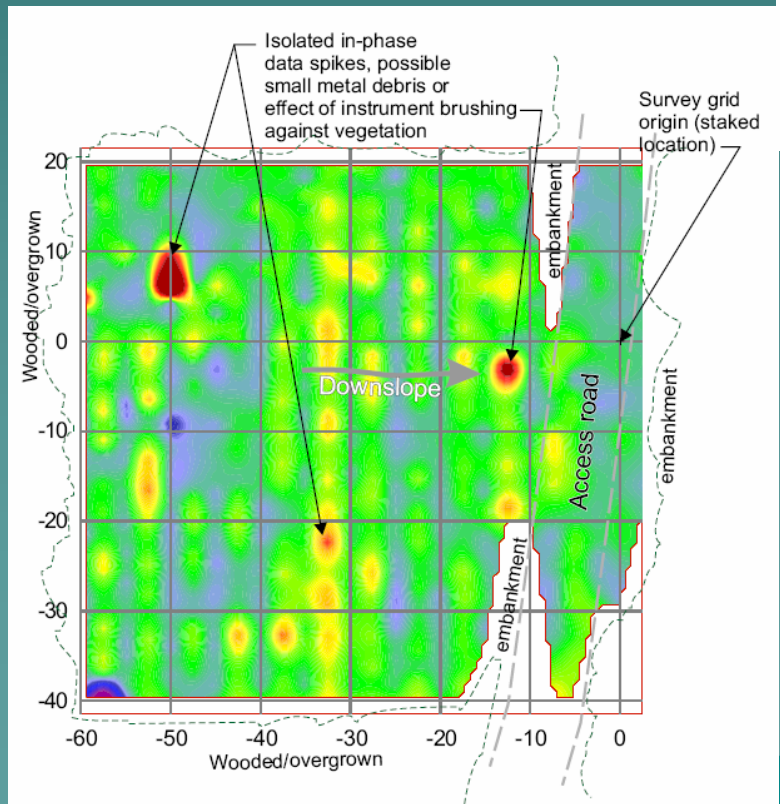
Geophysical Testing

- Grumann Exploration
- Relative Electromagnetic Terrain Conductivity





- In-Phase Response Contour Diagrams

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Borehole Camera

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III. Results of Exploration

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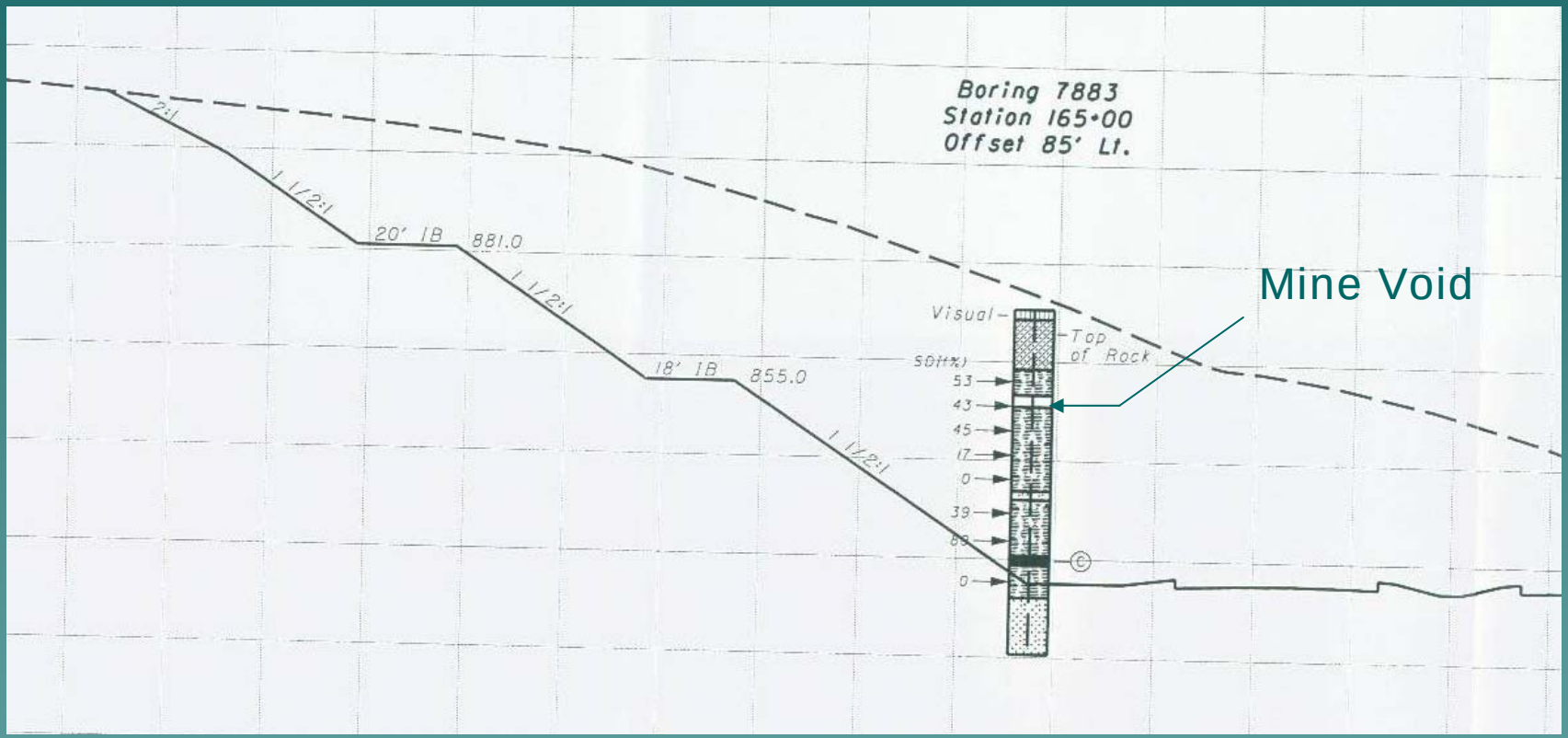
Exploration Results



Example 1 – Mine Void Exposed in Cut Slope

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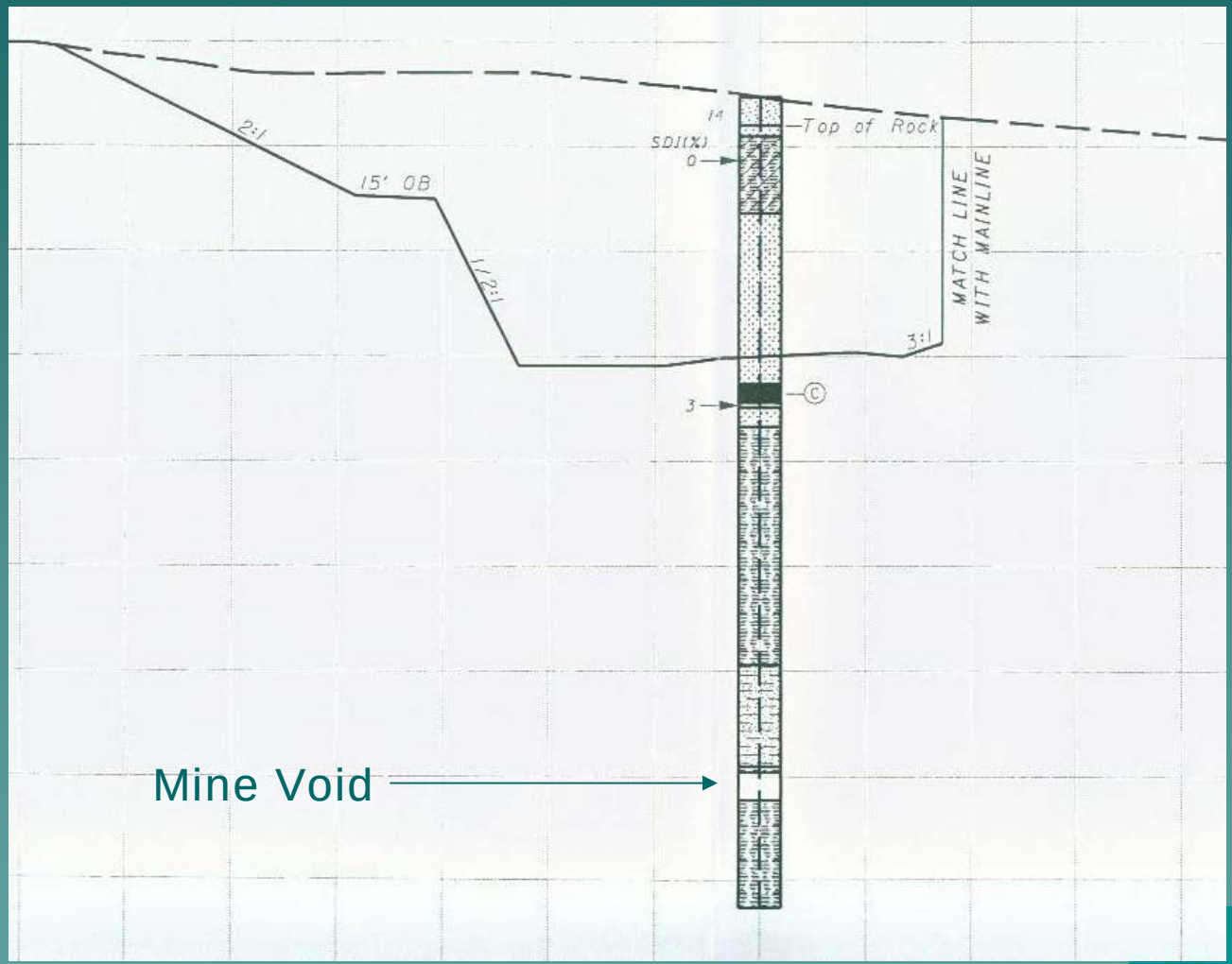
Exploration Results



Example 2 – Mine Void Well Below Proposed Grade

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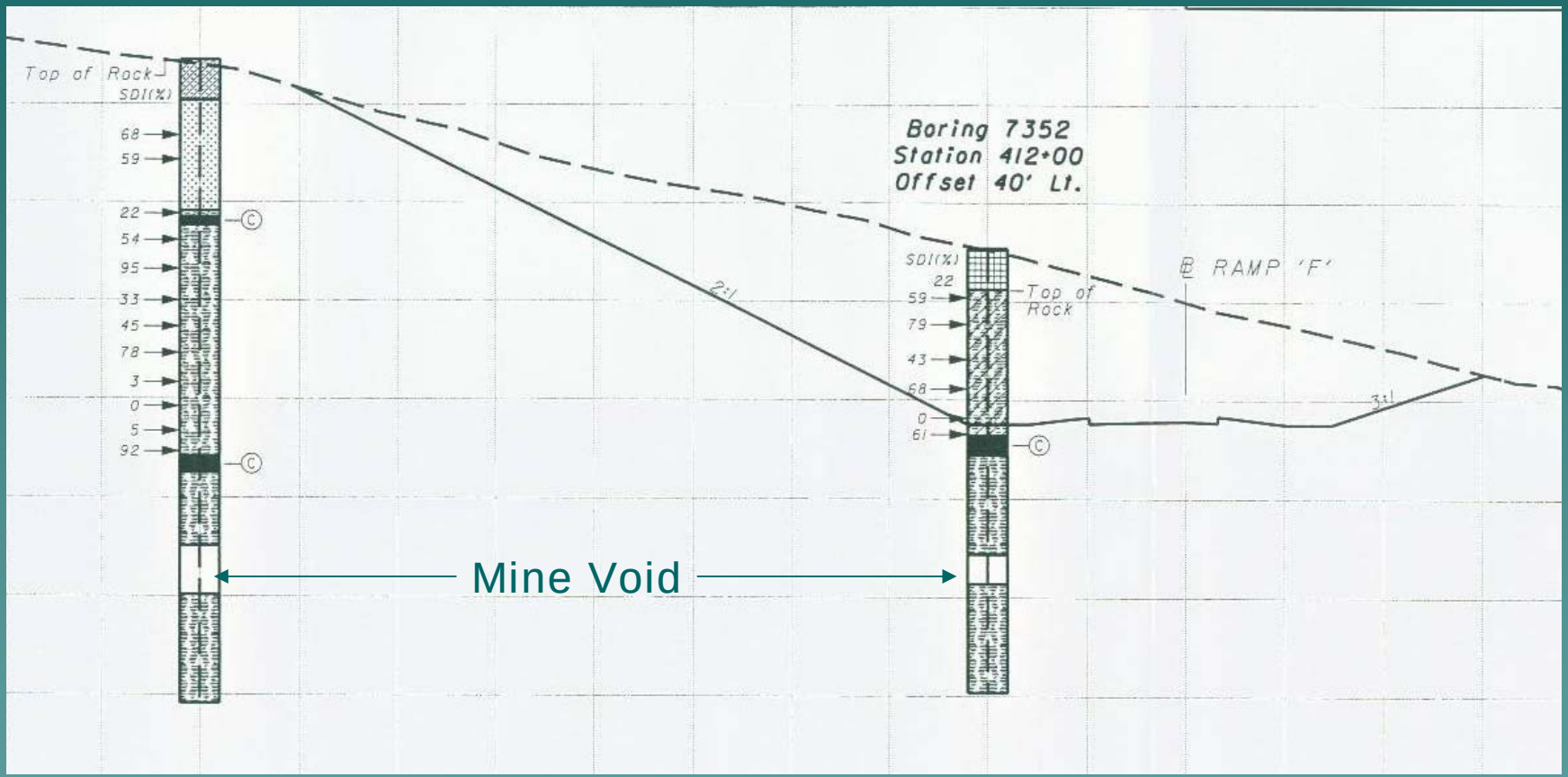
Exploration Results



Example 3 – Mine Void Near Proposed Grade

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IV. Mitigation of Mining Geohazards

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Abandoned Mine Mitigation: Three Primary Concepts/Options

- Undercut and Replace Concept
  - Generally if proposed grade is less than about 40 feet above the mine void
- Grouting Program Concept
  - Generally if proposed grade is greater that about 40 feet above the mine void
- Do Nothing Concept
  - With high quality roof rock and proposed grade is greater that about 100 feet above the mine void

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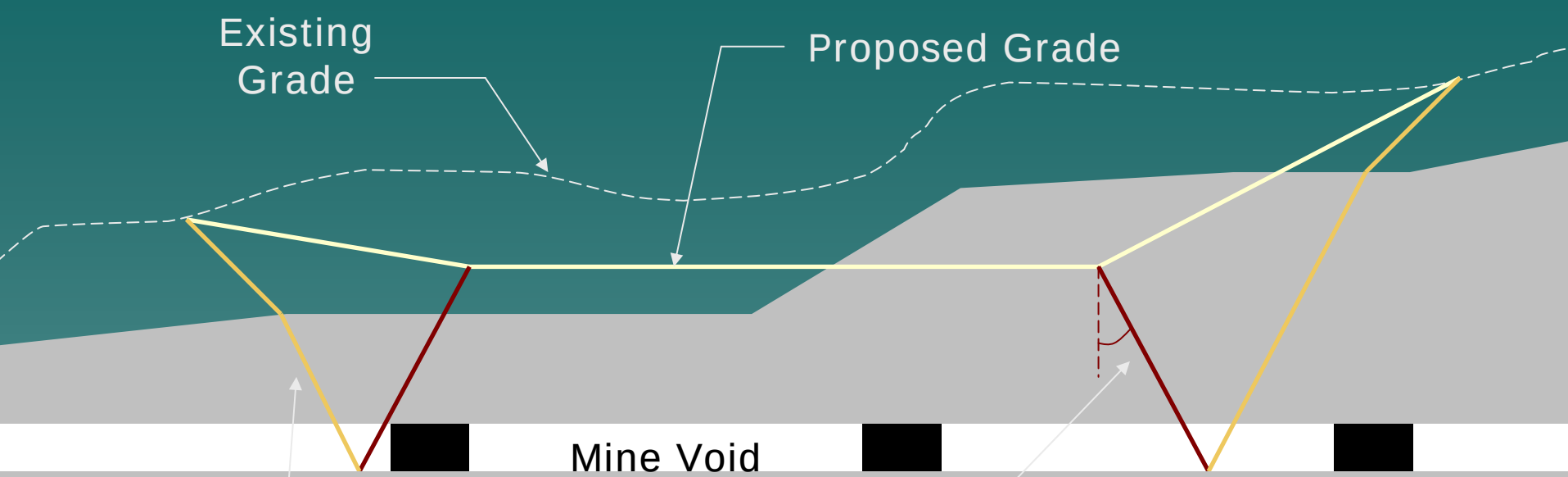
Undercut and Replace



Limits of Undercut

Assumed Angle of Draw = 30°

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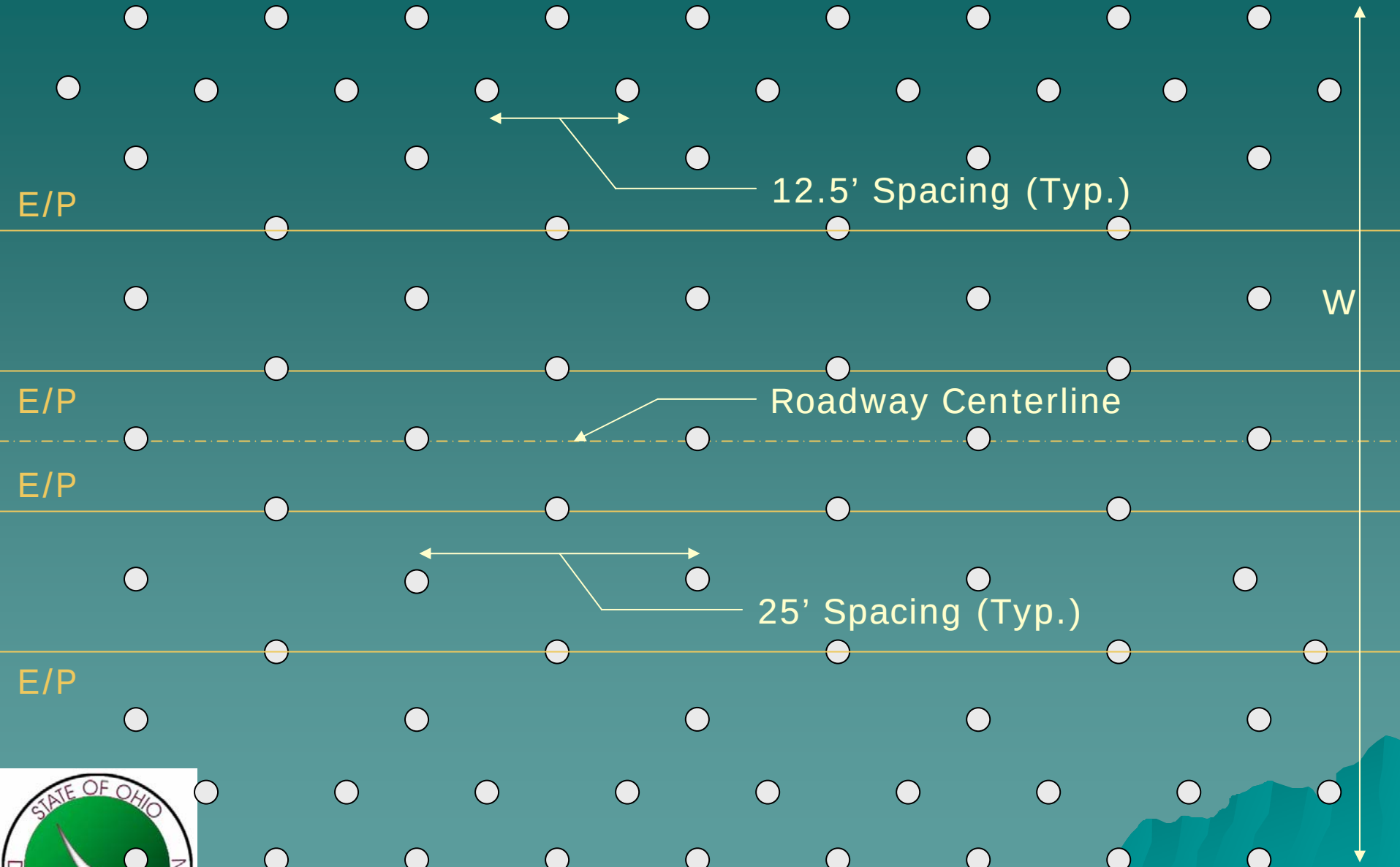
Typical Grouting Program



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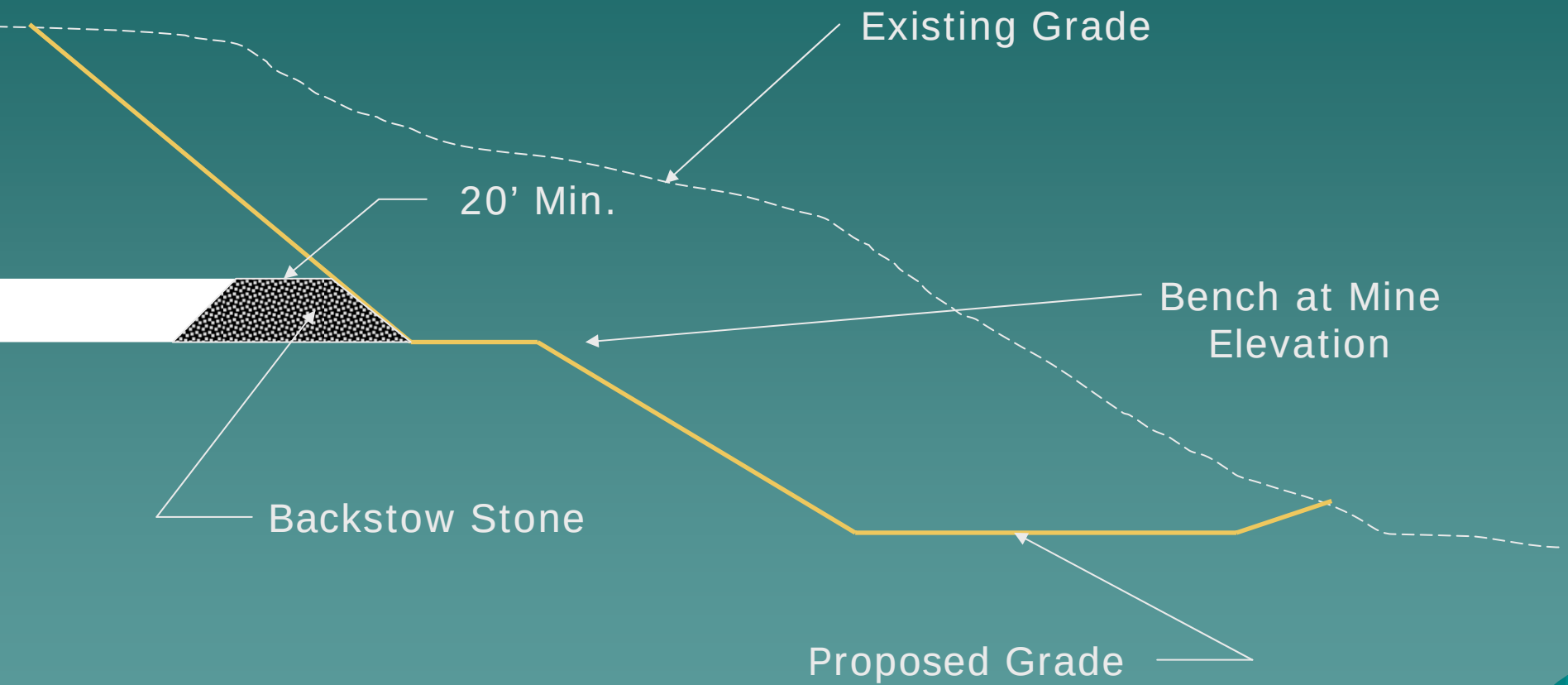
Pneumatic Backstowing



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V. Questions/Answers

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