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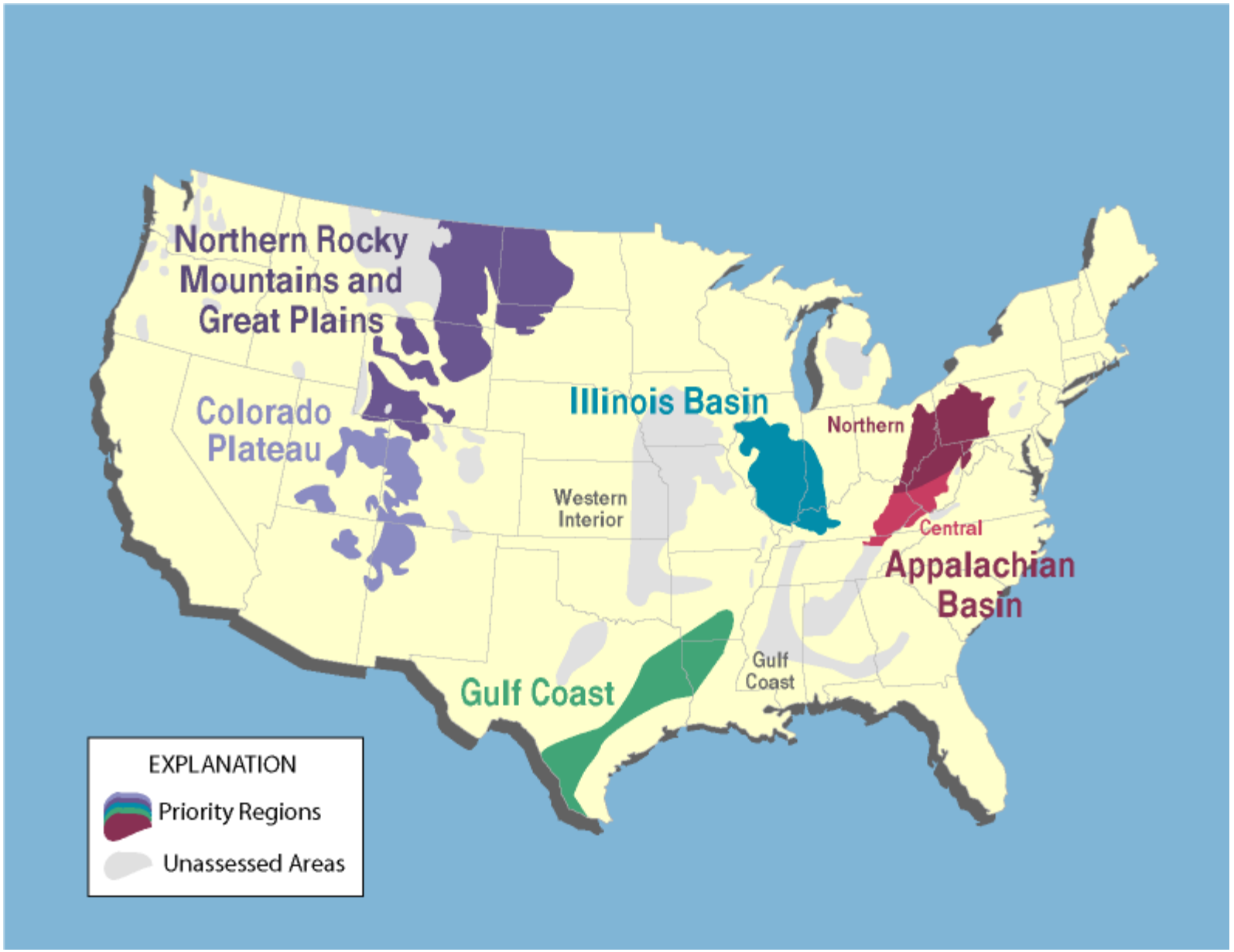
U.S. Geological Survey

Digitized maps used in coal resource/reserve evaluations:

National Coal Resource Assessment

Coal Availability/Coal Recoverability

USGS usually works closely with the State Surveys for these covers


Northern Rocky Mountains and Great Plains
Colorado Plateau
Illinois Basin
Northern
Western Interior
Central
Appalachian Basin
Gulf Coast
Gulf Coast
EXPLANATION
Priority Regions
Unassessed Areas

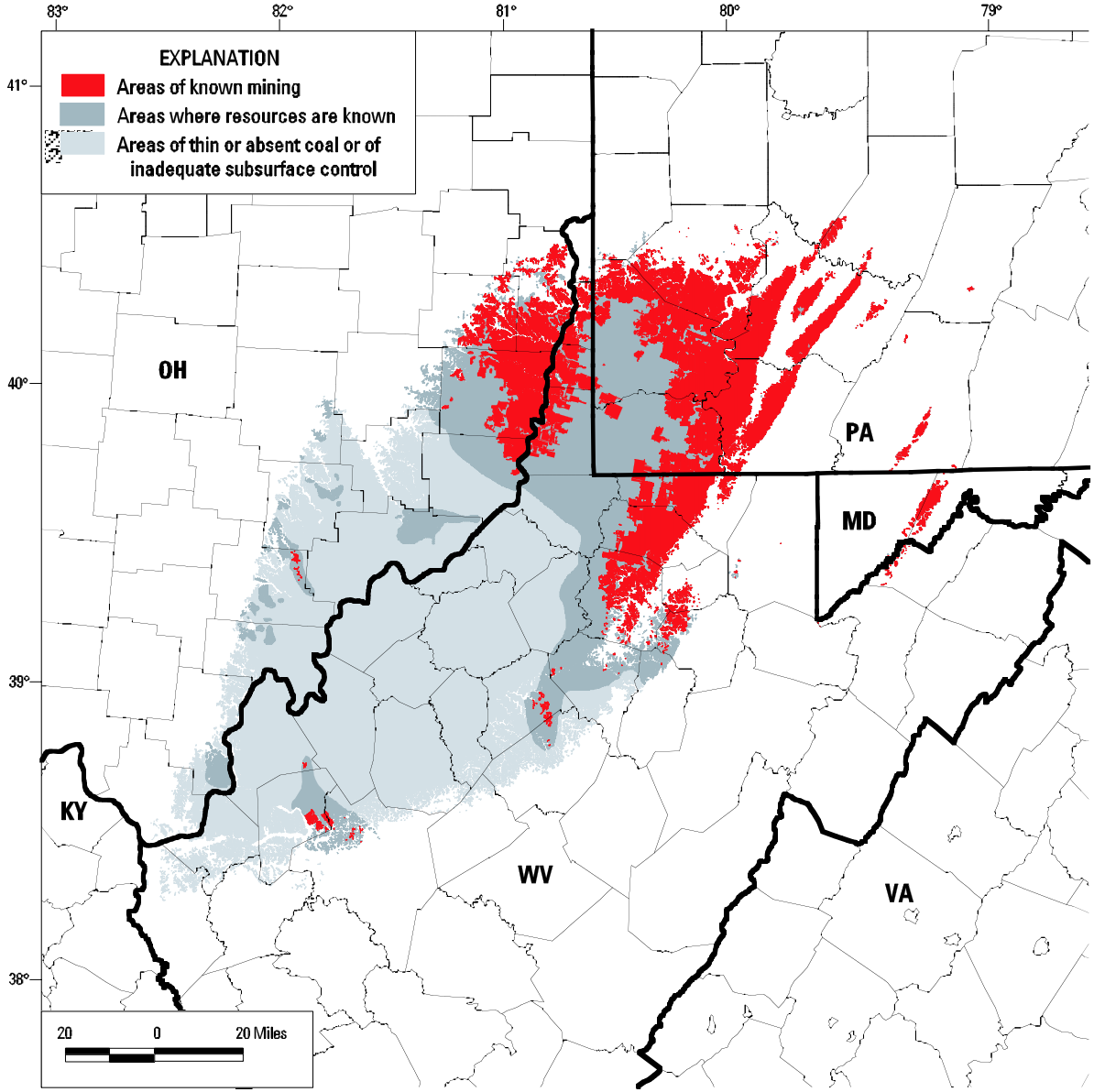
GIS attributes for NCRA mine coverages

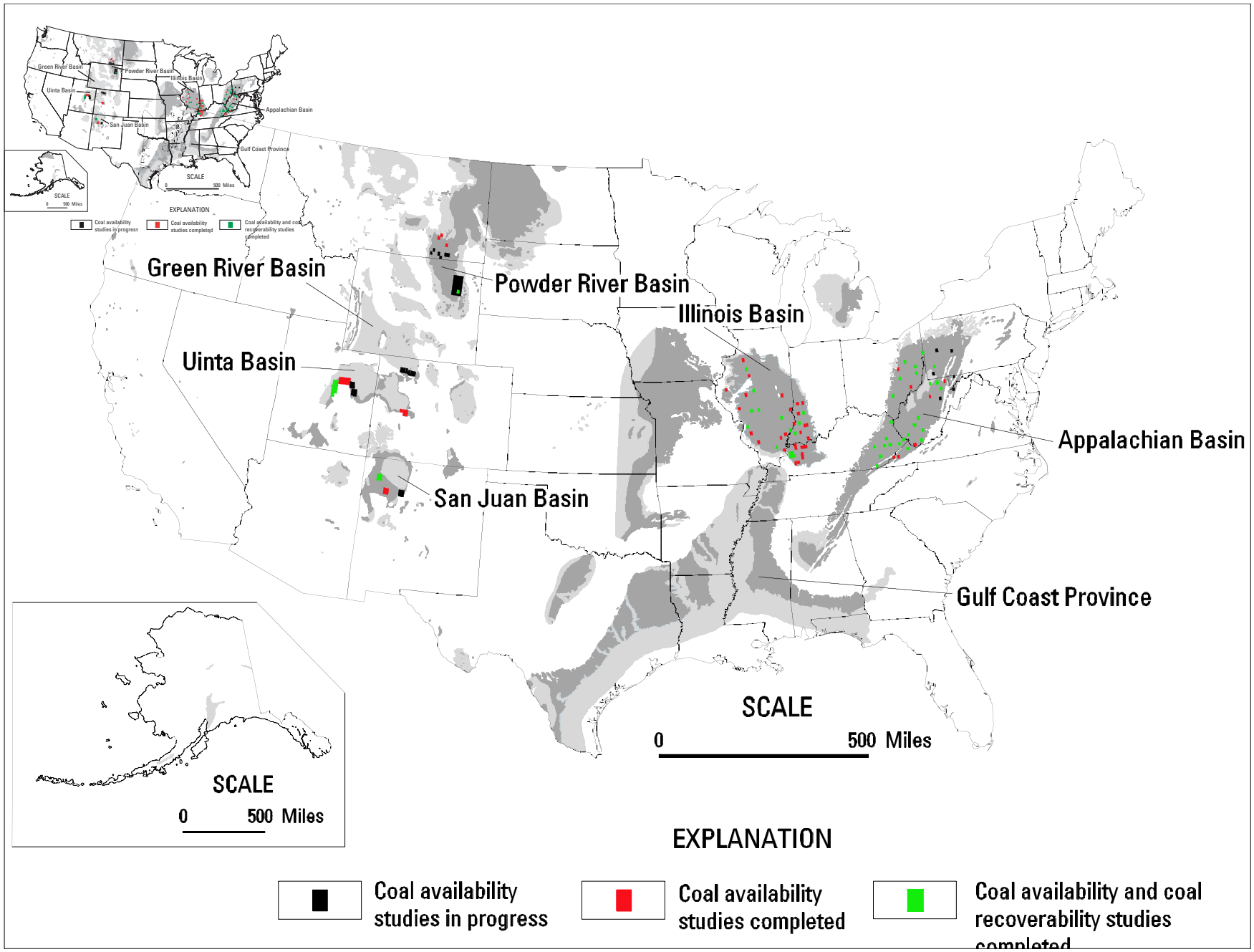
- Mined/unmined differentiation (numeric code or yes/no…)
- Mine method (surface, underground, etc; often incorporated into previous attribute)
- Mine name (for mine area or permitted area)
- Identification number or pit number
- Mining dates or status
- Leased areas
- NOTE: ONLY FIRST ONE IS COMMON, BUT STILL NOT IN ALL FILES.

Source scale or limitation on NCRA mined areas

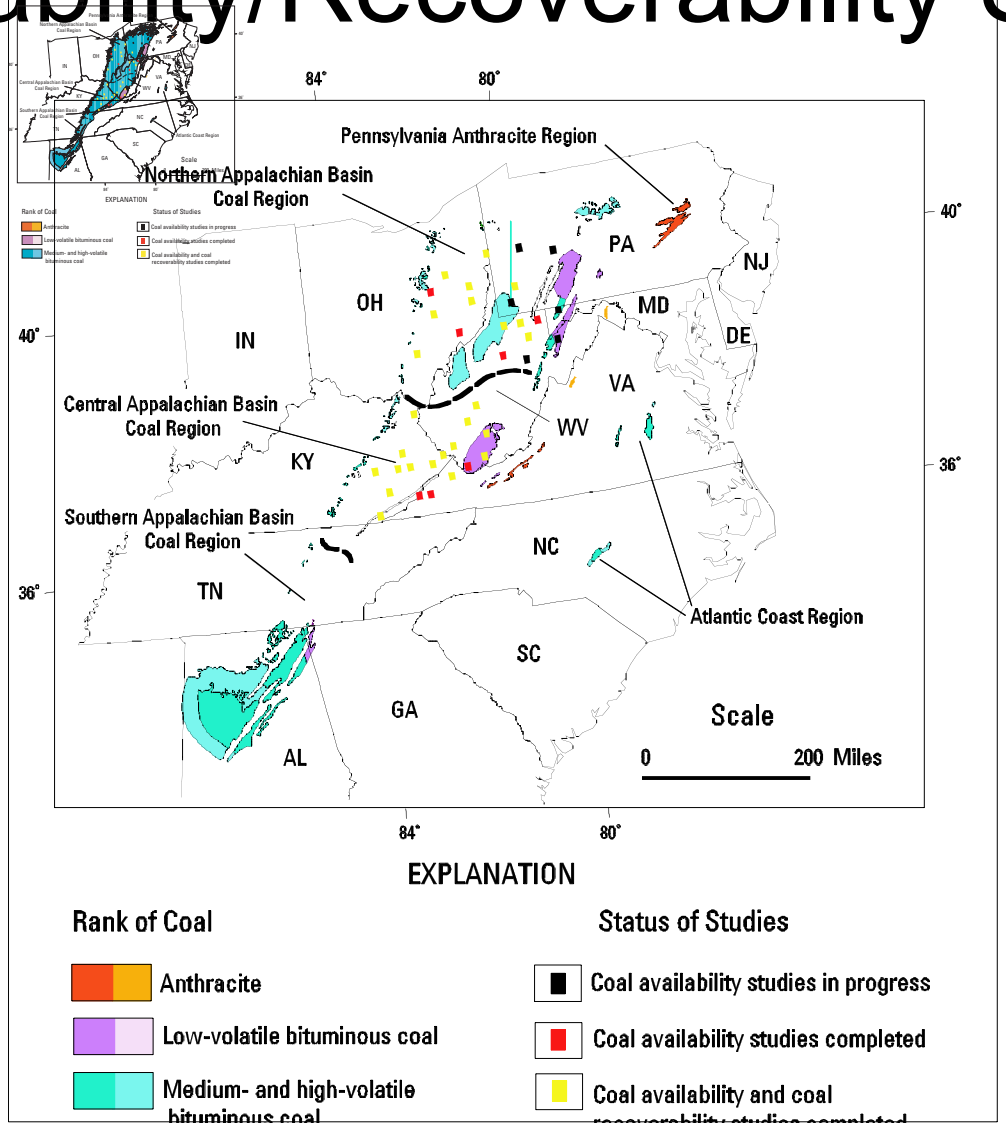
- Illinois Basin
  - 1:12,000 to 1:100,000 (in State files)
- Colorado Plateau
  - Varies (1:24,000 most common)
- Rocky Mountains & N Great Plains
  - (no scale limitation noted in metadata)
- Appalachian
  - 1:24,000 to 1:5,000,000 in same coverage
- Gulf Coast
  - 1:1,000 to 1:2,000,000 in same coverage

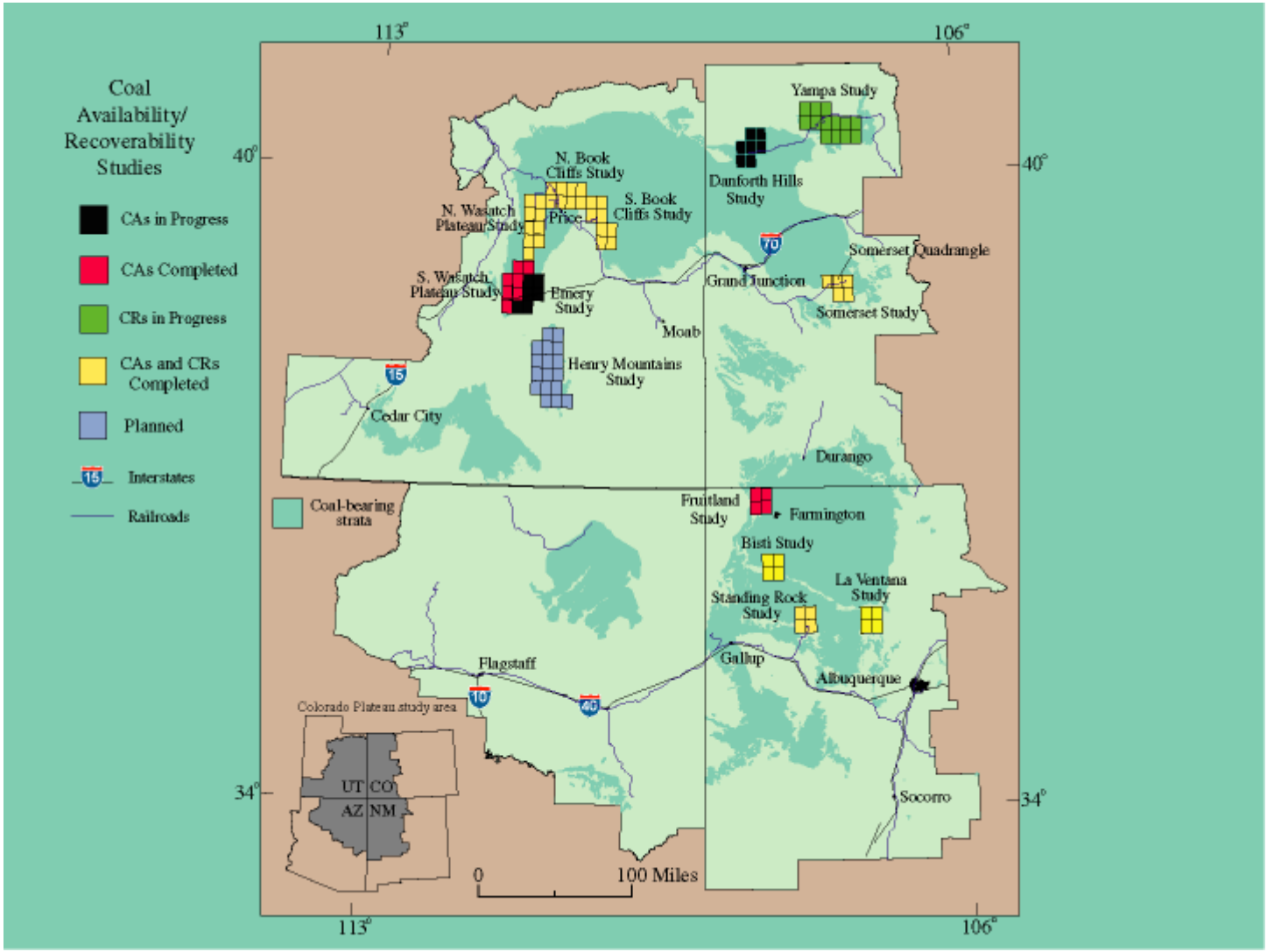
Appalachian Basin - Pittsburgh




Green River Basin
Powder River Basin
Illinois Basin
Uinta Basin
San Juan Basin
Appalachian Basin
Gulf Coast Province
SCALE
0 500 Miles
EXPLANATION
Coal availability studies in progress
Coal availability studies completed
Coal availability and coal recoverability studies completed

Appalachian Coal Availability/Recoverability Studies



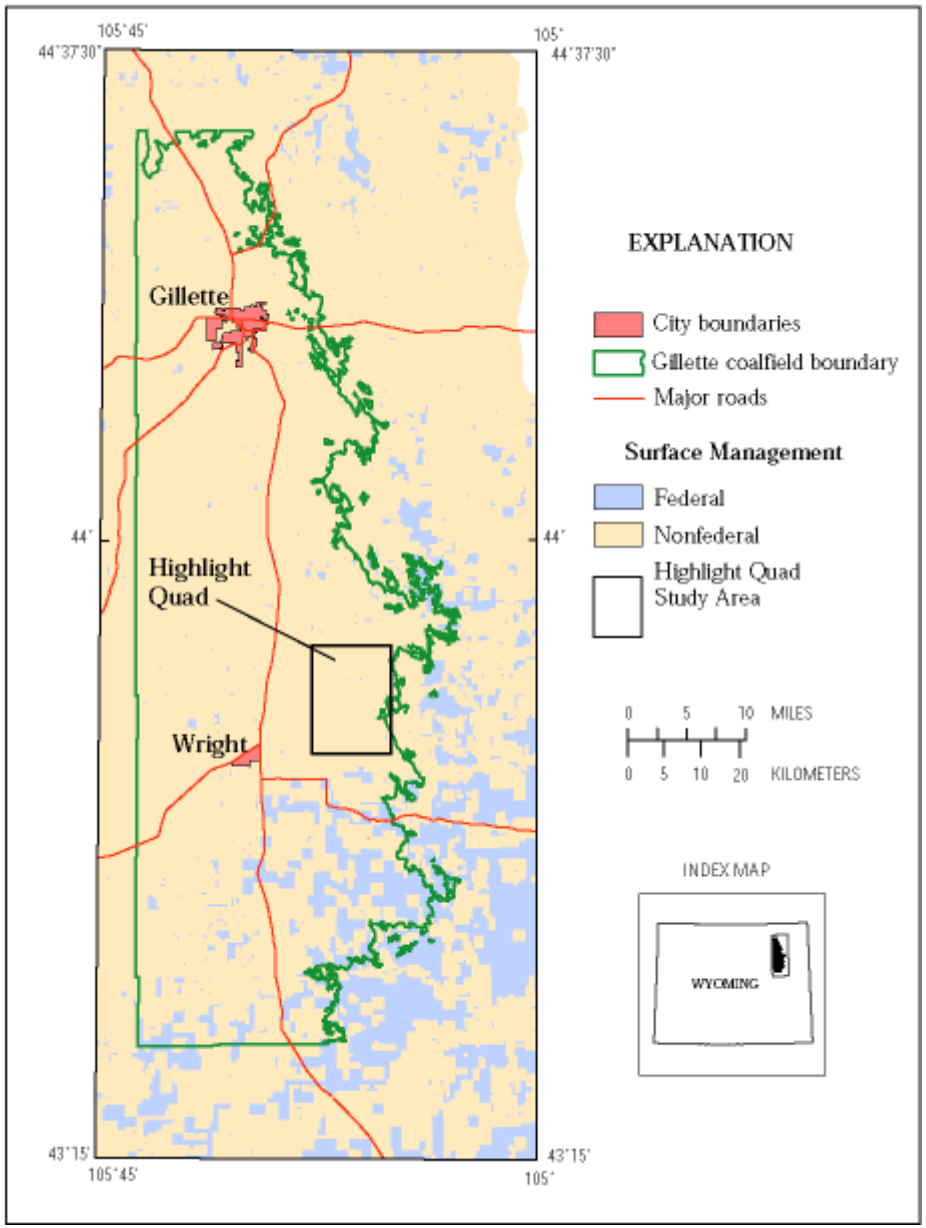

Coal Availability/ Recoverability Studies
CAs in Progress
CAs Completed
CRs in Progress
CAs and CRs Completed
Planned
15 Interstates
Railroads
Coal-bearing strata
113°
106°
40°
34°
N. Book Cliffs Study
S. Book Cliffs Study
N. Wasatch Plateau Study
Price
S. Wasatch Plateau Study
Emery Study
Moab
Henry Mountains Study
Cedar City
Yampa Study
Danforth Hills Study
Somerset Quadrangle
Grand Junction
Somerset Study
Durango
Fruitland Study
Farmington
Bisti Study
La Ventana Study
Standing Rock Study
Gallup
Albuquerque
Flagstaff
Socorro
Colorado Plateau study area
UT CO
AZ NM
0
100 Miles

Other Data Available

- USGS Minerals Program
  - Mine map preservation pgm – archiving and scanning
  - Efforts tied to research activities
  - Collections:
    - USBM Mine Map Repository
    - Defense Minerals Exploration Programs
    - Collections of company exploration records
- Oil and Gas GIS information?

Other Considerations

- Land surface covers important
  - Land ownership
  - Drainages
  - Easily available others – o&g well
- Need for one db that contains mine locations


105°45'
105°
44°37'30"
44°37'30"
Gillette
44°
44°
Highlight
Quad
Wright
43°15'
105°45'
105°
43°15'
EXPLANATION
City boundaries
Gillette coalfield boundary
Major roads
Surface Management
Federal
Nonfederal
Highlight Quad
Study Area
0 5 10 MILES
0 5 10 20 KILOMETERS
INDEX MAP
WYOMING

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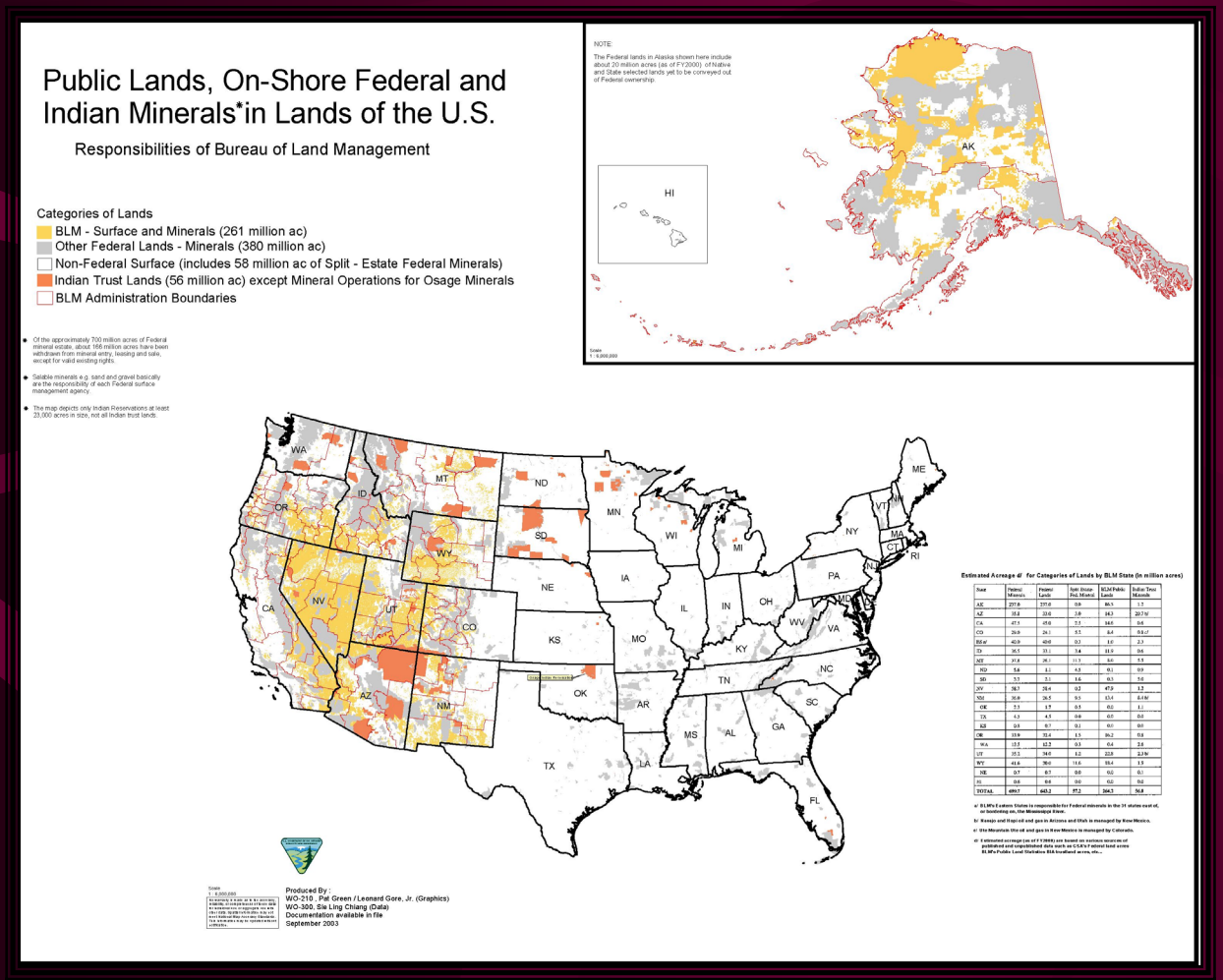
Interstate Mining Compact Commission Intergovernmental Benchmarking Workshop on Underground Mine Mapping

The Galt House Hotel
140 Fourth Avenue North
Louisville, KY 40202

October 15 & 16, 2003

FEDERAL LEASES
A BLM PERSPECTIVE ON MINERAL DEVELOPMENT



- BLM is the DOI agency responsible for leasing Federal minerals (Energy and Nonenergy solid minerals) on public lands.
- 40% of America's coal comes from public lands.
- OSM is the DOI agency responsible for regulating reclamation of coal mining operations. BLM is responsible for regulating reclamation of other federal mineral development.

Energy and Non-Energy Solid Minerals Mine Maps Many Formats, Locations, and Commodities

Underground map requirements for nonenergy minerals are similar to those for energy (coal) mining operations. BLM presently manages leases and requires maps for:

Commodities:
Coal (Nationwide)
Potassium (NM)
Sodium (WY)
Lead/Zinc (MO)
Limestone (VA)
Gilsonite (UT)

Locations:
State Offices
Field Offices
Satellite Offices
Storage
Archives

Formats:
Electronic (dwg)
Paper copies
Blueline
Mylar and Sepia
Velum
Mining/Operation Maps
Abandonment Maps

Mine Maps Required (Energy and Nonenergy)

BLM requires 2 types of maps:

Mining Plans and Operation Maps

Before mining can occur the lessee's plan must comply with the Mineral Leasing Act (MLA). The mining plan must demonstrate:

- **Maximum Economic Recovery (MER) of the coal or Ultimate Maximum Recovery (UMR) of a "nonenergy" mineral deposit**

- **Production maps must show all excavations in such a manner that the production of federal minerals for any royalty reporting period can be accurately ascertained.**

Abandonment Maps

The permanent abandonment map demonstrates the maximum extent of the mining operations, the achievement of MER or UMR, and the geological supports left to provide future access and protect surface resources.

General Mine Map (Plan) Requirements

Underground mine maps must include information such as:

- **Name of the operator/lessee;**
- **All federal lease or license serial numbers and boundary lines;**
- **Permit number and boundary lines;**
- **True north arrow and map scale;**
- **Location, diameter, and depth of auger holes;**
- **Any unusual geologic occurrences such as dikes, faults, splits etc.;**
- **All mine workings and the date of extension of the mine workings;**
- **Location of ventilation fans and controls at the time of submittal;**
- **Known bodies of standing water in other mine workings (in, above, or below the works);**
- **Elevations of surface and underground levels of all shafts, slopes, or drifts, and mine survey stations in the roof at regular intervals in main entries, panels, or sections; and**
- **Vertical cross sections when required.**

FOIA CONSIDERATIONS
Underground Coal Mine Map Information
(43 CFR 3481.3)

- **Release of any mine map information is subject to FOIA regulations.**

- **For coal leases the following information cannot be publicly disclosed without the consent of the operator/lessee:**
  - **Geologic and geophysical data and maps pertaining to Federal recoverable coal reserves**
  - **Information obtained from an operator/lessee that constitutes trade and commercial secrets**
  - **Financial information which is privileged or confidential**
  - **Other information may be withheld under the Freedom of Information Act (5 U.S.C. 552(b)) if the operator/lessee clearly marks it as "CONFIDENTIAL INFORMATION." All information not marked will be available for public inspection.**

- **Upon termination of a Federal lease, geologic and geophysical data and maps can be made available to the public**

Recommendations for the Underground Mine Map Repository

Centralized Repository

- Access for BLM
- Standardize the protocol for submitting historical underground mine maps (i.e. contacts, delivery and original map return policy)
- Affordable-Archiving and retrieving
- Protection of confidential data
- Guidance for our field offices

New Map Standards

- Maps need to be consistent with BLM data standards
- Map data must meet BLM's needs
- Maps must met the repository standards
- The map standard should be consistent regardless of land ownership

U.S. Department of the Interior Bureau of Land Management

Solid Minerals Group

Contacts:

Brenda Aird, Group Manager 202-452-0351

Bill Lesage, Min. Engineer 202-452-0360

John A. Lewis, Min. Engineer 202-785-6567

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Map Symposium

MCC Mining Compact Commission

Mine Mapping Workshop

Louisville, Kentucky

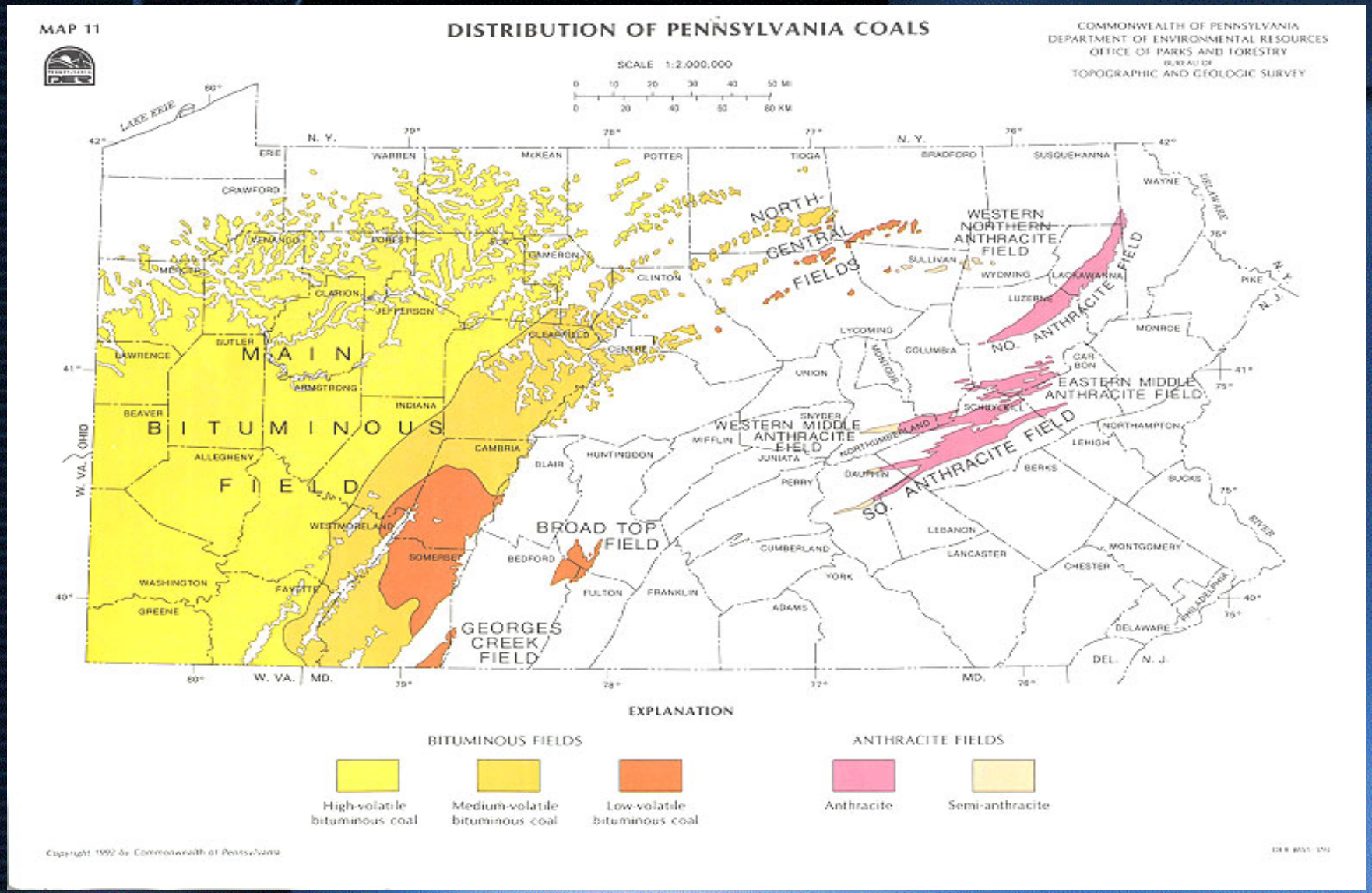
PA Bureau of Deep Mine Safety

Map Symposium

Pennsylvania's Initiative on Preservation of Maps of Abandoned Mines

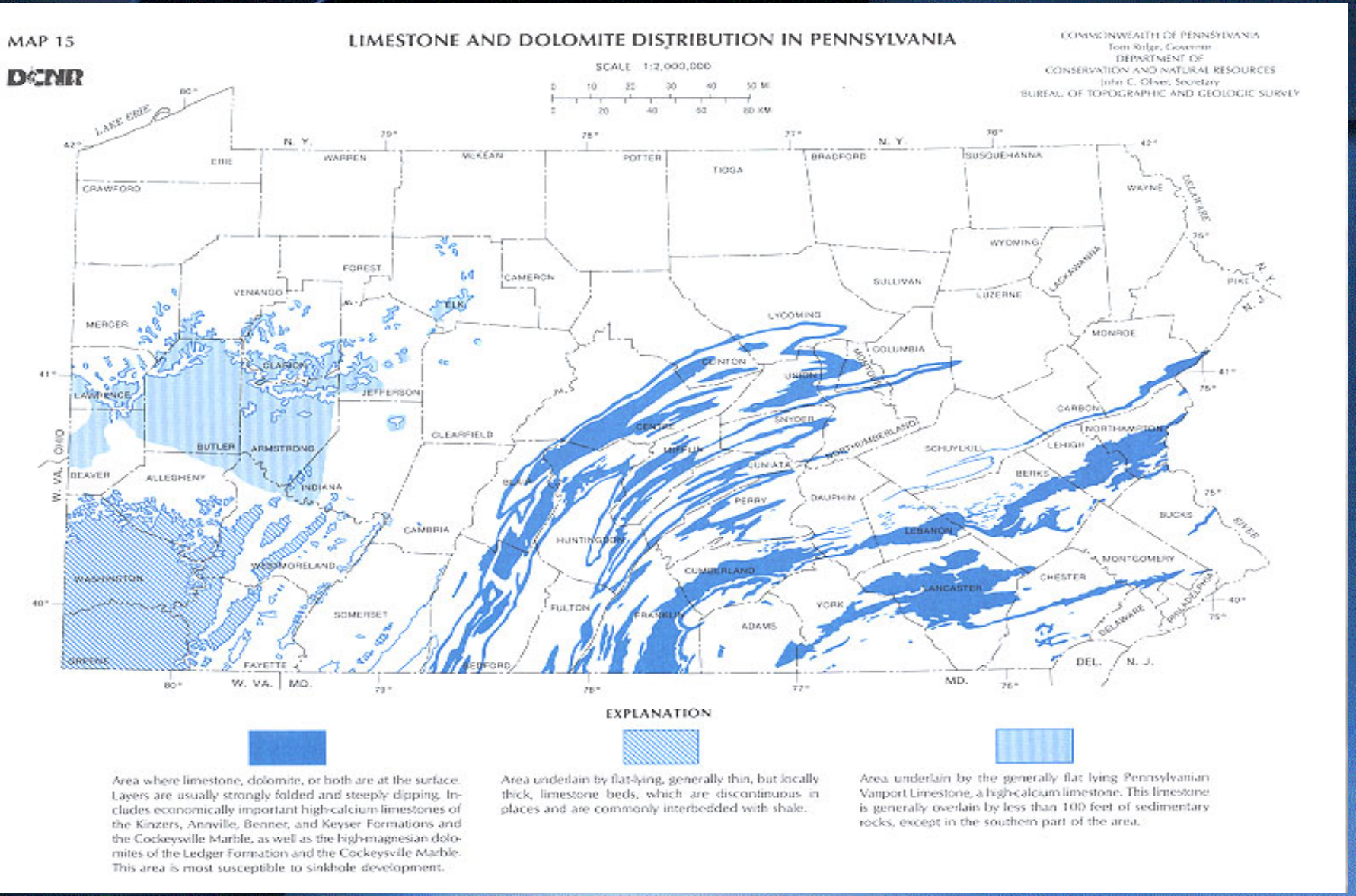
PA Bureau of Deep Mine Safety

Map Symposium



PA Bureau of Deep Mine Safety

Map Symposium

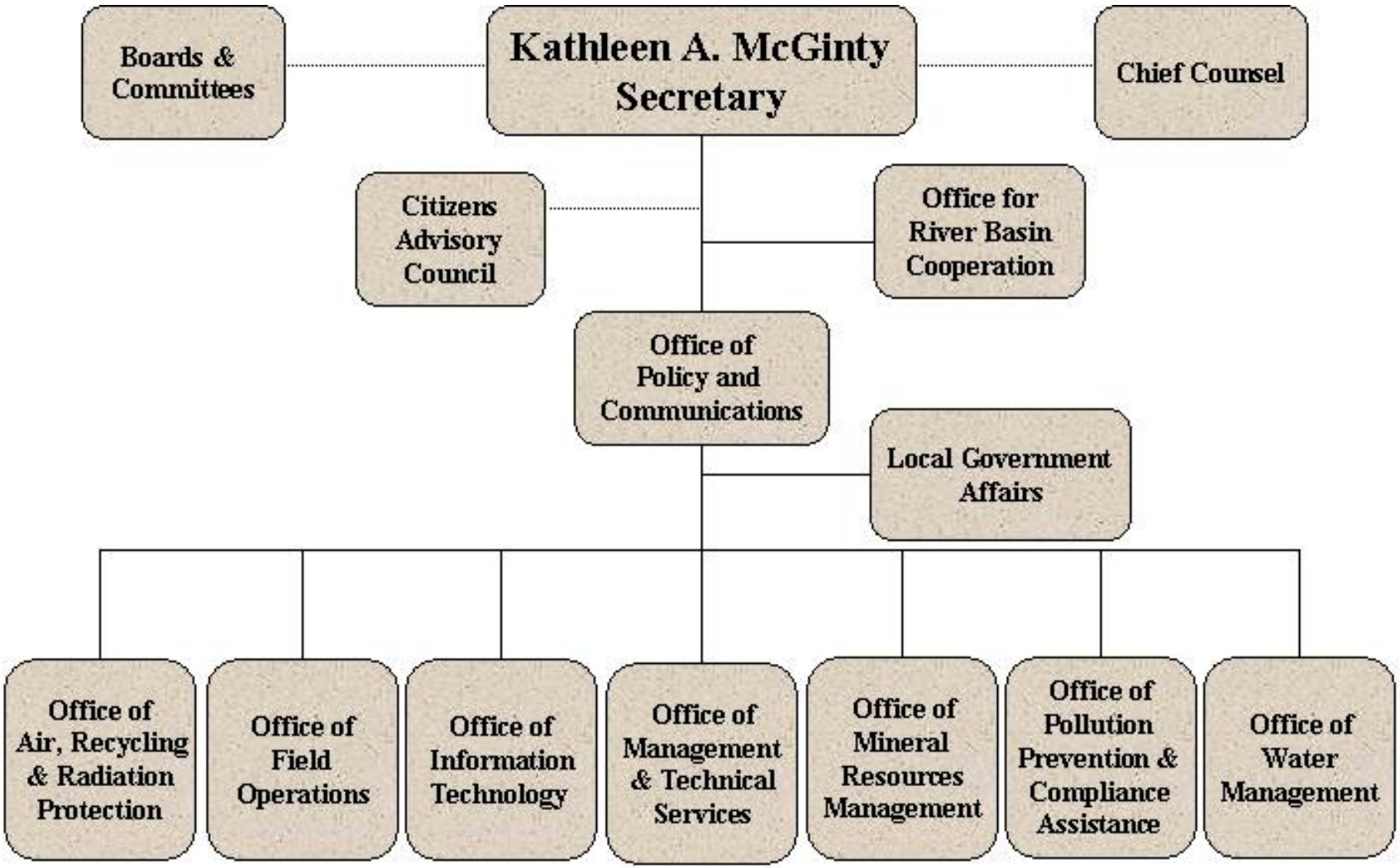


PA Bureau of Deep Mine Safety

Map Symposium

Department of Environmental Protection

Different Programs / Different Goals


Boards & Committees
Kathleen A. McGinty Secretary
Chief Counsel
Citizens Advisory Council
Office for River Basin Cooperation
Office of Policy and Communications
Local Government Affairs
Office of Air, Recycling & Radiation Protection
Office of Field Operations
Office of Information Technology
Office of Management & Technical Services
Office of Mineral Resources Management
Office of Pollution Prevention & Compliance Assistance
Office of Water Management

Office of Mineral Resources Management

Abandoned Mine Reclamation

Mining and Reclamation

District Mining Operations

Deep Mine Safety

Oil and Gas

Map Symposium

Bureau of Deep Mine Safety

District Mining Office

California Pa

Abandoned Mine Reclamation

Map Symposium

Bureau of Deep Mine Safety

Safety of Miners and General Public

District Mining Offices
Mine Subsidence
Mine Permits

Map Symposium

Abandoned Mine Reclamation

Resolving problems-mine fires, subsidence, highwalls – abating or treating acid mine drainage
Mine Subsidence

PA Bureau of Deep Mine Safety

Map Symposium

Bureau of Deep Mine Safety

Ability to drill into an entry

Ability to hit a specific pillar

Exact Extent and Location are Critical

Map Symposium

District Mining Offices

Was the Area Undermined
Was the area Pillared
What is Extent of Pillaring

Map Symposium

Abandoned Mine Reclamation

Location and extent of mining can be critical

Both specific and general mapping needs

Map Symposium

Program Goals
Determine Mapping Requirements

PA Bureau of Deep Mine Safety

Map Symposium

Map Storage and Preservation Issues

Deterioration of Maps

Need to Maintain for Future Generations

Map Symposium

Working Documents

Maps Stored –Folded- in Envelopes

Proper storage with minimal space

Map Symposium

Geo-Referencing Issues

- Lack of adequate base map
- Lack of reference points and coordinates
- Destruction of physical features

Map Symposium

Goals

Locate the Sources of maps

Identify each Source with Contact Information

Map Symposium

Goals

Build a database of contacts

Publish database on website

Obtain maps or copies

Preserve digital copy or all maps

Map Symposium

Goals

Work with PHMC to develop preservation plan

Develop database of key information within annual reports – Link to maps

Map Symposium

Questions

Thank You for the opportunity to Let others know what we are doing

Map Symposium

Bureau of Deep Mine Safety

Vidar Atlas 40” Scanner

CopyPro Software

Ability to clean image

Map Symposium

.tif Images

300 dpi acceptable compromise between quality and file size

Map Symposium

District Mining Office

Monochrome Scanner
400 to 800 dpi

.tiff MSB-G3 images

Map Symposium

District Mining Office Contact

Joe Taranto

724-769-1100

jtaranto@state.pa.us

Map Symposium

BAMR

Bureau of Abandoned Mine Reclamation

Wilkes-Barre Pa

PA Bureau of Deep Mine Safety

Map Symposium

Map Sources

Own Collection

2715 cataloged maps

OSM Microfilms

Can Scan- Poor Quality

OSM Map Folios

Map Symposium

OSM Map Folios

Cooperative agreement with OSM

1998 Pilot Project to Scan and Geo-reference Folios 1:1200 Scale

559 of 734 Folios Scanned

Map Symposium

OSM Map Folios

Color Scan at 200dpi

.tif images

CD Back-ups

ARCview digital folio index

PA Bureau of Deep Mine Safety

Map Symposium

OSM Map Folios

Contact

Kim Snyder

570-830-3176

Kisnyder@state.pa.us

Map Symposium

Questions

Thank You for the opportunity to Let others know what we are doing

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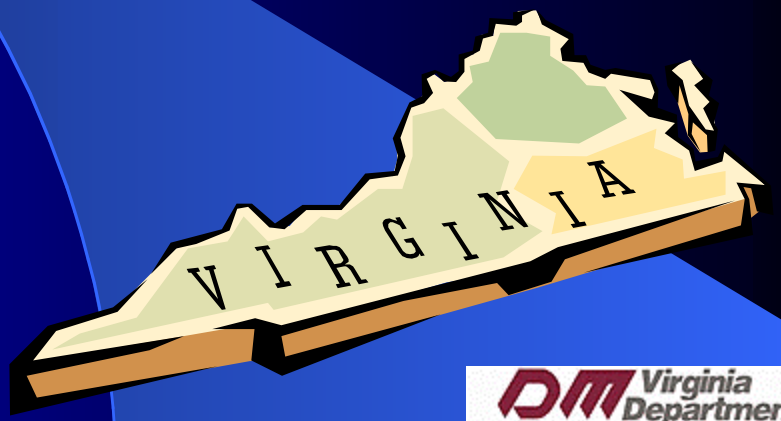
Virginia Mine Mapping Information System

Virginia Department of Mines, Minerals and Energy



Intergovernmental Benchmarking Workshop on Underground Mine Mapping

October 15 & 16, 2003

Louisville, Kentucky

Virginia Department of Mines Minerals and Energy

Background of Mine Mapping Program

Coalbed Mapping Program

- DMME has had a mine archiving/mine cataloging/ digital spatial database activity underway since 1990 that has located abandoned mines in the Southwest Virginia coalfields

Scope of Coalbed Mapping Program

- Collect and Catalog all available abandoned Mine Maps
- Scan maps with large format scanner
- Georeference scanned mine map images
- Digitize boundary of mine works
- Create database containing information derived from maps

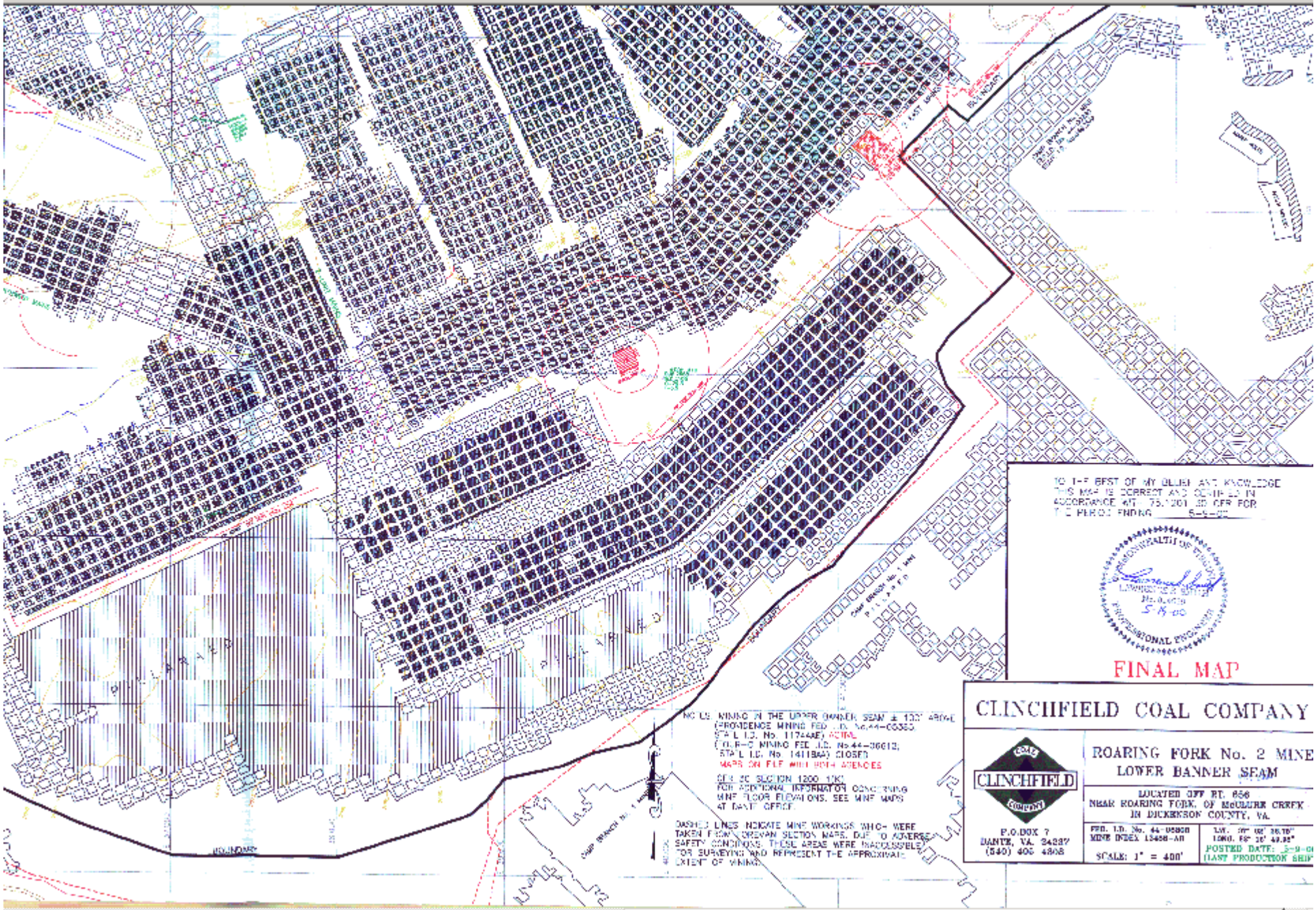
Map Sources

- State Library of Virginia
- DMME Client Assistance Center
- OSM National Mine Map Archive
- DMME Active Mines
- Map Archives of Collaborating Mining and Land Companies
- DMME Division of Mineral Resources Archive
- DMME Previously Donated Map Collection
- DMME Scanned Map Archives

Acquisition of Mine Maps

- Campaign launched through various media outlets requesting mine maps
- On-site scanning – large format scanner taken on site to scan company map archives
- Private Party collections donated for scanning

View Page Zoom Help



Tools

- Hardware
  - Laptop/Desktop
  - Large-format Scanners
    - ColorTrac 5480
    - Vidar Titan TruScan
    - Vidar TruScan B&W
- Software
  - Proprietary scanning software
  - ESRI
  - AutoDesk
- Data Available
  - Coal Mine Map and Mine Database
- Printers/plotters
- Internet web browser

Georeferencing

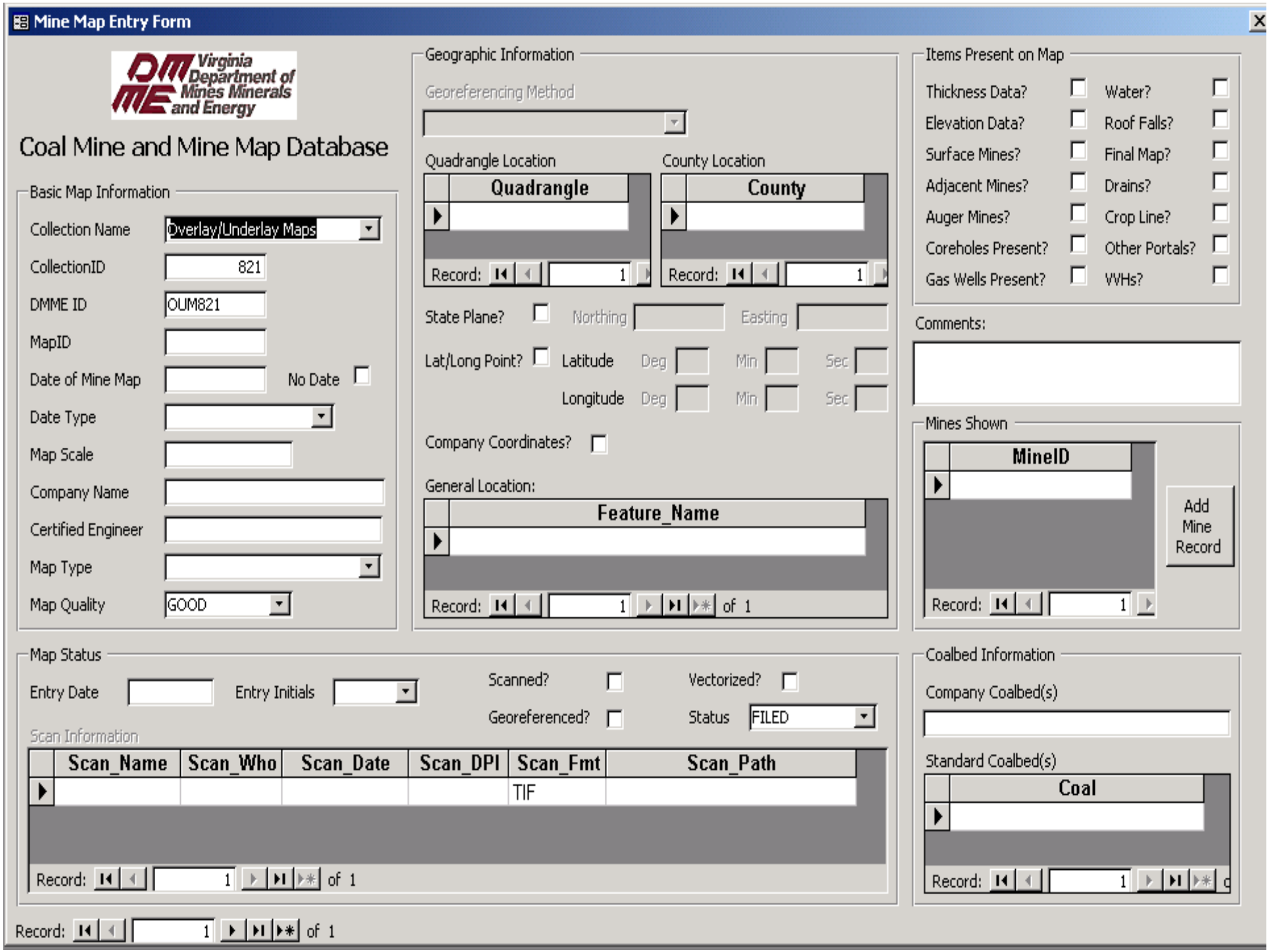
- Maps geo-referenced into Virginia State Plane Coordinate System
- Information shown on the map such as coordinate grids, identifiable surface features, coal outcrop configuration, land tracts, etc., are used to place maps.

Database

- Capture important information shown on maps
- User friendly intuitive input screen developed to aide in efficient data entry
- Data stored on Microsoft SQL server

Data Entry

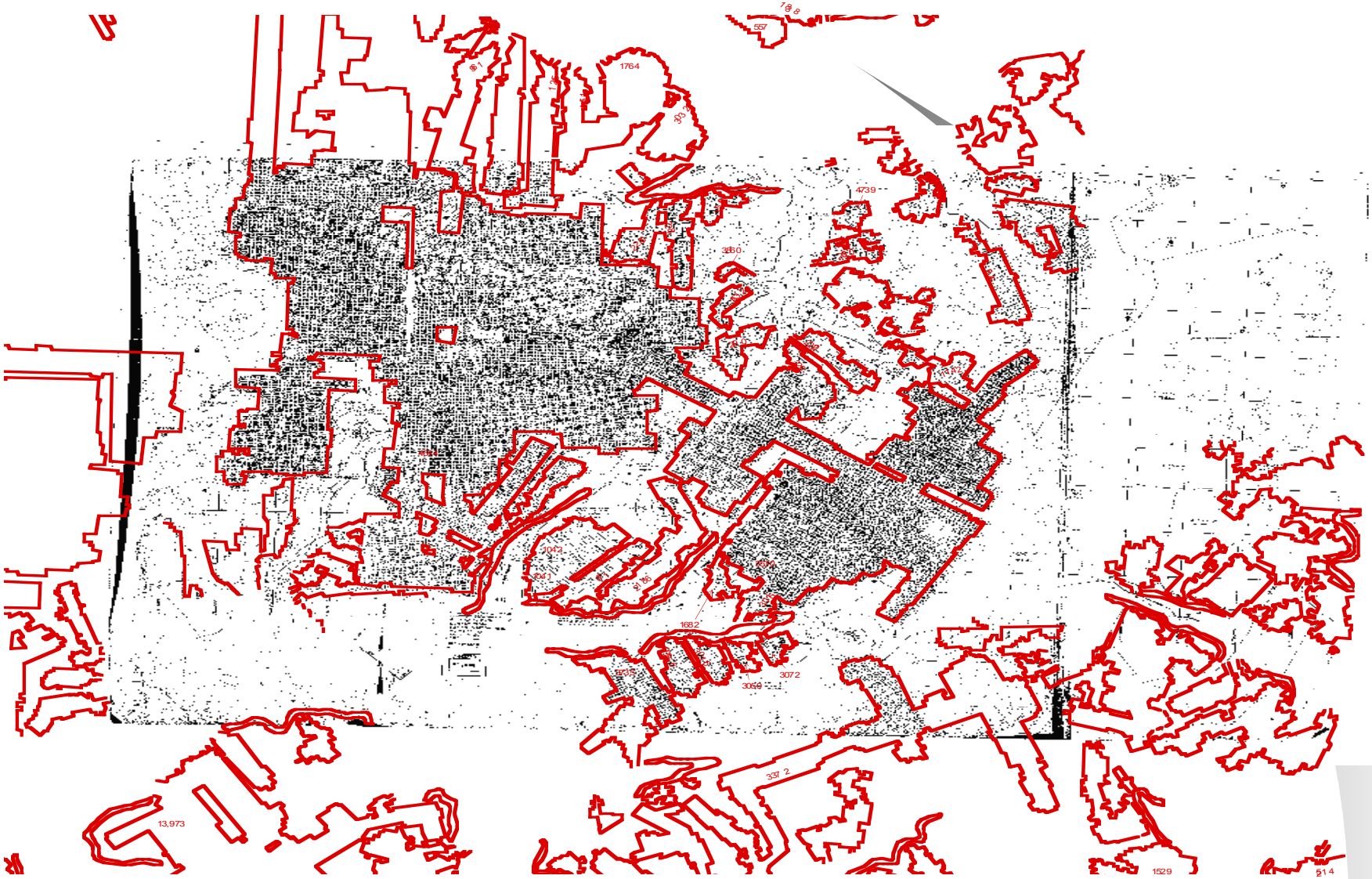

Main Menu
Virginia Department of Mines Minerals and Energy
Coal Mine Map and Mine Database
Enter New Mine Map Record
Amend Existing Mine Map Record
Enter New Mine Record
Amend Existing Mine Record


Mine Map Entry Form
Virginia Department of Mines Minerals and Energy
Coal Mine and Mine Map Database
Basic Map Information
Collection Name
Overlay/Underlay Maps
CollectionID
821
DMME ID
OUM821
MapID
Date of Mine Map
No Date
Date Type
Map Scale
Company Name
Certified Engineer
Map Type
Map Quality
GOOD
Geographic Information
Georeferencing Method
Quadrangle Location
Quadrangle
Record: 1
County Location
County
Record: 1
State Plane?
Northing
Easting
Lat/Long Point?
Latitude
Deg
Min
Sec
Longitude
Deg
Min
Sec
Company Coordinates?
General Location:
Feature_Name
Record: 1 of 1
Items Present on Map
Thickness Data?
Elevation Data?
Surface Mines?
Adjacent Mines?
Auger Mines?
Coreholes Present?
Gas Wells Present?
Water?
Roof Falls?
Final Map?
Drains?
Crop Line?
Other Portals?
VWHs?
Comments:
Mines Shown
MineID
Record: 1
Add Mine Record
Map Status
Entry Date
Entry Initials
Scanned?
Georeferenced?
Vectorized?
Status
FILED
Scan Information
Scan_Name
Scan_Who
Scan_Date
Scan_DPI
Scan_Fmt
Scan_Path
TIF
Record: 1 of 1
Coalbed Information
Company Coalbed(s)
Standard Coalbed(s)
Coal
Record: 1
Record: 1 of 1

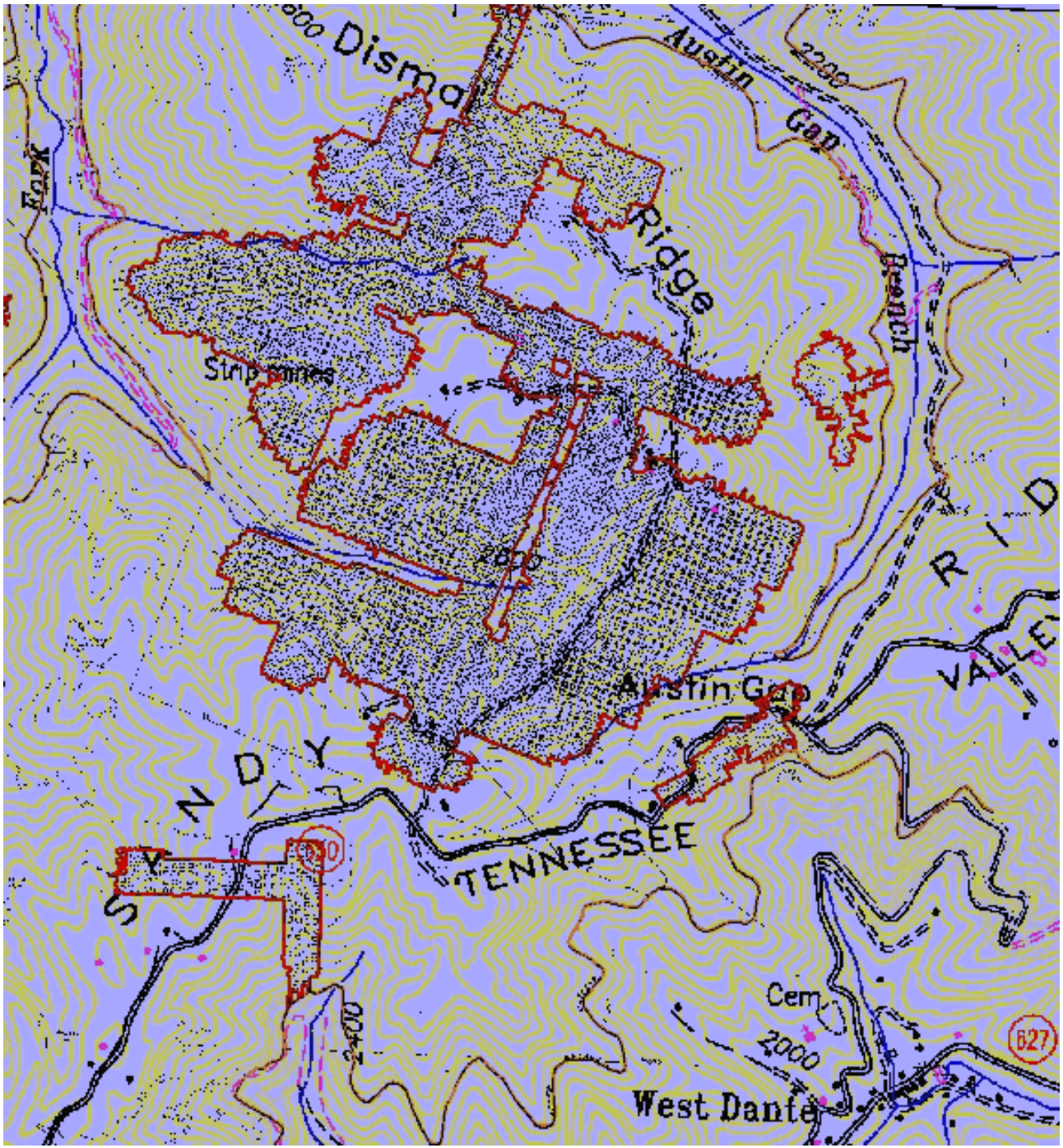
Digitizing

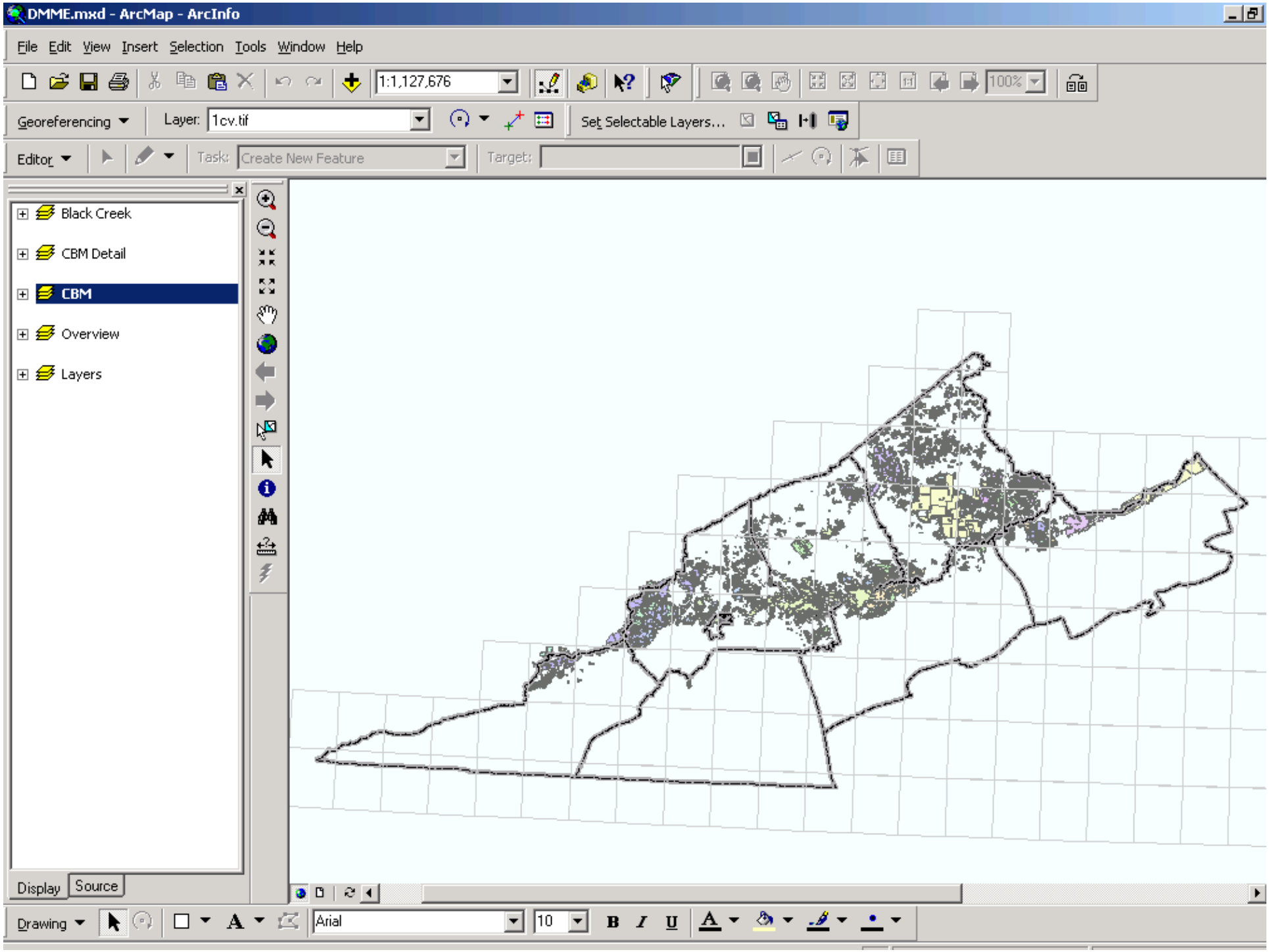
- Heads-up onscreen digitizing performed with geo-referenced images
- Industry standard software used – ESRI, AutoDesk
- Industry standard file formats – allows for easy migration from one software package to another

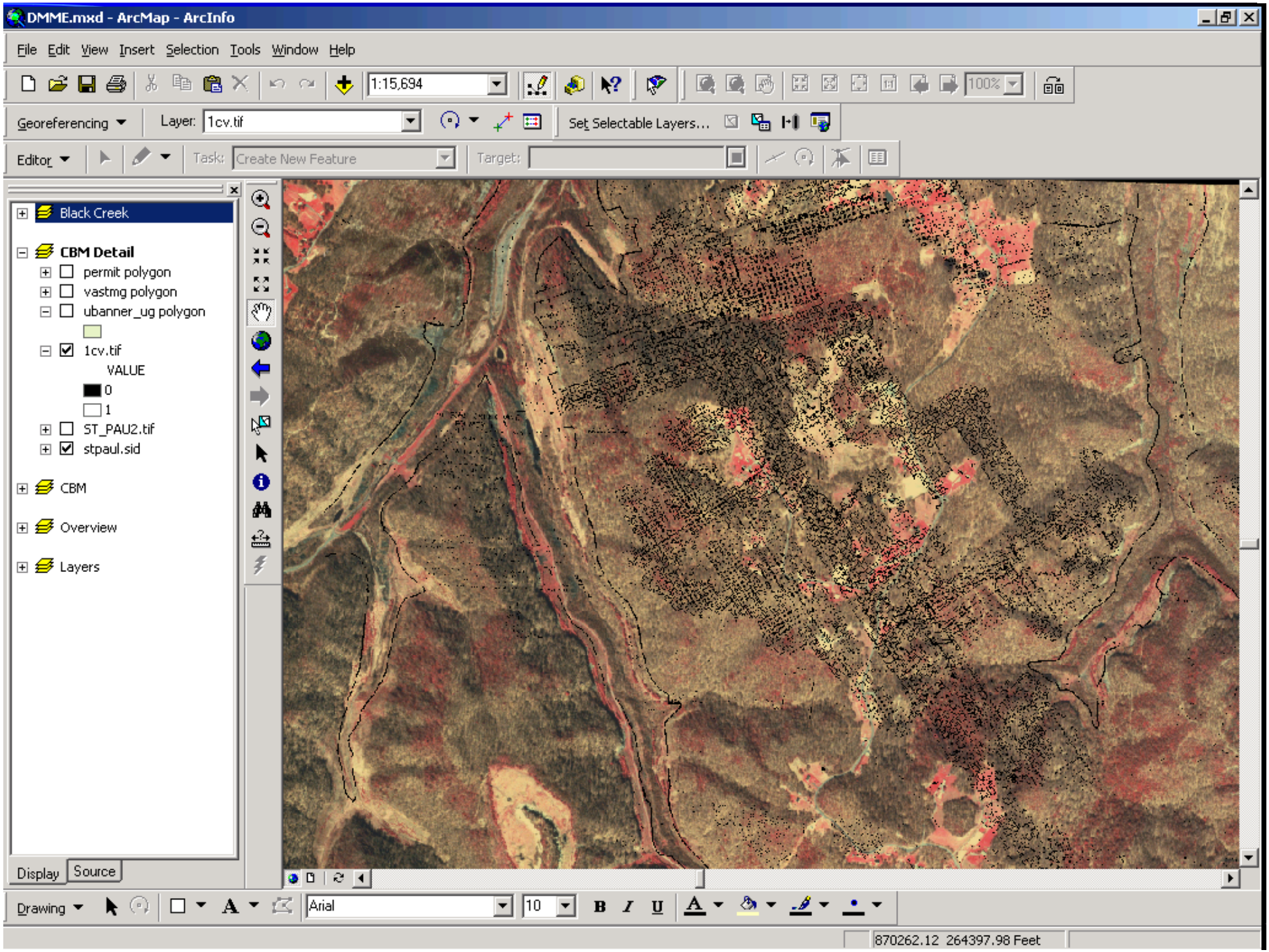
Scanned Map

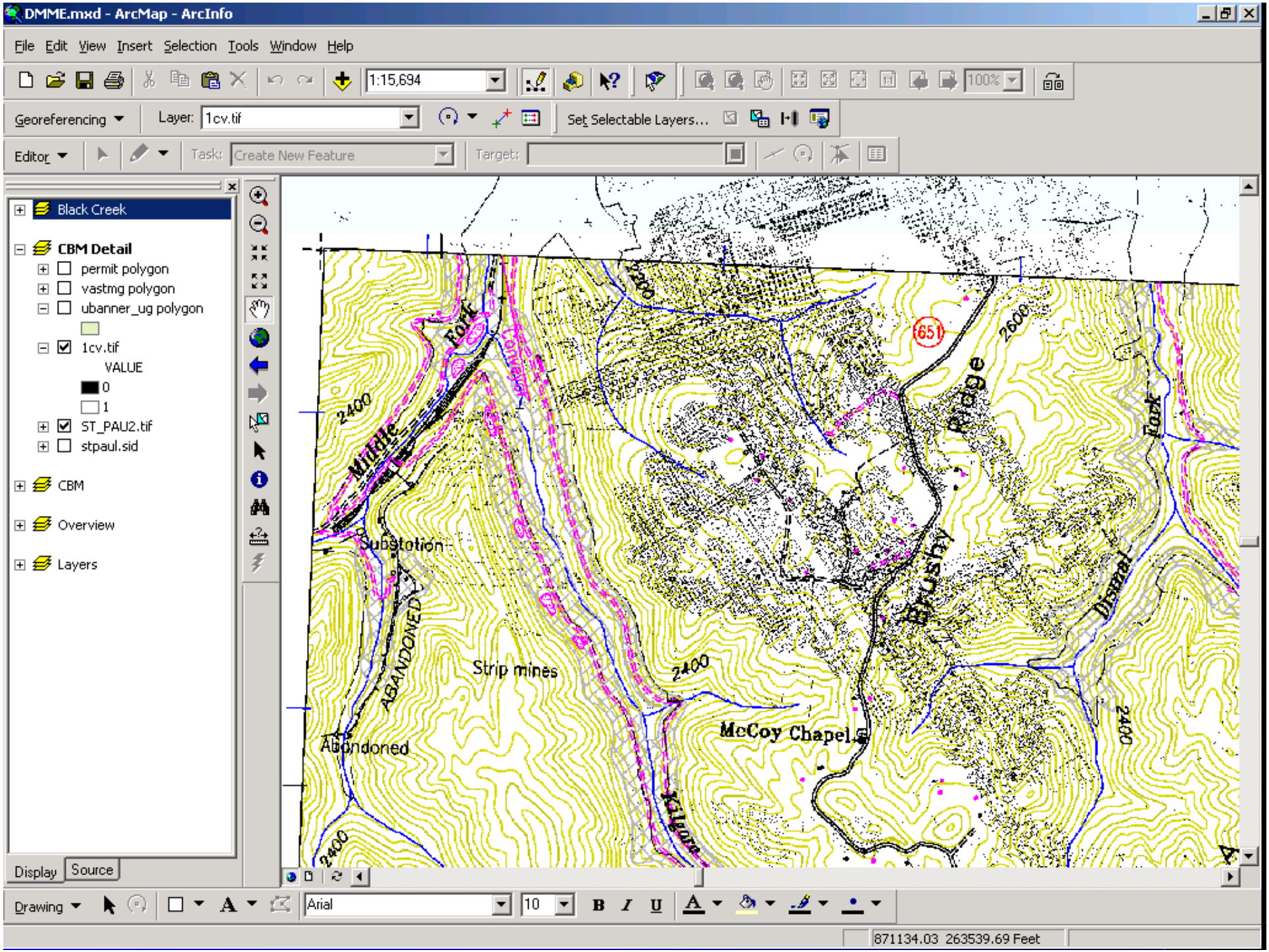


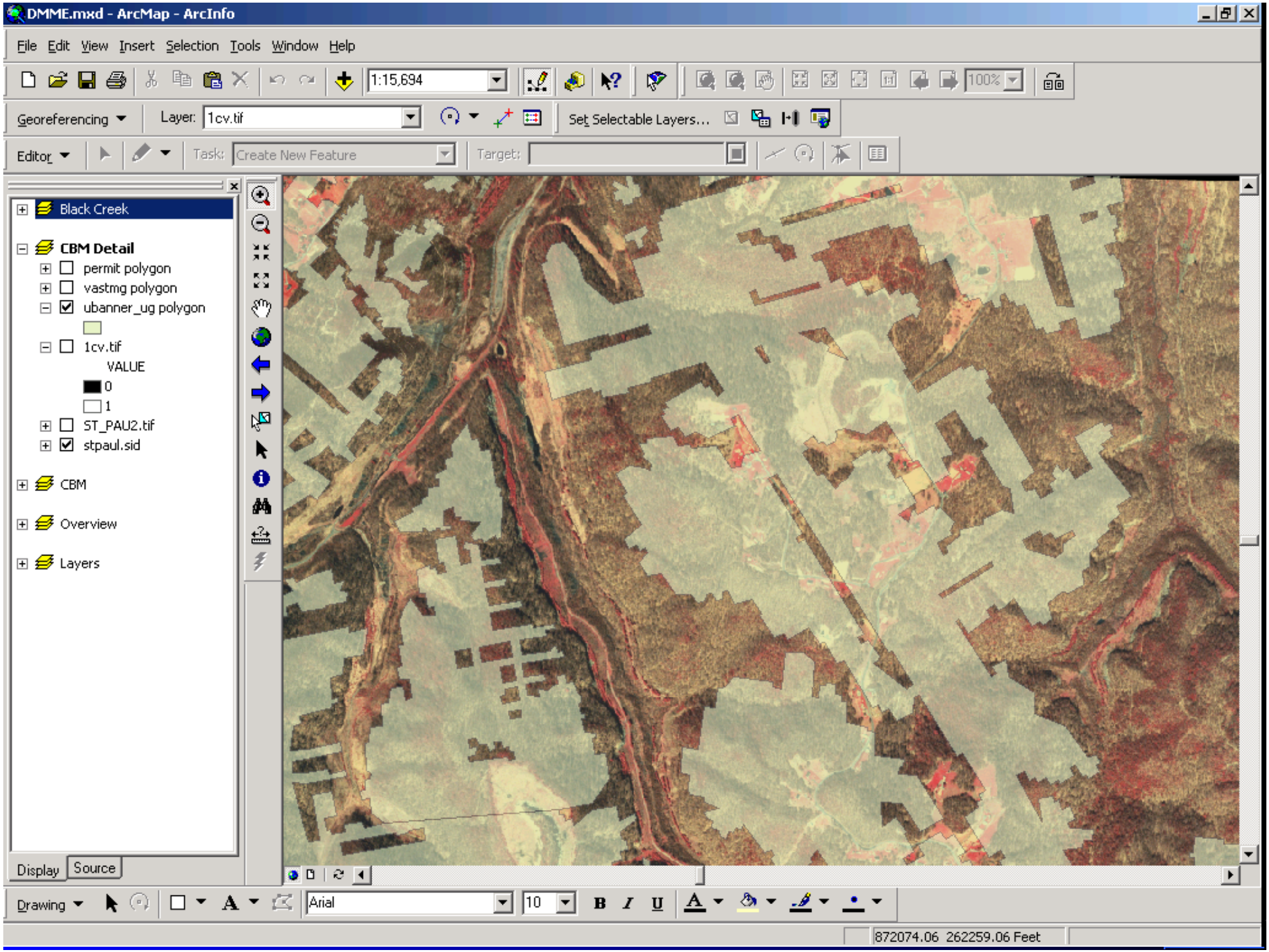
Raster mine map inserted into underground mine outlines




DMME.mxd - ArcMap - ArcInfo
File Edit View Insert Selection Tools Window Help
1:1,127,676
Georeferencing
Layer: 1cv.tif
Set Selectable Layers...
Editor
Task: Create New Feature
Target:
Black Creek
CBM Detail
CBM
Overview
Layers
Display
Source
Drawing
Arial
10

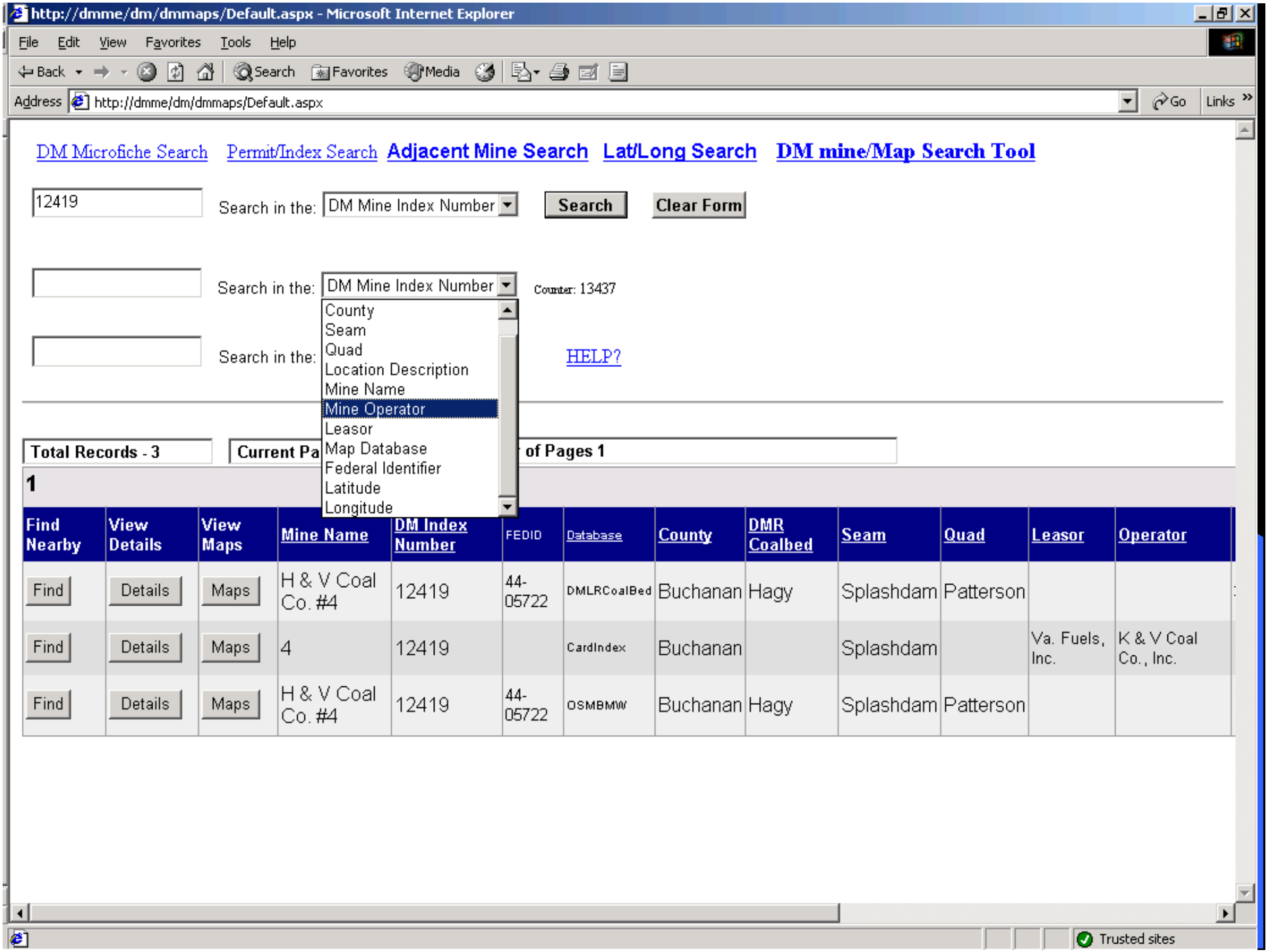

DMME.mxd - ArcMap - ArcInfo
File Edit View Insert Selection Tools Window Help
1:15,694
Georeferencing
Layer: 1cv.tif
Set Selectable Layers...
Editor
Task: Create New Feature
Target:
Black Creek
CBM Detail
permit polygon
vastmg polygon
ubanner_ug polygon
1cv.tif
VALUE
0
1
ST_PAU2.tif
stpaul.sid
CBM
Overview
Layers
Display
Source
Drawing
Arial
10
870262.12 264397.98 Feet


DMME.mxd - ArcMap - ArcInfo
File Edit View Insert Selection Tools Window Help
1:15,694
Georeferencing
Layer: 1cv.tif
Set Selectable Layers...
Editor
Task: Create New Feature
Target:
Black Creek
CBM Detail
permit polygon
vastmg polygon
ubanner_ug polygon
1cv.tif
VALUE
0
1
ST_PAU2.tif
stpaul.sid
CBM
Overview
Layers
Display
Source
Middle Fork
Substation
ABANDONED
Strip mines
Abandoned
McCoy Chapel
Brushy Ridge
Dismal Fork
Kellgore
651
2400
2600
Drawing
Arial
10
871134.03 263539.69 Feet


DMME.mxd - ArcMap - ArcInfo
File Edit View Insert Selection Tools Window Help
1:15,694
Georeferencing
Layer: 1cv.tif
Set Selectable Layers...
Editor
Task: Create New Feature
Target:
Black Creek
CBM Detail
permit polygon
vastmg polygon
ubanner_ug polygon
1cv.tif
VALUE
0
1
ST_PAU2.tif
stpaul.sid
CBM
Overview
Layers
Display
Source
Drawing
Arial
10
872074.06 262259.06 Feet

Retrieval of Information

- Geographic Information System – Spatial data joined with database can be utilized for quick retrieval of information. Information is easily accessed through a standard ArcView project activated in Electronic permitting application
- DMME intranet "Mine Map Search Tool" – Allows users to search for mine maps and related information based on specific queries
- DMME is continuing to develop web-based access to mapping information, which will allow the public to view certain maps and information while restricting other information that is not open to the public


http://dmme/dm/dmmaps/Default.aspx - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://dmme/dm/dmmaps/Default.aspx
Go Links
DM Microfiche Search
Permit/Index Search
Adjacent Mine Search
Lat/Long Search
DM mine/Map Search Tool
12419
Search in the: DM Mine Index Number
Search
Clear Form
Search in the: DM Mine Index Number
Counter: 13437
County
Seam
Quad
Location Description
Mine Name
Mine Operator
Leasor
Map Database
Federal Identifier
Latitude
Longitude
Search in the:
HELP?
Total Records - 3
Current Pa
of Pages 1
1
Find Nearby
View Details
View Maps
Mine Name
DM Index Number
FEDID
Database
County
DMR Coalbed
Seam
Quad
Leasor
Operator
Find
Details
Maps
H & V Coal Co. #4
12419
44-05722
DMLRCoalBed
Buchanan
Hagy
Splashdam
Patterson
Find
Details
Maps
4
12419
CardIndex
Buchanan
Splashdam
Va. Fuels, Inc.
K & V Coal Co., Inc.
Find
Details
Maps
H & V Coal Co. #4
12419
44-05722
OSMBMW
Buchanan
Hagy
Splashdam
Patterson
Trusted sites

Efficiencies and Deficiencies

- Increased scan quality allows more accurate map interpretation
- Utilization of industry standard software
- Improved and expanded data entry and collection procedures
- Qualification of geo-referenced accuracy assessments

Efficiencies and Deficiencies

- Mine map condition
- Lack of mine location information
- Undecipherable or illegible map information
- Coordinate transformation methods from local or company coordinate systems
- Duplication of mine map scans
- Lack of elevation and coal seam data

Program today

- Over 8,000 Mine Maps Scanned and over 3,300 Mines Digitized
- Spatial Data generated by Coal Seam and Quadrangle
- User friendly intranet search engine to identify and locate mines in database
- Continuing effort to scan and catalog mine maps from various sources

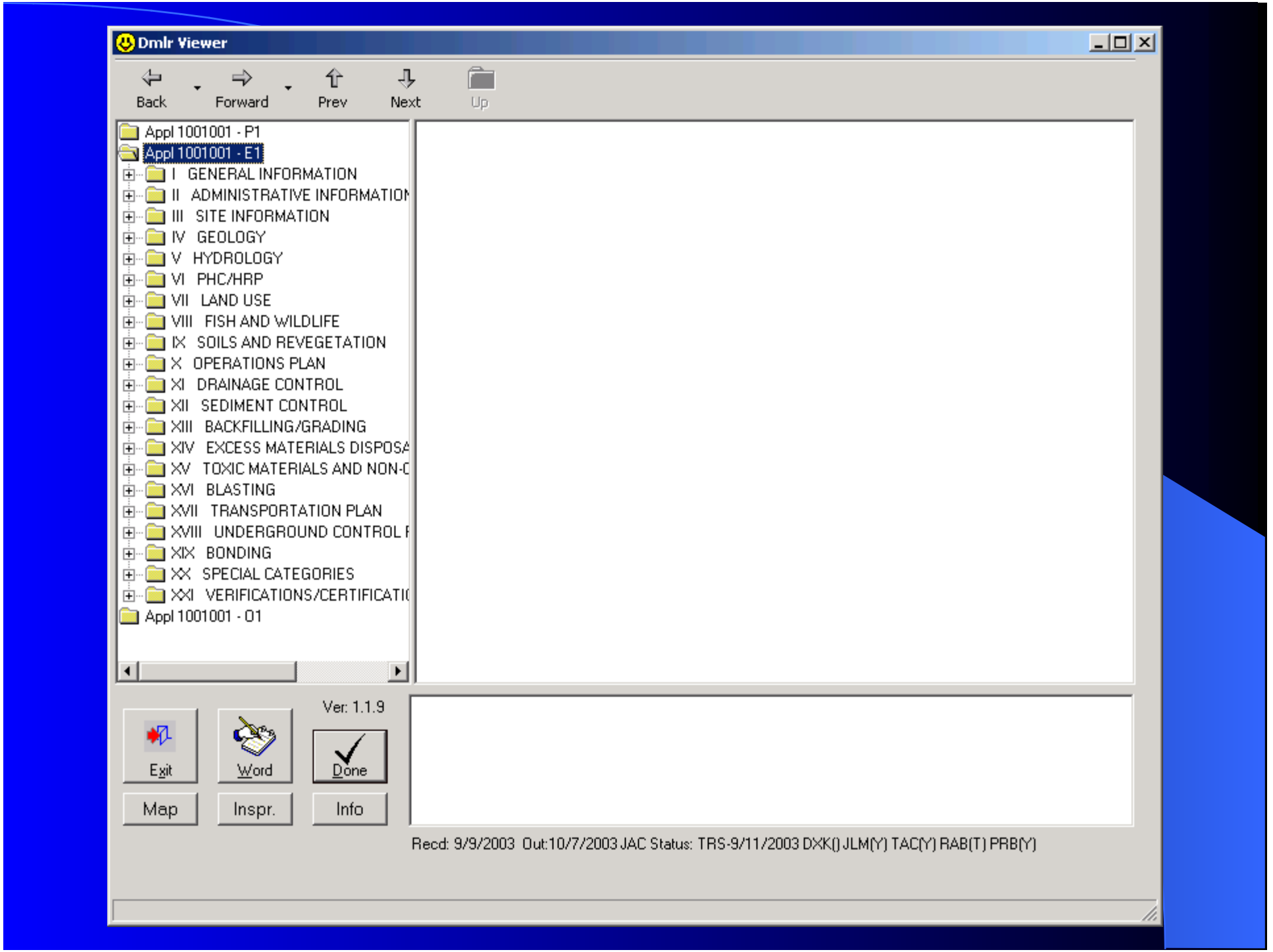
Evolution of Program

So, What has changed?

- Software and Hardware capabilities have advanced
- Improvements have been made to database structure and data entry procedure
- Availability of maps not previously accessible

Data Dissemination

- Electronic Permitting Application
  - Eastman Workflow System
- DMME Laptop System
- DMME website – ftp data sharing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Back
Forward
Prev
Next
Up
Appl 1001001 - P1
Appl 1001001 - E1
I GENERAL INFORMATION
II ADMINISTRATIVE INFORMATIO
III SITE INFORMATION
IV GEOLOGY
V HYDROLOGY
VI PHC/HRP
VII LAND USE
VIII FISH AND WILDLIFE
IX SOILS AND REVEGETATION
X OPERATIONS PLAN
XI DRAINAGE CONTROL
XII SEDIMENT CONTROL
XIII BACKFILLING/GRADING
XIV EXCESS MATERIALS DISPOSA
XV TOXIC MATERIALS AND NON-C
XVI BLASTING
XVII TRANSPORTATION PLAN
XVIII UNDERGROUND CONTROL F
XIX BONDING
XX SPECIAL CATEGORIES
XXI VERIFICATIONS/CERTIFICATI
Appl 1001001 - O1
Ver: 1.1.9
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Word
Done
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Inspr.
Info
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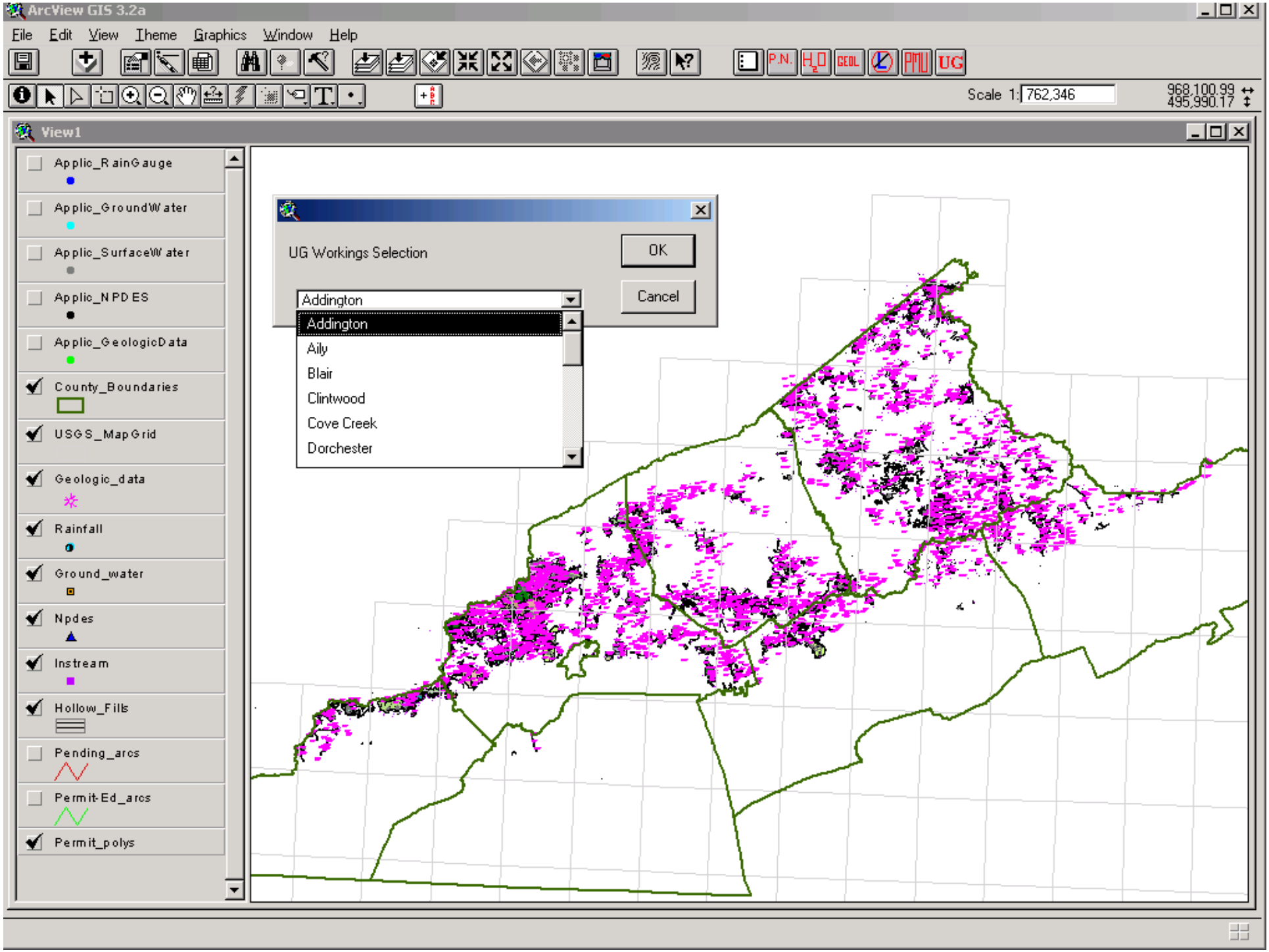
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Applic_GroundWater
Applic_SurfaceWater
Applic_NPDES
Applic_GeologicData
County_Boundaries
USGS_MapGrid
Geologic_data
Rainfall
Ground_water
Npdes
Instream
Hollow_Fills
Pending_arcs
Permit-Ed_arcs
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Blair
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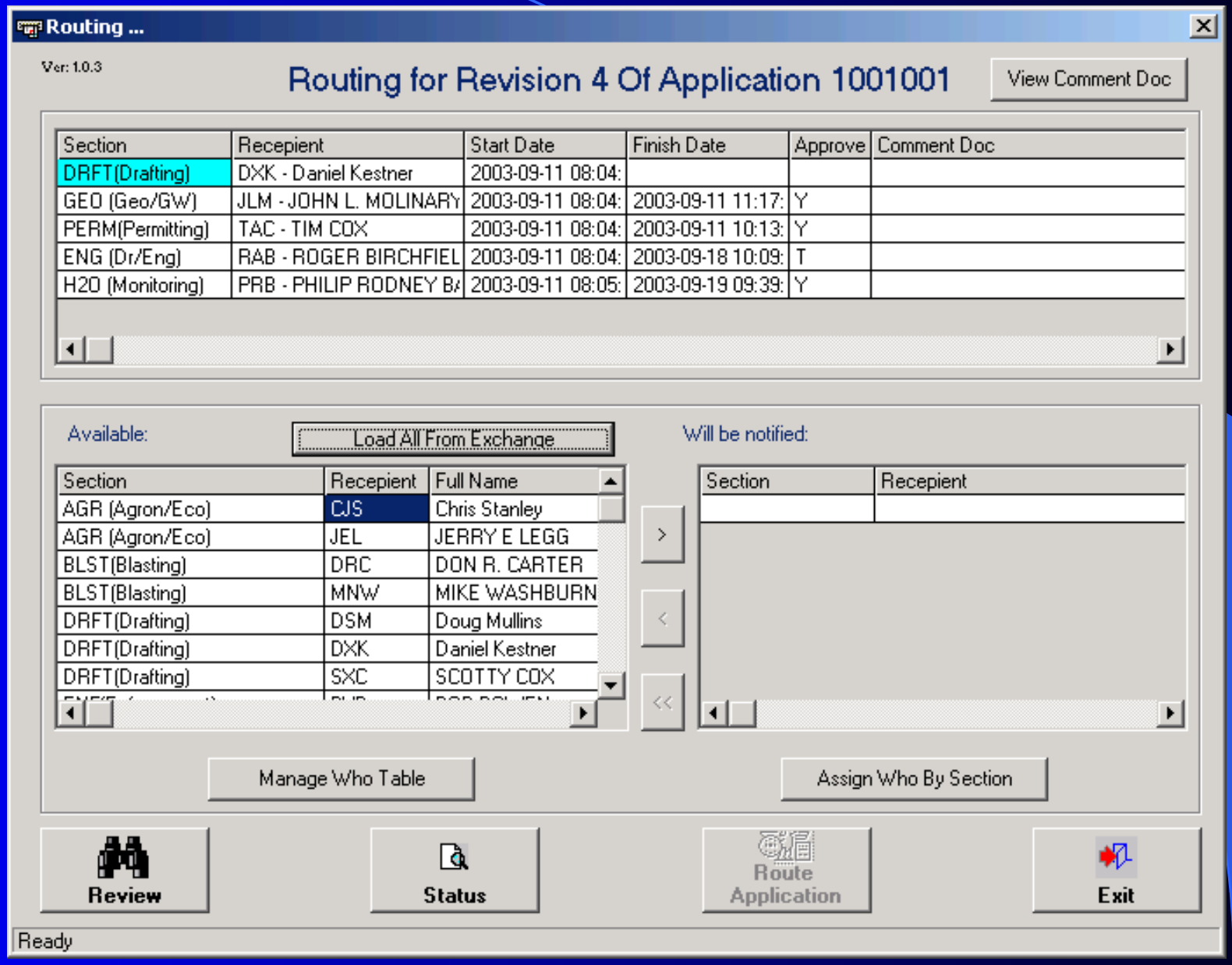
Cove Creek
Dorchester

Workflow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View Comment Doc
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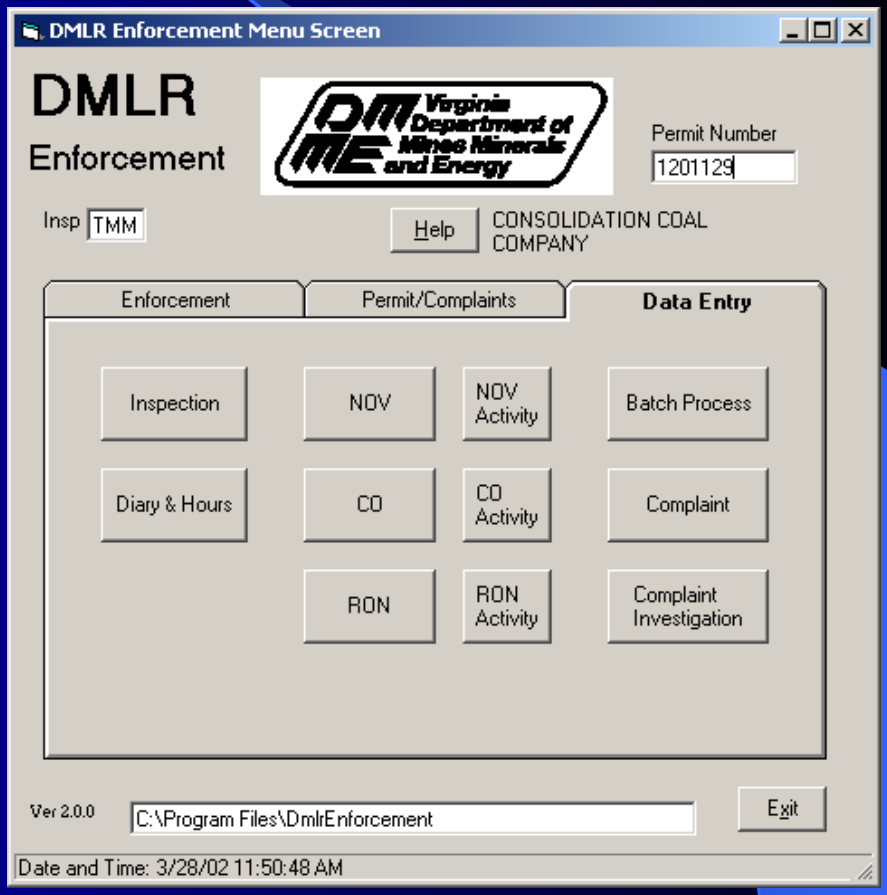
DRFT(Drafting) | DXK - Daniel Kestner | 2003-09-11 08:04: | | |
GEO (Geo/GW) | JLM - JOHN L. MOLINARY | 2003-09-11 08:04: | 2003-09-11 11:17: | Y |
PERM(Permitting) | TAC - TIM COX | 2003-09-11 08:04: | 2003-09-11 10:13: | Y |
ENG (Dr/Eng) | RAB - ROGER BIRCHFIEL | 2003-09-11 08:04: | 2003-09-18 10:09: | T |
H2O (Monitoring) | PRB - PHILIP RODNEY B/ | 2003-09-11 08:05: | 2003-09-19 09:39: | Y
Available:
Load All From Exchange
Will be notified:
Section | Recepient | Full Name
AGR (Agron/Eco) | CJS | Chris Stanley
AGR (Agron/Eco) | JEL | JERRY E LEGG
BLST(Blasting) | DRC | DON R. CARTER
BLST(Blasting) | MNW | MIKE WASHBURN
DRFT(Drafting) | DSM | Doug Mullins
DRFT(Drafting) | DXK | Daniel Kestner
DRFT(Drafting) | SXC | SCOTTY COX
Section | Recepient
Manage Who Table
Assign Who By Section
Review
Status
Route Application
Exit
Ready

Types of Technology Used by Inspectors




DMLR Main Page - Microsoft Internet Explorer
File Edit View Favorites Tools Help
Back Search Favorites Media
Address http://www.dmme.virginia.gov/Dmlr/default.htm
Go Links
Virginia Department of Mines Minerals and Energy
Division of Mined Land Reclamation
Customer Services
Remining
Coal in Virginia
Complaints
Laws
Regulations
Reasonably Available Spoil
Public Participation Opportunities
Abandoned Mine Land Program
Technical Services
Reclamation Services
E-Mail IDs
Office Locations
Operator Memos
Awards
Forms/Guides/Maps for Downloading
Public Access to Agency Records
Dmlr
Server: 165.176.6.36
User Name: Anonymous
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downloads
Drawing
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USGS_DWGs
Word
WordPerfect
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Internet

Future of the Virginia Mine Mapping Information System

- Continuing to advance current procedures and enact the following:
  - Creating a comprehensive digital mine map system by collection, digital conversion and analysis of all available sources of mine maps.
  - Using high-resolution remote sensing data to develop topographic data sets and to map abandoned mine features with accuracy and order of magnitude better than available data.
  - Creating a three-dimensional model of the 54 mineable coal beds in the Southwest Virginia coalfields.

- Continued
  - Creating an abandoned mine map information system designed to enable site-specific risk assessments including quantitative estimates of factors such as uncertainty in mine boundary locations and the probability that a particular abandoned mine is flooded.
  - Evaluating the cost effectiveness of geophysical techniques for underground void detection
  - Developing information sharing consortiums and partnerships with industry and other states

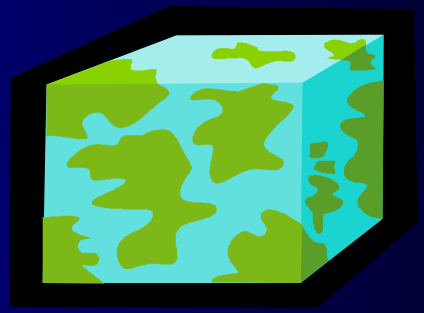
Virginia's Mine Map Inventory Prototype Project

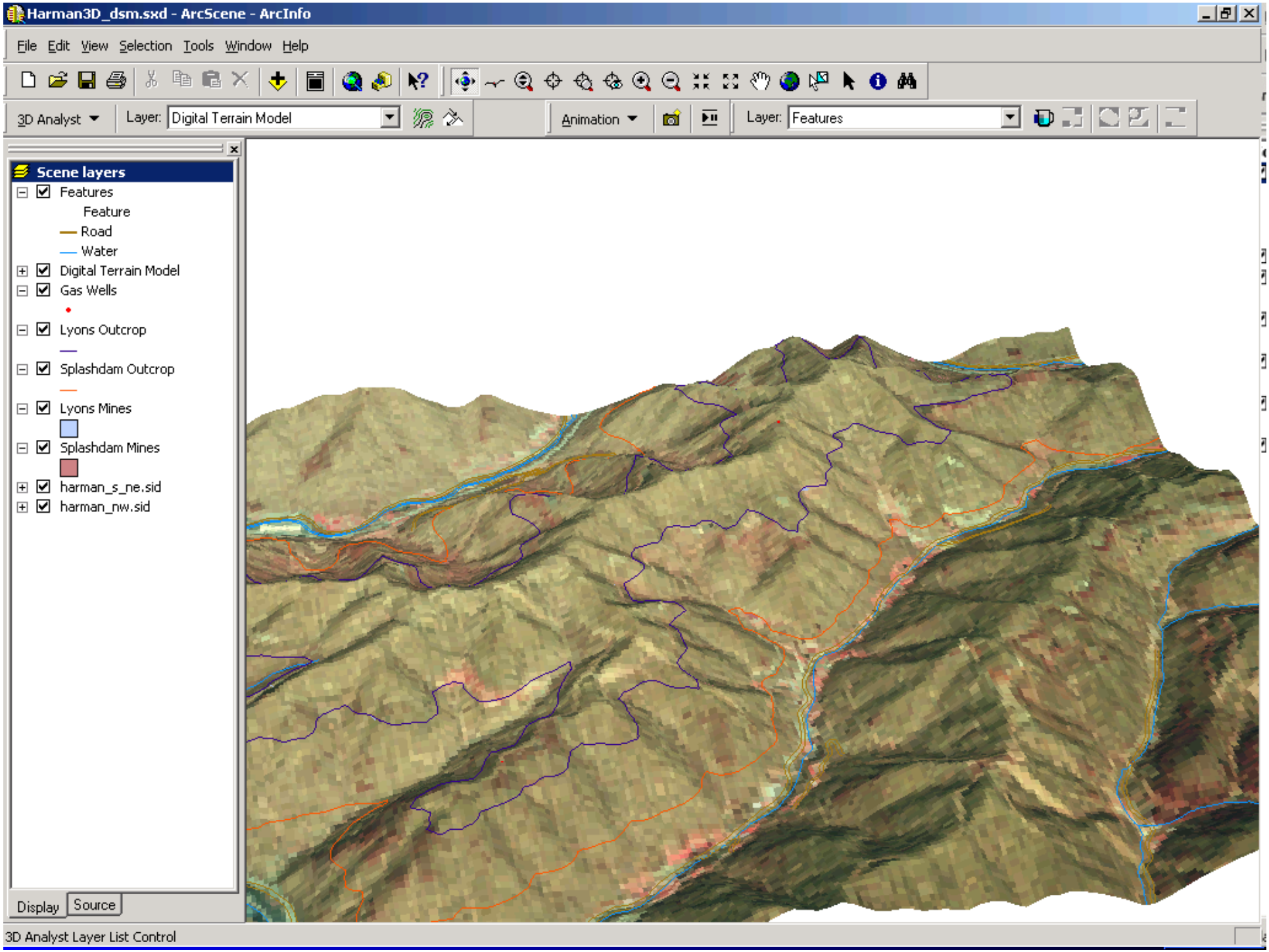
- Proposed project consists of six major tasks. They include:
  - Task One: Creating a comprehensive, digital underground coal mine map inventory and database
  - Task Two: Acquiring and interpreting high-accuracy remote sensing data to more accurately show the locations of underground coal seams and mines relation to the surface and each other.
  - Task Three: Creating a three-dimensional model of Virginia's 54 coal seams and underground mines.
  - Task Four: Enhancing the DMME Coal Mine Map Information System based on the database and maps of coal mines and the three-dimensional model of the coal seams.
  - Task Five: Evaluating various geophysical void-detection technologies to determine which are appropriate for use in Virginia's mining environment.
  - Task Six: Providing information sharing and technology transfer based on the results of this project.

3-D Modeling

- 3-dimensional models of the 54 mineable coal beds in the Southwest Virginia coalfields will be generated

- * Demo of 3-d model prototype

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Animation
Layer: Features
Scene layers
Features
Feature
Road
Water
Digital Terrain Model
Gas Wells
Lyons Outcrop
Splashdam Outcrop
Lyons Mines
Splashdam Mines
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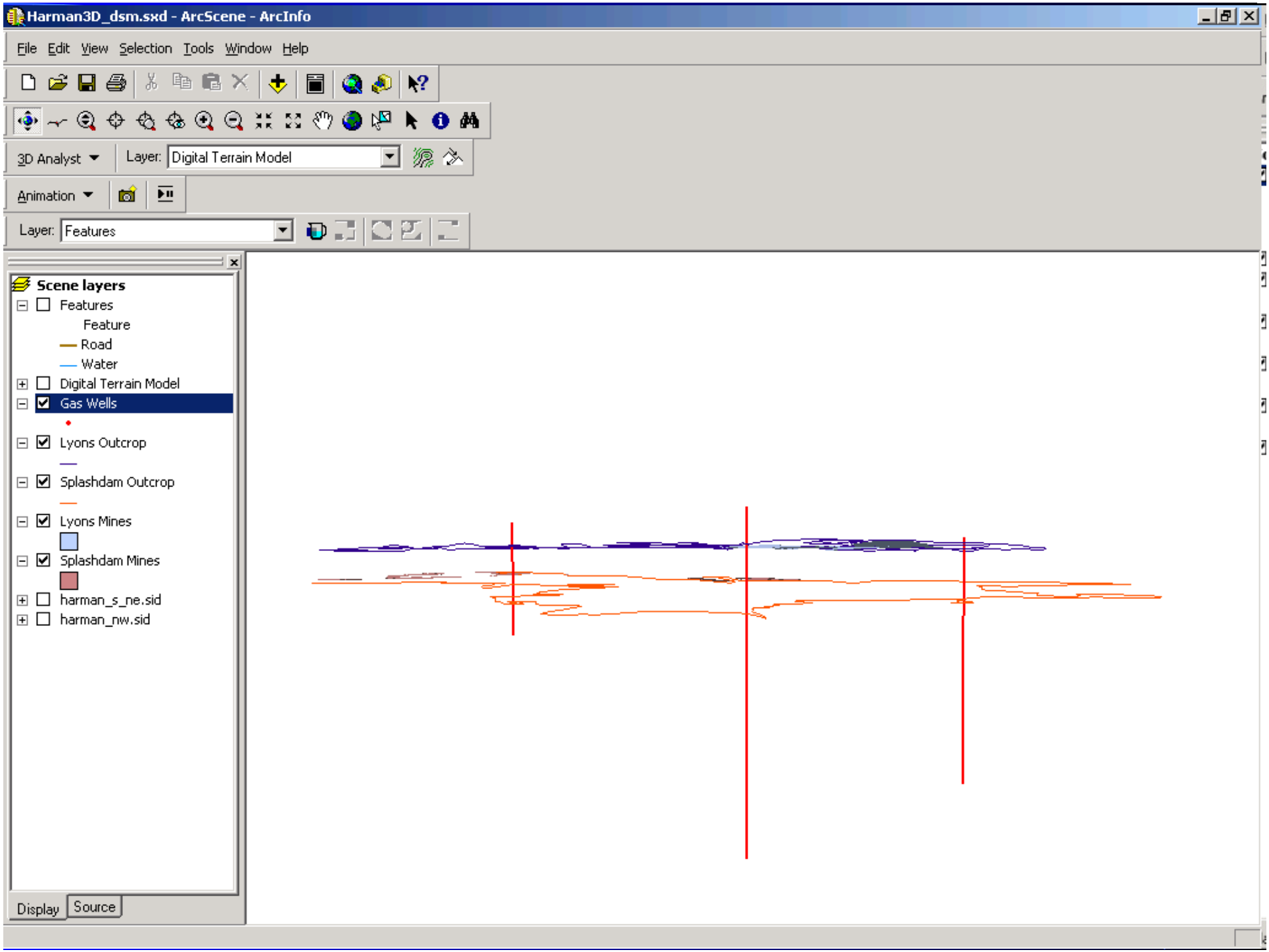
3D Analyst Layer List Control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Layer: Features
Scene layers
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Water
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Gas Wells
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Lyons Mines
Splashdam Mines
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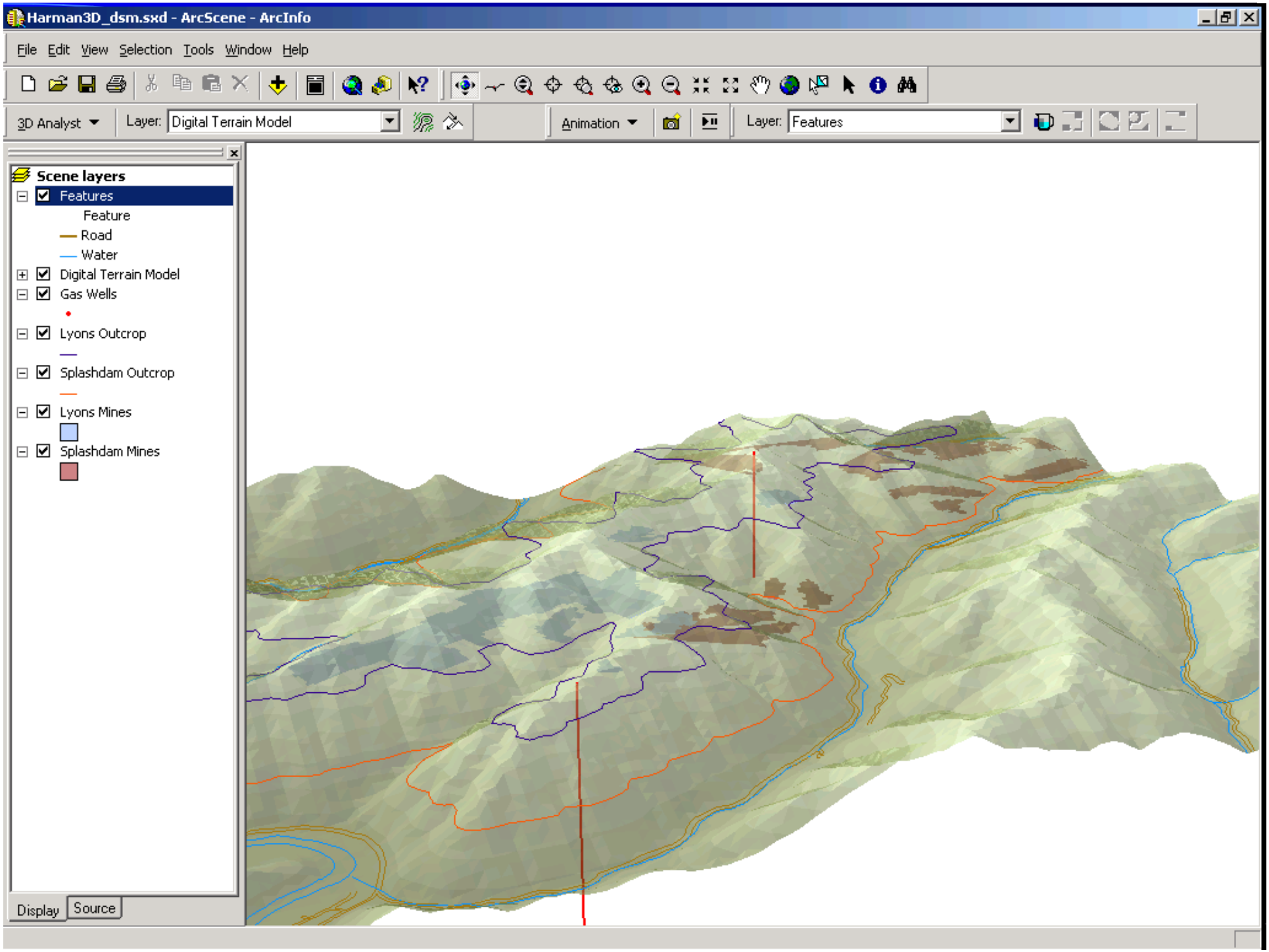
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Feature
Road
Water
Digital Terrain Model
Gas Wells
Lyons Outcrop
Splashdam Outcrop
Lyons Mines
Splashdam Mines
Display
Source

Summary

- Questions?

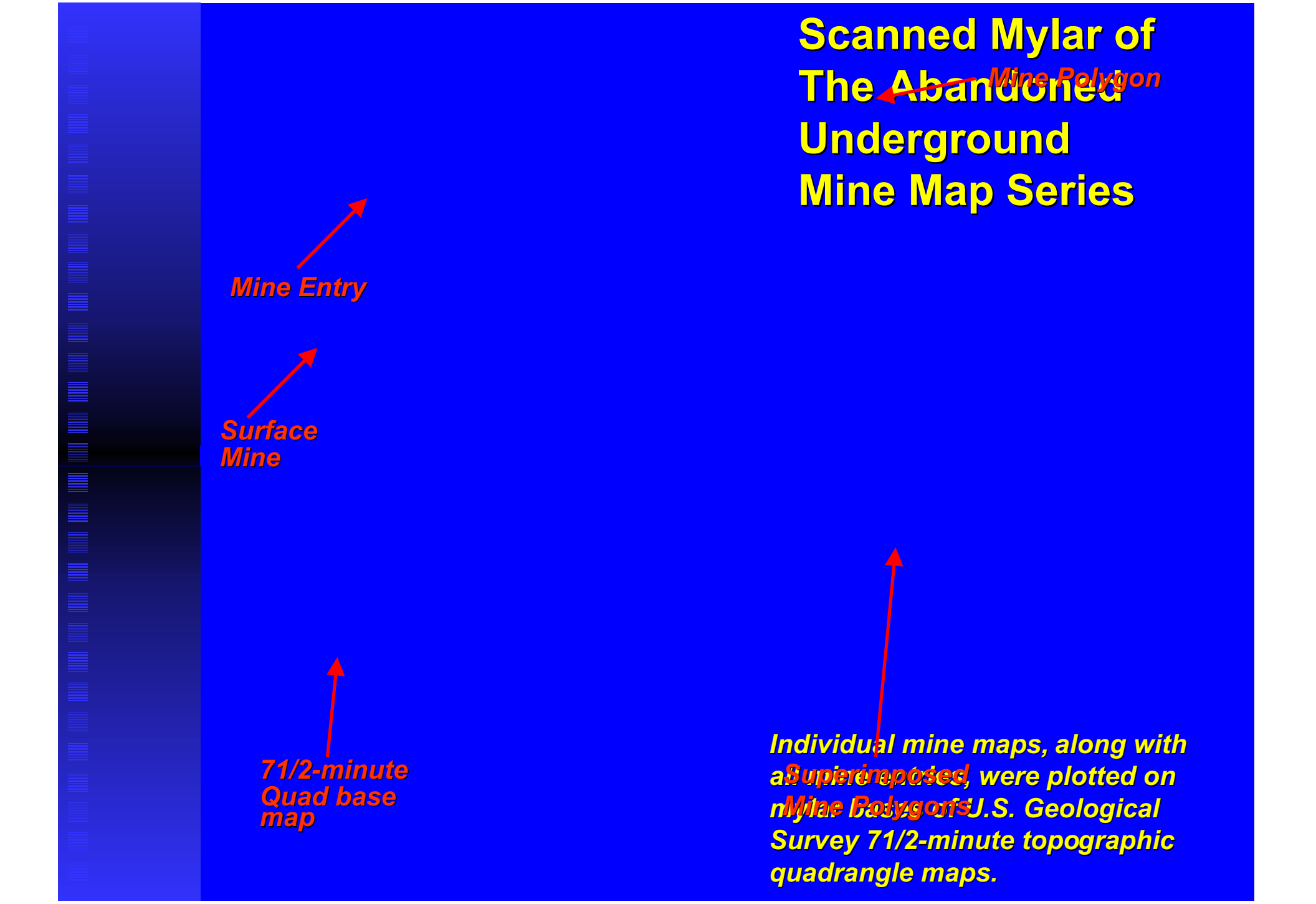
Return to Contents

ABANDONED UNDERGROUND MINES GIS FOR OHIO

CHARLES E. BANKS --- Ohio Division of Geological Survey, Columbus, Ohio
JAMES MCDONALD --- Ohio Division of Geological Survey, Columbus, Ohio
DOUGLAS L. CROWELL --- Ohio Division of Geological Survey, Columbus, Ohio
LAWRENCE H. WICKSTROM --- Ohio Division of Geological Survey, Columbus, Ohio

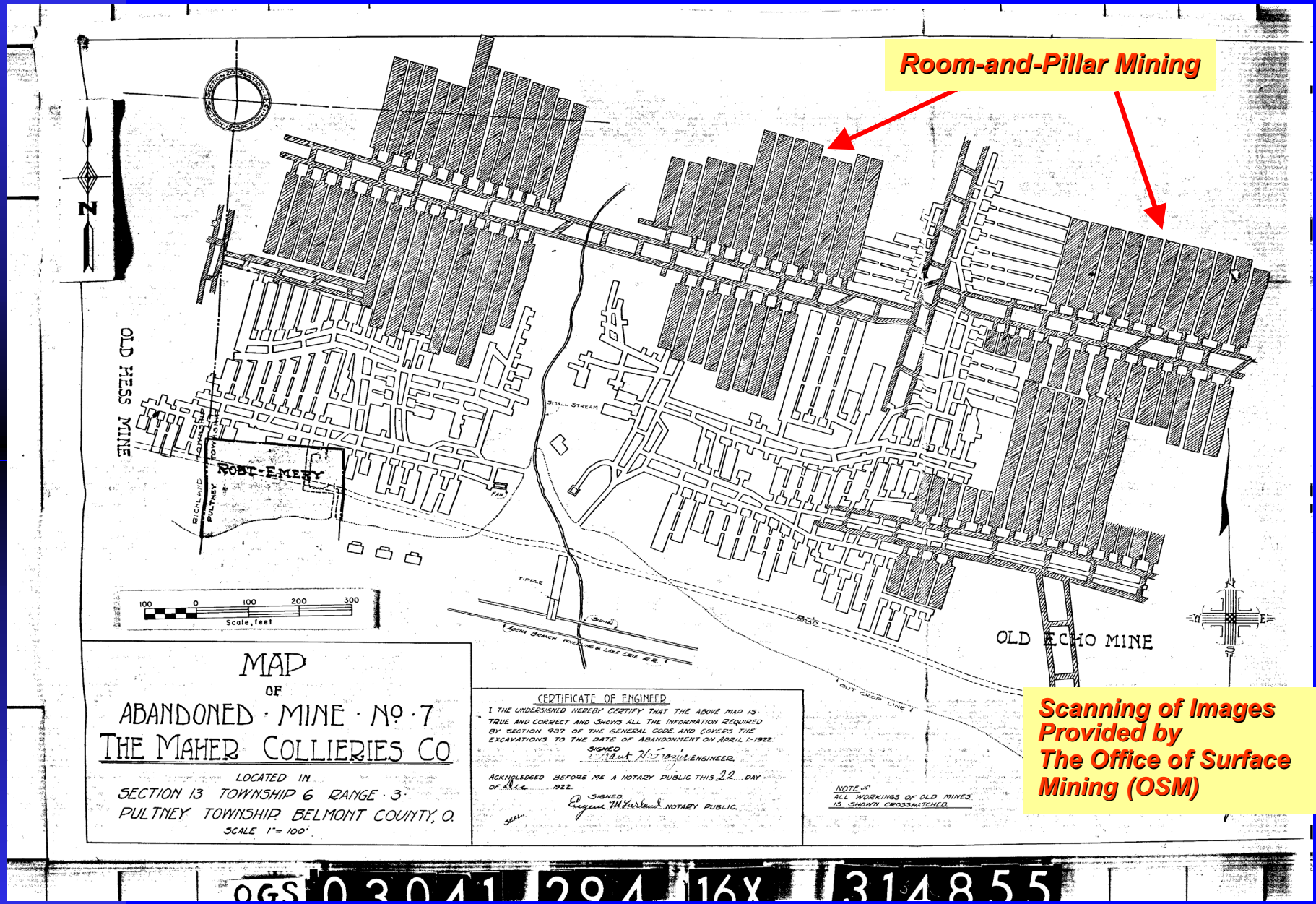
The AUM Historic Development, Development Methods, GIS Data, and Challenges

Scanned Mylar of The Abandoned Underground Mine Map Series



Individual mine maps, along with an aerial photo, were plotted on mylar bases of U.S. Geological Survey 71/2-minute topographic quadrangle maps.

Scanned Image of Abandoned Underground Detailed Mine Map



Scanning of Images Provided by The Office of Surface Mining (OSM)

Abandoned Mine BT-005, Pultney Township, Belmont County, Ohio

Photo: Ohio Geological Survey

ANNUAL MINE MAP DATA SHEET

AND TO FR

AUM Opening Database Entry and Retrieval Form

OHIO DEPARTMENT OF NATURAL RESOURCES
Division of Geological Survey

Microsoft Access - [frmMineOpening : Form]

File Edit View Insert Format Records Tools Window Help

Tahoma 12 B I U

Abandoned Underground Mine Map Openings

Mine Opening ID:

Opening Type: Source: Date of Rec:

County: Township:

Commodity: Quadrangle:

Operator: Mine Name:

Seam Name: Elev: ft. Thickness: in.

Comment(s):

Find Record Add New Quit

O.D.N.R. GEOLOGICAL SURVEY

DATA SHEETS TO DATABASES

Record: 1 of 2144

Form View NUM

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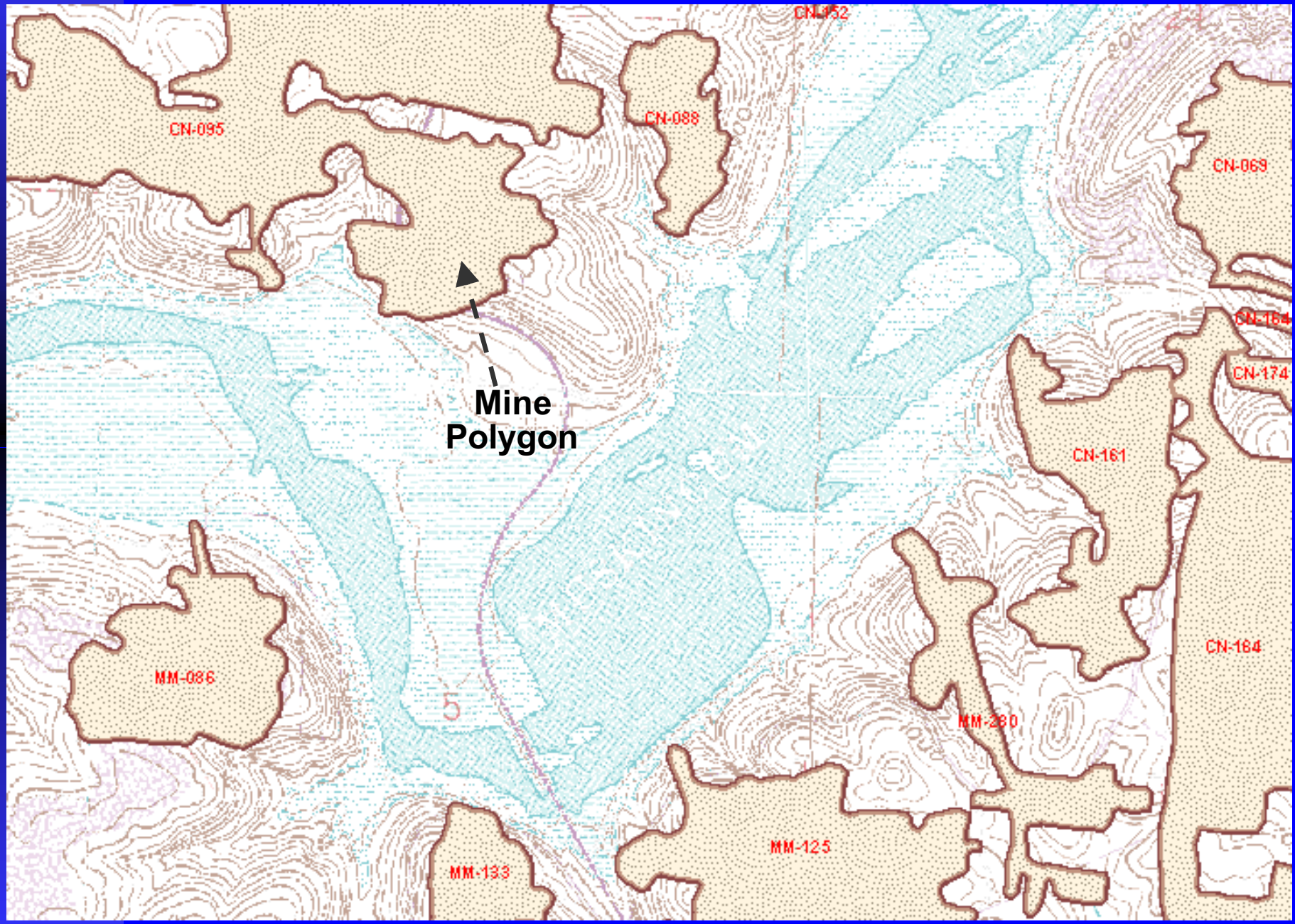
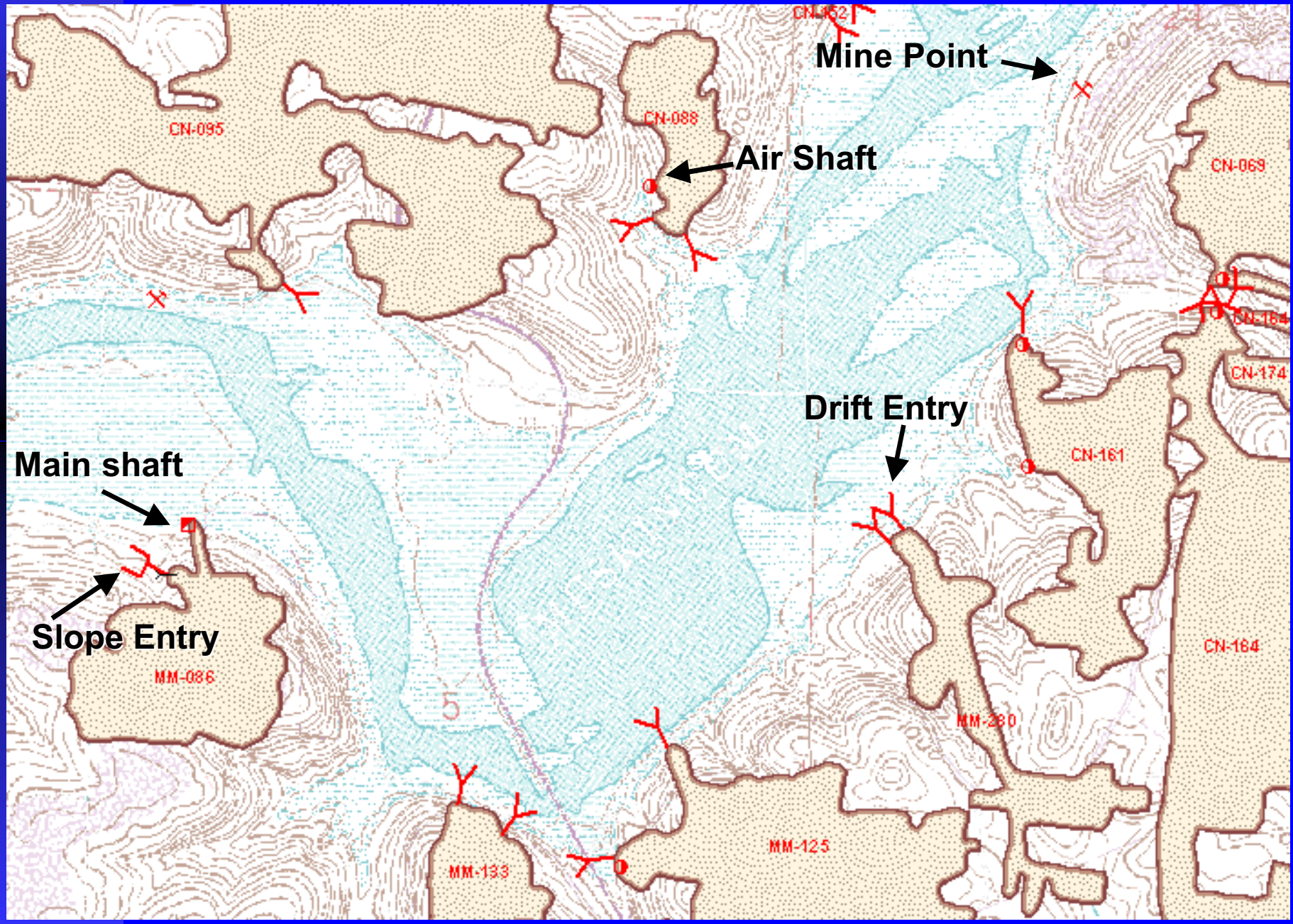
Start frmMai... 3:59 PM

☐ Other

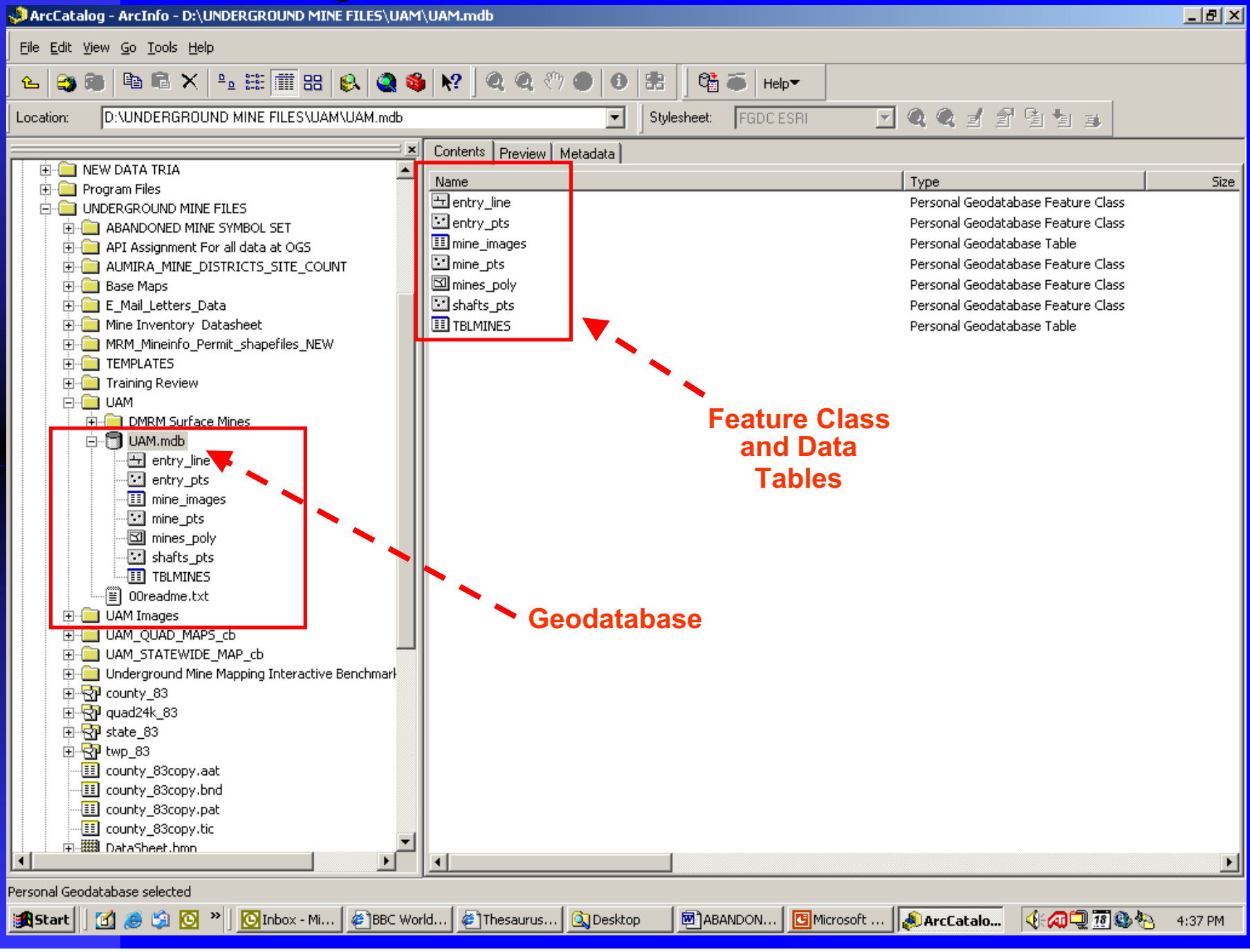
Digitized Mine Polygons



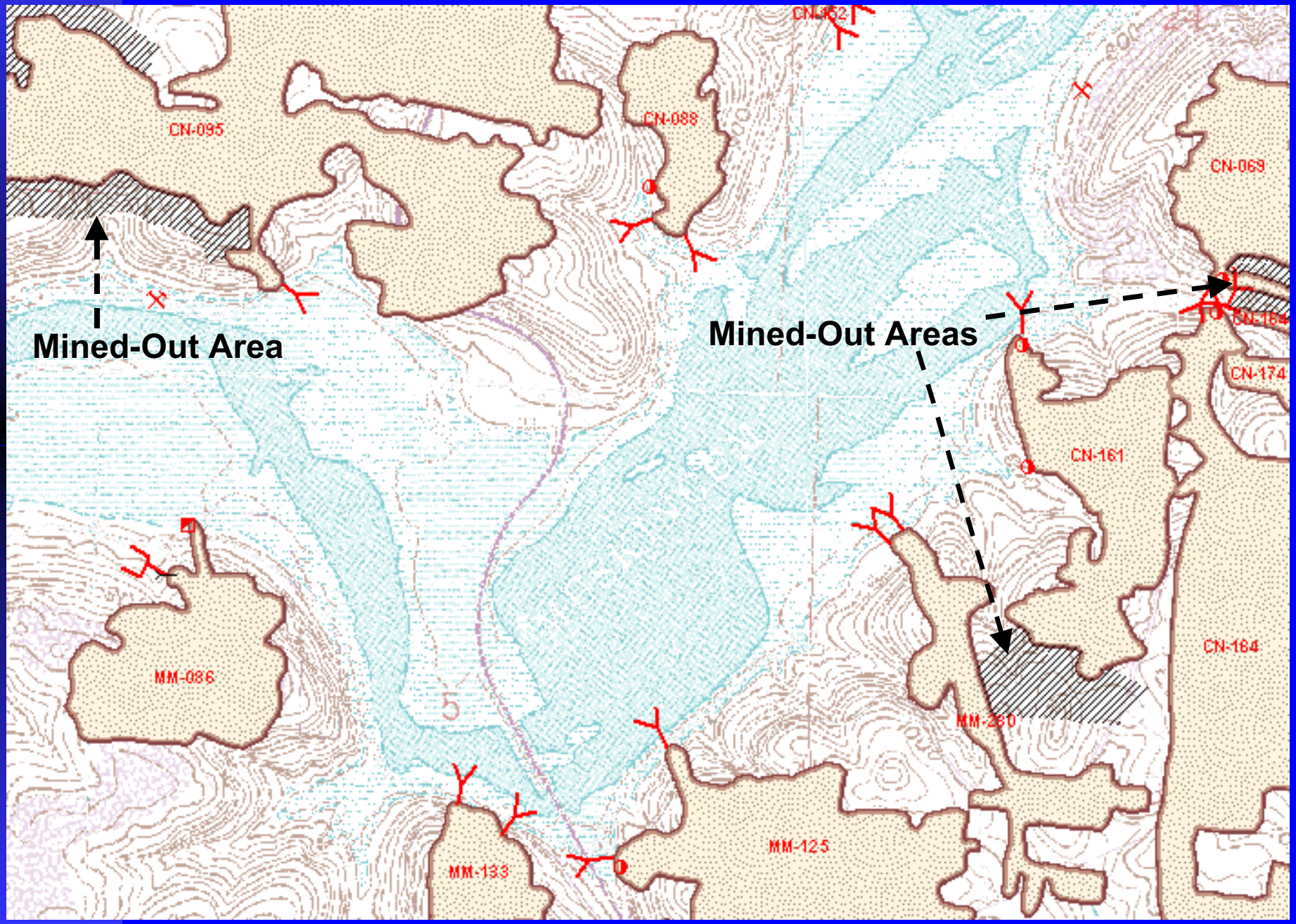
Digitized Mine Points and Entry Points



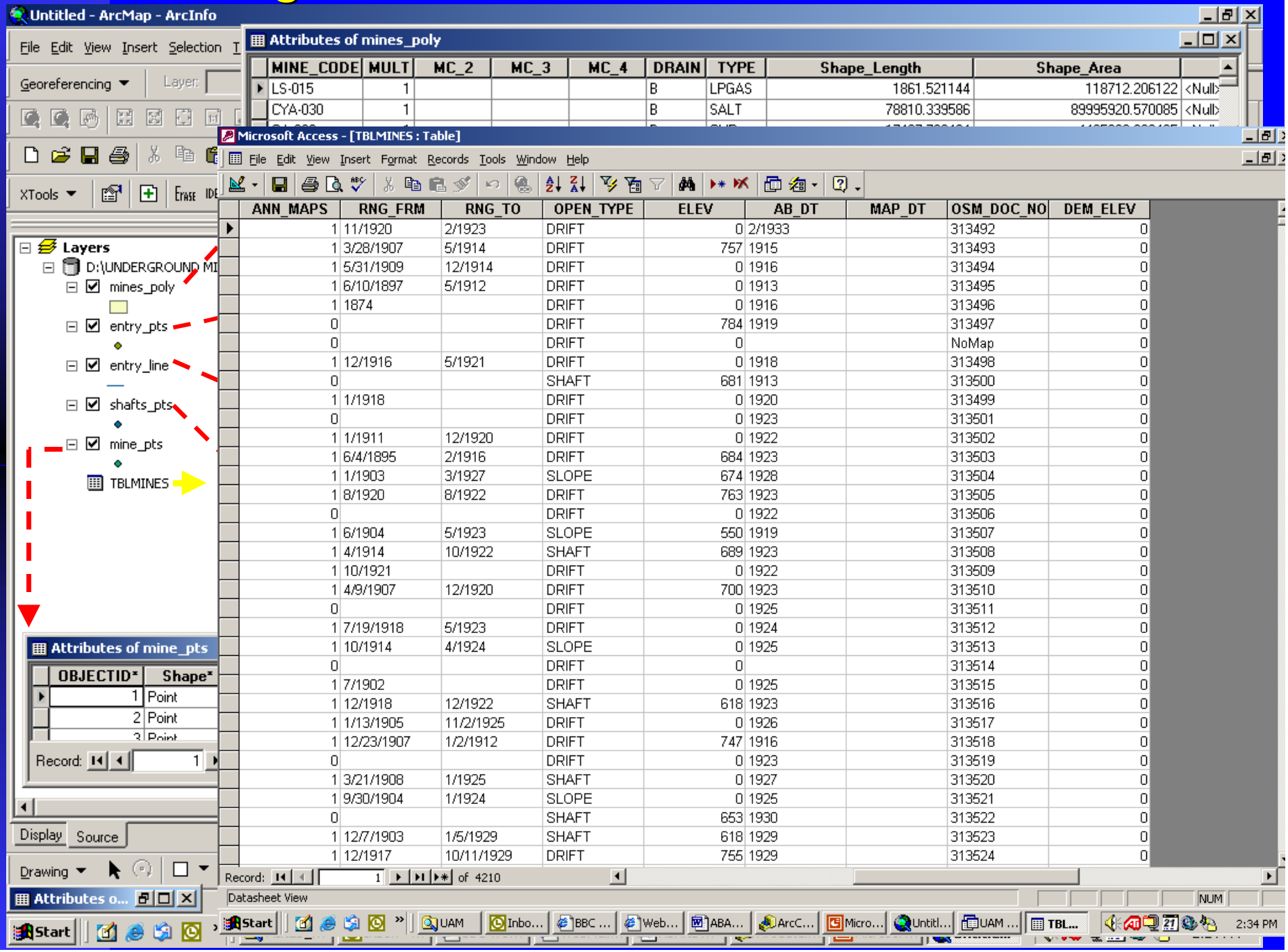
Original AUM Personal Geodatabase



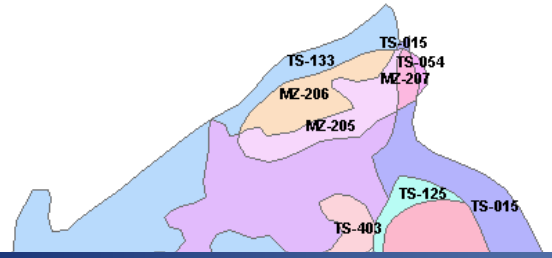
Mine Polygons and Mined-Out Areas



Original AUM Feature Class Attribute Tables



Issues with Over-lapping Mines --- MZ POLYGONS AND "OUT" AREAS



Attributes of Mine_temp_new

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1	Polygon	5320	TS-133	1				A	16754.692306	4735654.50535	341578013302
2	Polygon	5321	TS-403	2	TS-113	TS-403		A	13528.463440	2708229.90325	341578040302
3	Polygon	5322	TS-015	1				A	5737.191397	906893.86735	341578001502
4	Polygon	5323	TS-015	1				A	835.660227	29214.36755	341578001502
5	Polygon	5324	TS-039	1				A	3178.682121	502278.0266	341578003902
6	Polygon	5325	TS-125	1				B	4118.097432	844539.4124	341578012502
7	Polygon	5326	TS-401	2	TS-401	TS-062		A	11685.311356	1929930.00625	341578040102
8	Polygon	5327	TS-062	1				A	14696.417275	4365297.09005	341578006202
9	Polygon	5419	TS-054	2	TS-403	TS-054		A	2201.343978	261912.0351	341578005402

Overlapping Mines

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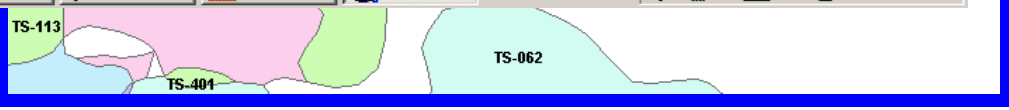
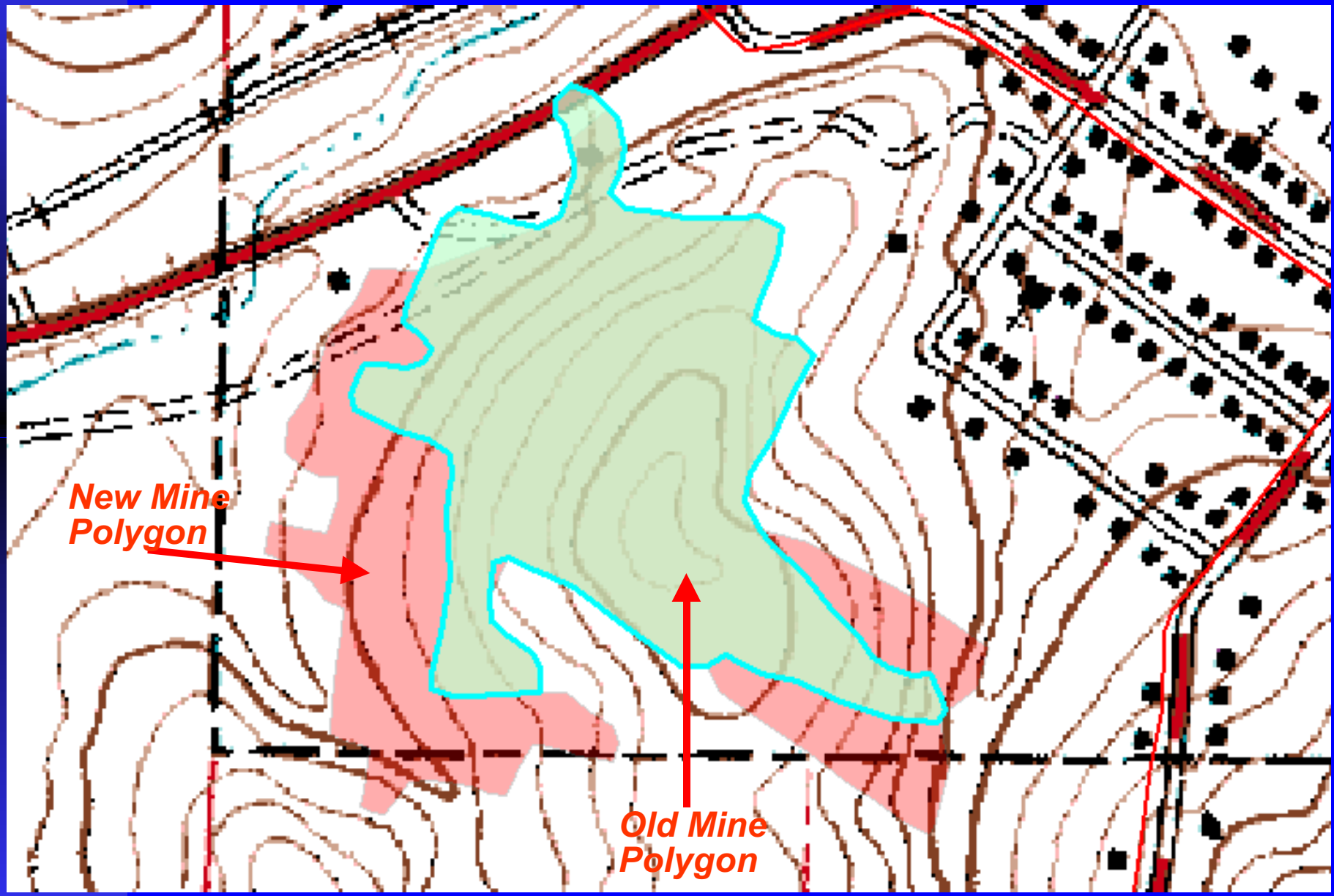
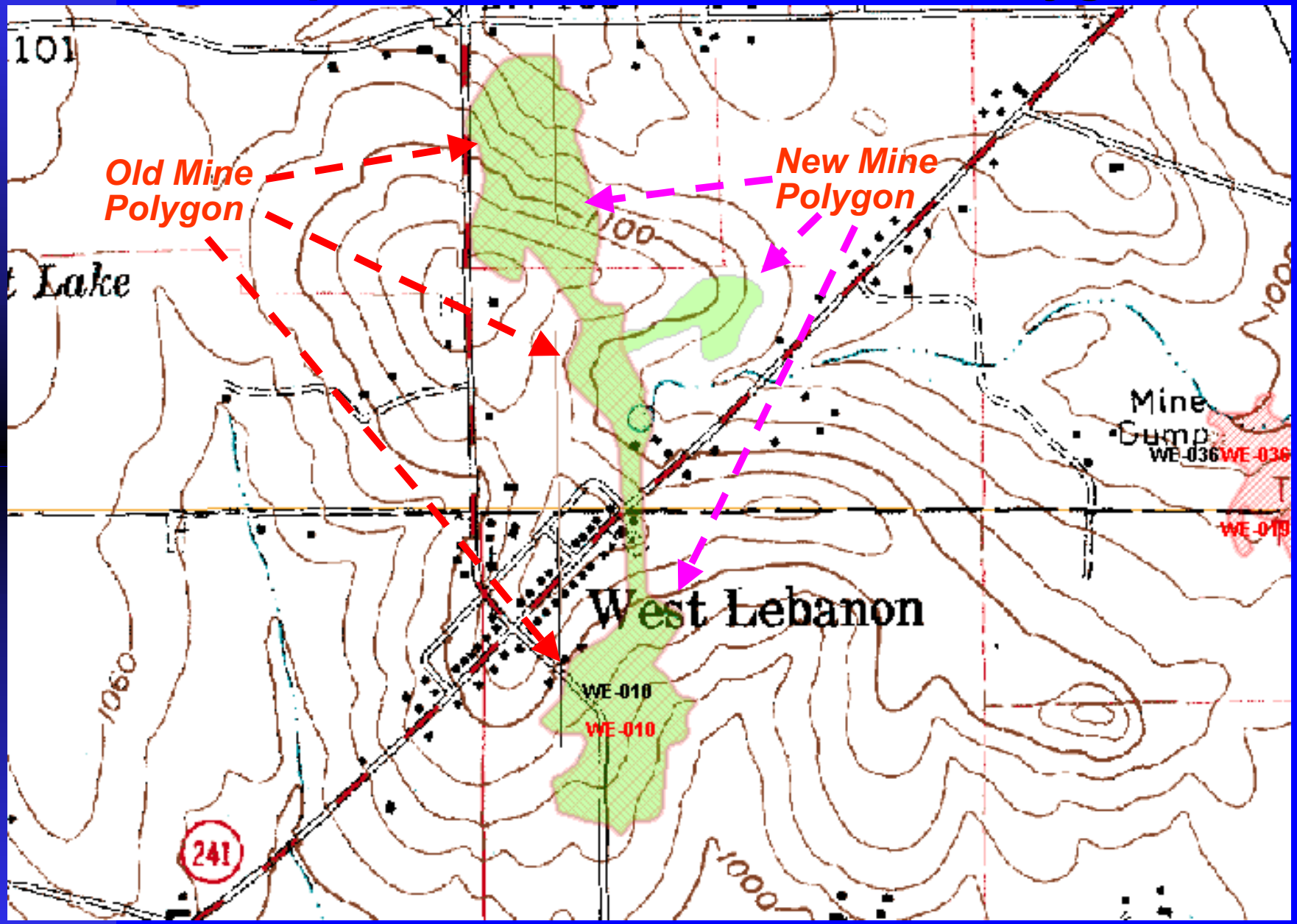


Re-Digitizing Mine Polygons

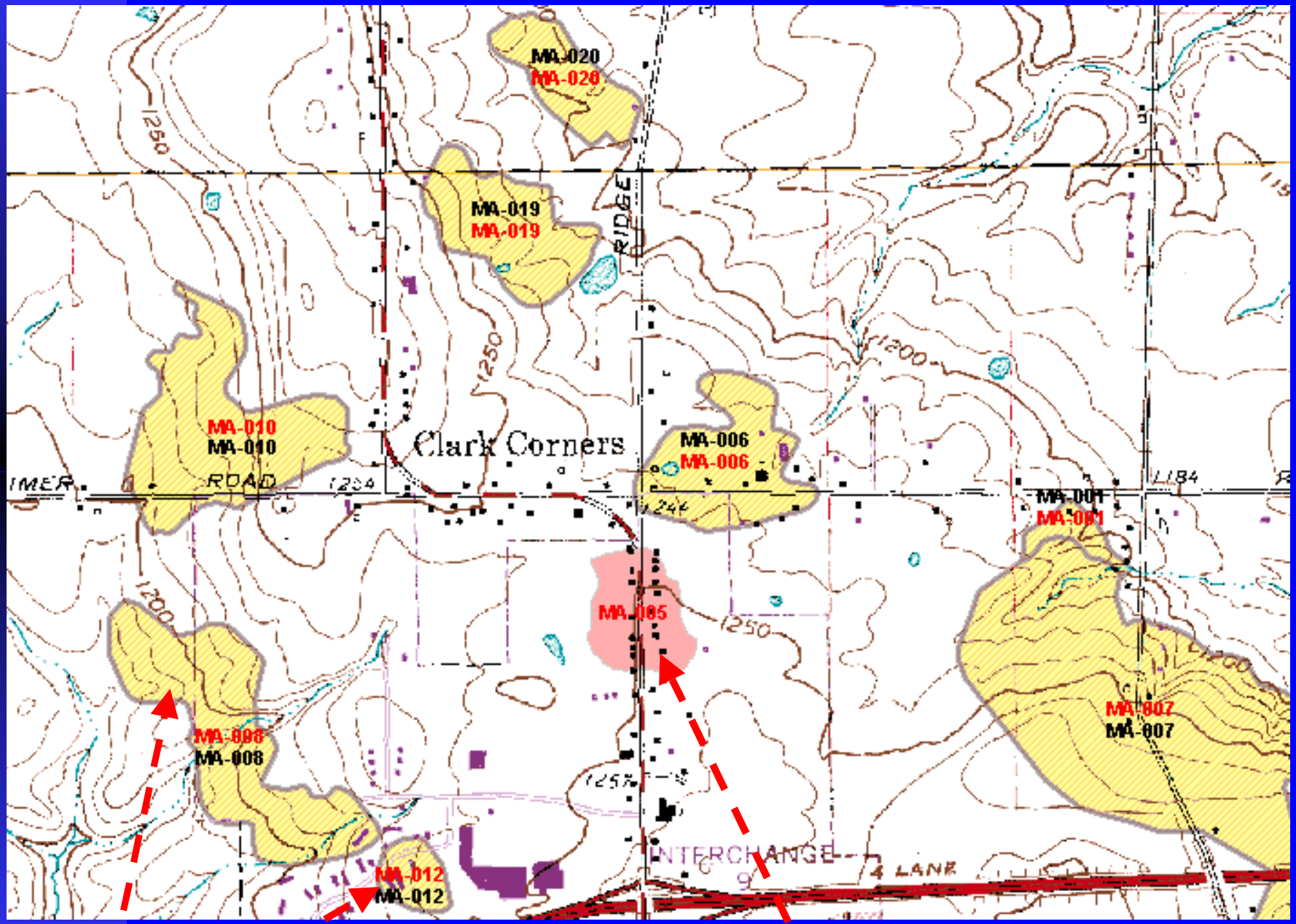


HN-002, Bowerston Quadrangle, Ohio

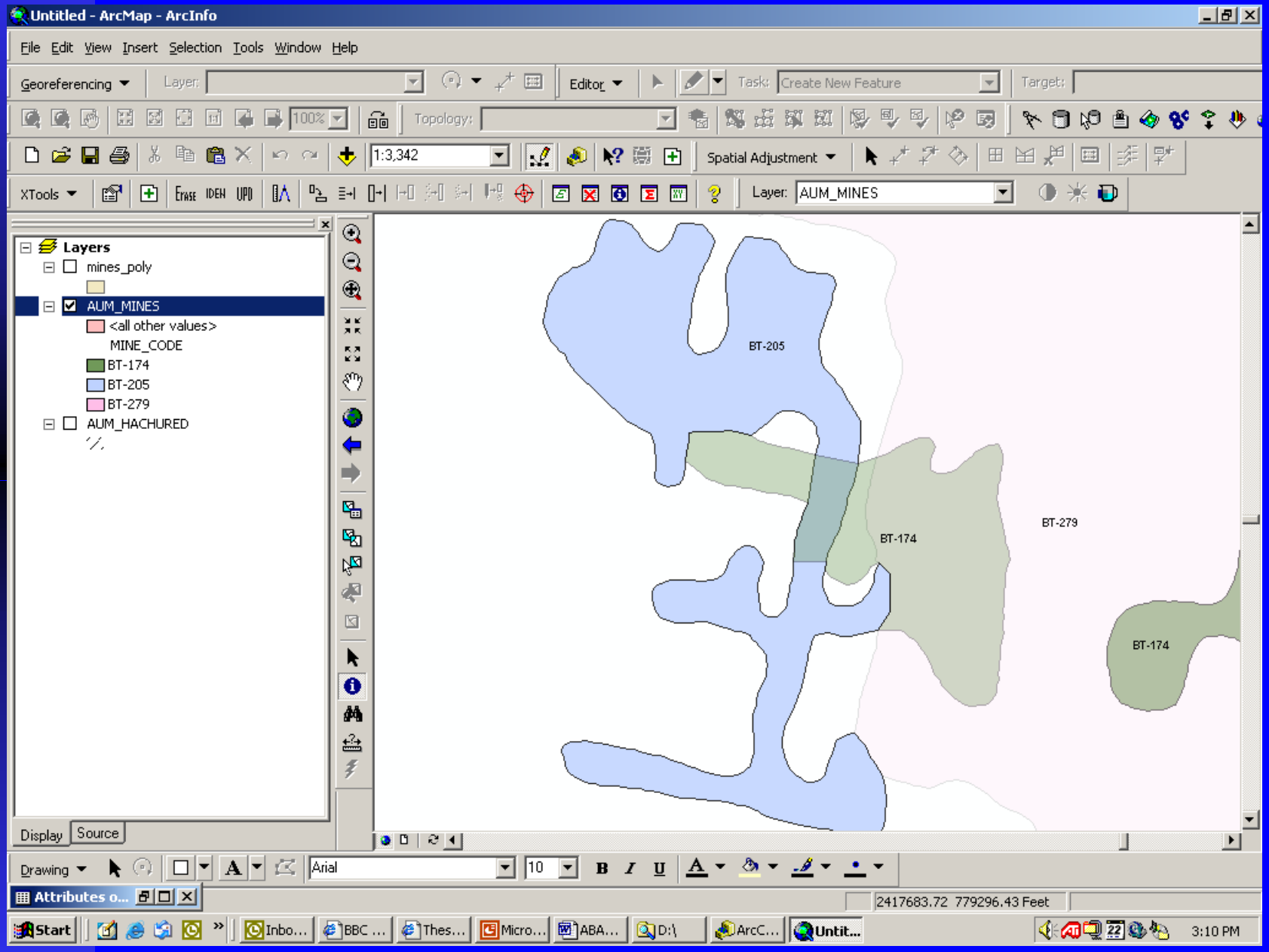
Reshaped and Additional Mine Polygons



Addition of Mine Polygons

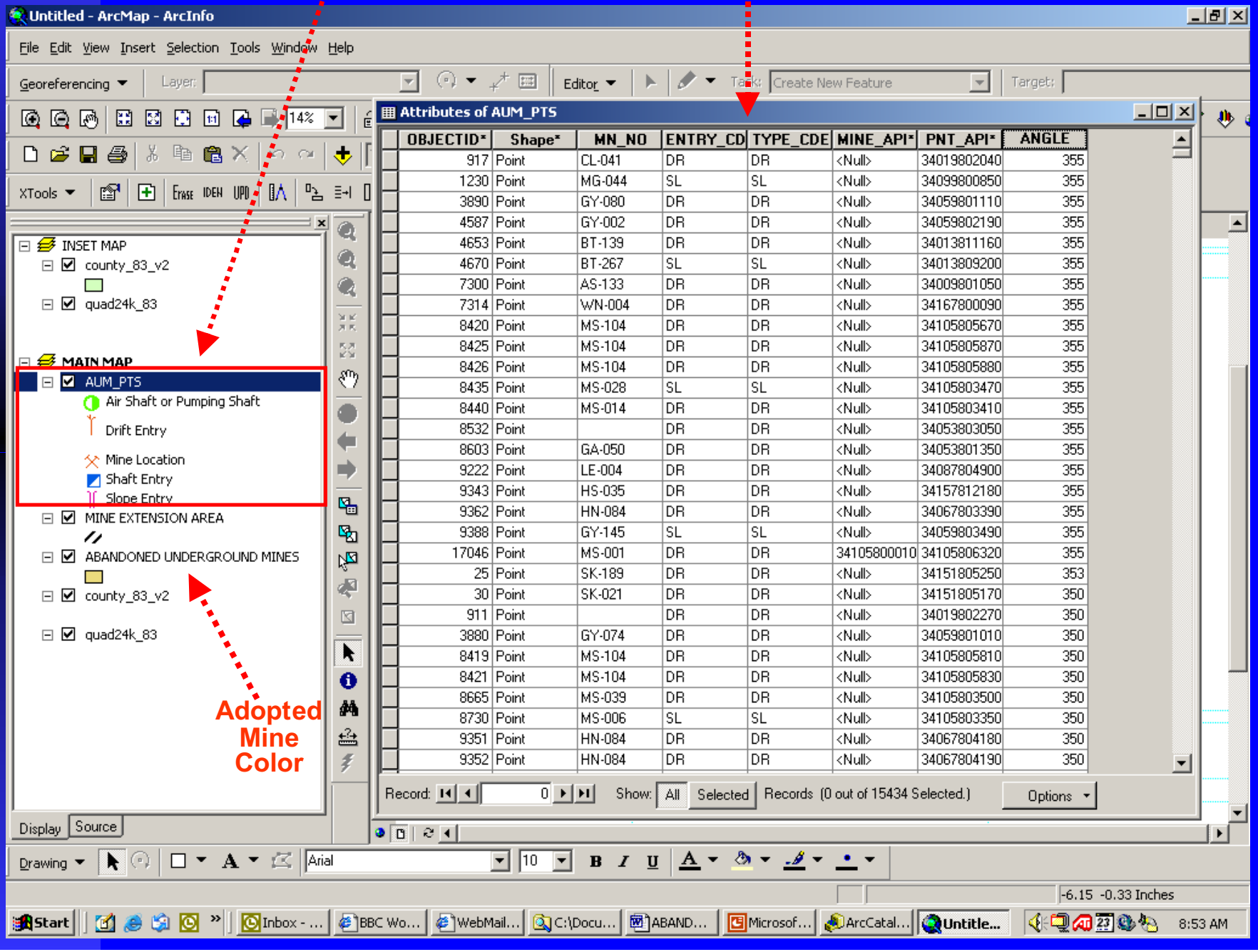


Displaying Superimposed Mine Polygons



The New AUM Feature Classes, Geodatabase, and Data Storage

AUM Points Symbology and Feature Class Attribute Table



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4653	Point	BT-139	DR	DR	<Null>	34013811160	355
4670	Point	BT-267	SL	SL	<Null>	34013809200	355
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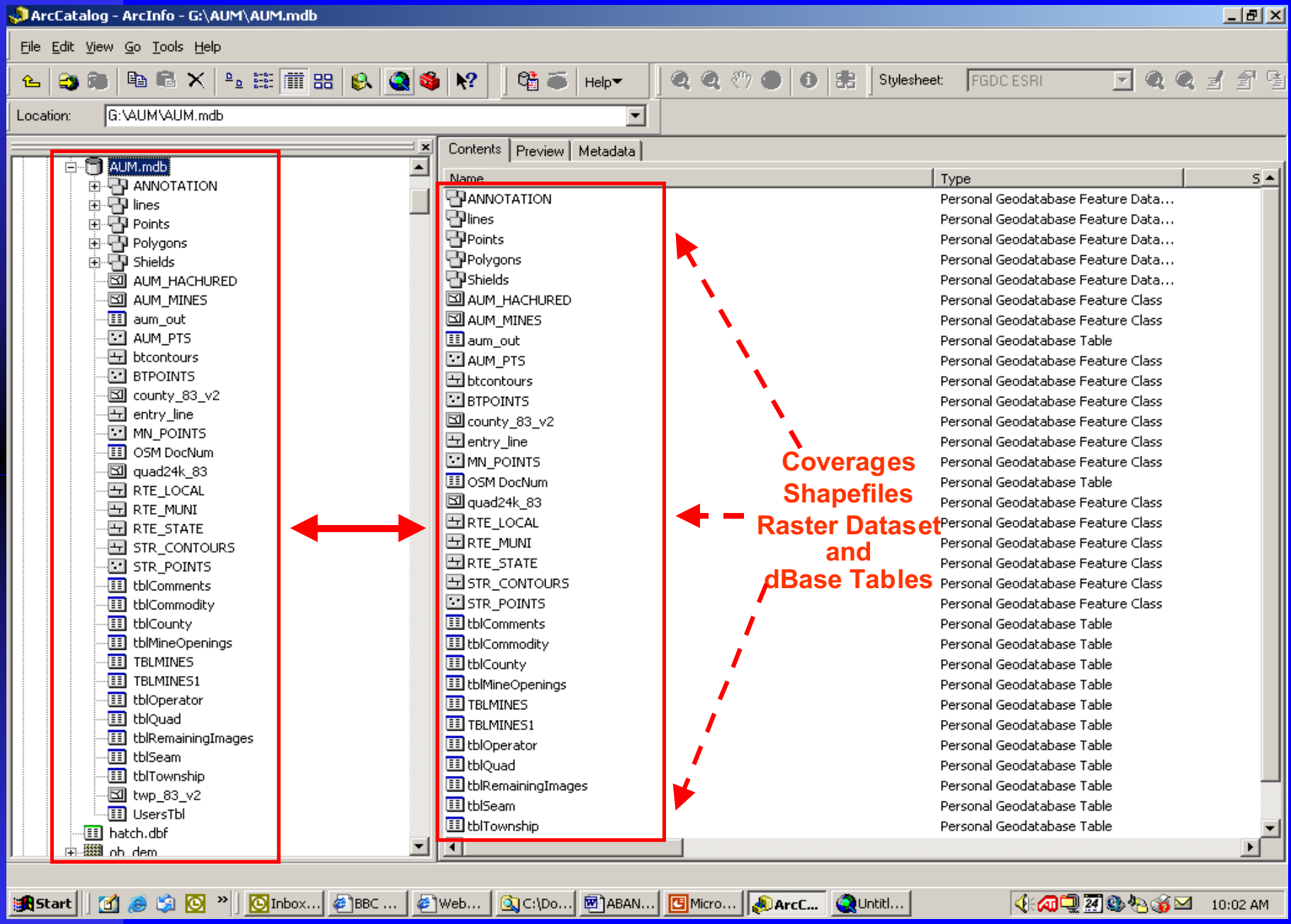
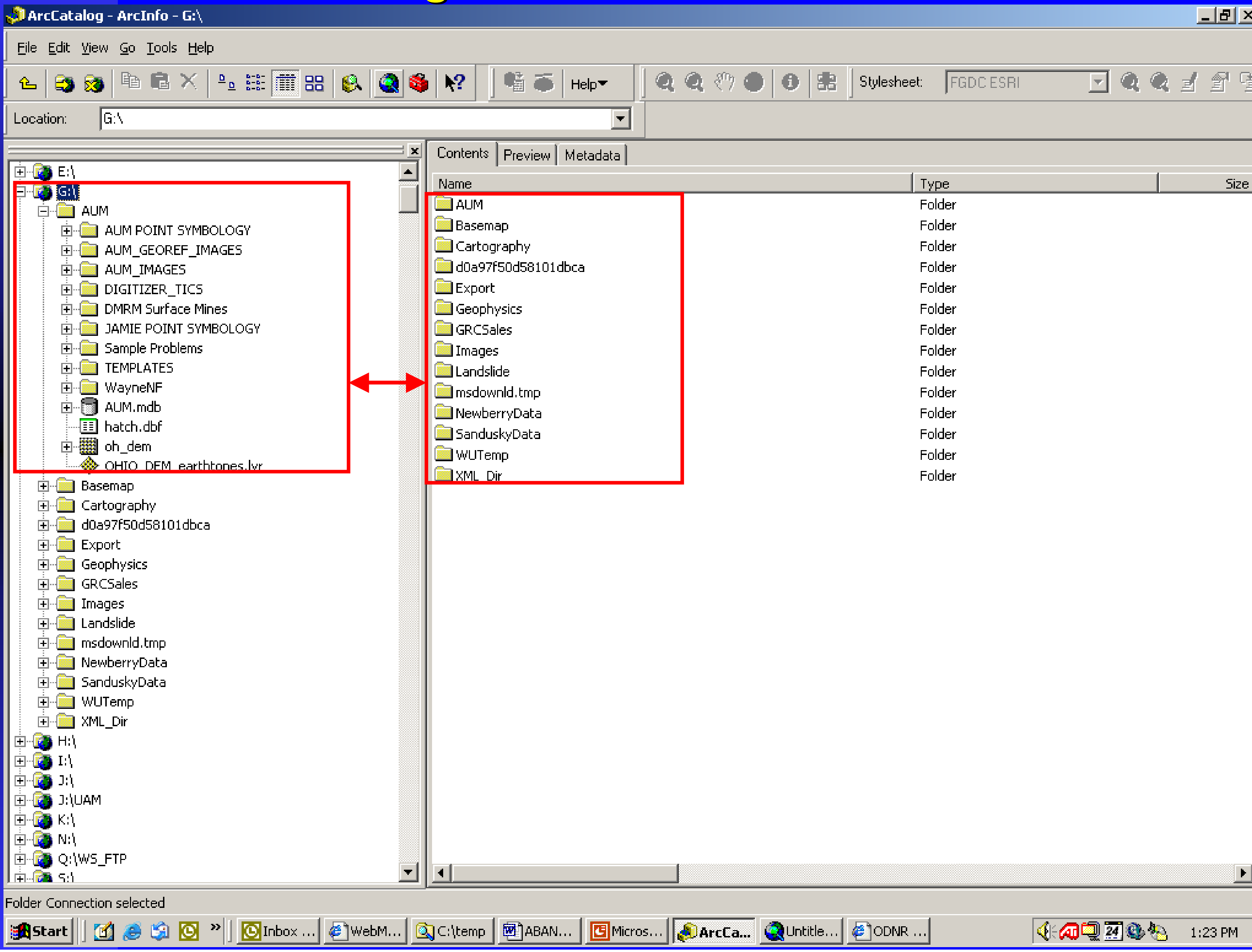
The New AUM Personal Geodatabase



A Single Data Repository !!!

The AUM Data Storage Folder -- on the NR728Mather Server

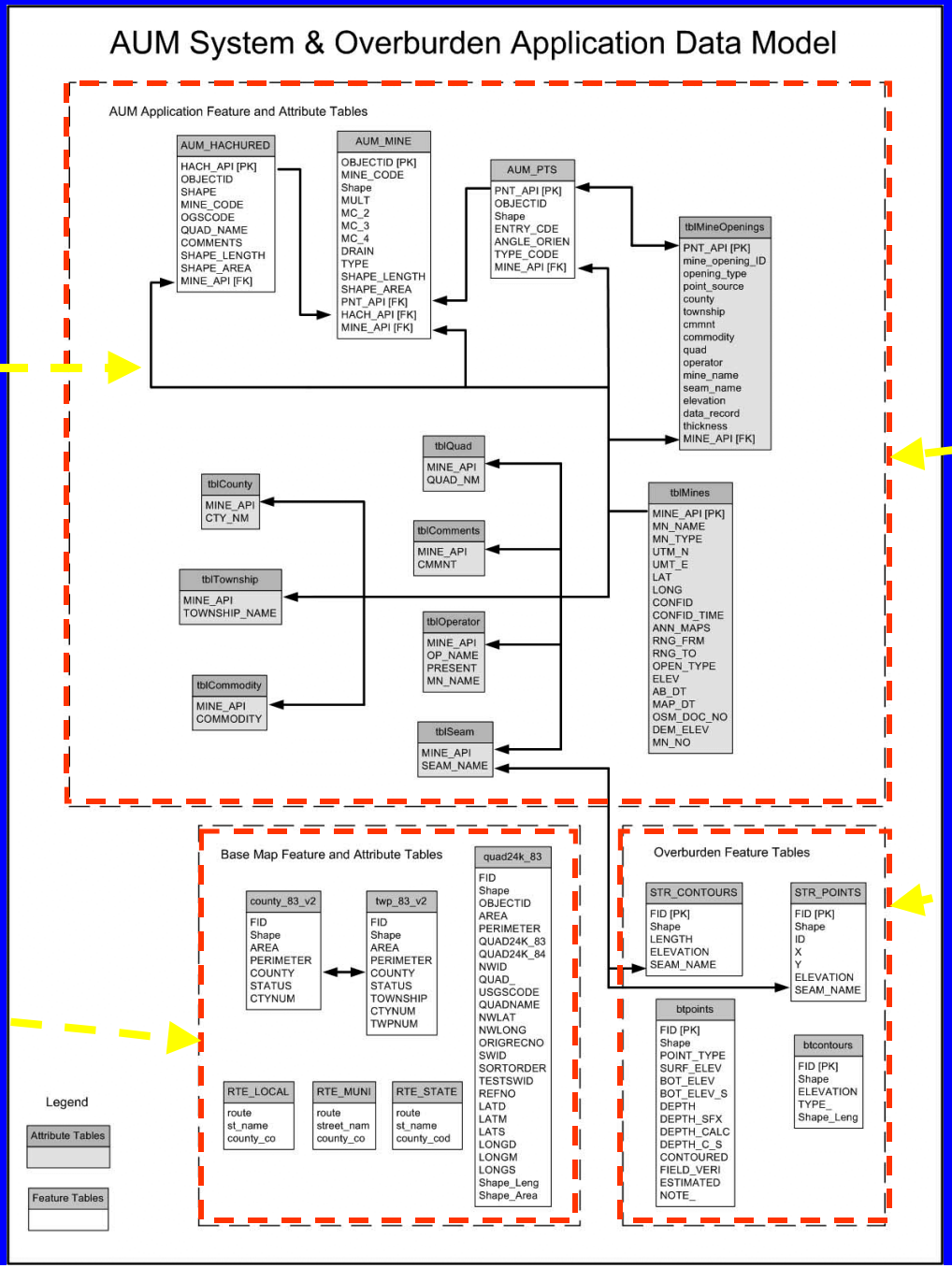


ODNR (OGS)/ODOT Application Development Contract --- Assisting Efforts for the AUM Inventory and Risk Assessment (AUMIRA) Program

Development of the AUM Application :

- ***Application Tools***
- ***Mapping Tools***
- ***Templates***

AUM Data Model



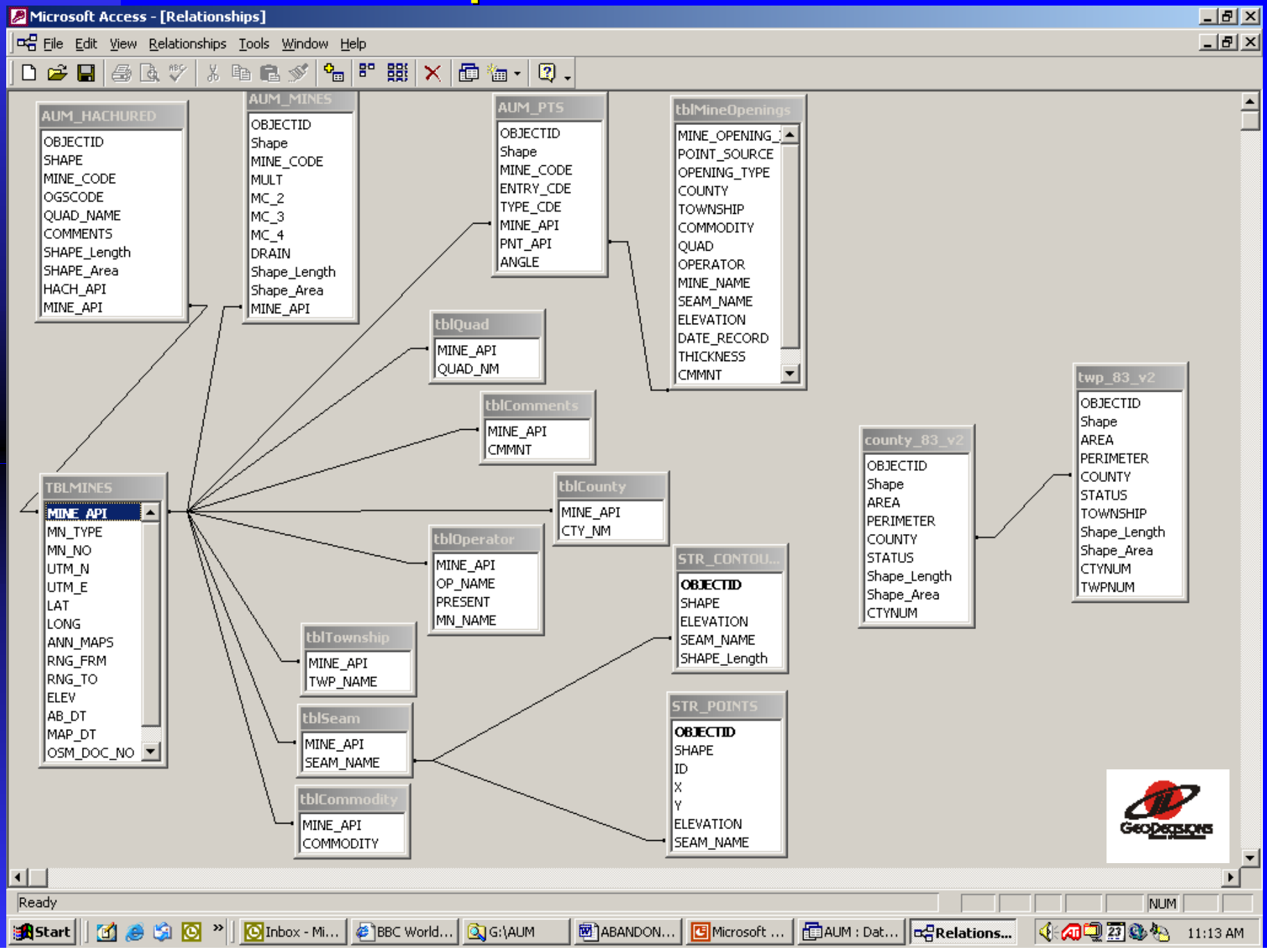
Relationship Links

AUM Feature and Attribute Tables

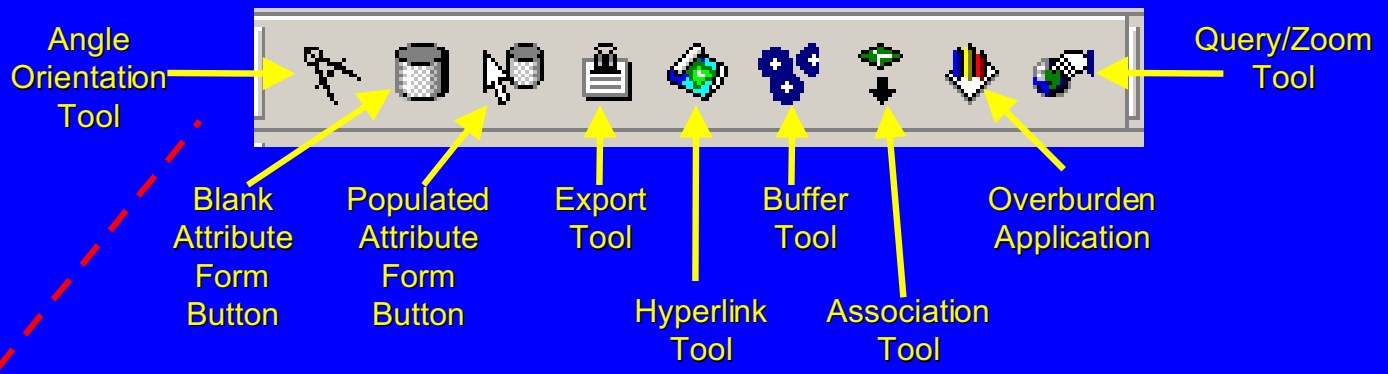
Overburden Feature Tables

Base Map Feature and Attribute Tables

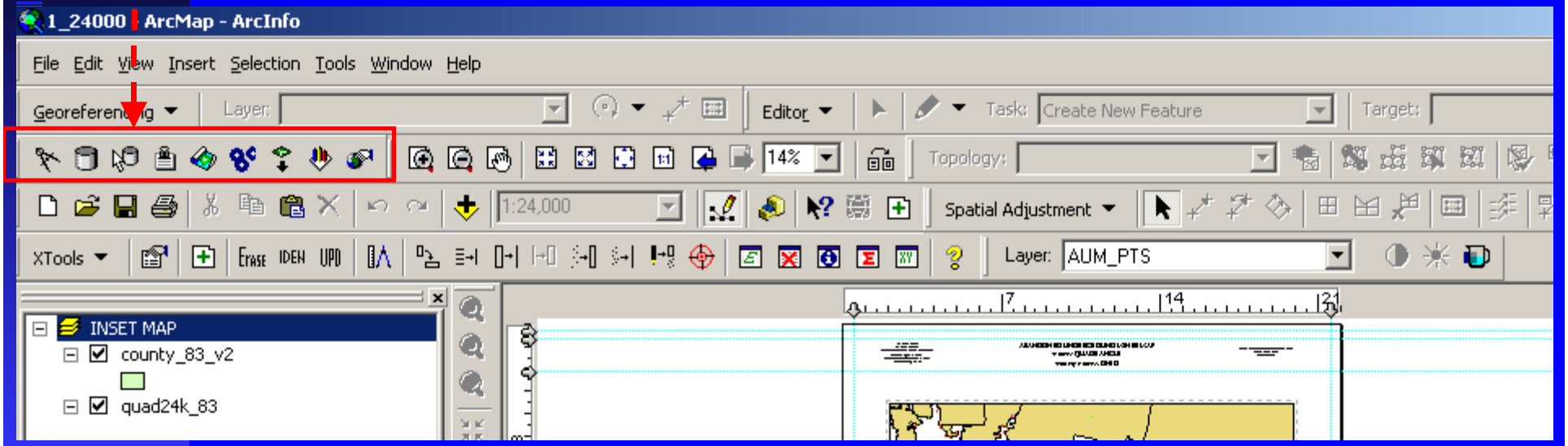
AUM Data Model Implementation in Microsoft Access



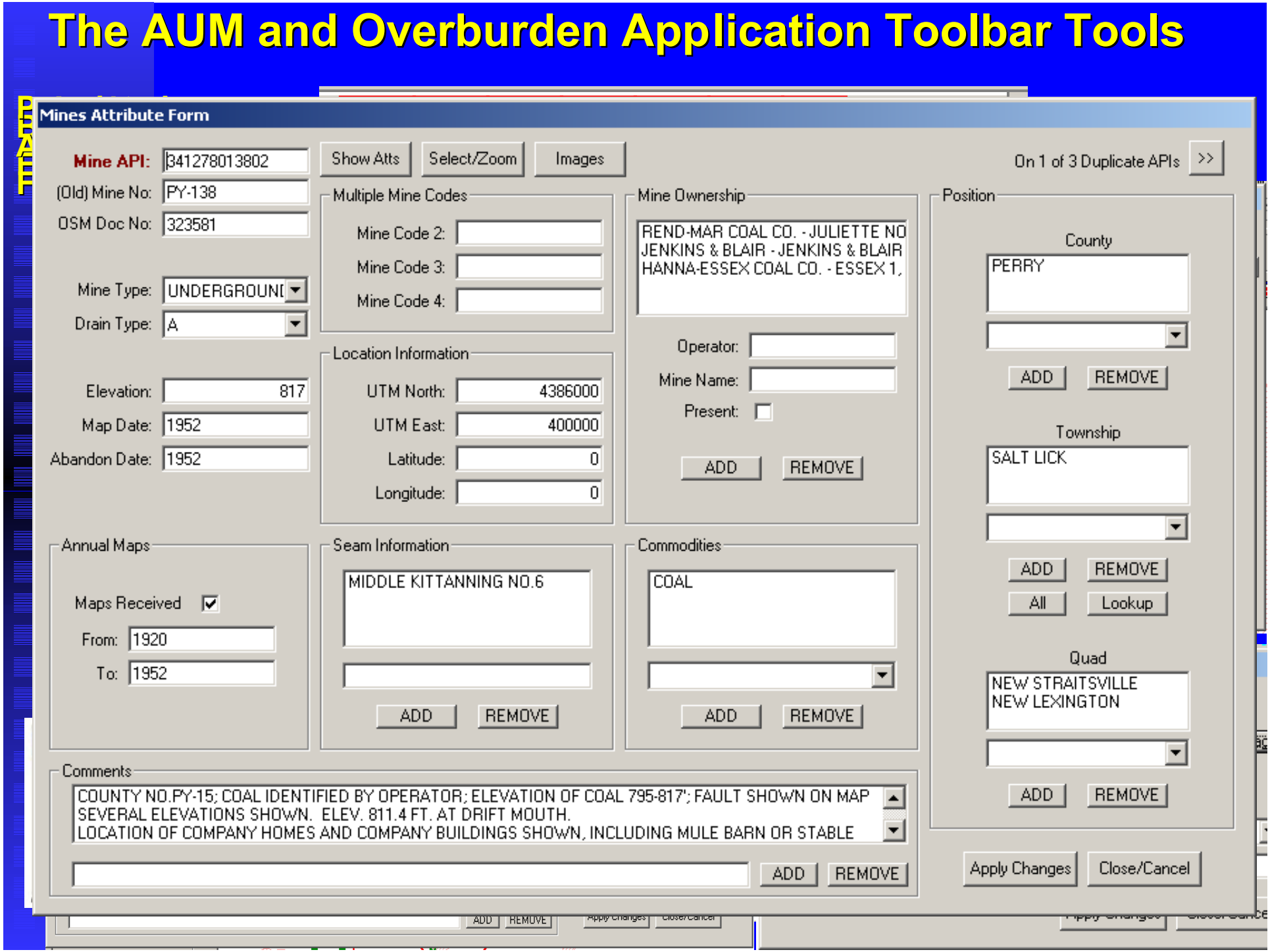
The AUM and Overburden Application Toolbar



Placement Within the ArcGIS ArcMap Environment

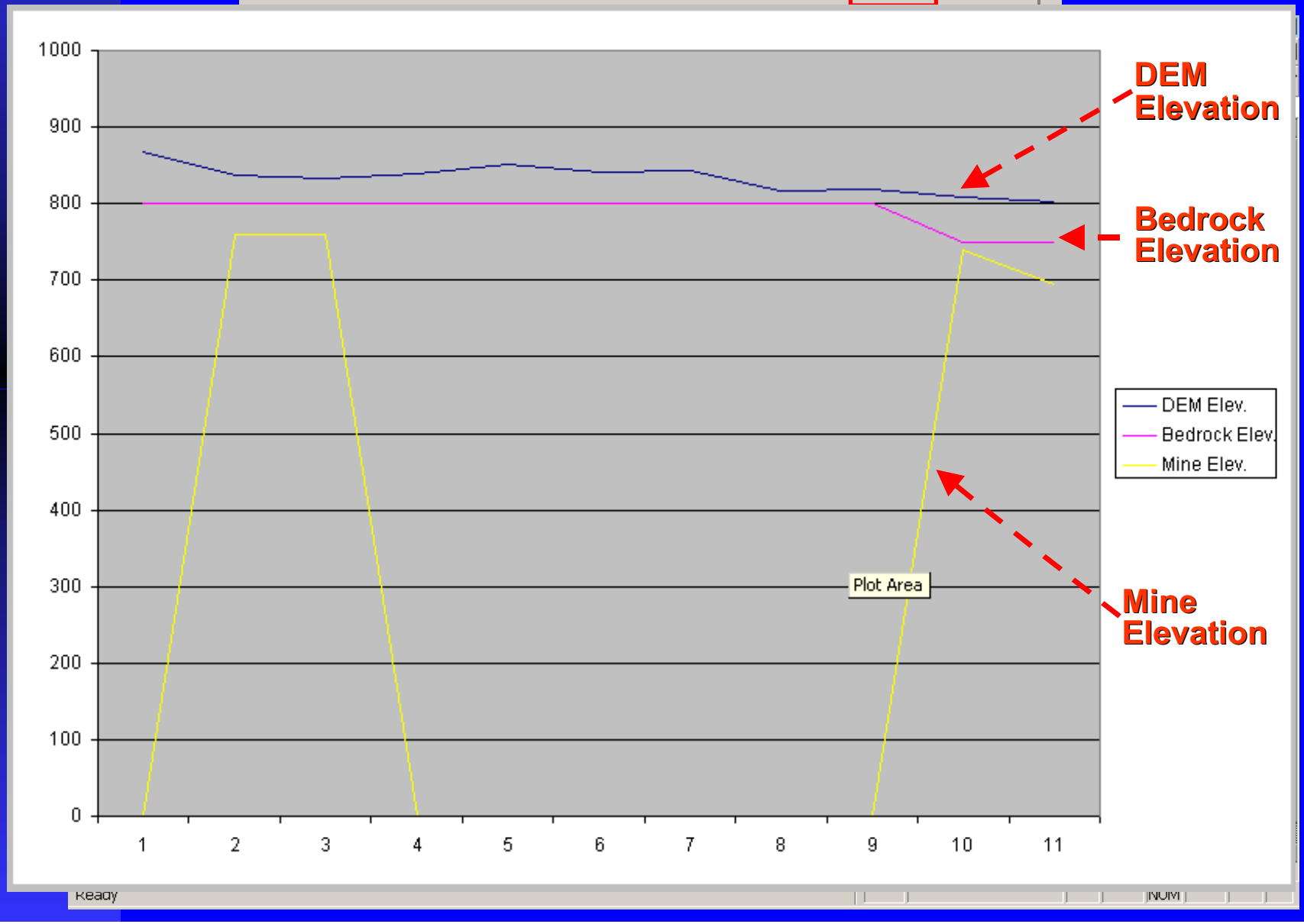


The AUM and Overburden Application Toolbar Tools



The AUM Overburden Application Tool

Query/Zoom Tool



The AUM Plotting Tools

The 'DRG' , 1:24000 Loader

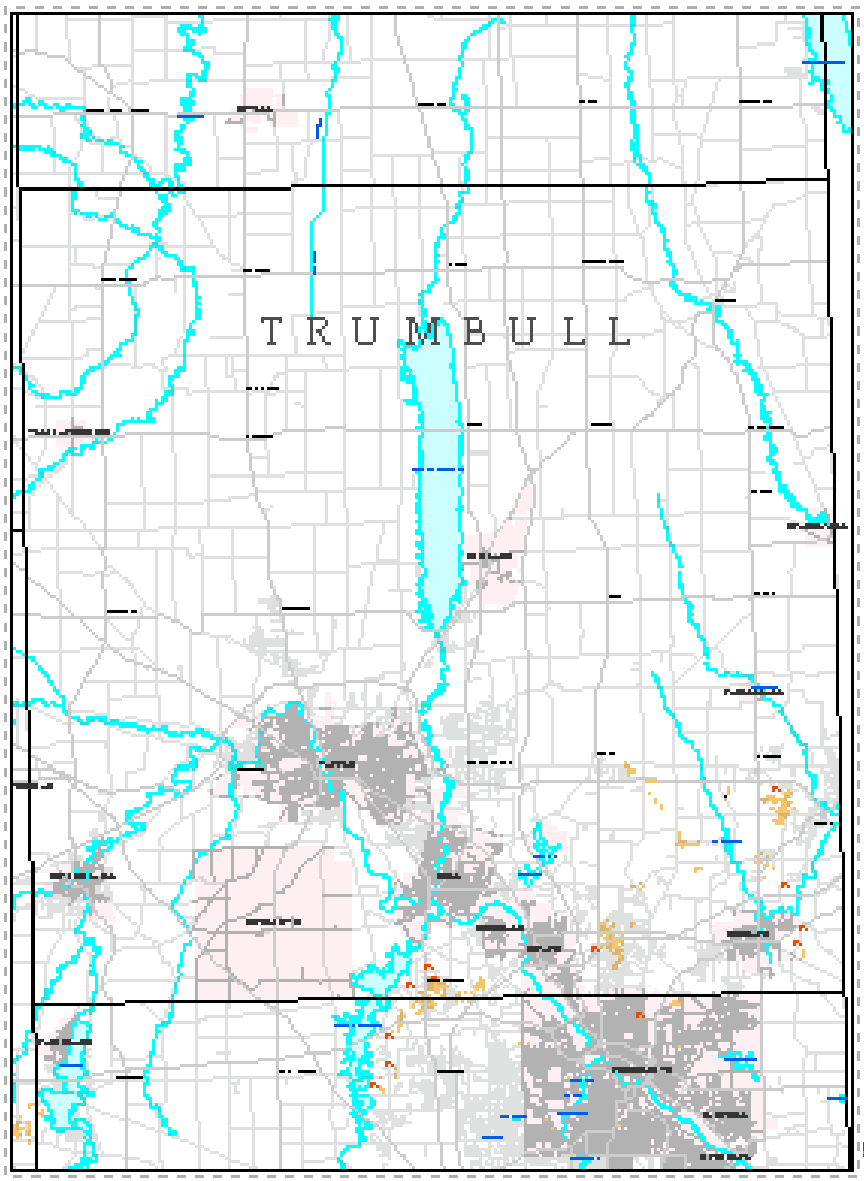
Quadrangle Selection Box

Mine Images Tool for the 1:24000 Map

County or Region Selection Tool

- AUM Final Map Products
- Counties with AUM's
- Statistics
- Future Work

The AUM Maps



1: 24000

cales

00

line Map

s

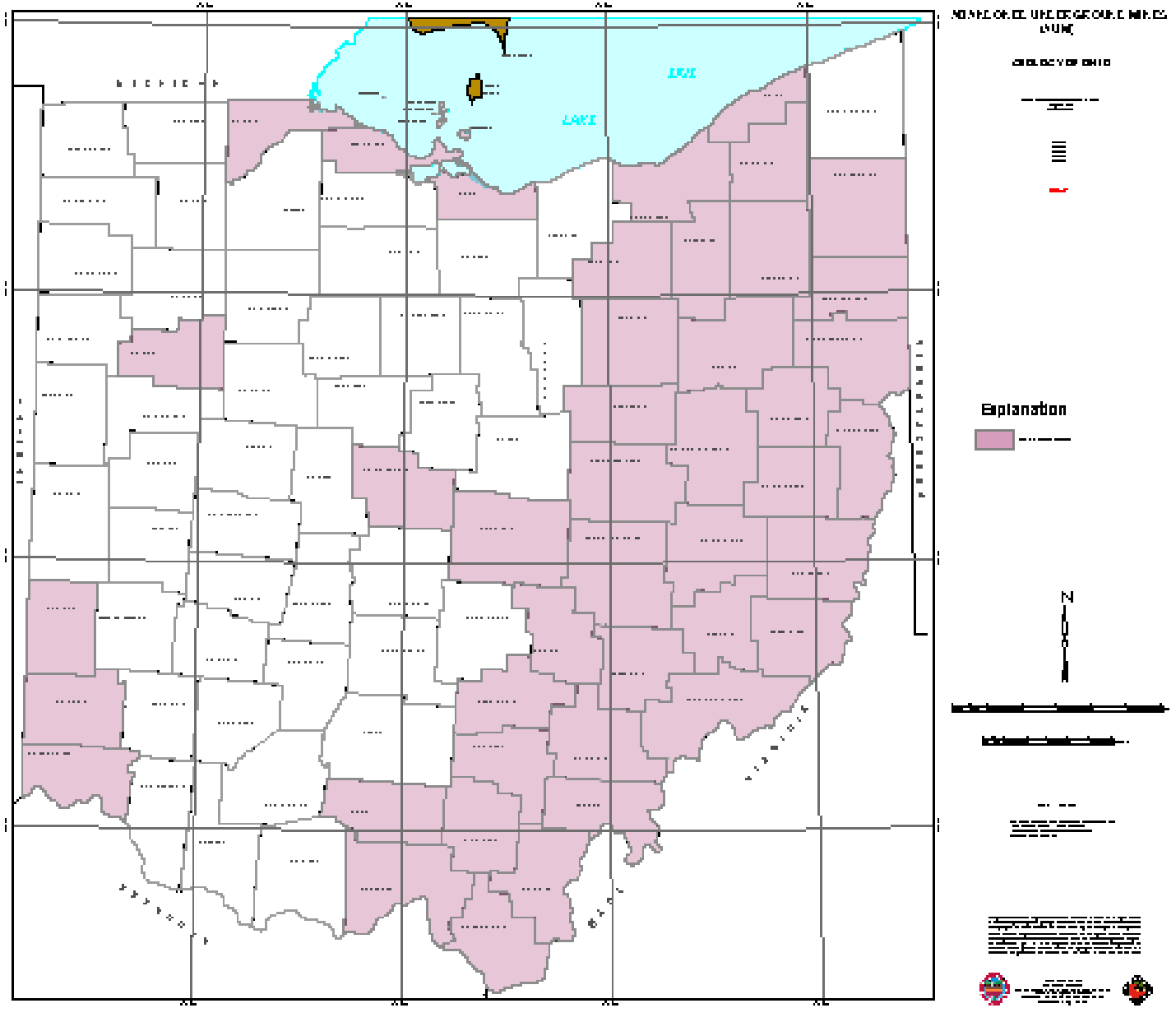
Explanation

ent

ad	1: 62,500
ad	Portrait
de" County	and
ll" County	Landscape
jional (quarters of state)	
tewide	

000

State of Ohio Counties with known AUM's



43 Counties with AUM's

AUM Statistics

- Approx. Number of AUM Polygons = 4,166
- Mined-Out Areas = 889
- Mine Point Locations = 1,945
- Air/Pumping Shaft entry points = 2,878
- Main Shaft entry points = 585
- Drift entry points = 9,475
- Slope entry points = 564

Recent Undertakings…..

•**AUM Geodatabase**: Migration from a personal geodatabase to a multi-user geodatabase in ArcSDE running on a SQL Server DBMS.

•**OGS/ODOT Cooperative Agreement** :

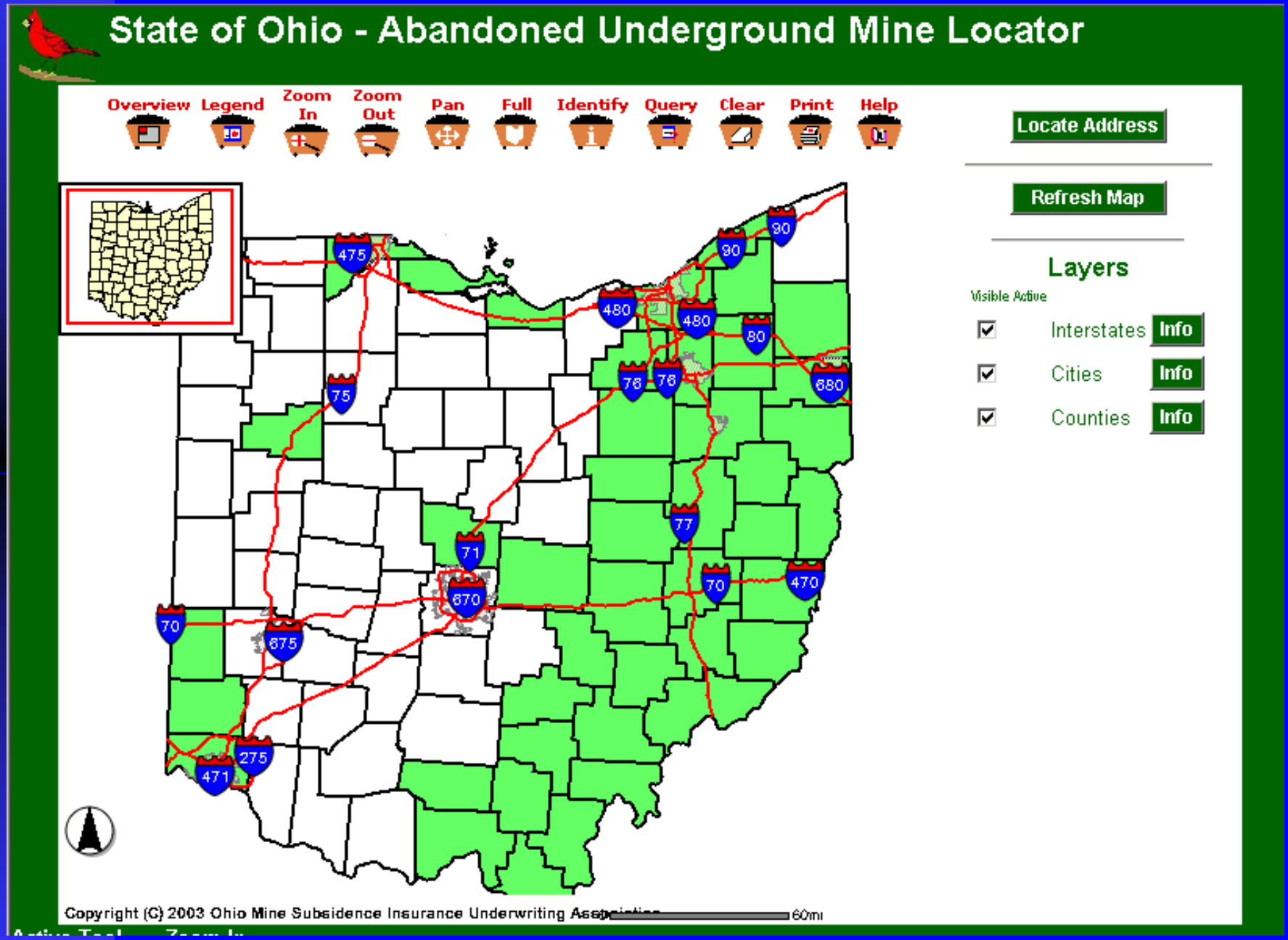
-Field mapping and data collection (GPS data) of mine subsidence-related information.

- Geo-referencing and rectification of all AUM map images (TIFF images) of mines that are located within 500 feet of any state or federal roadway. The geo-referenced images will be used in both ESRI and GeoMedia software environments.

•**The Ohio Subsidence Insurance Underwriters Association (OMSIUA) and ODNR, Division of Geological Survey and Division of Mineral Resources Management (DMRM)**

- Currently initiating the development of an ESRI ArcIMS Property Location Web Application for the State of Ohio.

Now Available….. AUM ArcIMS Website



On the Ohio Geological Survey Website --- http://www.dnr.state.oh.us/geosurvey/index.html

Future Work Includes:

Geo-referencing and Rectification of Mine Map TIFF Images.

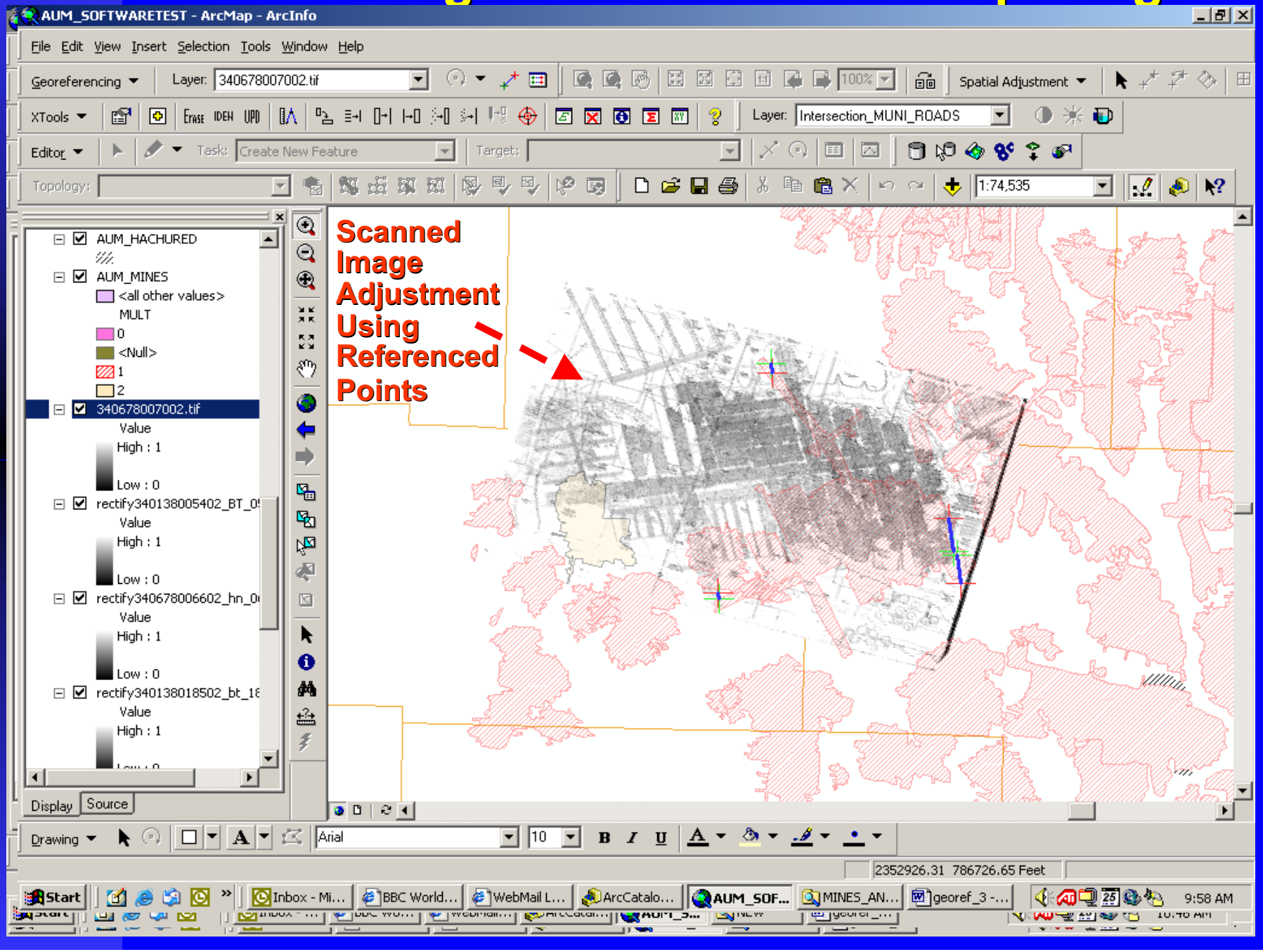
Rescanning of TIFF Images.

Re-organizing the AUM Data to Assign Unique Identifiers to Mine Polygons for Mines having Multiple Polygons.

Locating Additional Mine Maps from the Public, Institutions, Private Companies, Conservation Societies, Historical Societies, Etc..

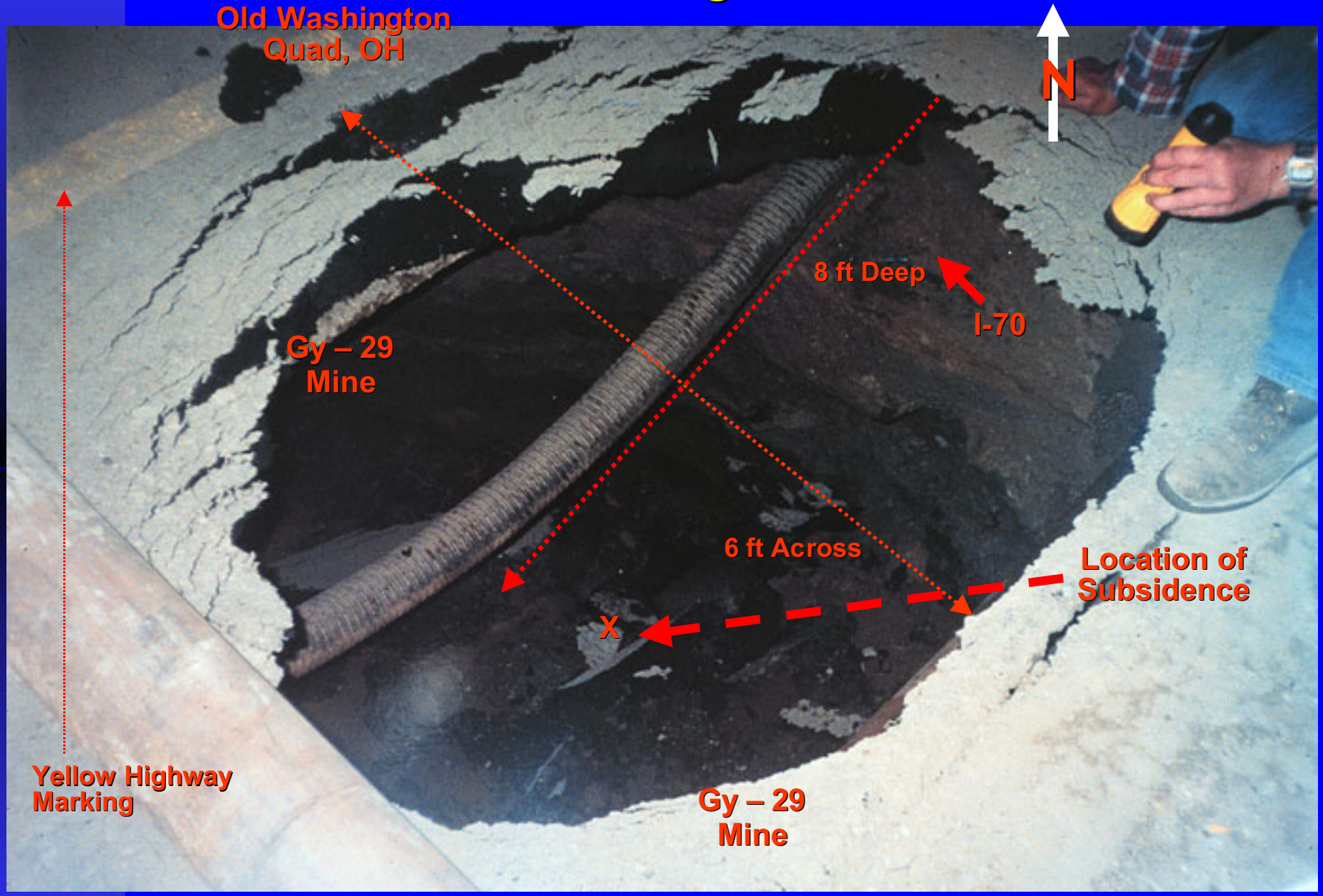
Additional QA/QC on AUM Data Including Certifying which Coal was Mined and Insuring Each Mine has a Proper Depth

Geo-Referencing of Scanned Mine Map Images



Images of Mine Entrances and AUM Related Hazards in Ohio

Interstate 70 Abandoned Underground Mine Subsidence



1995, I-70, Pit subsidence in the eastbound lane, OH

Photo Courtesy: OGS (ODNR) / ODOT

Mine Repair Work by ODOT on Interstate 70, Ohio, 1995

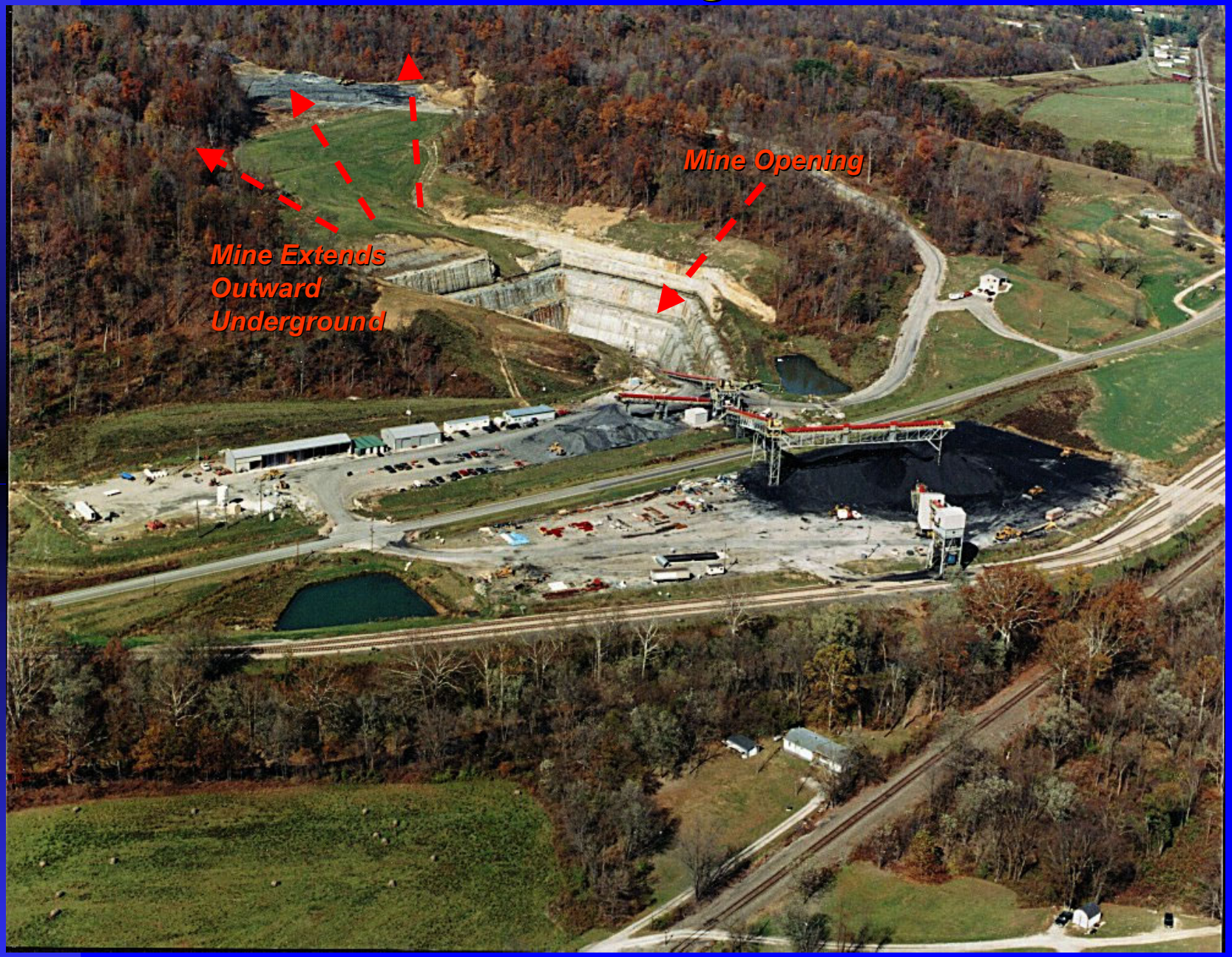
Repair Totaled 3.6 Million Dollars

Photo Courtesy: ODOT

Entrance to an Abandoned Underground Mine

Photo: OSMRE

Room-and-Pillar Underground Mine



View from the Buckingham Mine Area and Mine Entrance

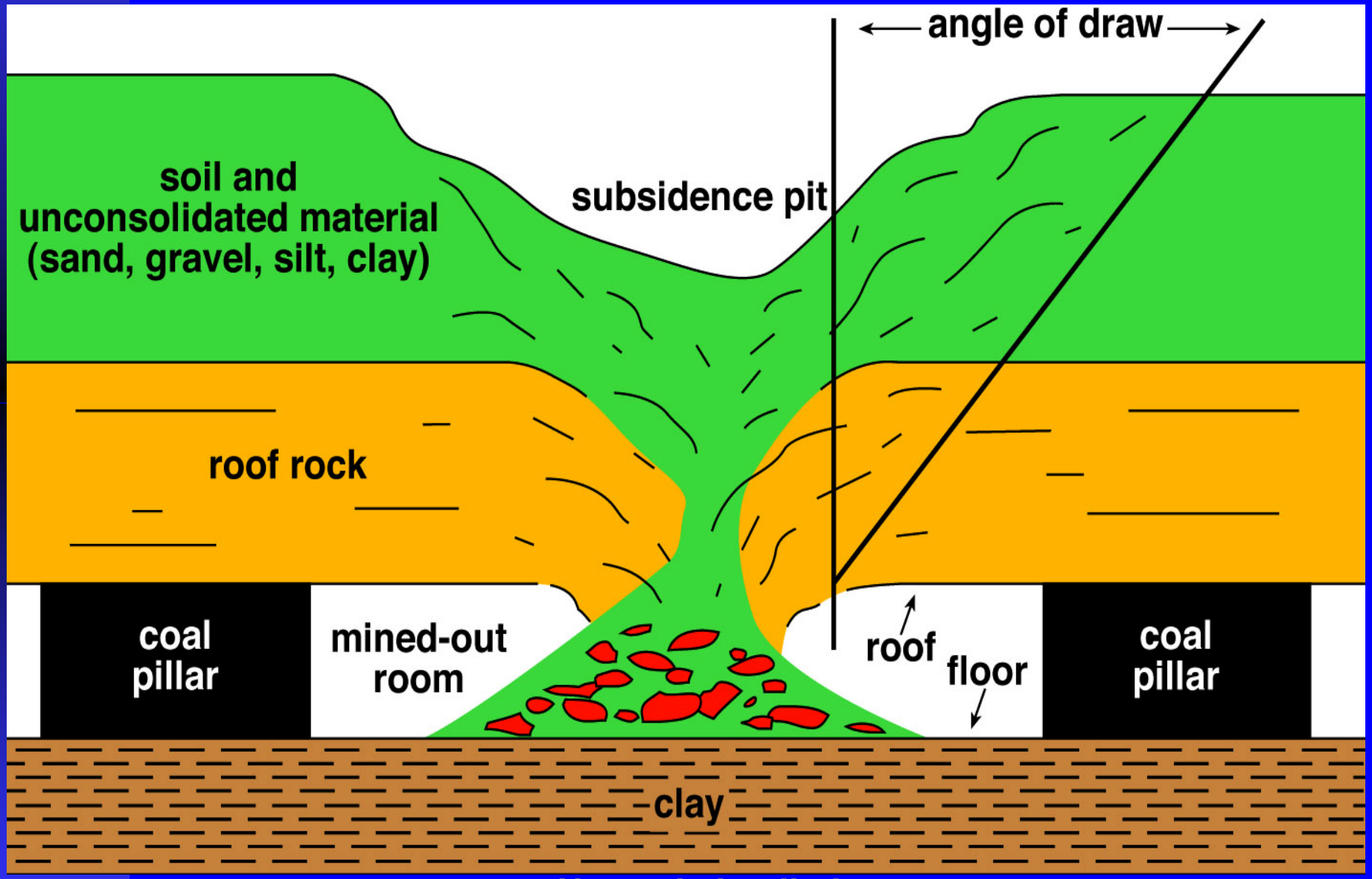
Photo: Dave Clarke, DMRM

Mine Void along a Roadside

Jackson County Roadside Void along SR - 327, Wellston, OH

Photo: DMRM

Diagrammatic Cross Section of Typical Subsidence resulting from Mine-Roof Collapse.



No scale implied.

Photo: Ohio Geological Survey

Pit Subsidence in Residential Area

North Canton, Stark County in 1995. Subsidence pit measured: 35 feet across and 25 feet deep.

Photo: DMRM

Structural Damage due to Mine Subsidence

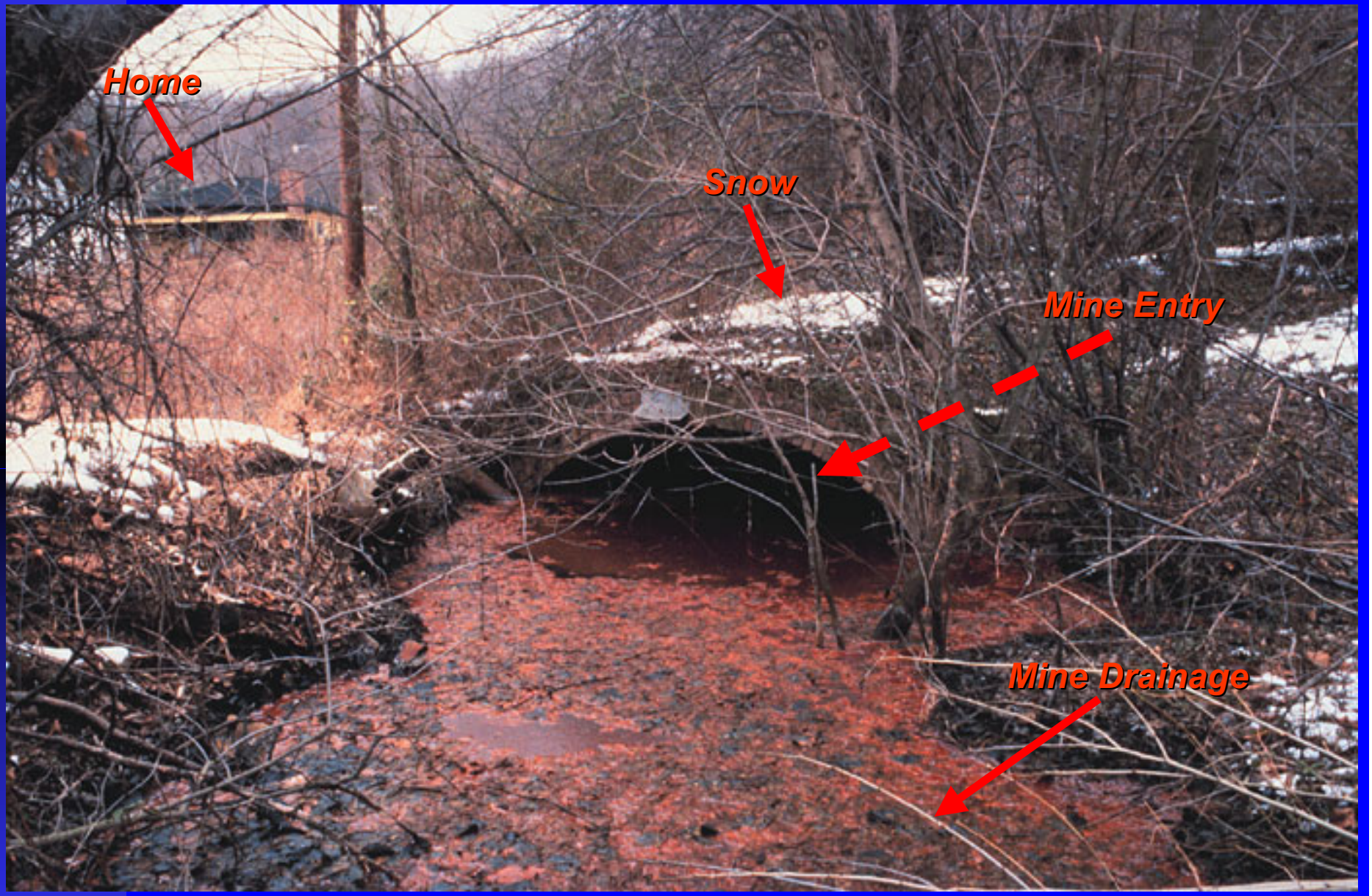
Two Homes in Wellston, Jackson County , 1994.

Photo: DMRM

Tension-Surface Cracks Developed over a Longwall Mine, 1983.

Photo: OSMRE

Entrance to a Flooded Abandoned Drift Mine



Hocking County, OH

Photo: OSMRE

Interior of a Flooded Abandoned Underground Mine

Mine Located Beneath the Playground at Curtis Elementary School, Brookfield Township, Trumbull County, 1979.

Photo: DMRM

Acid Mine Drainage from Abandoned Underground Mines

Photo: DMRM

East PA Mine

Courtesy of AMLIS Website

Rice Mine, Carbondale, Athens County, OH

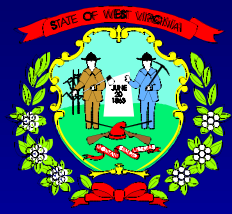
Return
to
Contents

Mapping Underground Mined Areas in West Virginia: The Problem and the Approach

Nick Fedorko

West Virginia Geological & Economic Survey

Morgantown, West Virginia



In Cooperation With:

West Virginia Office of Miners' Health, Safety, & Training

Charleston, West Virginia

Doug Conaway, Director

Coal Bed Mapping Project (CBMP) Goal

Create a 1:24,000-scale Geographic Information System (GIS)-based inventory of coal in West Virginia.

Coal Resource Maps in a GIS Environment

- Structural contour and outcrop maps
- Variation in bed thickness
  - Total bed thickness
  - Net coal thickness
- Percent non-coal material (partings) in bed
- Depth of overburden

Coal Resource Maps in a GIS Environment

- Mined areas
  - Underground
  - Surface
  - Auger
  - Highwall
- Other supporting maps

Compiling Underground Mined Areas

- **Goal: Create as complete and accurate compilations of underground mined areas as possible**

Coal Mining in WV

- Historic production: 1883-2002
  - Over 12.5 billion tons
  - Production from about 35 counties and about 65 beds
  - All pre-1940s production from underground mines
  - Estimated 100,000 abandoned underground mines
- About 270 underground permits annually
  - 100,600,258 tons in 2002 (61% of total)

OSM Mine Map Repository

40,894 WV cards

37,432 mine maps

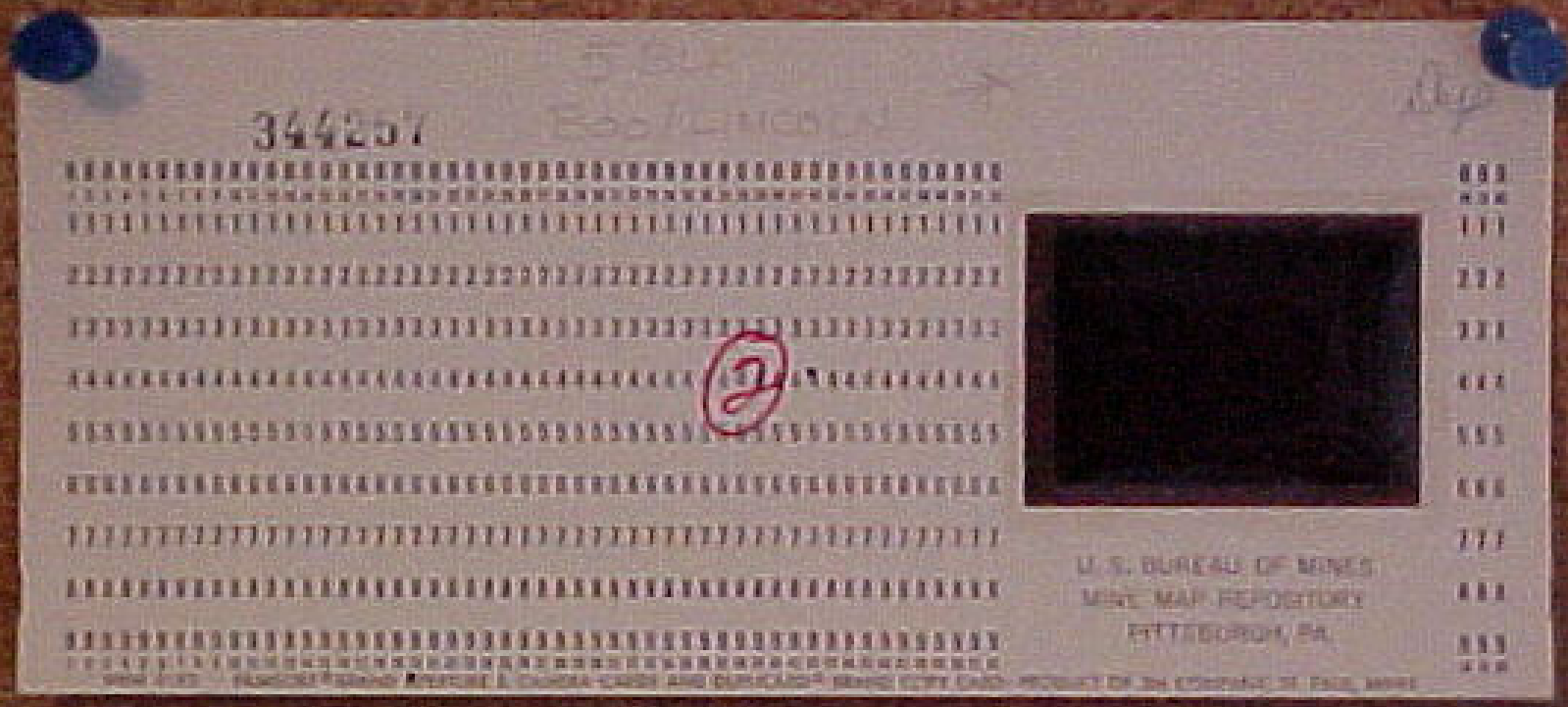
Pre-1970 Maps

Duplicates
Various Vintages
Various Scales

Partial Maps

Final Map?

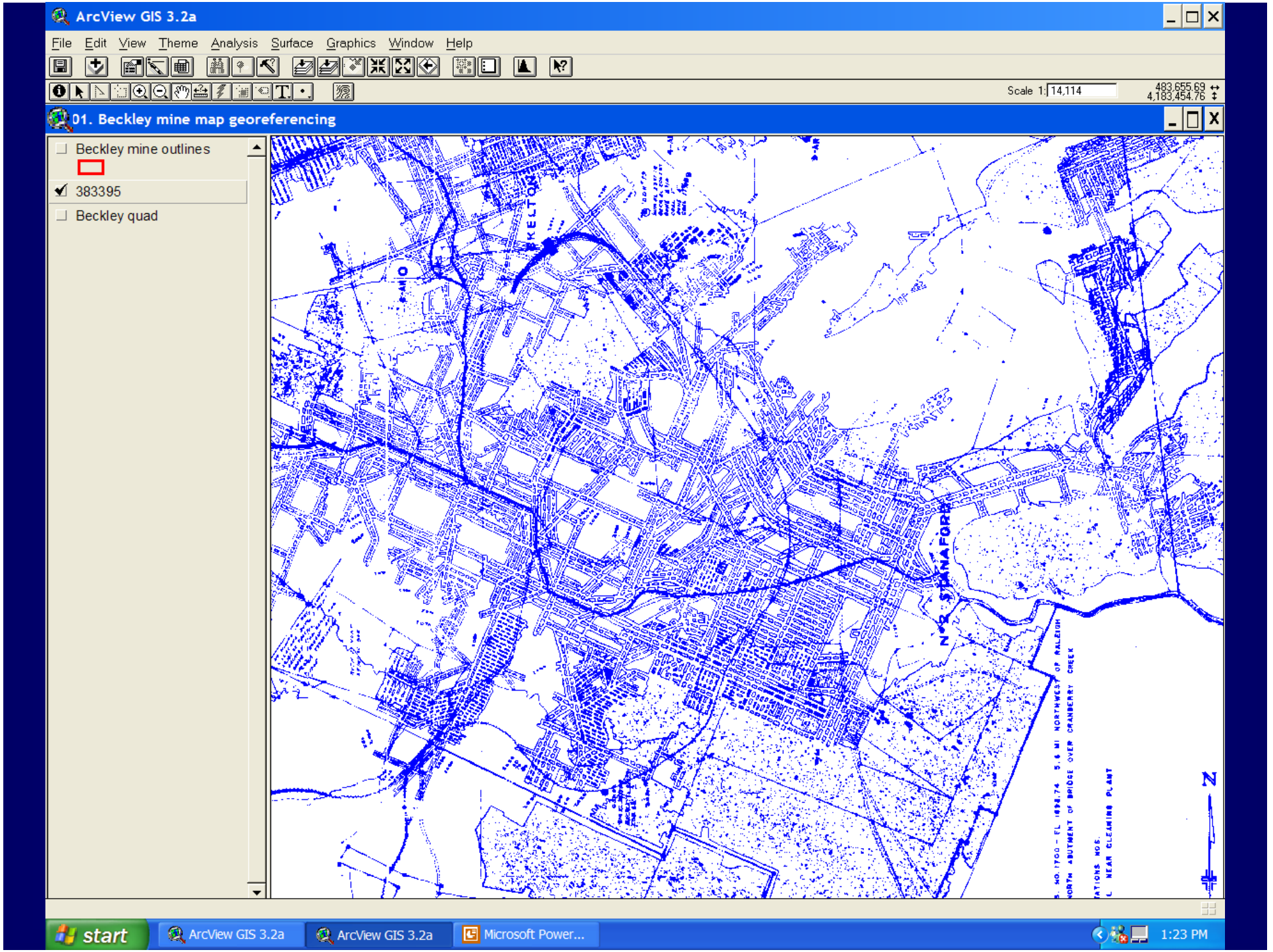
OSM Mine Map Repository



Post-1970 Maps
Abandonment or Closure Map


Maps of active mines from
Miners' Health, Safety & Training
CRAIG, ET AL
NEW LAND LEASING CO., INC.
PERMIT S-3038-91
FULLER MCCLUNG &
WESLEY O'DELL HEIRS - FEE
HAMILTON DISTRICT
BEAVER DISTRICT
PF-1-89
K & P MINING - FEE
KP-5-90
SURFACE MINED AREA
K & P MINING - FEE
SURFACE MINED AREA
CRAIG & WILLIAMS
STATION NO. 10
BA COAL COMPANY
PERMIT S-100-85
ERMIT, SURVEYED BY, COASTAL COAL-WEST VIRGINIA, LLC
MARCH 11, 2000
KP-4-90
SURFACE MINED AREA
FULLY AUGERED BY TIM UNDERWO
OPERATOR, AS PER PHONE CONVER
DATED JANUARY 14, 2000
LEGEND
OFFICIAL IN CHARGE OF HEALTH AND SAFETY
AND INFORMATION ON MAP
MIKE MORALES
NO MINING WILL TAKE PLACE ON ADVERSE PROPERTIES
(PROPERTIES UNDER LEASE NEGOTIATION)
UNTIL WRITTEN NOTICE IS RECEIVED FROM
COASTAL COAL-WEST VIRGINIA, LLC
NOTE: THERE ARE NO MINE WORKINGS ABOVE OR BELOW THIS MINE
THERE ARE NO KNOWN OIL OR GAS WELLS
WITHIN THE MINING AREA.
ALL VENTILATION CONTROL LOCATIONS AND
AIR READINGS FURNISHED BY THE MINE OPERATOR
FAN DATA
APPROXIMATE
END OF STRIP MARKER
PERMIT S-100-85
N: 479,000
SEAL
TWO OR THREE 18"
TRIPLE HEAD AUGER HOLES

Pittsburgh coal mining,
Fairmont West 7.5’
Quadrangle overlay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4,183,454.76
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Beckley mine outlines
383395
Beckley quad
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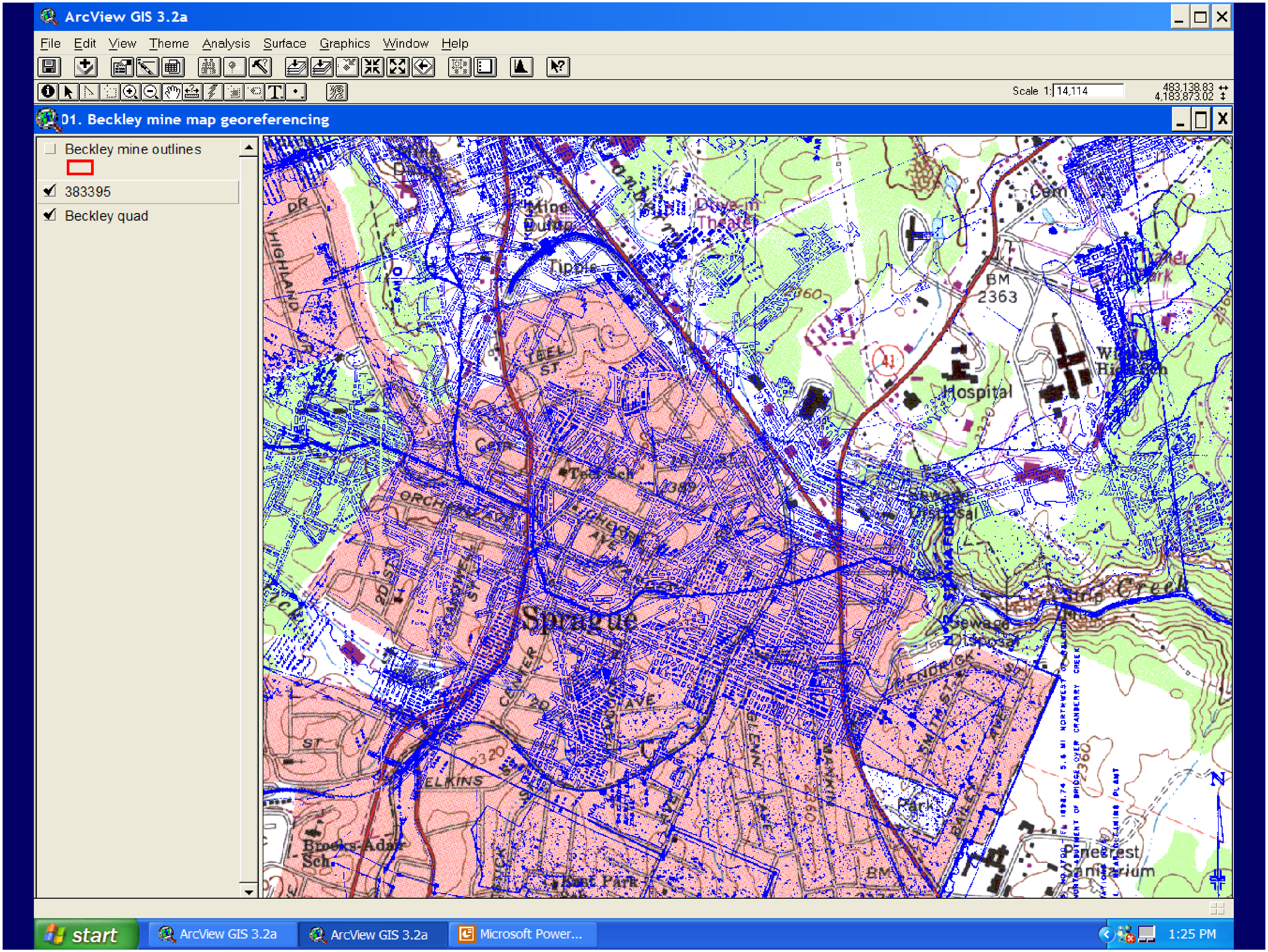
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Beckley mine outlines
383395
Beckley quad
Sprague
Hospital
Tipple
BM
2363
ORCHARD AVE
ELKINS
Pinecrest
Sanitarium
Brooks-Adair
Sch
Park
KENDRICK
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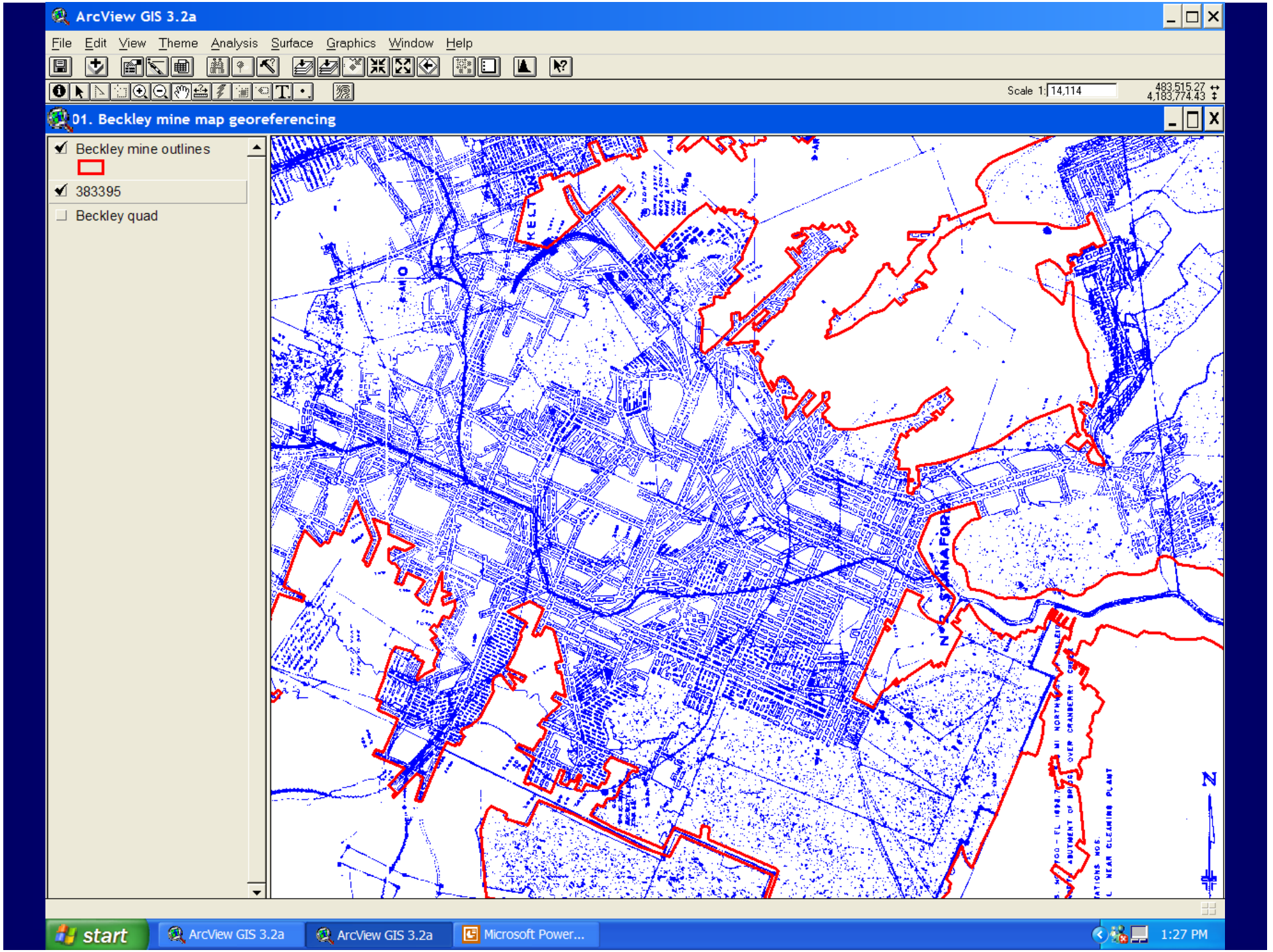
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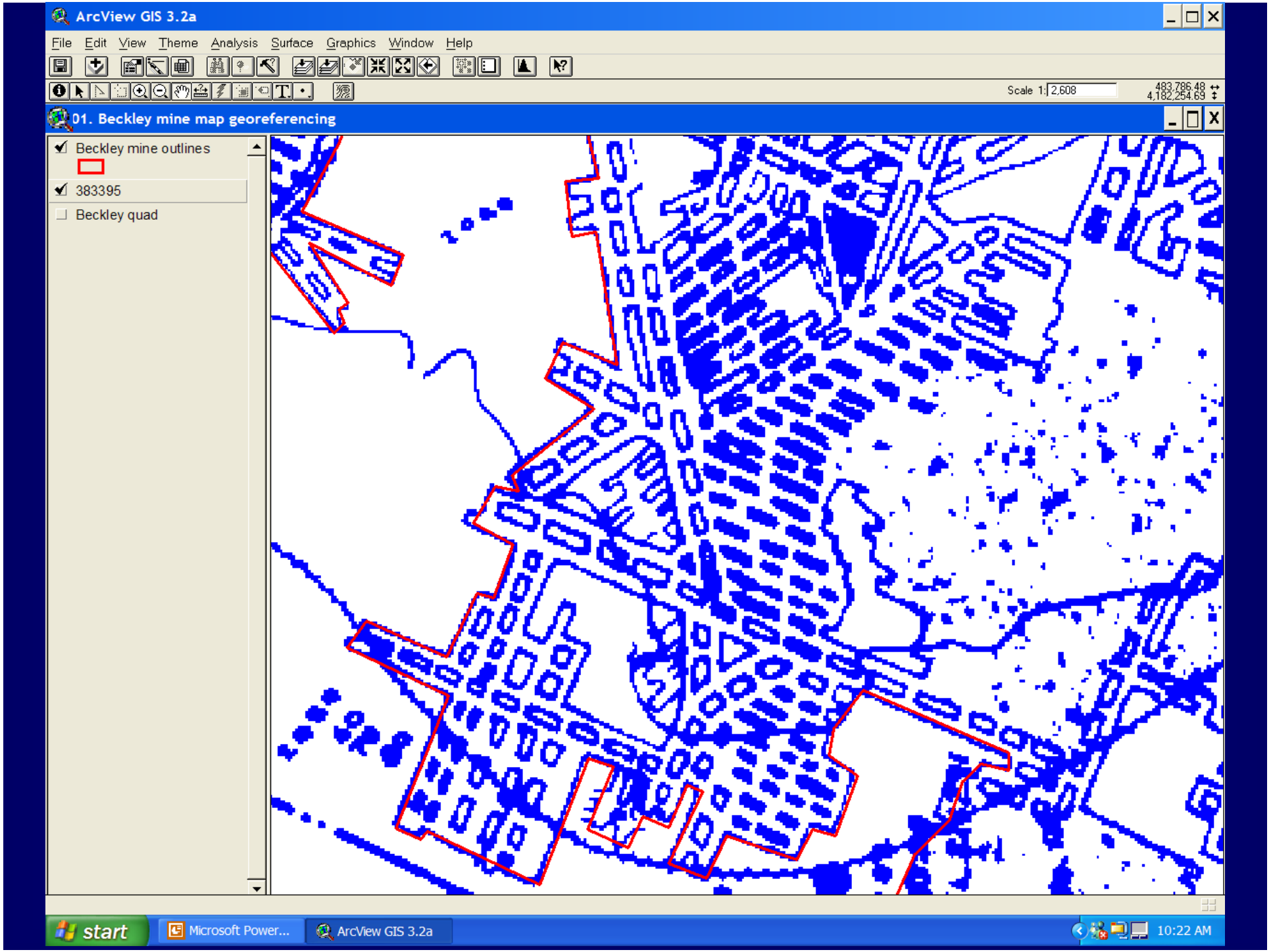
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Beckley mine outlines
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Beckley quad
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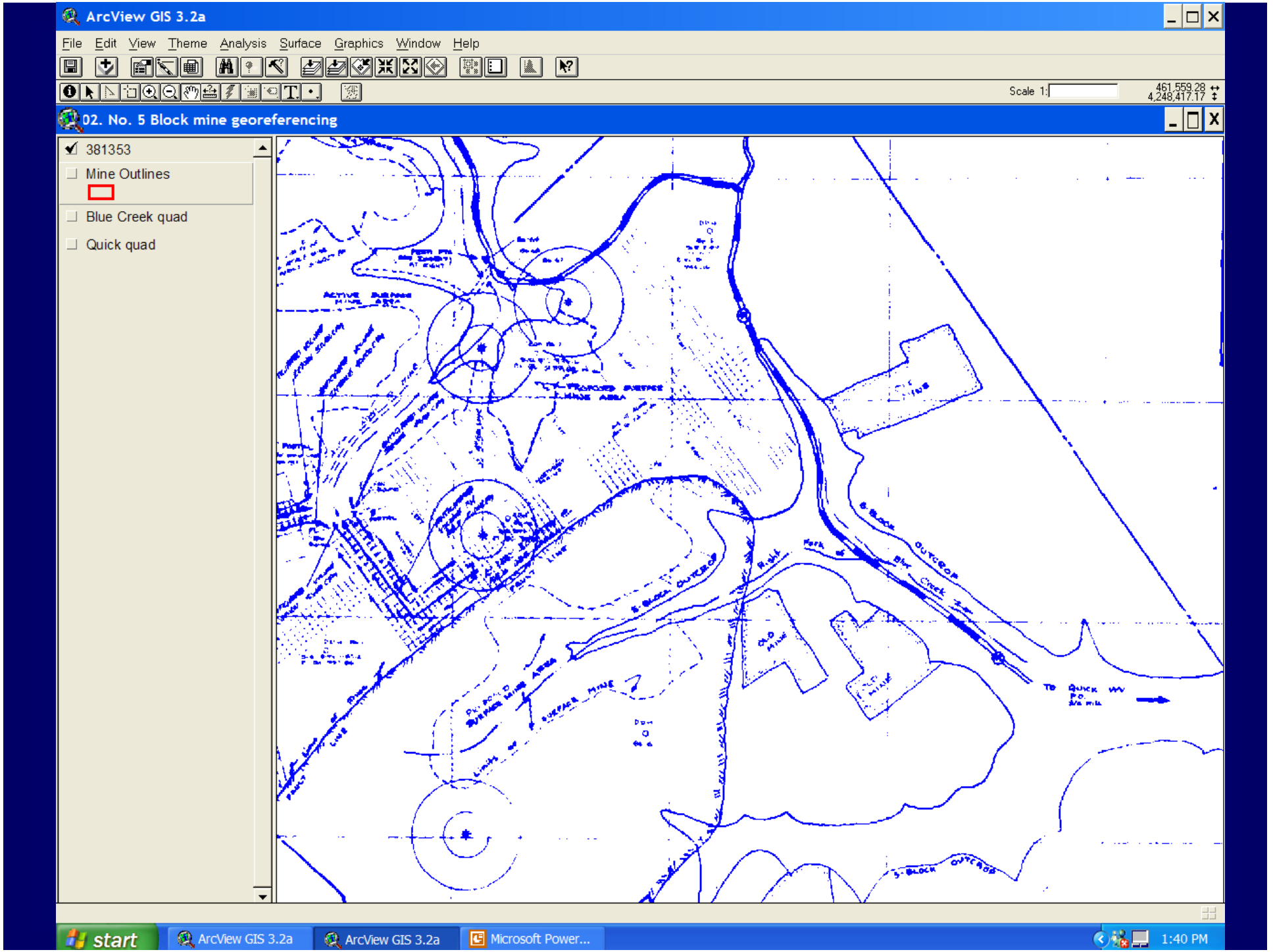
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Mine Outlines
Blue Creek quad
Quick quad
start
ArcView GIS 3.2a
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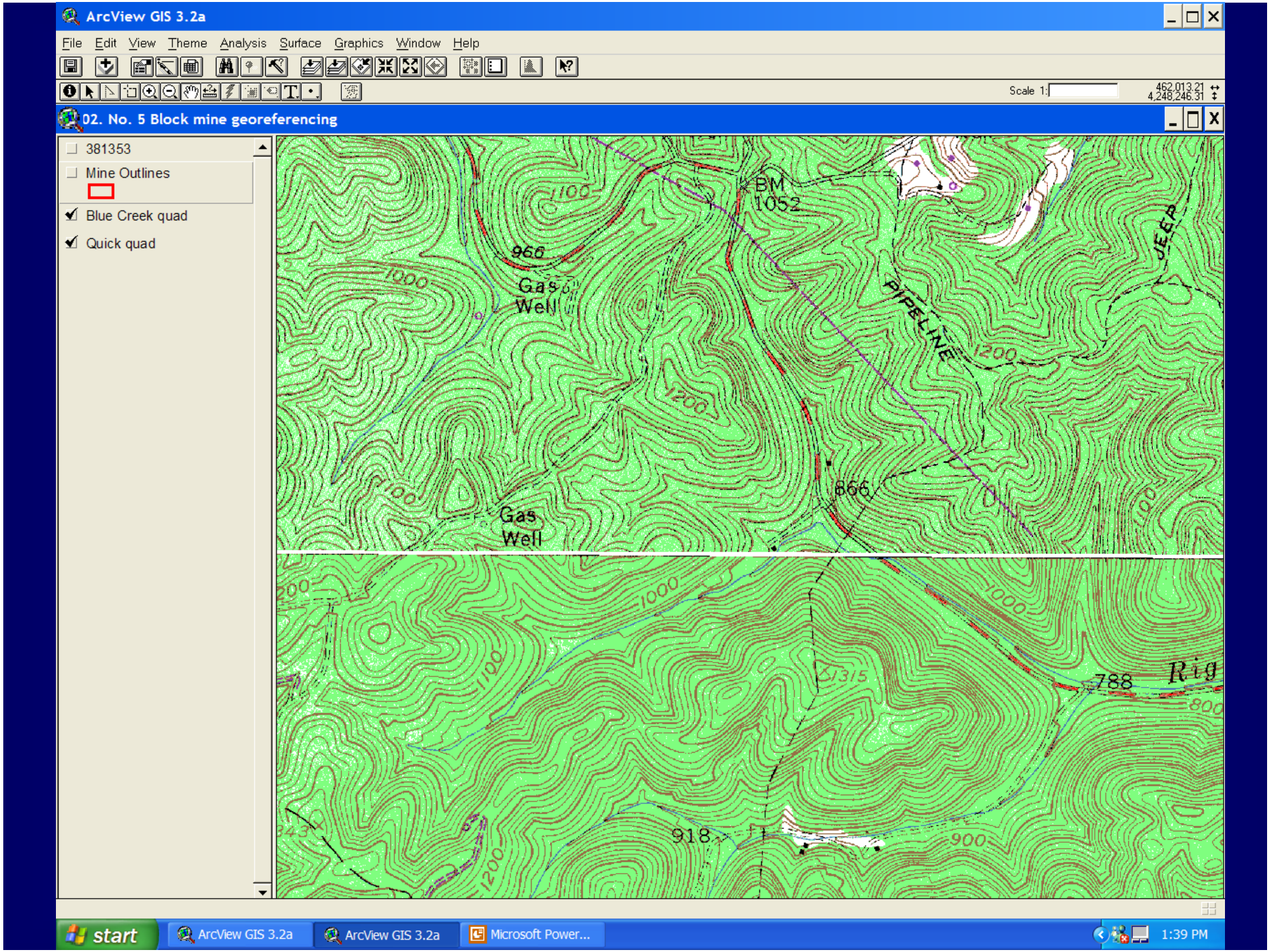
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381353
Mine Outlines
Blue Creek quad
Quick quad
BM
1052
966
Gas
Well
1100
1000
1200
PIPELINE
JEEP
866
Gas
Well
1000
1315
788
Rig
800
918
900
start
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ArcView GIS 3.2a
Microsoft Power...
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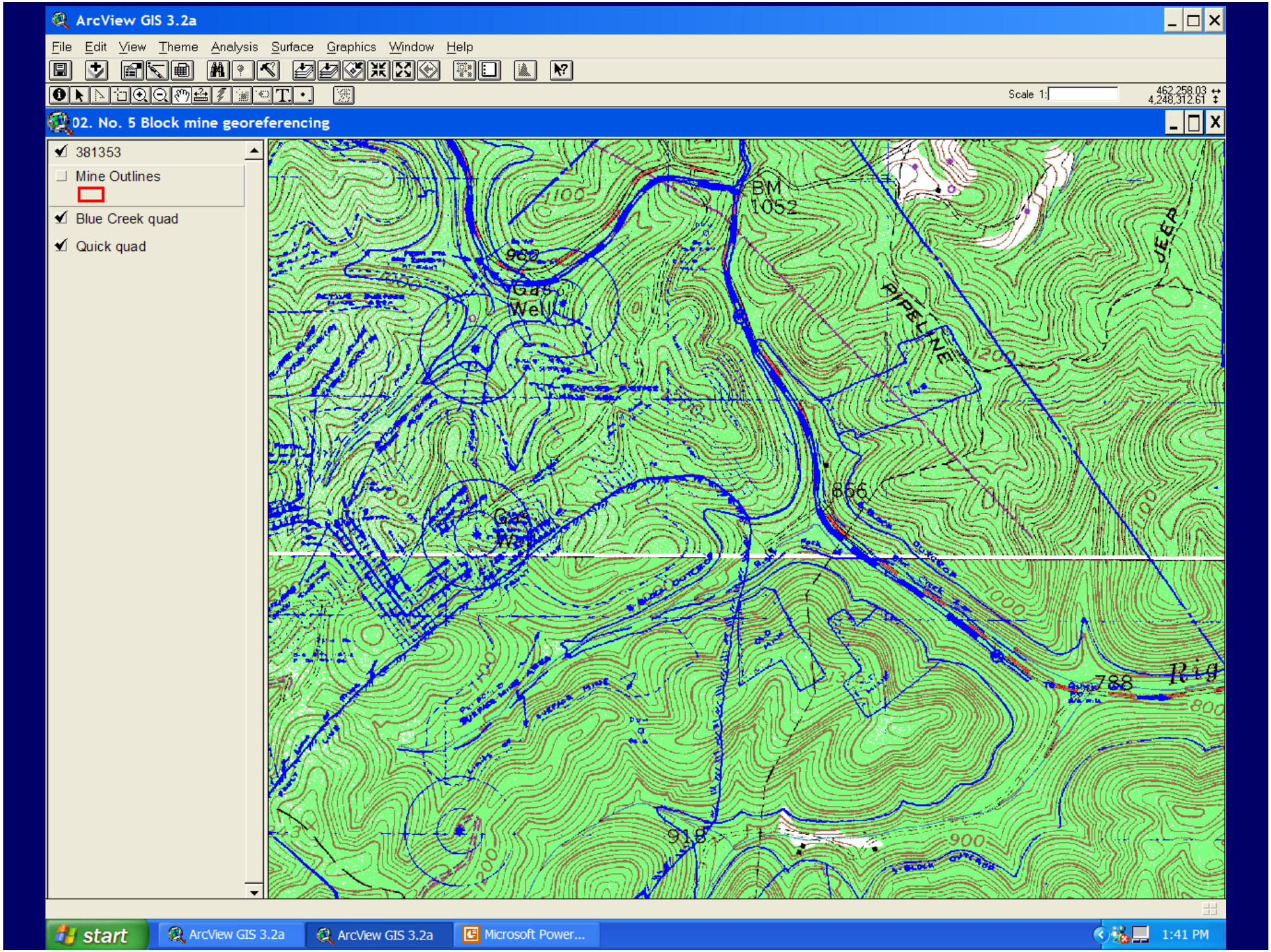
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381353
Mine Outlines
Blue Creek quad
Quick quad
BM 1052
Gas Well
PIPELINE
JEEP
866
788
Rig
918
start
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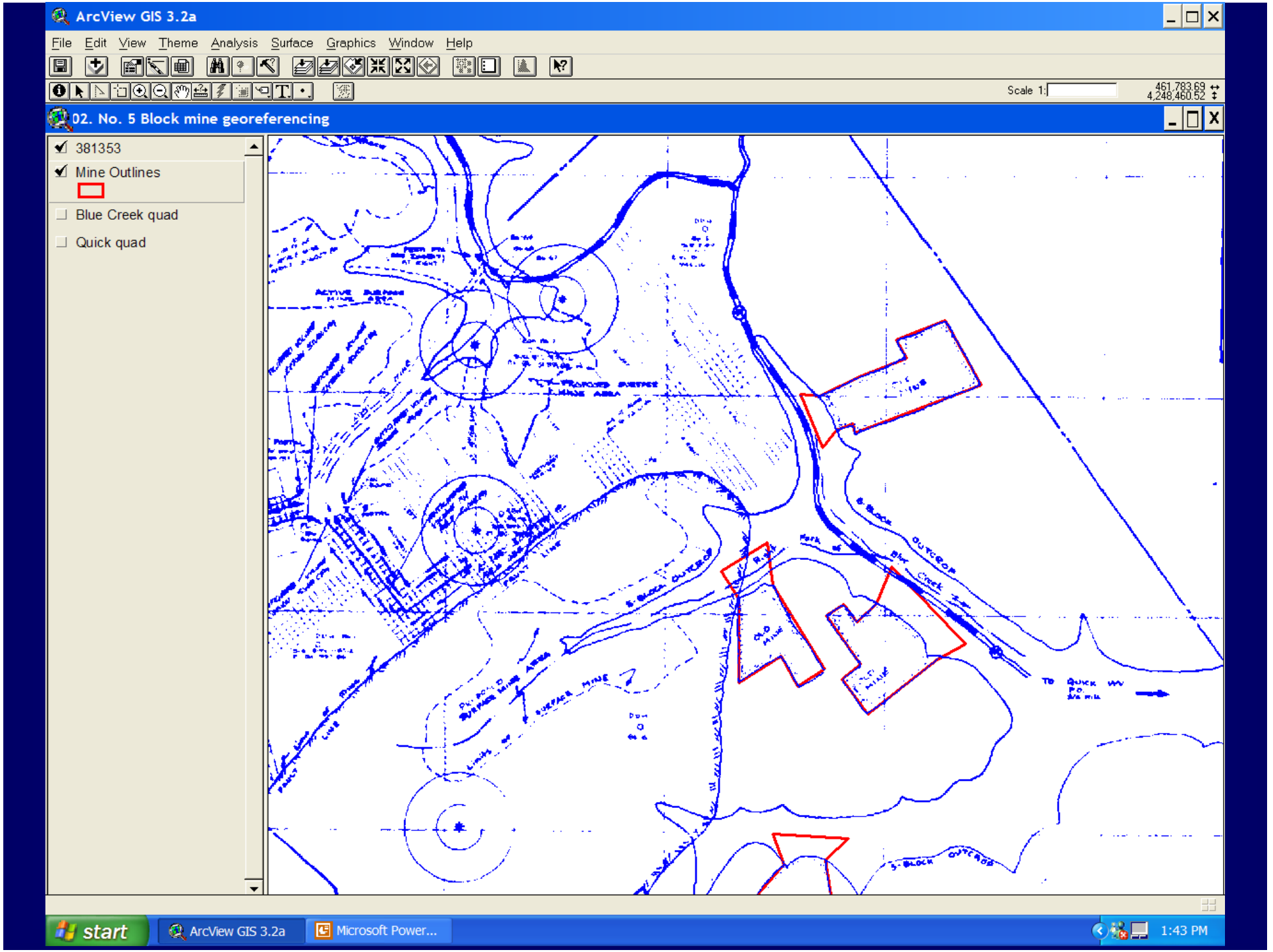
ArcView GIS 3.2a
Microsoft Power...
1:41 PM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Mine Outlines
Blue Creek quad
Quick quad
start
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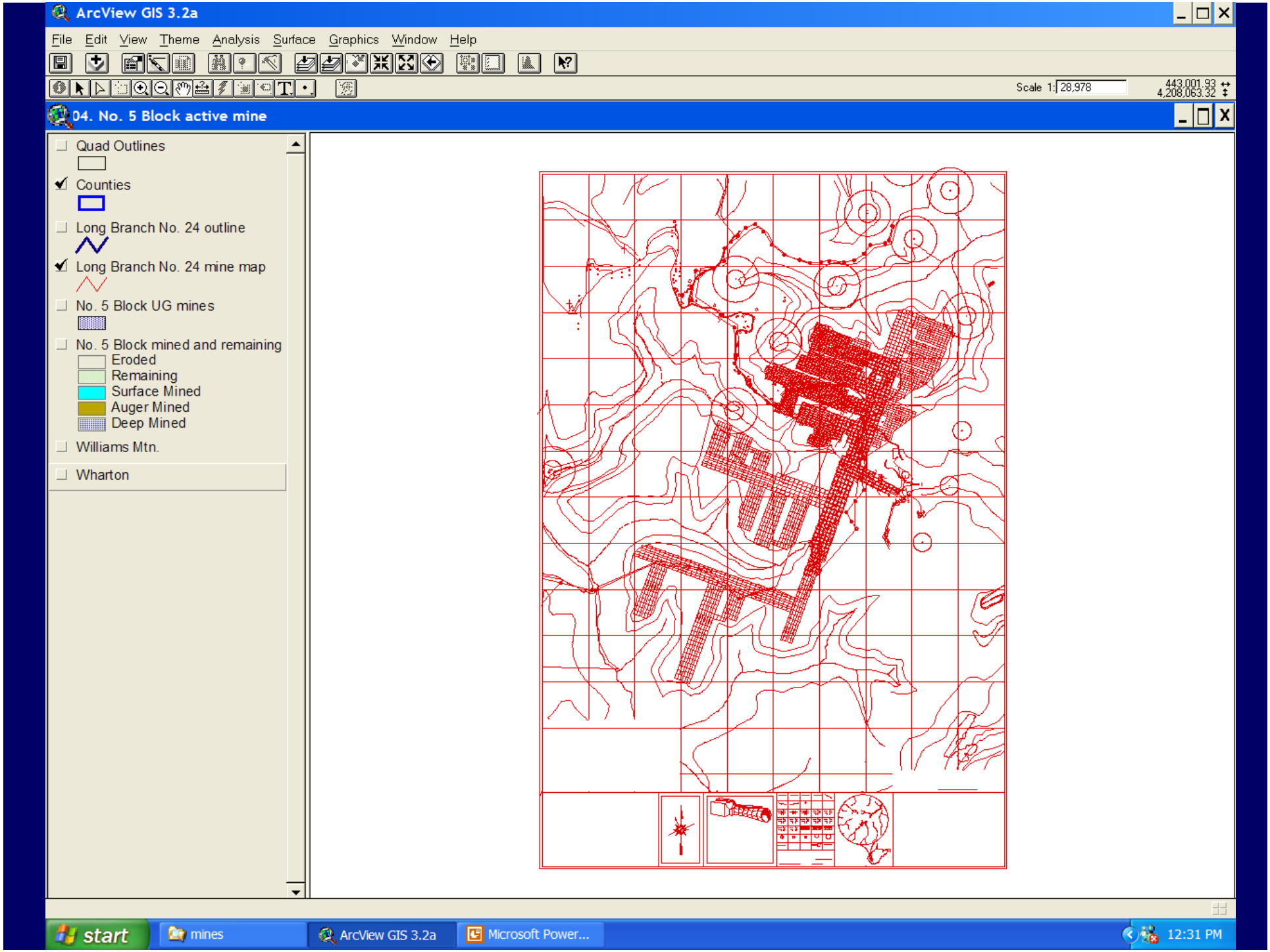
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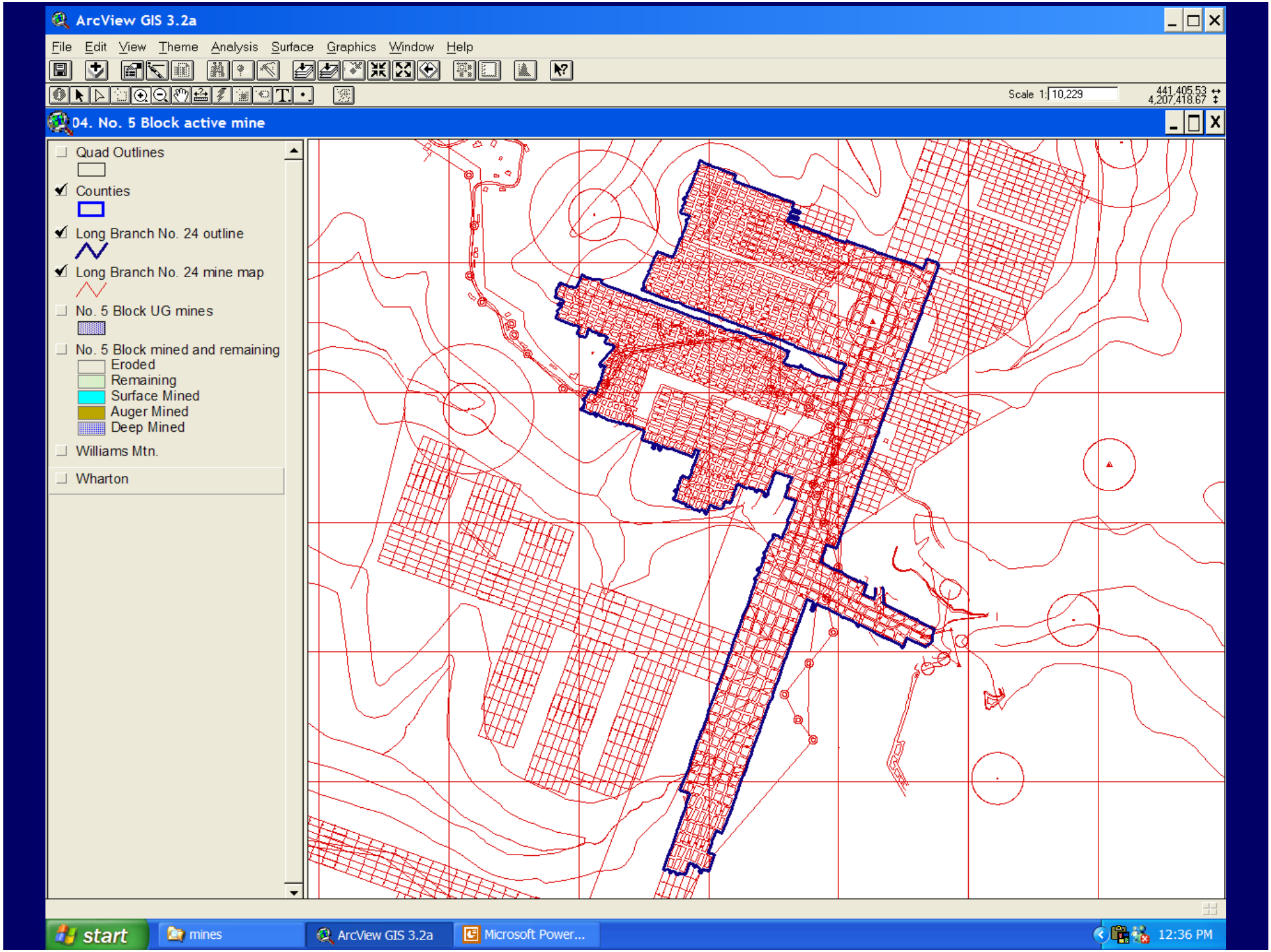
Quad Outlines
Counties
Long Branch No. 24 outline
Long Branch No. 24 mine map
No. 5 Block UG mines
No. 5 Block mined and remaining
Eroded
Remaining
Surface Mined
Auger Mined
Deep Mined
Williams Mtn.
Wharton
start
mines
ArcView GIS 3.2a
Microsoft Power...
12:31 PM


ArcView GIS 3.2a
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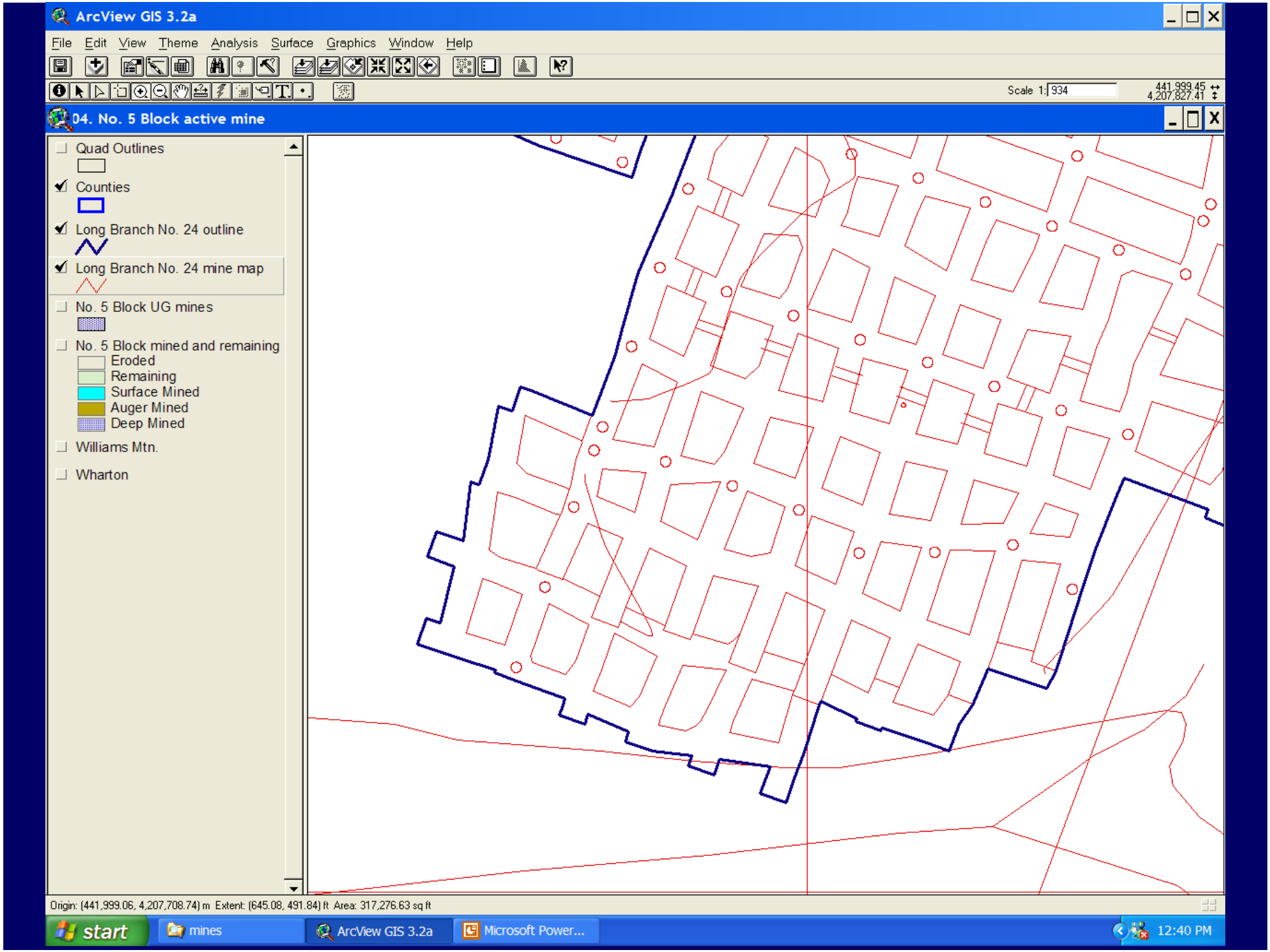
Scale 1:10,229
441,405.53
4,207,418.67
04. No. 5 Block active mine
Quad Outlines
Counties
Long Branch No. 24 outline
Long Branch No. 24 mine map
No. 5 Block UG mines
No. 5 Block mined and remaining
Eroded
Remaining
Surface Mined
Auger Mined
Deep Mined
Williams Mtn.
Wharton
start
mines
ArcView GIS 3.2a
Microsoft Power...
12:36 PM


ArcView GIS 3.2a
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Scale 1: 934
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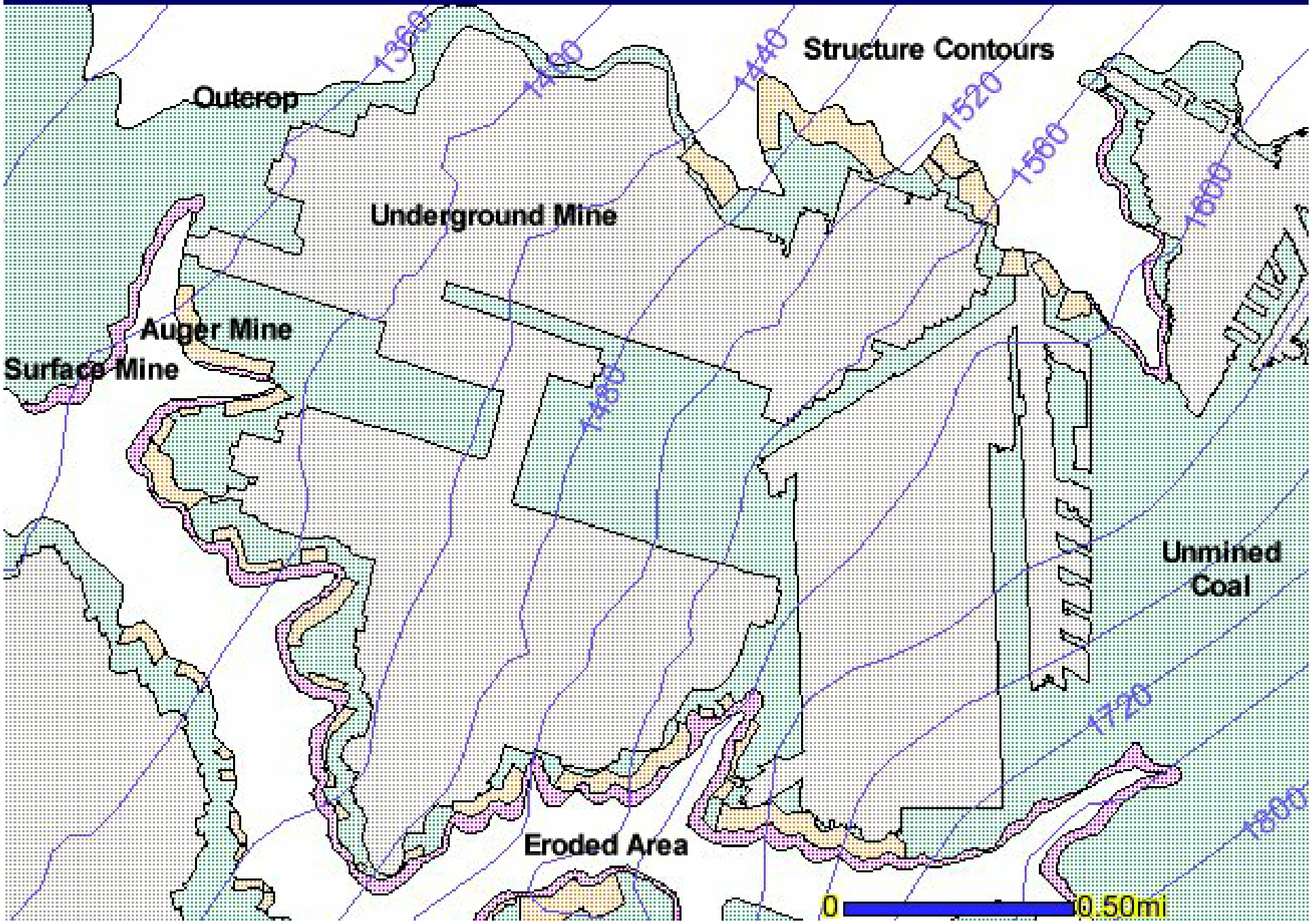
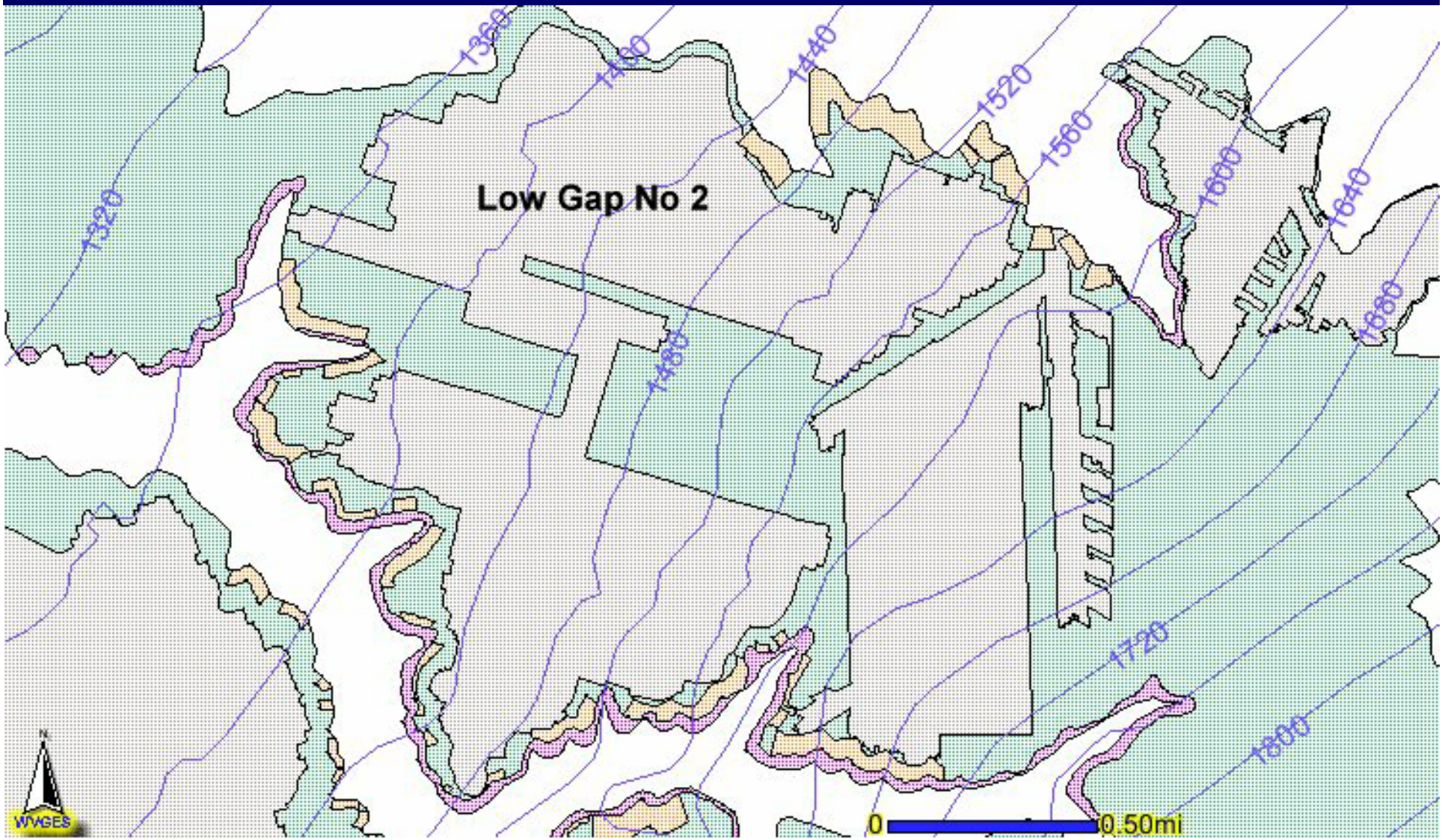
4,207,827.41
04. No. 5 Block active mine
Quad Outlines
Counties
Long Branch No. 24 outline
Long Branch No. 24 mine map
No. 5 Block UG mines
No. 5 Block mined and remaining
Eroded
Remaining
Surface Mined
Auger Mined
Deep Mined
Williams Mtn.
Wharton
Origin: (441,999.06, 4,207,708.74) m Extent: (645.08, 491.84) ft Area: 317,276.63 sq ft
start
mines
ArcView GIS 3.2a
Microsoft Power...
12:40 PM

No. 2 Gas Coal, Raleigh County

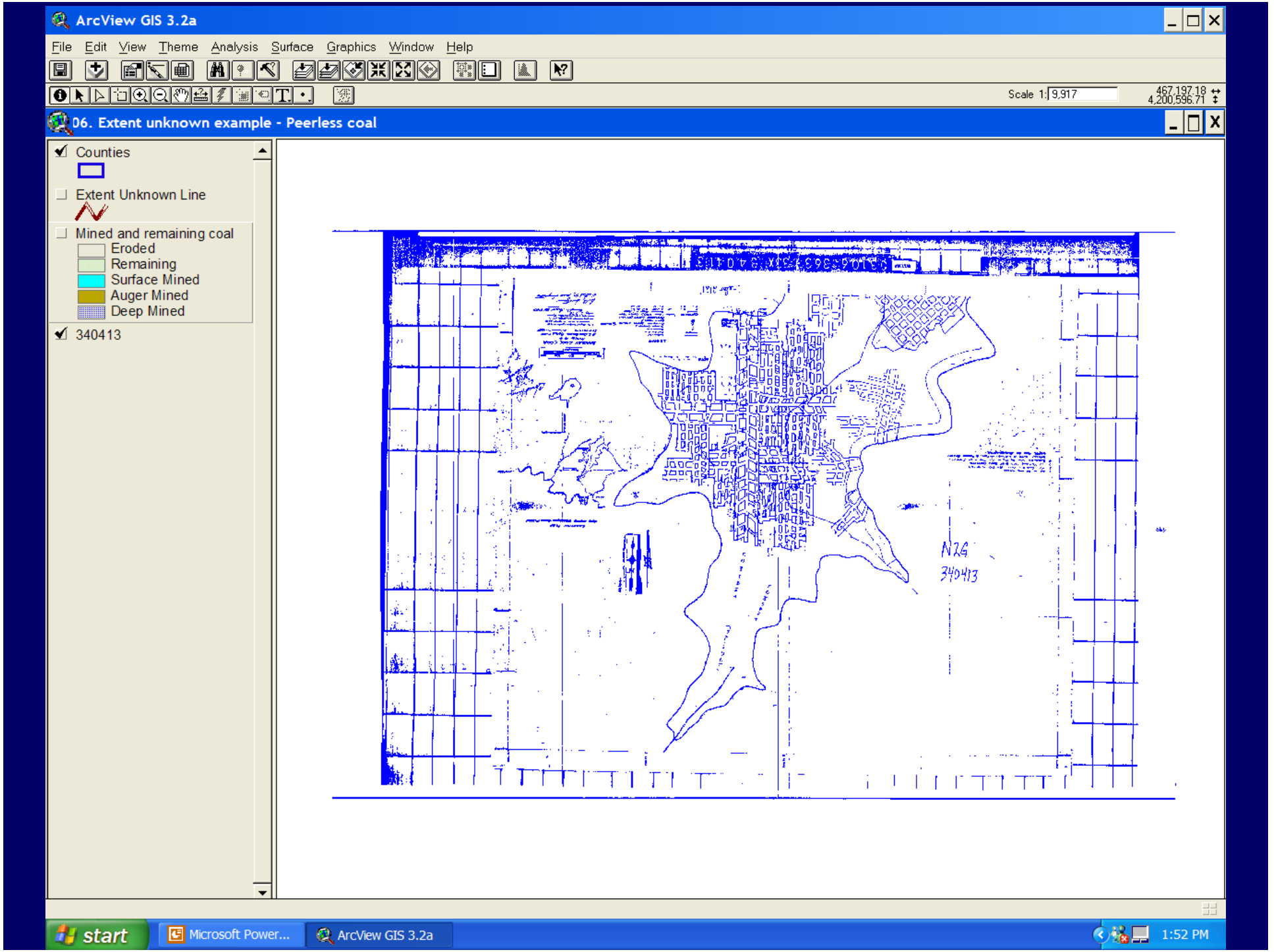


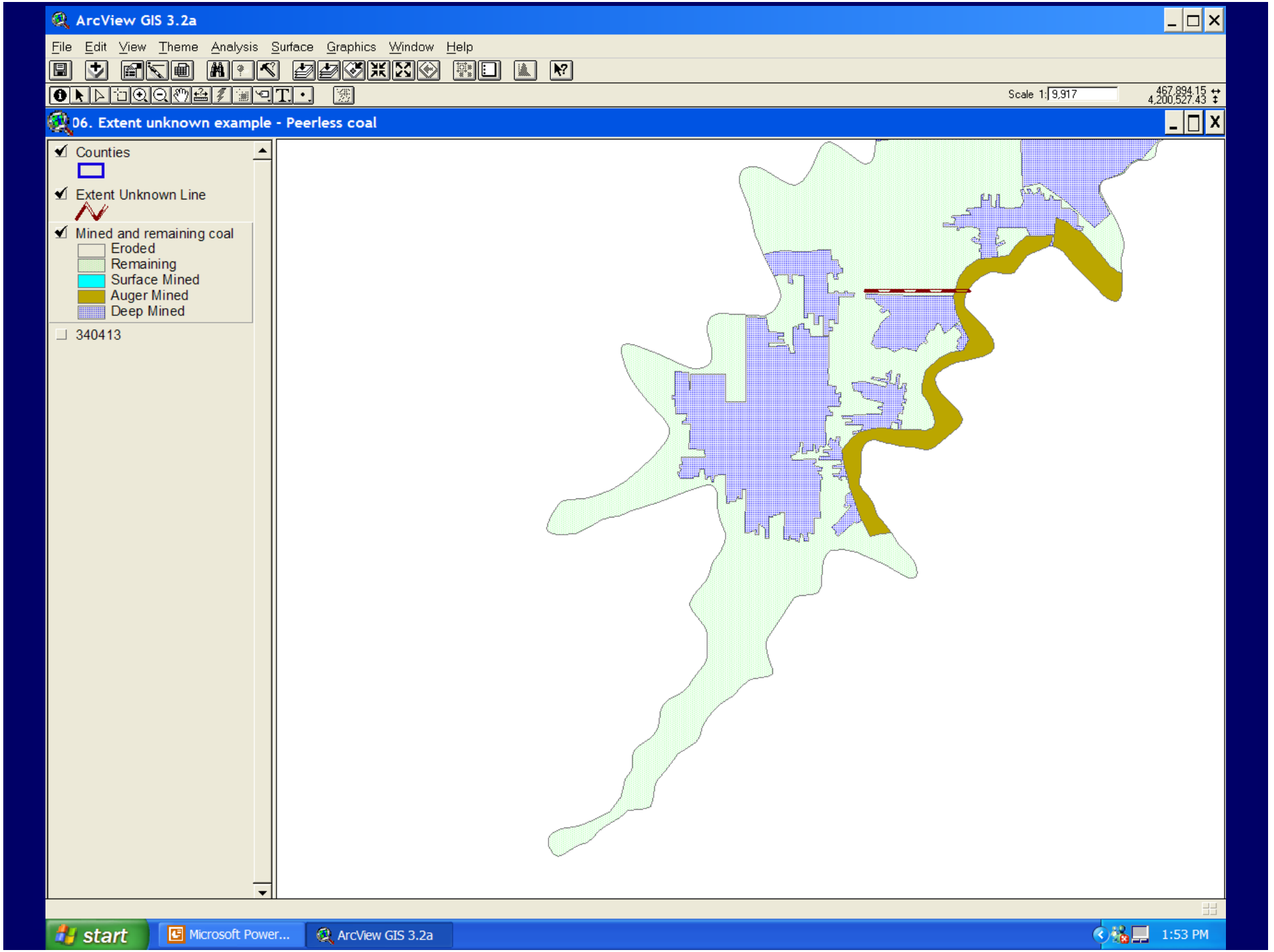
Underground Mine Attributes

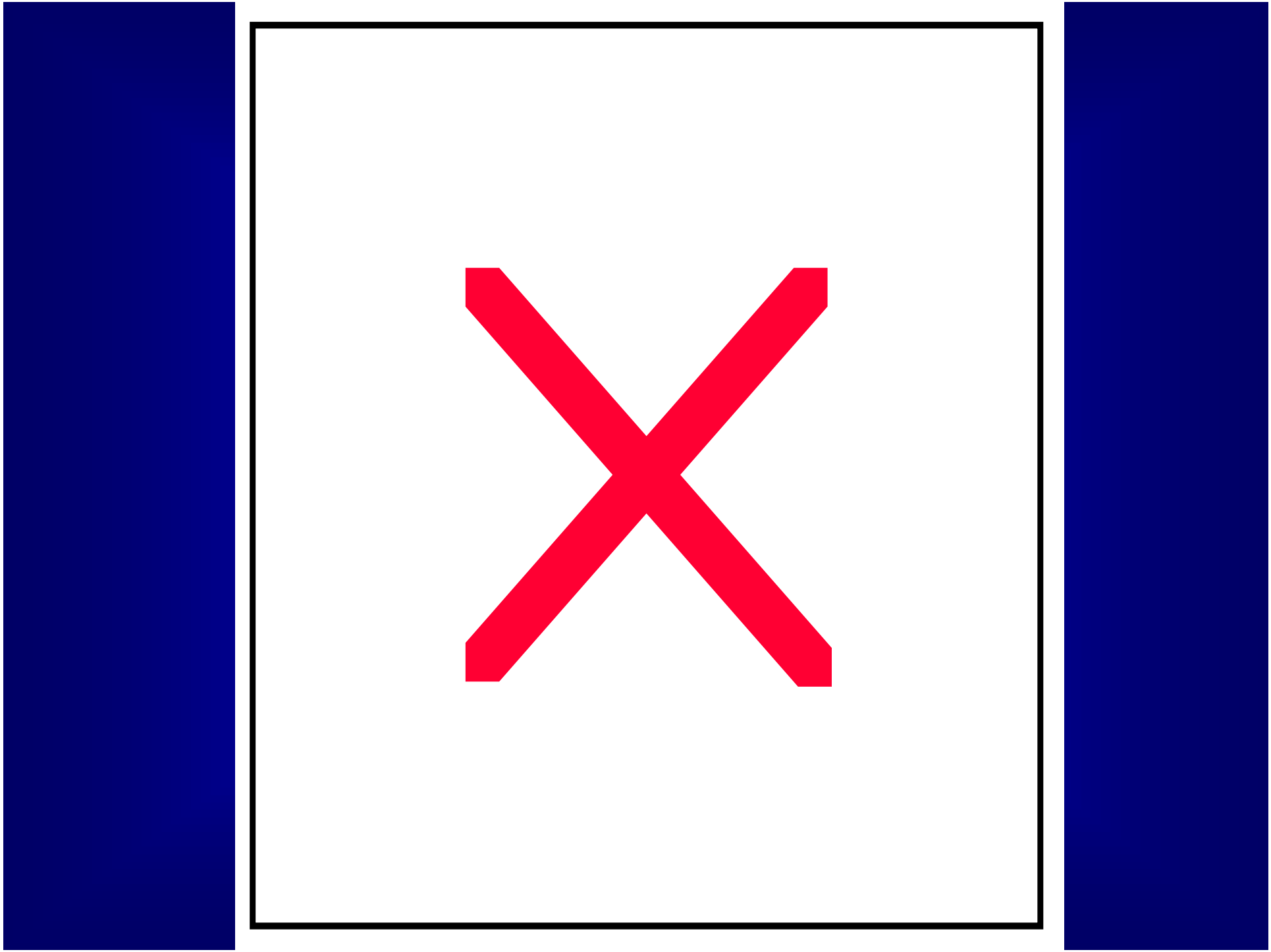


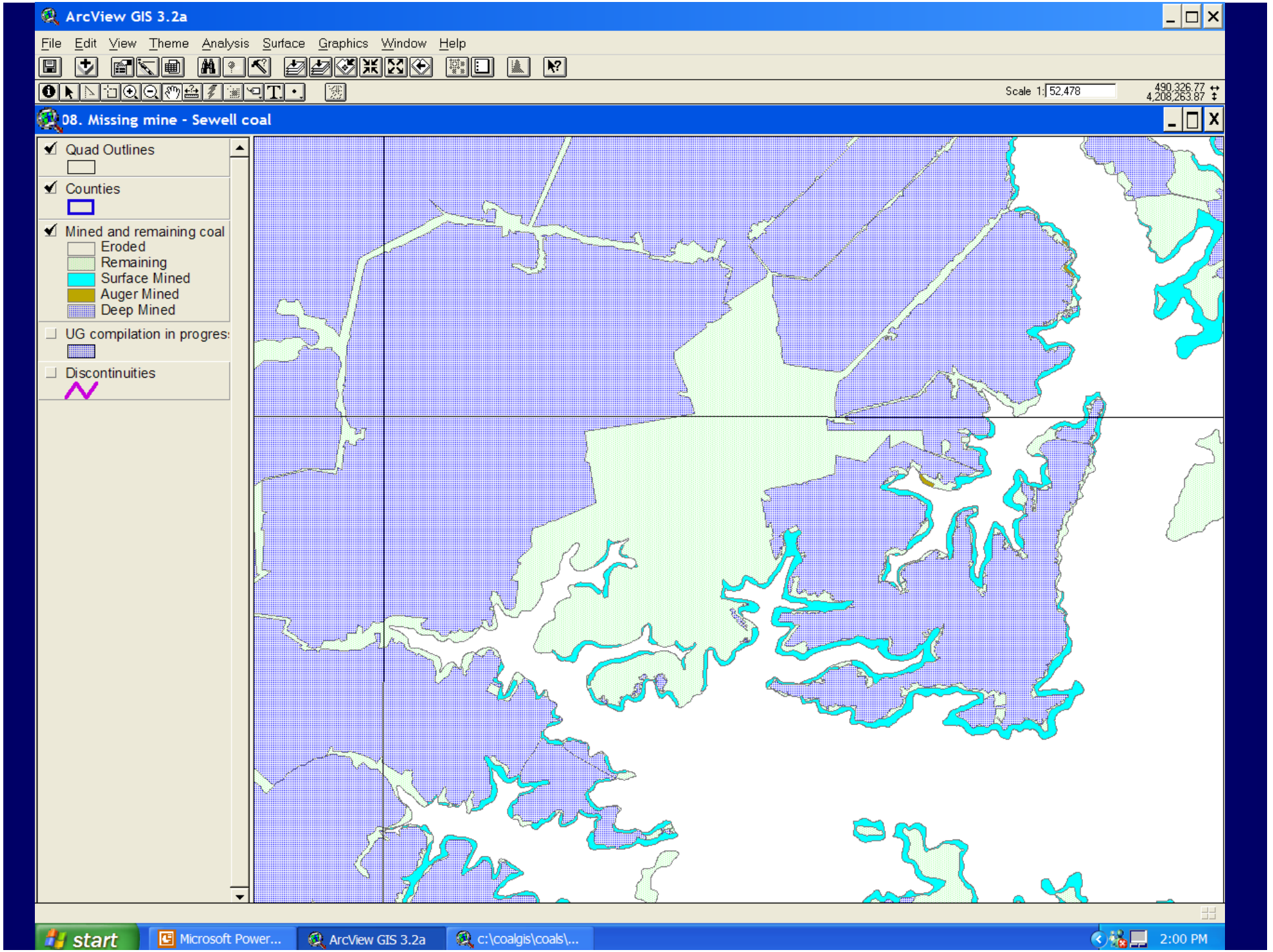
Mined and Remaining Coal

Rec	Mine Type	Aperture Card Number	Mine Name	Company Name	Permit Number	Comment	Map Date	#SHAPE#	#ID#
1	Underground Mine	953095A	LOW GAP NO 2	MARFORK COAL CO	U-3004-94	COPIED FROM OAK HILL MHST, 7/98	1998	[polygon]	729


ArcView GIS 3.2a
File Edit View Theme Analysis Surface Graphics Window Help
Scale 1: 9,917
467,197.18
4,200,596.71
06. Extent unknown example - Peerless coal
Counties
Extent Unknown Line
Mined and remaining coal
Eroded
Remaining
Surface Mined
Auger Mined
Deep Mined
340413
N24
340413
start
Microsoft Power...
ArcView GIS 3.2a
1:52 PM


ArcView GIS 3.2a
File Edit View Theme Analysis Surface Graphics Window Help
Scale 1: 9,917
467,894.15
4,200,527.43
06. Extent unknown example - Peerless coal
Counties
Extent Unknown Line
Mined and remaining coal
Eroded
Remaining
Surface Mined
Auger Mined
Deep Mined
340413
start
Microsoft Power...
ArcView GIS 3.2a
1:53 PM

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Scale 1: 52,478
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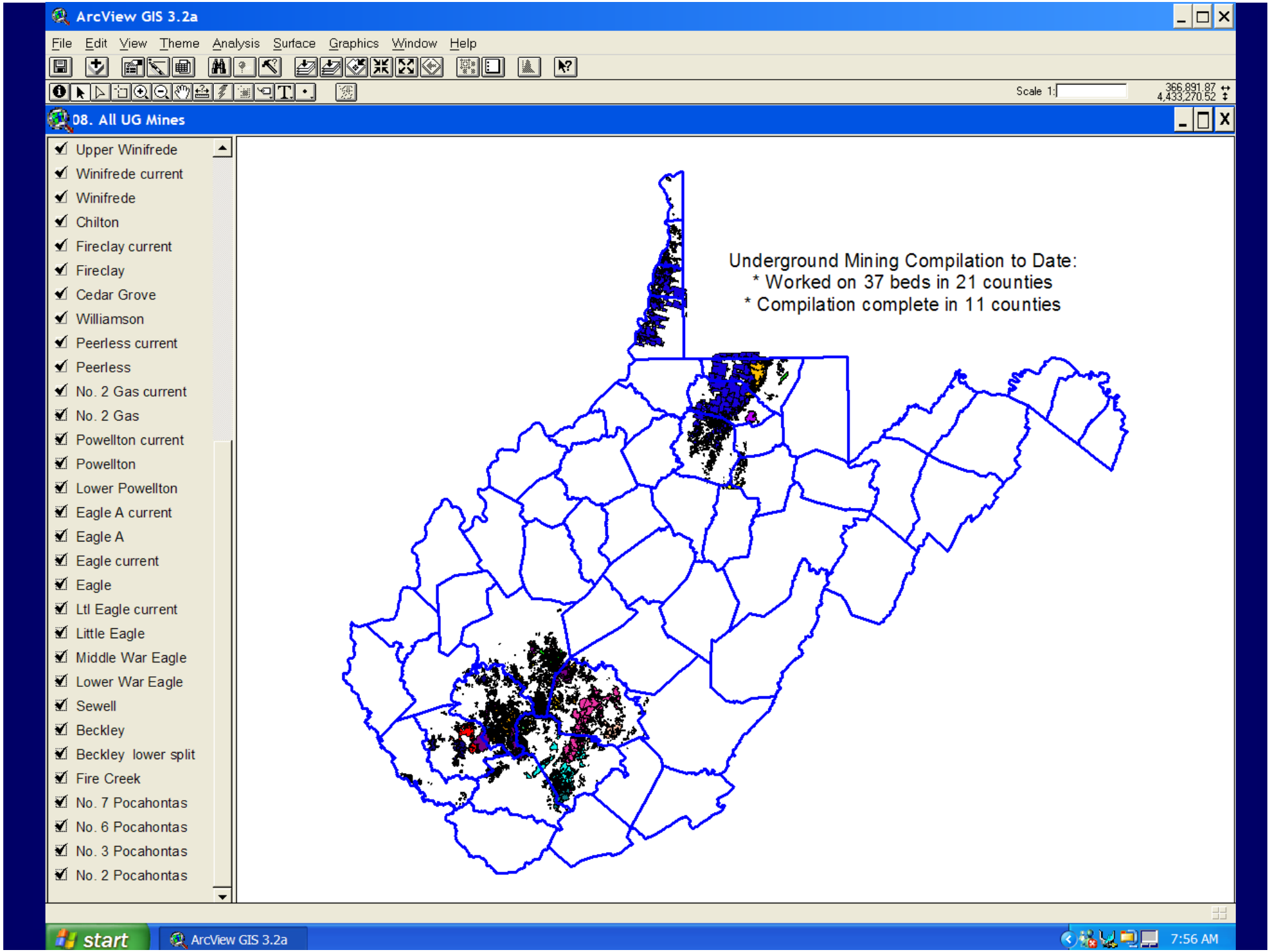
4,208,263.87
08. Missing mine - Sewell coal
Quad Outlines
Counties
Mined and remaining coal
Eroded
Remaining
Surface Mined
Auger Mined
Deep Mined
UG compilation in progres
Discontinuities
start
Microsoft Power...
ArcView GIS 3.2a
c:\coalgis\coals\...
2:00 PM


ArcView GIS 3.2a
File Edit View Theme Analysis Surface Graphics Window Help
Scale 1:
366,891.87
4,433,270.52
08. All UG Mines
Upper Winifrede
Winifrede current
Winifrede
Chilton
Fireclay current
Fireclay
Cedar Grove
Williamson
Peerless current
Peerless
No. 2 Gas current
No. 2 Gas
Powellton current
Powellton
Lower Powellton
Eagle A current
Eagle A
Eagle current
Eagle
Ltl Eagle current
Little Eagle
Middle War Eagle
Lower War Eagle
Sewell
Beckley
Beckley lower split
Fire Creek
No. 7 Pocahontas
No. 6 Pocahontas
No. 3 Pocahontas
No. 2 Pocahontas
Underground Mining Compilation to Date:
* Worked on 37 beds in 21 counties
* Compilation complete in 11 counties
start
ArcView GIS 3.2a
7:56 AM

Summary

- Creating a 1:24,000 scale index to underground mines in WV
- Maintaining connection to detailed mine maps
- Local planning or activity should be based on the detailed maps of mine workings

Improvements

- Fill in partial maps, missing maps
- Review for completeness
- Make geo-referenced maps and all other maps available via the web
- Tie in production records
- Add people and resources to speed up process

wvges

West Virginia Geological & Economic Survey

PO Box 879, Morgantown, West Virginia 26507-0879

Tel: (304) 594-2331 Fax: (304) 594-2575

Web Site http://www.wvgs.wvnet.edu