Promoting Geospatial Technology in Coal Mining

Bill Card

National Meeting of SMCRA Geospatial Data Stewards

June 27, 2006

Agenda

- Why we are here
- National Coal Mining Geospatial Committee
- Meeting goals
- Expectations for Geospatial Data Stewards

We Are Here Because

- Our world is changing
- Our work is changing
- We need to change, too

Our Work Has Purpose

- The nation needs energy
- Coal helps the nation meet energy needs
- Mining coal has potential environmental consequences
- These consequences can be minimized through careful planning
- Planning requires accurate, timely data
- Managing spatial data is becoming very important to us and is rapidly evolving

Coal mining activities have impacts

Mountaintop mining

which affect large areas of land

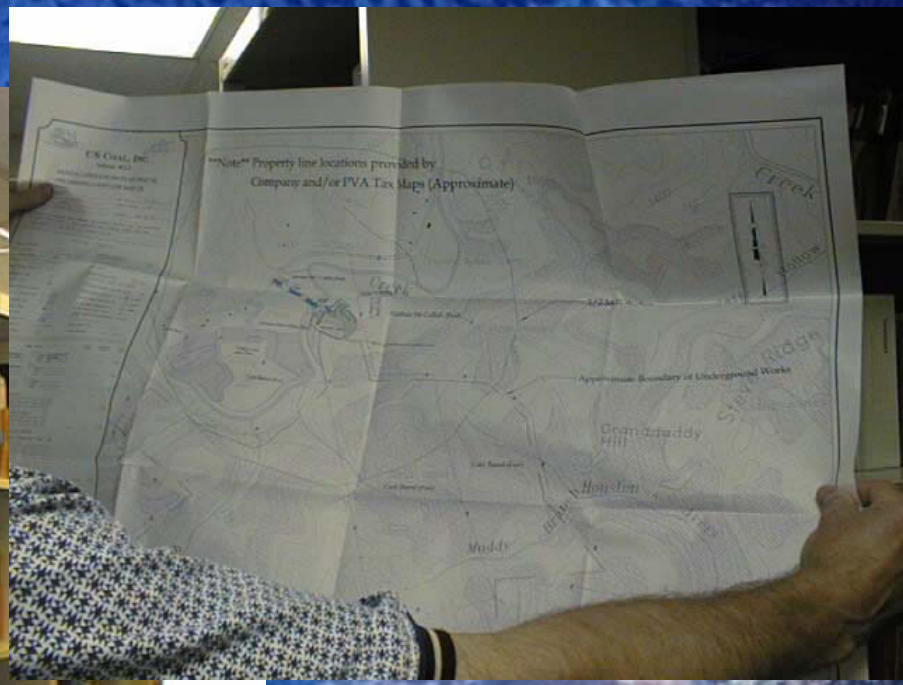
Area mining

and alter waterways.

Valley Fill

We require data from industry

Paper permit application files



to understand the proposed activities,

General Geology Statement

The proposed Leach Mountain Area #6C and 6D mine sites are located in Claiborne County, Tennessee on the Eagan, TN/KY U.S.G.S. quadrangle map. Area #6C is an extension of an existing surface mining operation. The mine sites are located at latitude 36 degrees 31′ 23″ and longitude 83 degrees 54′ 03″. The proposed mine sites are situated within the Cumberland Block (see enclosed "Structural features of the Tennessee coal field" diagram). The Cumberland Block is bounded by the Pine Mountain Fault Zone to the west, the Jacksboro Tear Fault to the south, the Cumberland Mountains to the east, and extends north into Kentucky.

Regionally, strata dips to the northwest, away from the Cumberland Mountains. The proposed mine site is located within or near the Middlesboro Syncline. The local dip of the coal seams to be mined, as calculated from the spot elevations depicted on the Kopper Glo Fuel, Inc., Deep Mine #2, underground mine maps, is approximately 1.3 degrees to the east-northeast. Field inspections of existing highwalls and review of the exploratory drilling conducted for the sites, showed no signs of local faulting.

The mine site stratigraphy consists of sedimentary units within the Slatestone, Indian Bluff, Graves Gap, and Redoak Mountain Groups (see enclosed "Generalized stratigraphic sequence of
its are within the middle Pennsylvanian age
k group. The Slatestone Formation includes
and the top of the Jellico Coal seam.
Included in this formation are the Poplar Creek, Ant, Coal Creek (locally known as the Kent), Petros, Blue Gem (locally known as the Rich Mountain), Terry Creek, and Jellico (locally known as the Mingo or Mason) coal seams. The Ant, Petros, and Terry Creek coal seams are not known to be

Paper narrative descriptions

model the potential impacts,

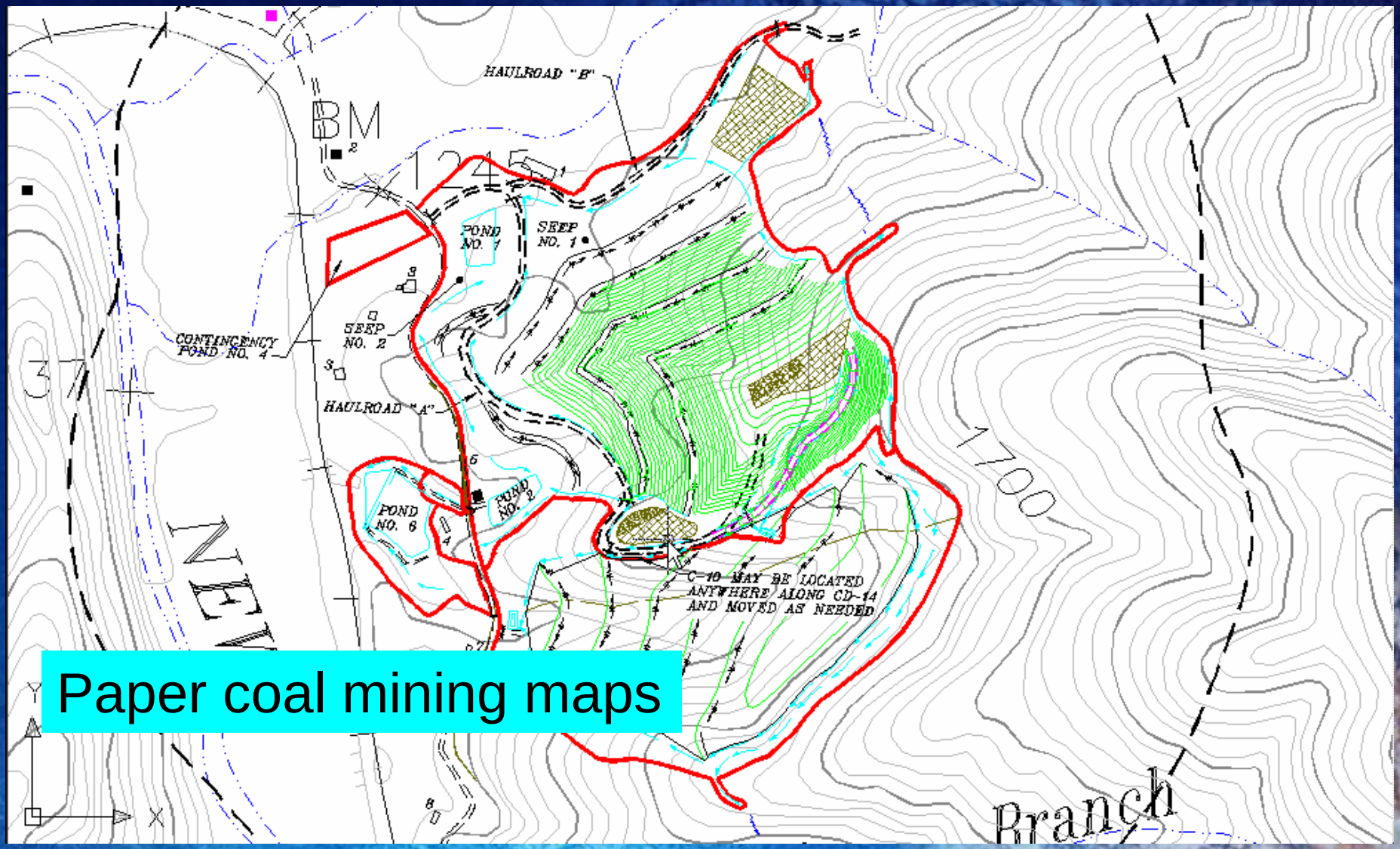
B. Provide, in the table below, surface-water baseline data for each surface-water resource identified above to represent areal variations in surface-water quality and quantity typically associated with seasonal variation in streamflow rates.

Provide Surface-Water Site Identification number here from item 40A **SW-001 (Page 1 of 3)**

Seasonal Variation (Show date of sample collection)				
	11/07/2001	12/21/2001	01/09/2002	02/28/02
pH	5.9	5.3	4.9	5.4
Total Dissolved Solids (mg/l)	17	13	15	11
OR				
Specific Conductance (umhos/cm)	36	22	23	23
Total Suspended Solids (mg/l)	2	<1	<1	<1
Iron, total (mg/l)*	<0.05	0.04	0.05	0.01
[illegible]	[illegible]	0.03	0.04	<0.02
[illegible]	[illegible]	5	7	5
Alkalinity as $CaCO_3$ (mg/l)**	12	1	2	2
Acidity as $CaCO_3$ (mg/l)**	4	8	27	20

Paper tabular data

and determine where these may occur.



Paper coal mining maps

On February 26, 1988 TIPS was created.

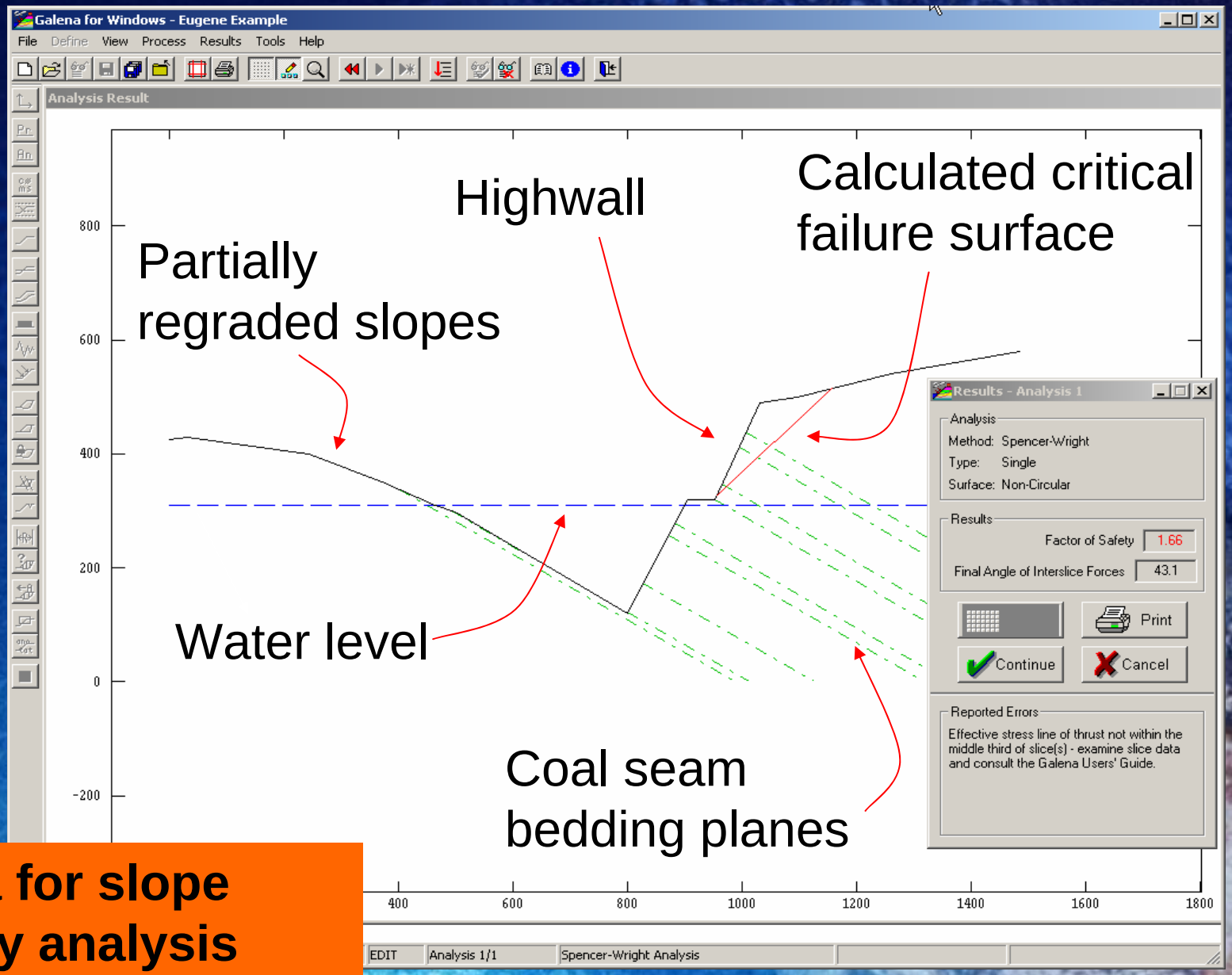
Today, we know TIPS as:

Technical Innovation and Professional Services
U.S. Dept of the Interior
Office of Surface Mining

TIPS provided resources

- Scientific software
- Customized training designed by in-house professionals using real coal mining scenarios
- Specialized hardware
- Technical assistance

to conduct better analyses



Galena for slope stability analysis

enabling objective decisions based on competent and scientifically sound data.

We acquired current digital data,

Microsoft Excel - Groundwater_2981.xls

File Edit View Insert Format Tools Data Window Help

MS Sans Serif 10

A1 = 'PERMIT

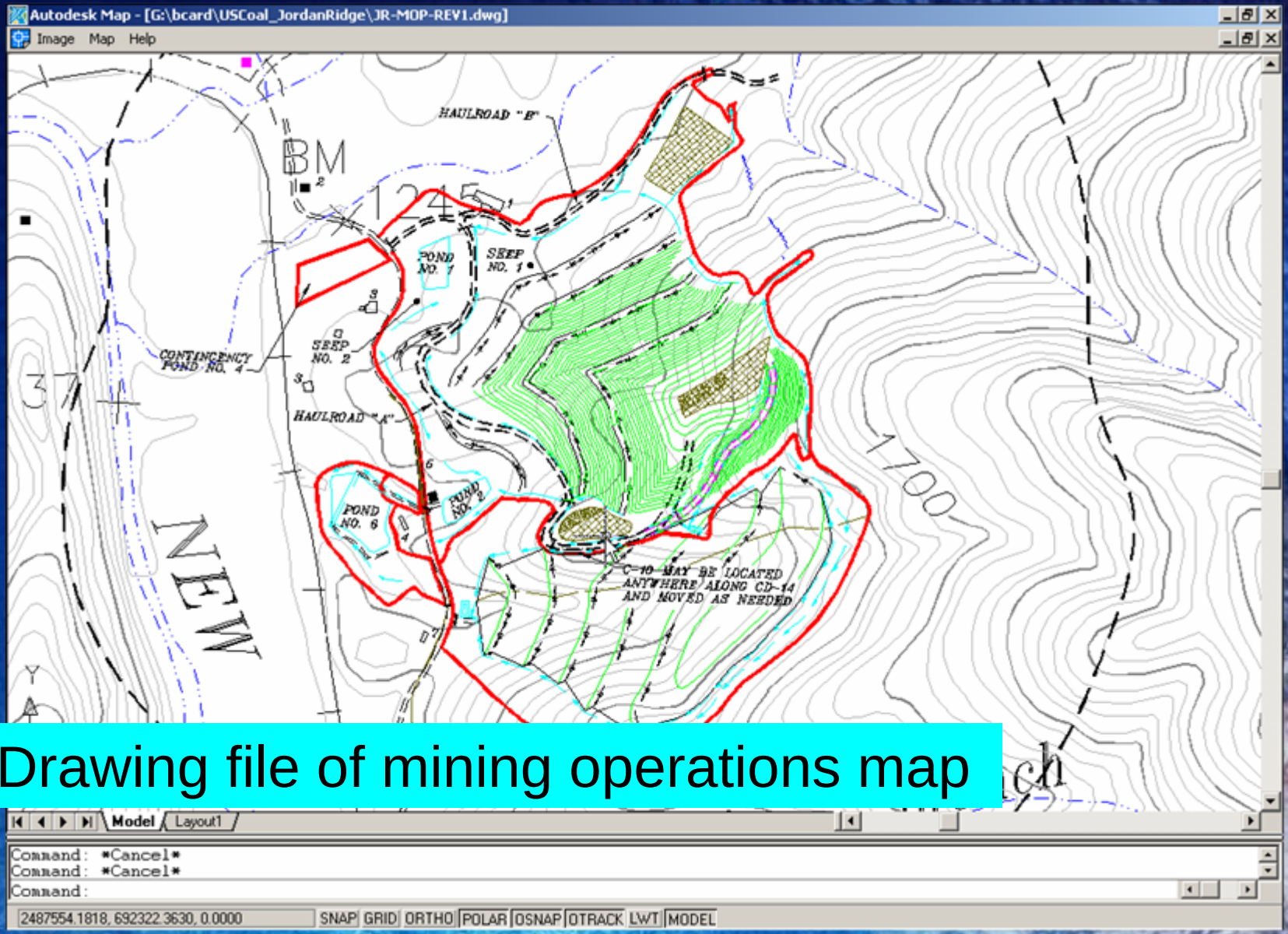
	A	B	C	D	E	F	G	H	I	J
1	PERMIT	SITENO	DATE	TDS	TOTAL_IRON	TOTAL_MANGANESE	PH	SULFATE	ACIDITY	ALKALINITY
2	2981	PP	3/30/1999	638	0.21	0.17	11.32	52.5	0	180
3	2981	N2	3/30/1999	56	6.7	0.86	5.9	19	2	22
4	2981	SC1	3/30/1999	29	0.39	0.26	5.41	5	10	7
5	2981	SC2	3/30/1999	82	4.9	0.16	6.82	5	0	45
6	2981	N1a	3/30/1999	140	1.71	0.56	6.8	10.5	0	90
7	2981	PP	12/29/1998	597	0.74	0.08	11.14	52.5	0	200
8	2981	N1a	12/29/1998	168	0.81	0.36	7.23	10	0	100
9	2981	N2	12/29/1998	40	3.02	0.7	6.15	0.5	0	20
10	2981	SC1	12/29/1998	36	0.25	0.12	6.25	77.5	0	30
11	2981	SC2	12/29/1998	83	1.98	0.25	6.6	0.5	0	64
12	2981	PP	9/23/1998	717	4	0.17	12	60	0	230
13	2981	N1a	9/23/1998	167	4.88	0.9	7.02	19	0	80
14	2981	N2	9/23/1998	61	19.8	1.31	6.2	6	0	40
15	2981	SC1	9/23/1998	38	0.9	0.2	5.56	9	5	20
16	2981	SC1	9/23/1998	38	0.9	0.2	5.56	9	5	20
17	2981	SC2	9/23/1998	79	9	0.36	6.52	5.5	-20	50
18	2981	N1a	3/24/1998	117	1.6	0.66	6.17	22	0	12
19	2981	N2	3/24/1998	31	2.06	0.42	5.88	7	4	20
23	2981	N1a	6/24/1998	140	0.44	1.02	8.8	5.5	0	84
24	2981	N2	6/24/1998	46	7	0.89	5.79	0.5	10	20
25	2981	SC1	6/24/1998	50	0.19	0.26	4.96	10	40	10
26	2981	SC2	6/24/1998	88	1.02	0.33	5.98	0.5	10	37

2981Ground

Ready

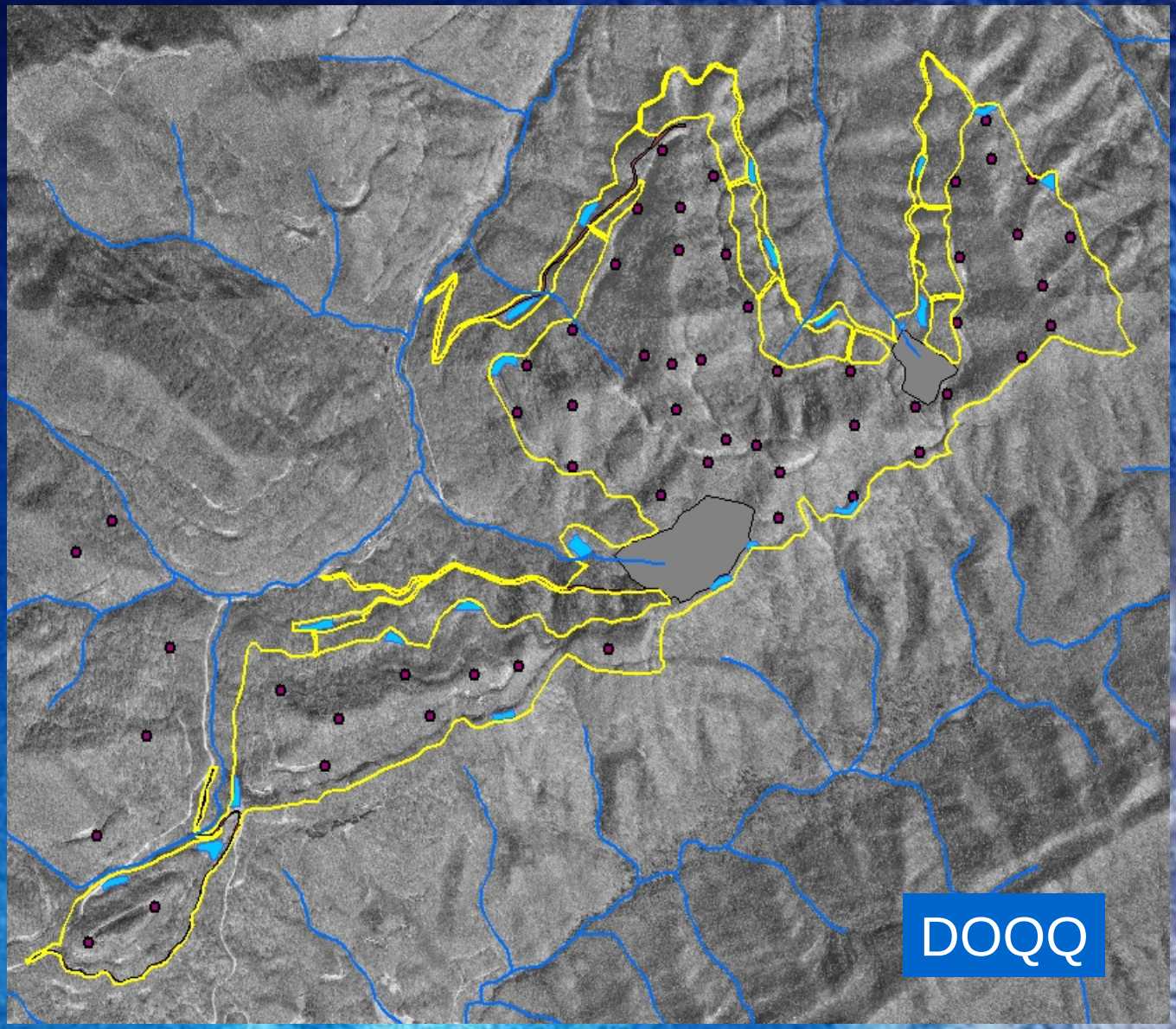
Spreadsheet of water quality sampling results

including mining features on maps,

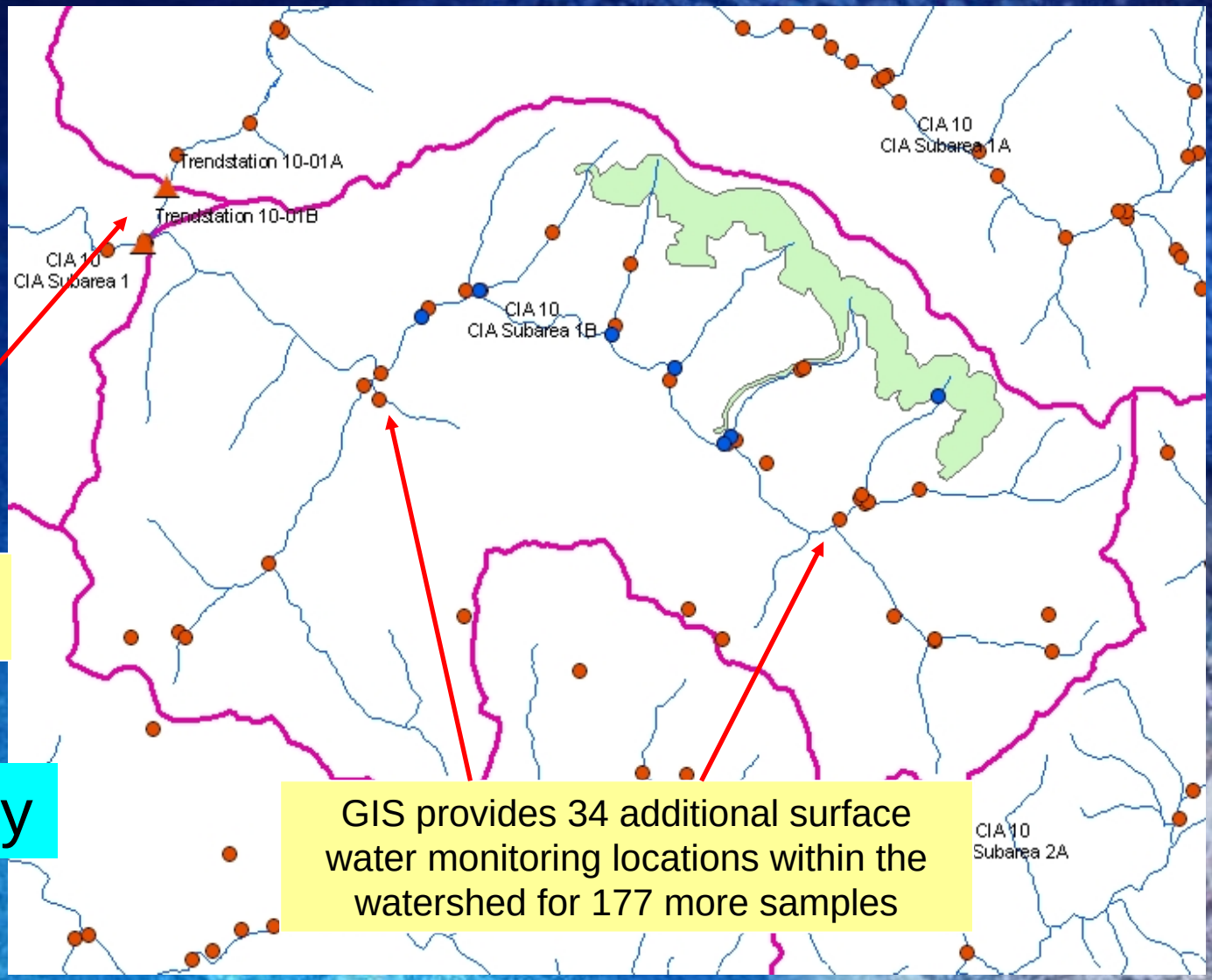


Drawing file of mining operations map

for use with other spatial datasets.



TIPS changed the way we worked

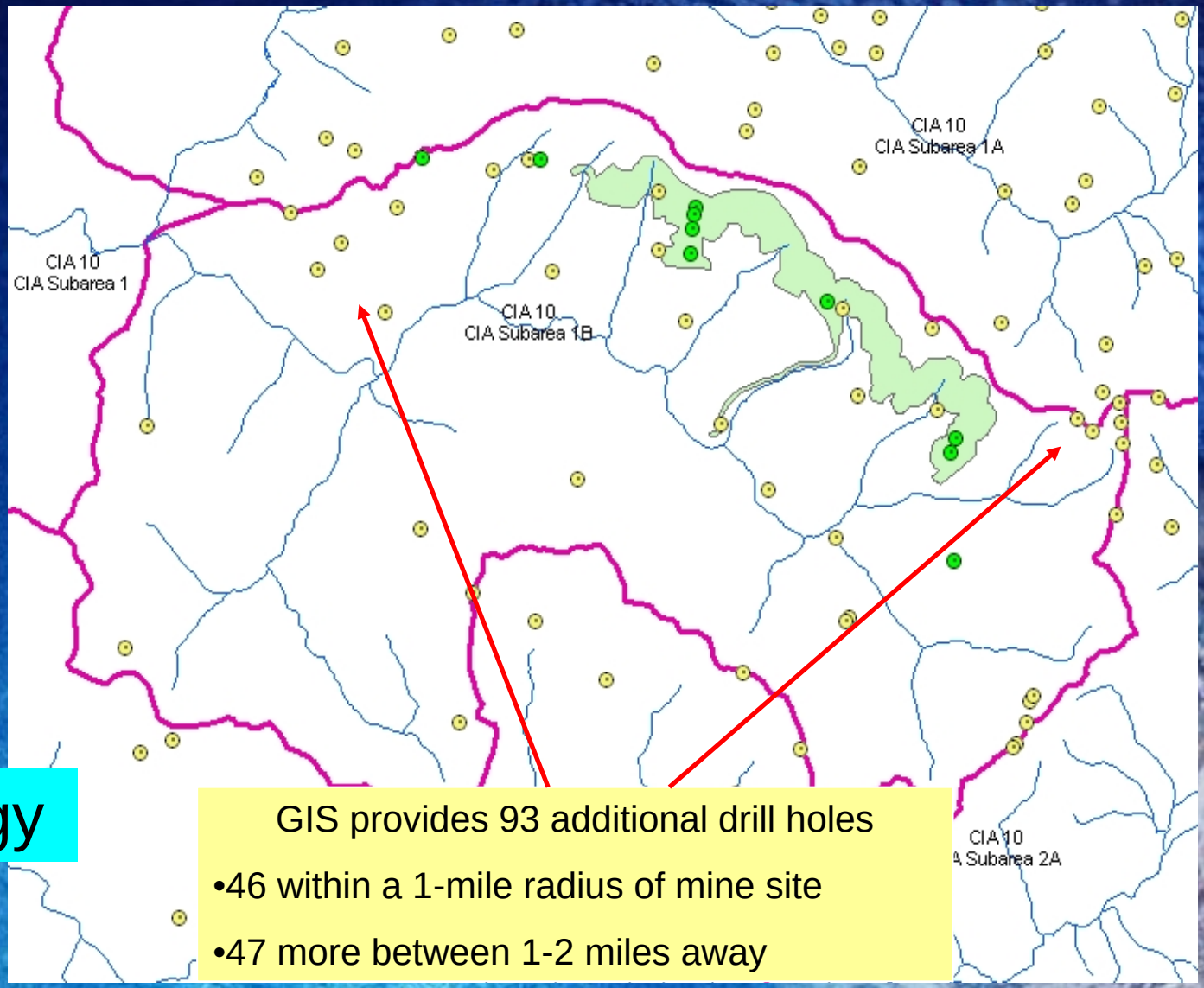


15 samples at trendstation

Hydrology

GIS provides 34 additional surface water monitoring locations within the watershed for 177 more samples

in the office

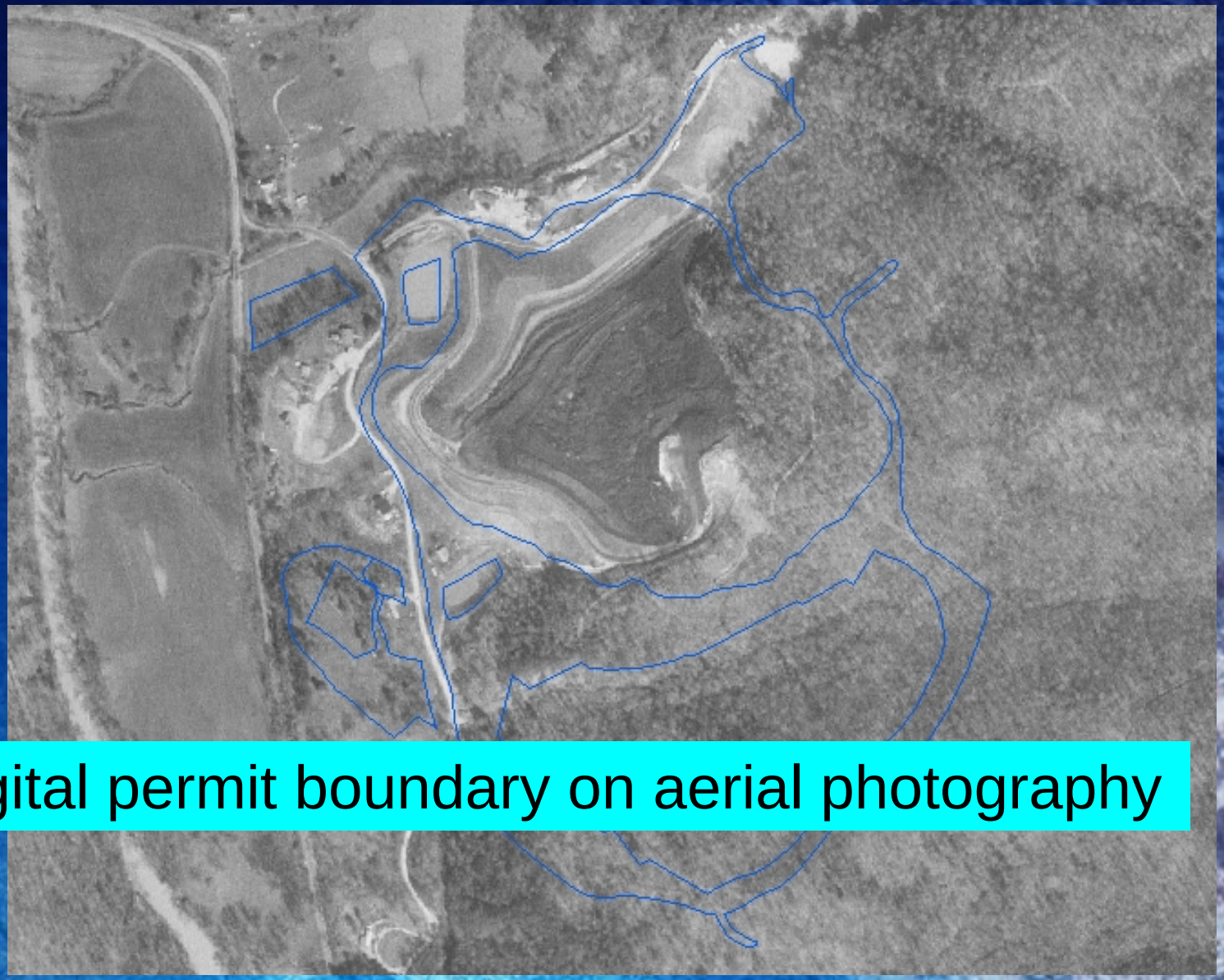


Geology

GIS provides 93 additional drill holes

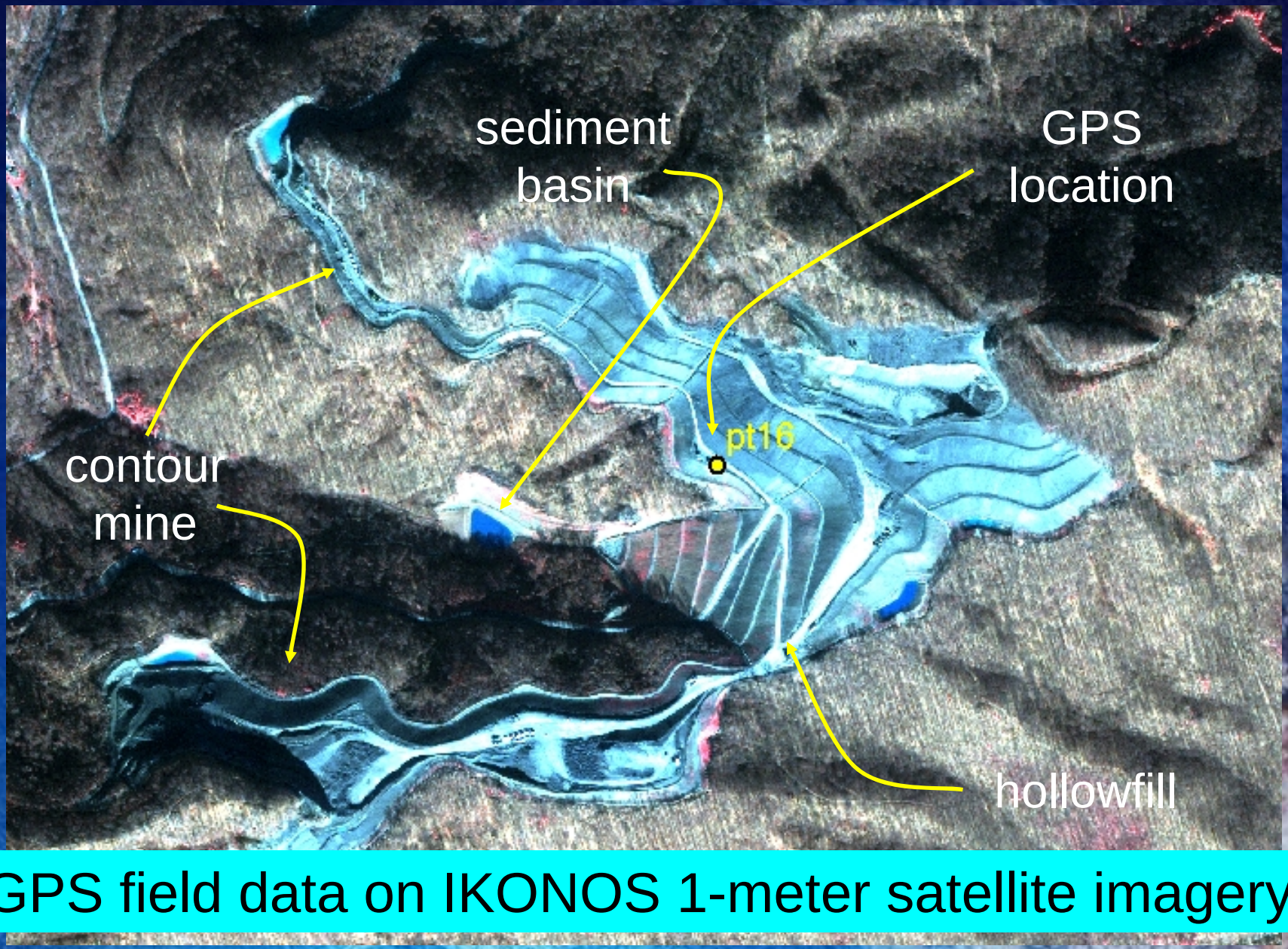
- 46 within a 1-mile radius of mine site
- 47 more between 1-2 miles away

and in the field.



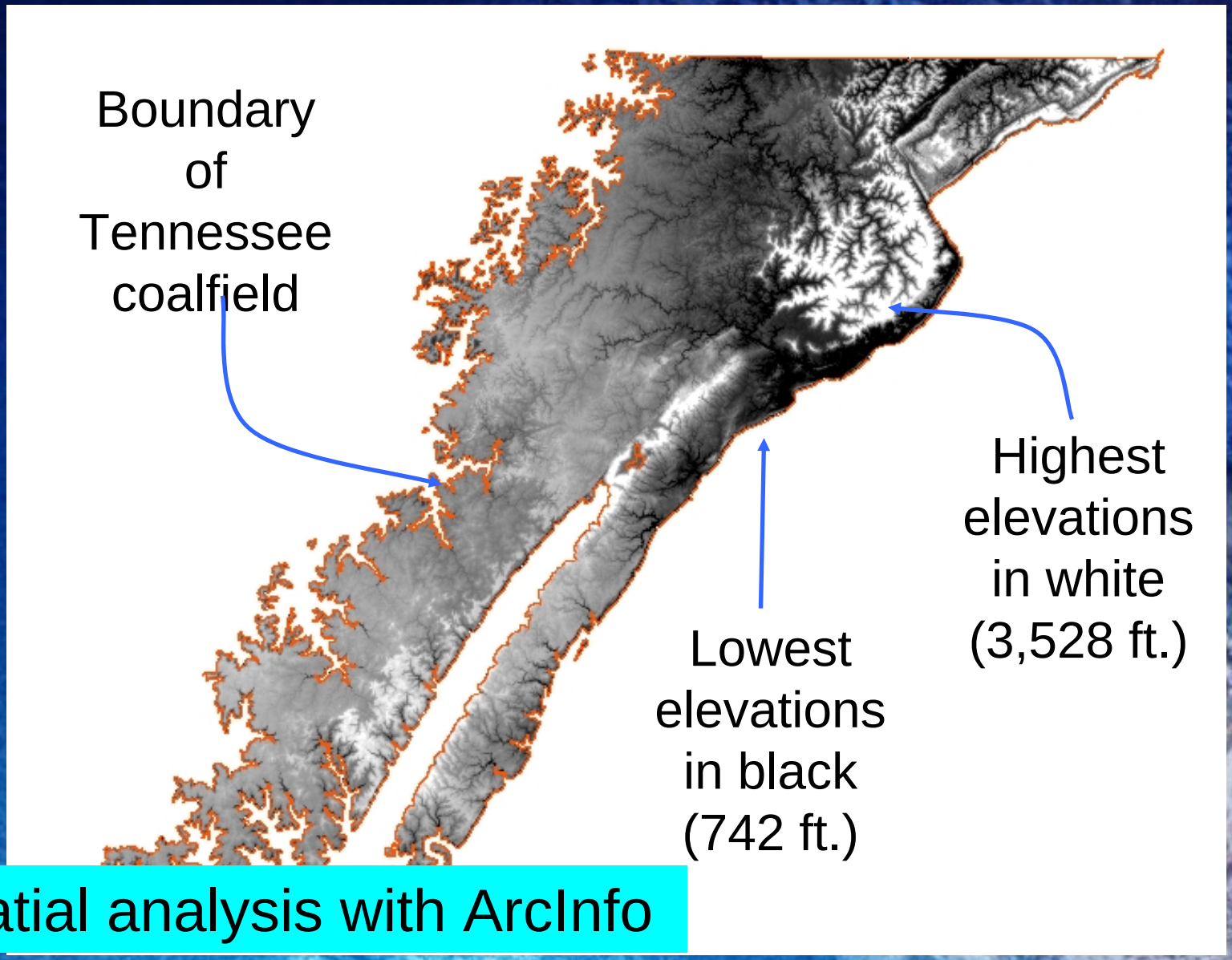
Digital permit boundary on aerial photography

We learned to use advanced tools



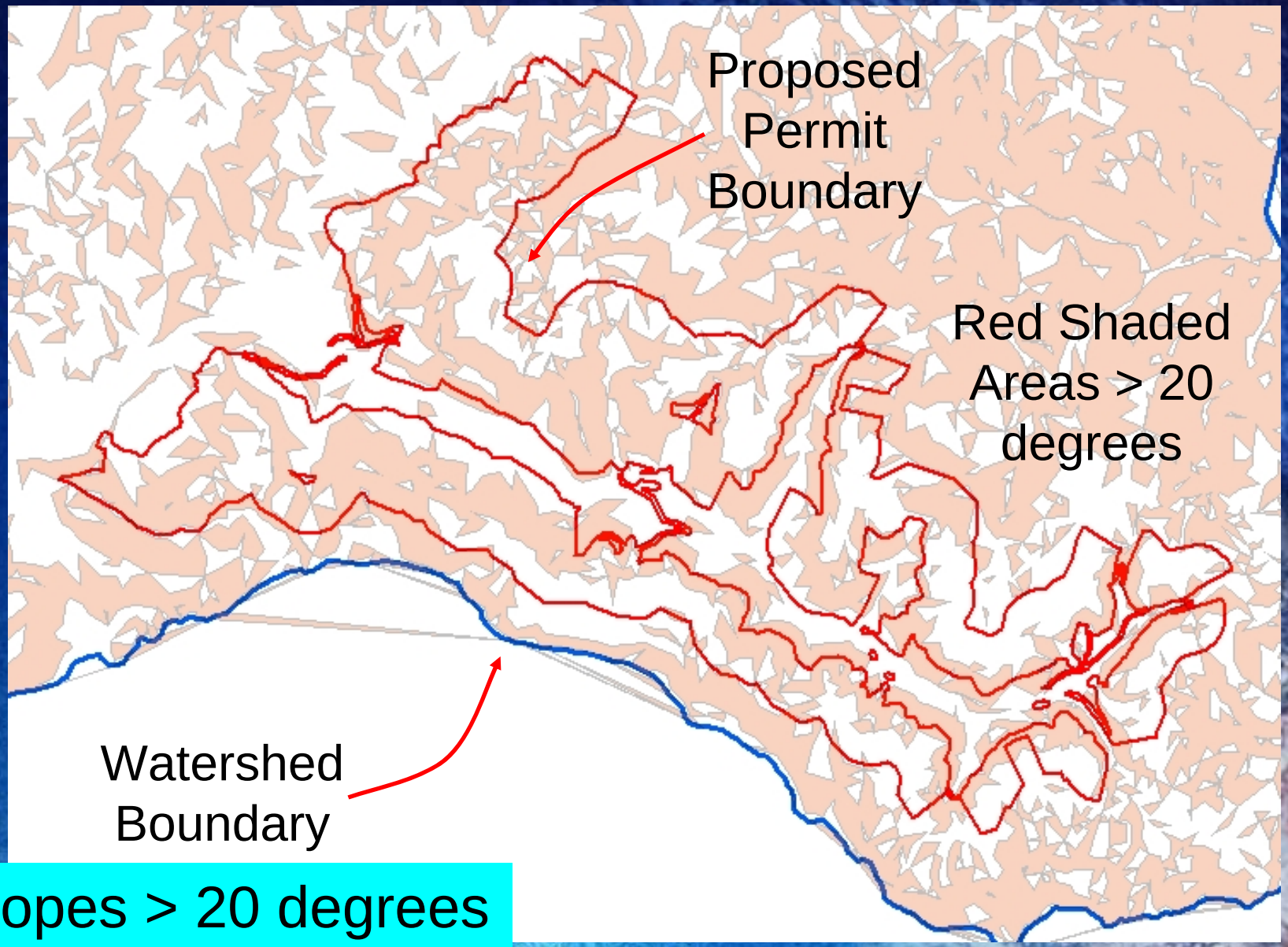
GPS field data on IKONOS 1-meter satellite imagery

and perform advanced analyses



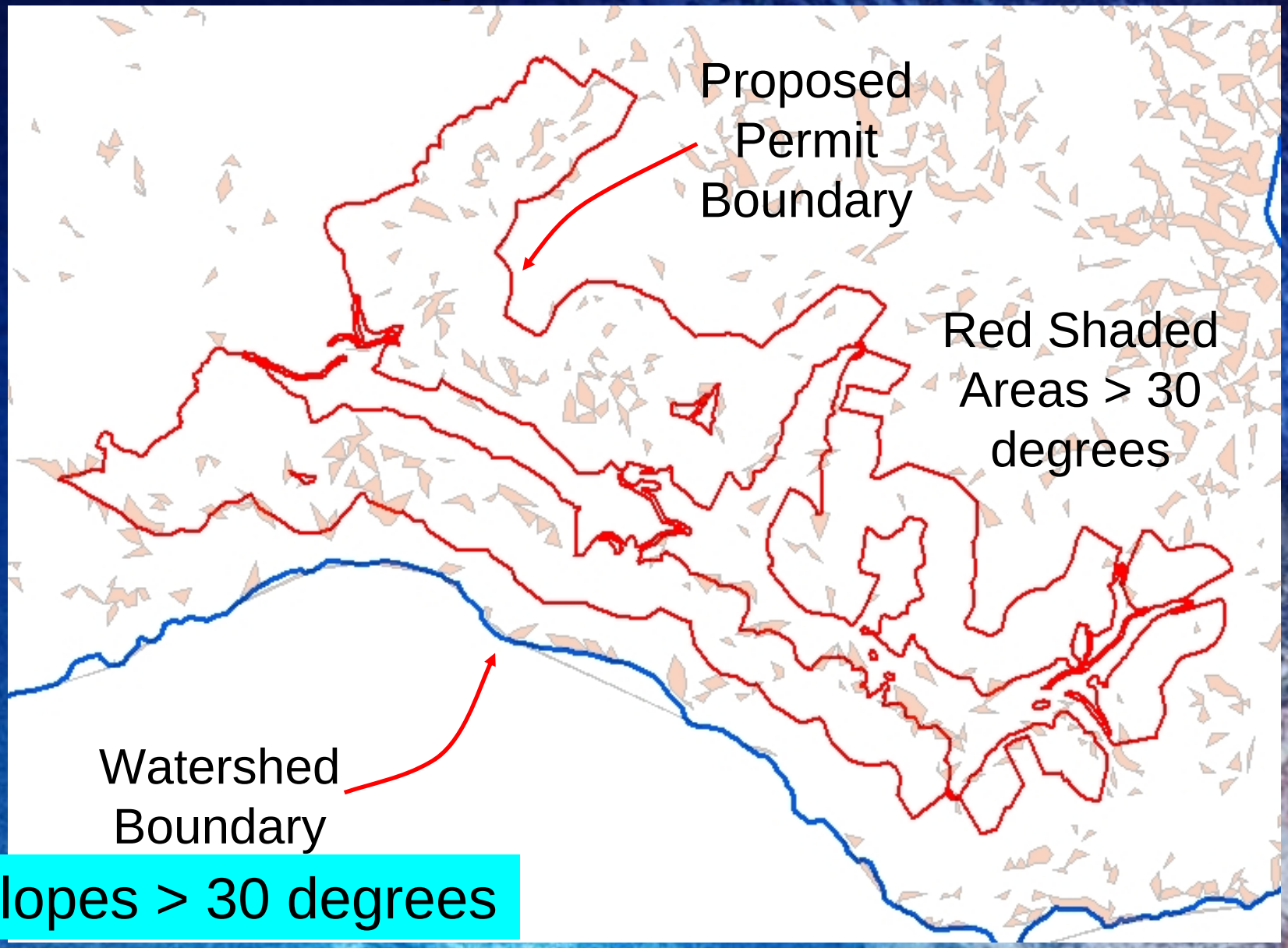
Spatial analysis with ArcInfo

that helped us identify problems



Slopes > 20 degrees

with greater accuracy.

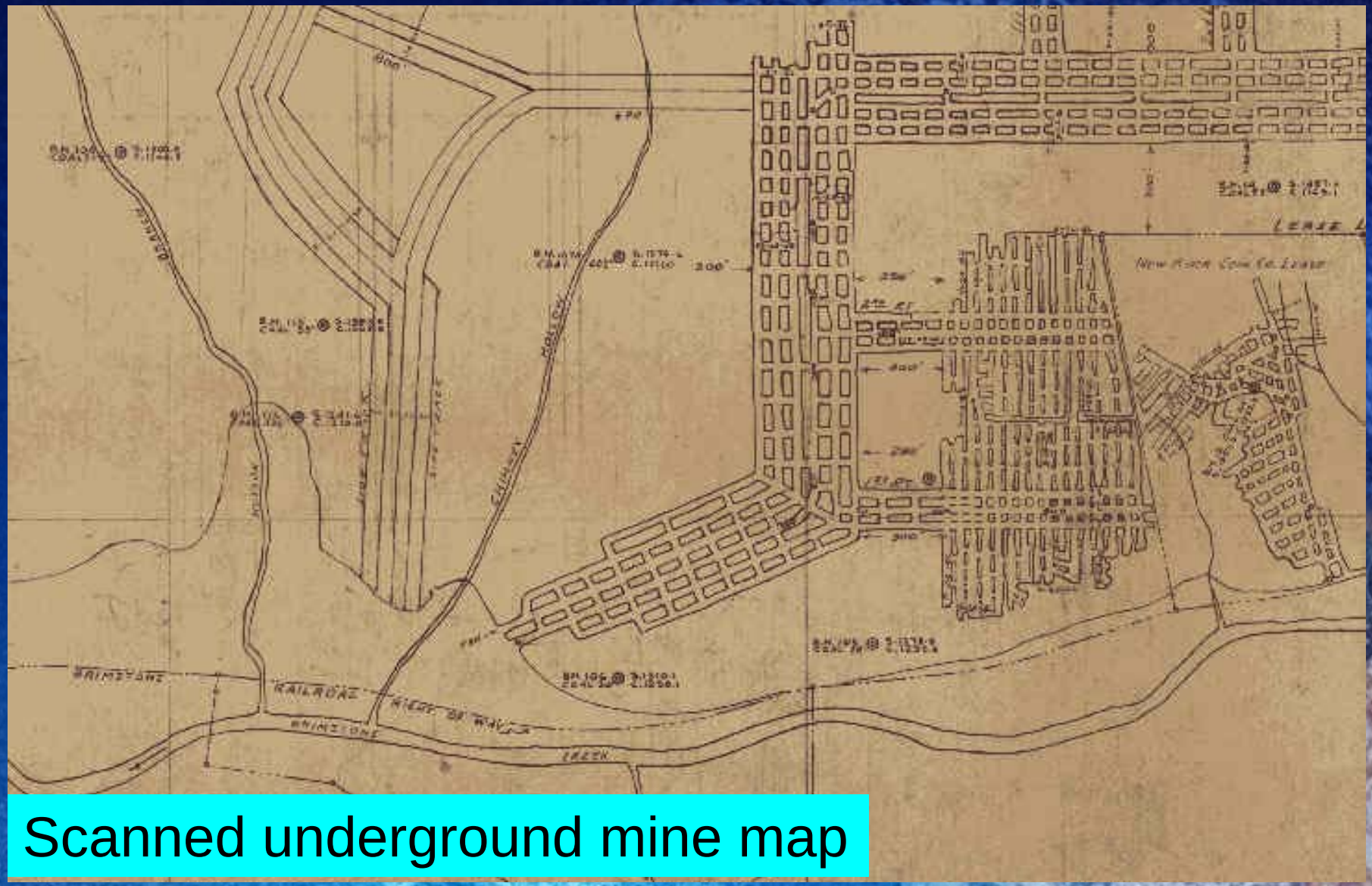


Slopes > 30 degrees

We began to collect legacy data

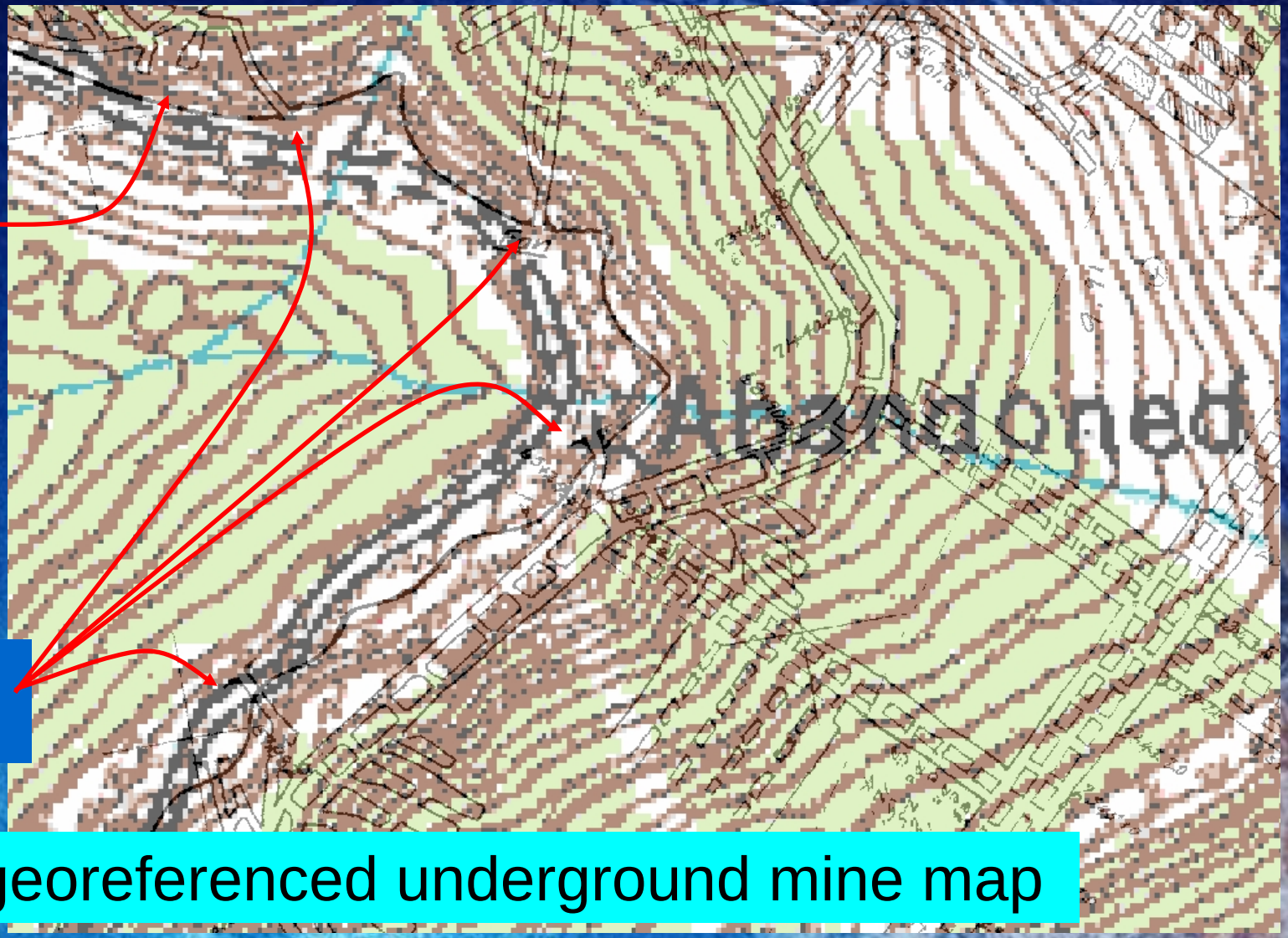
Scanning underground mine maps

before it was forever lost to time



Scanned underground mine map

to help us solve today's problems.

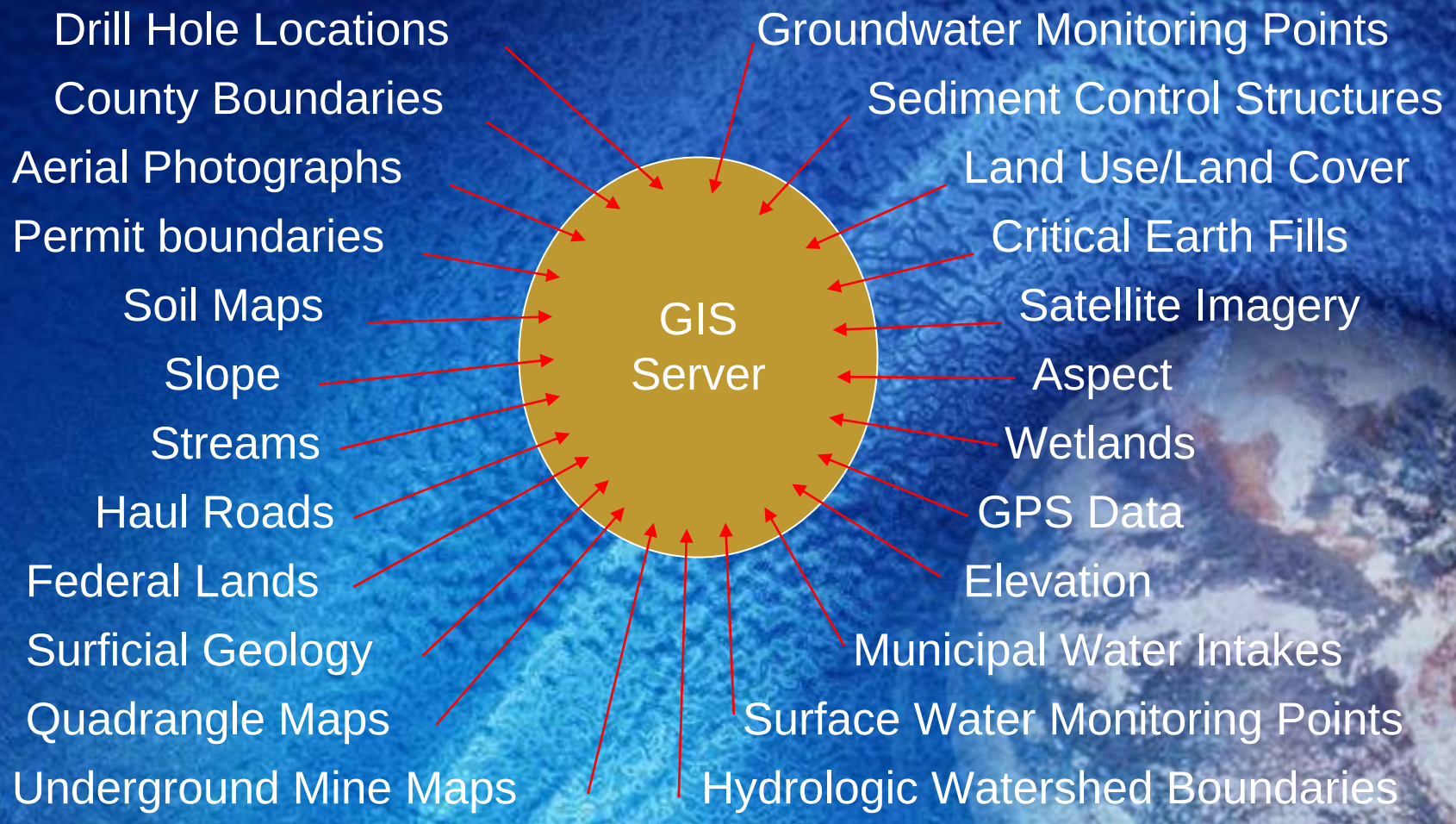


Coal Outcrop

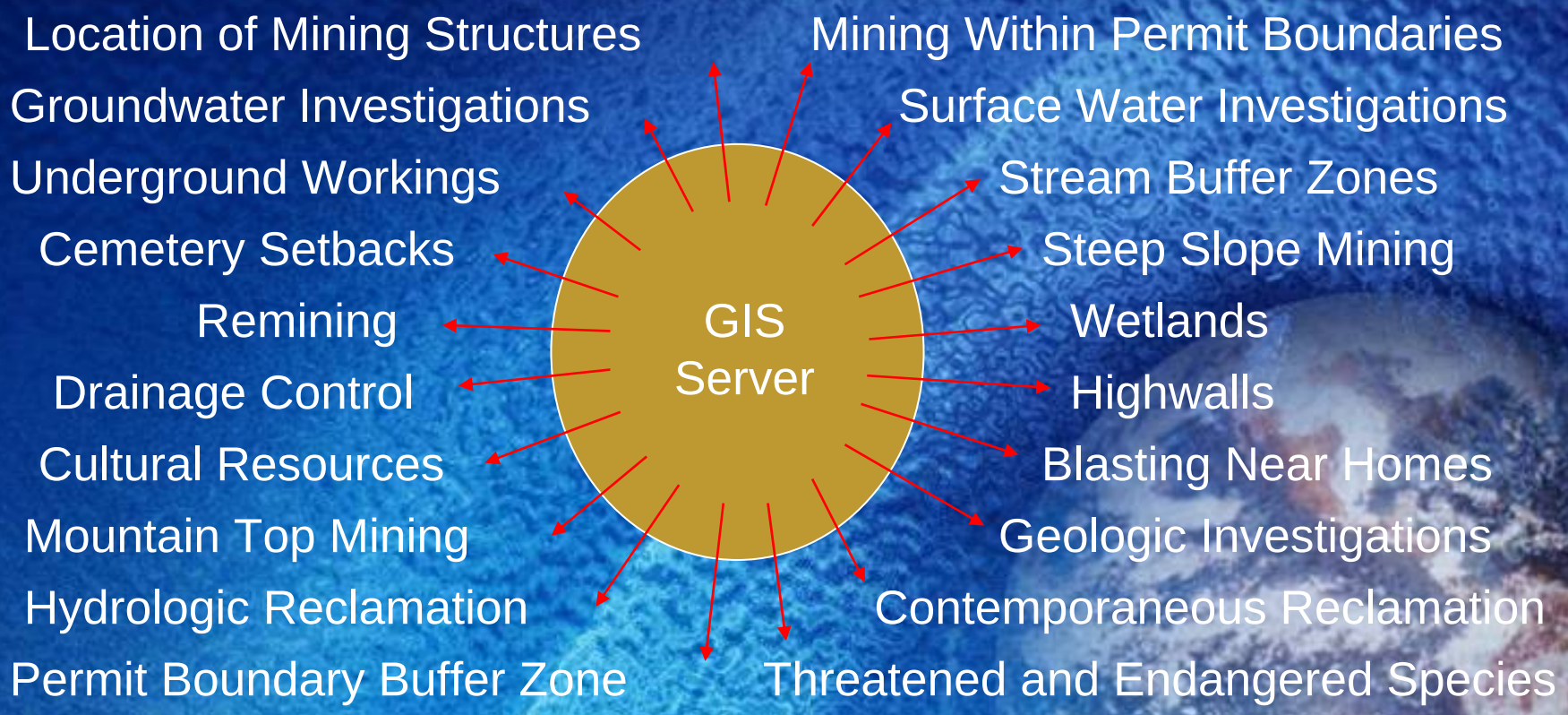
Abandoned Entries

Digital georeferenced underground mine map

We collect many types of spatial data



and use these data to solve problems.



Our business processes are changing.

Training

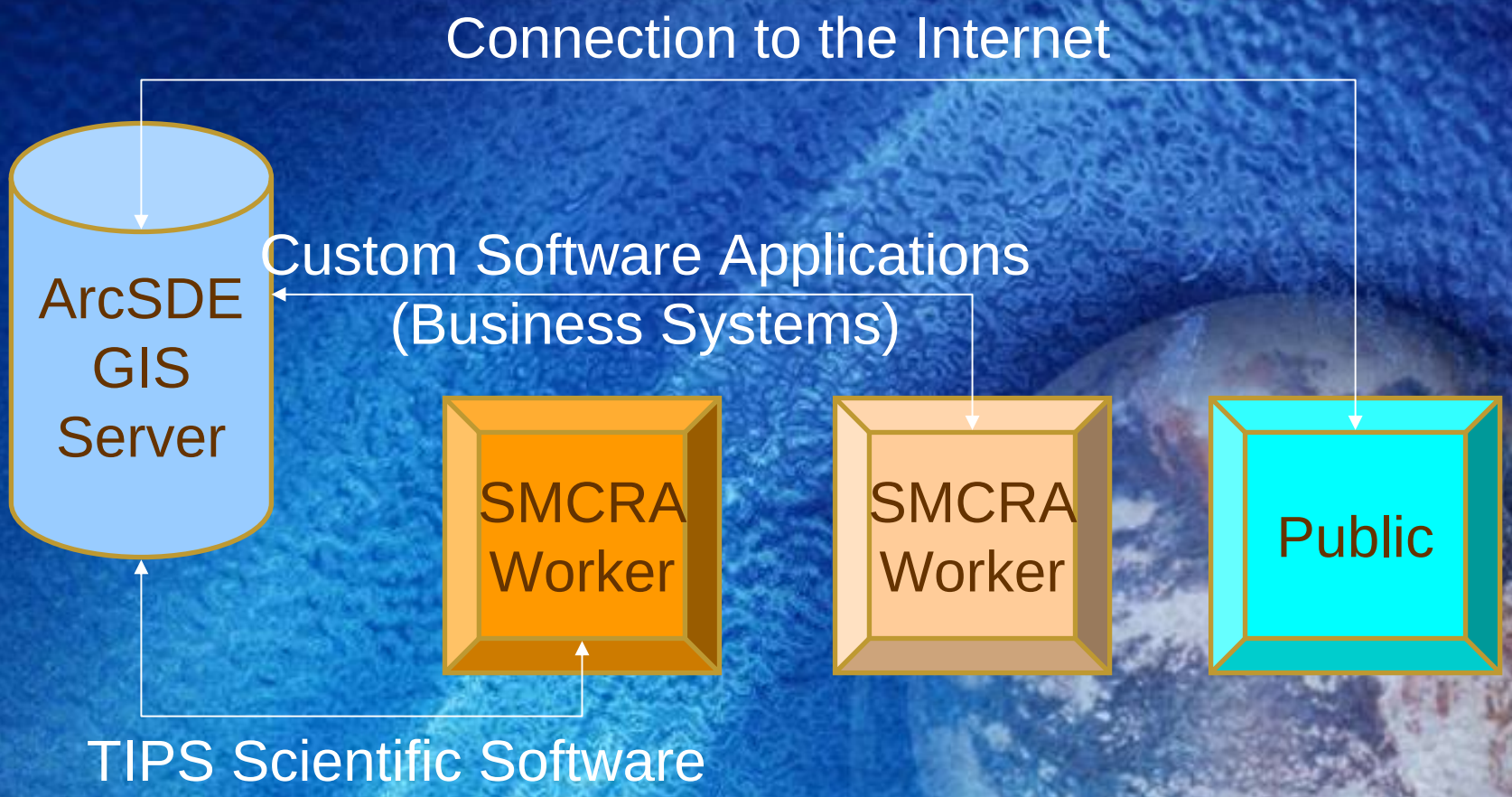
REGULATORY ACTIVITY	BUSINESS PROCESSES	DATA REQUIREMENTS	WORK PRODUCT
Permit Review	Geologic / hydrologic evaluation	Records of geology, surface water, ground water samples; location of mining operations	CHIA
	Engineering calculation	Engineering drawings, location of mining operations	Bond Calculation
	Biological review	Locations of environmental resources, [illegible] resources, mining operations	FONSI, Decision Documents
Mine Site Inspection	Inspection	Location of mining operations	Inspection Report
	Inspection	Location of mining operations	Enforcement Action
Citizen Complaint Investigation	Investigation	Locations of citizen and mining operations	Report
Bond Release Request	Bond release evaluation	Location of mining operations, records of water quality	Bond Release Report

Data

Increased demand for spatial data has brought new challenges

- Institutional spatial data storage and management
- Institutional DBMS storage of environmental attribute data
- Digitizing of hard copy maps
- Scanning of hard copy maps
- Specialized data conversion
- Specialized software applications
- Production of information products
- Sharing spatial data with others

requiring new solutions



that provide new information

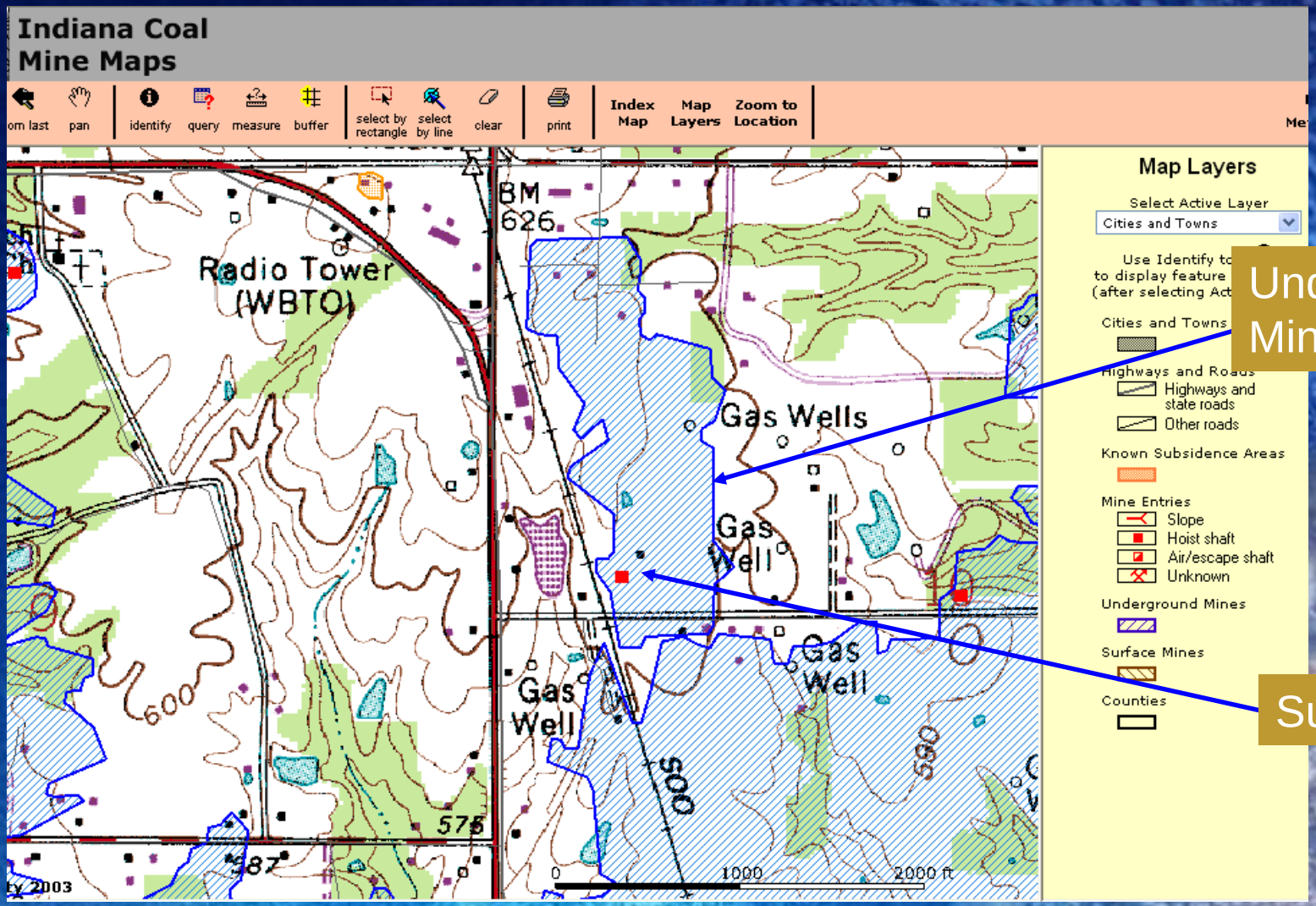
Sediment Basins

Under-ground Mining Extent

Mountain top

Kentucky Mine Mapping Information System

# of greater use to more people.



Indiana Coal Mine Information System on the Internet

Geospatial technology has become important to us

- Fundamental application to natural resources work
- Efficiently capture, store, update, manipulate, analyze, and display geographically referenced coal mining information
- Model spatial relationships to better understand and control the potential environmental impacts of surface coal mining operations
- Helps fulfill the requirements of SMCRA
- Helps us communicate digitally
- Helps us do a better job, more objectively, in less time

and it produces benefits.

- Increased efficiency and effectiveness
- Better agency work products
- Improved decision-making by the Regulatory Authority (RA)
- Better understanding of issues by public
- Enhanced appearance of accountability
- Improved public trust

Geospatial technology has ability to support our initiatives

- SMCRA organization business needs
- Electronic Permitting (EP)
- e-Government (disintermediation)
- President's Management Agenda
  - Expanded e-Government
  - Government reuse of data
  - Sharing information among government agencies
  - Automate internal processes to reduce cost
- Electronic work place (digital office)
- On-line Analytical Processing (OLAP)
  - Multidimensional analysis (time-series, trend analysis)

but its costs require careful planning.

- Data conversion
- Software
- Hardware
- Personnel
- Training
- Planning and management
- Intangible costs

Coal mining spatial data is governed by Executive Order and OMB circular.

- Executive Order 12906
  - Public access to geospatial data Sec. 3(c)
- OMB Circular No. A-16
  - Themes of national significance Sec 2.b.(1) and Appendix E
  - Applies to all agencies using spatial data Sec 5.
  - Applies to all spatial activities funded with federal funds Sec 6.
  - Agency responsibilities and reporting requirements Sec 8.a.
  - Spatial data are subject to Exhibit 300 Sec 8.b.

Geospatial technology helps us implement SMCRA.

30 USC Sections:

- 102(j) – Development of data and analyses
- 201(c)(8) – Information and data center on surface and underground mining impacts
- 507(b)(11) – Probable hydrologic consequences
- 522(a)(1) – Designating lands unsuitable for mining
- 522(a)(4)(B) – Database and inventory system … of different land areas
- 705(b)(2) – Inventory of surface coal mining and reclamation operations

and our regulations.

30 CFR Parts:

- 779 – Environmental resources information for surface mining permit applications
- 780 – Reclamation and operation plan for surface mining permit applications
- 783 – Environmental resources information for underground mining permit applications
- 784 – Reclamation and operation plan for underground mining permit applications

We are here today because geospatial technology

- Adds value to our work efforts
- Helps us evolve toward a digital working environment
- Requires careful planning
- Requires support from management
- Will become a component of our Information Technology infrastructure
- Will be essential in our SMCRA business processes

National Coal Mining Geospatial Committee

- Purpose
- Benefits
- Members
- Charter
- Technical Support Group

Purpose of NCMGC

- Promote development of geospatial technology to support SMCRA
- National forum to identify geospatial needs of SMCRA organizations
- Discover and share best practices
- Help in migration to enterprise geospatial architectures
- Help implement change
- Help improve SMCRA business processes

Benefits of NCMGC

- Find highly qualified geospatial expertise
- Share technological successes
- Help meet development requirements with available resources
  - Reduced budget
  - Limited personnel
- Faster implementation of geospatial technology
- Help meet requirements for spatial data compliance

NCMGC Members

- IMCC – Larry Evans, WV
- NAAMLP – Doug Mullins, VA
- WIEB – Rick Koehler, NM
- OSM AR – Bill Card, TN (Chairman)
- OSM MCR – Len Meier, IL
- OSM WR – Alan Wilhelm, CO
- OSM HQ – Vacant

NCMGC Charter

- Deliberative, advisory body
- Subject Matter Experts (SME)
- Represent SMCRA community
- Identify geospatial technology issues
- Facilitate sharing of geospatial technology
- Technical support personnel
- Supported by TIPS
- Report to Chief, TMD WR
- Executive Sponsor - Regional Director, WR

NCMGC Technical Support Group

- Subject matter experts
- Extension of committee
- Advise committee on technical matters
- Help share geospatial technology with others
- Short term tasking

Technical Support Group Members

Member	Organization	Specialty
Natalie Carter	OSM, CHFO	Geology/GIS/Remote Sensing
Jo Gault	OSM, AR	MS SQL Server, ArcSDE
Lou Hamm	OSM, AR	ArcPad, Mobile Computing
Daniel Lewis	OSM, AR	MS SQL Server, ArcSDE, Information Technology (IT)
Tom Mastrorocco	OSM, AR	ArcGIS
Greg Morlock	OSM, TIPS	MS SQL Server, ArcSDE, ArcIMS
Dianne Osborne	OSM, TIPS	Remote Sensing
Dan Rivers	OSM, WR	Information Technology (IT), Capital Planning Investment Control (CPIC)
Mike Shank	WV DEP	GIS Databases
Robert Welsh	OSM, TIPS	Global Positioning System (GPS)

NCMGC Activities FY 2006

Doug Mullins Presentation – June 27

NCMGC Communications Plan

Rick Koehler Presentation – June 28

Meeting Goals

- Establish Geospatial Data Stewards
- Inform Geospatial Data Stewards about NCMGC activities and plans
- Provide a forum to exchange ideas about using geospatial technology in coal mining
- Share successes in geospatial technology
- Provide recommendations to NCMGC for use in future planning efforts
- Promote development of geospatial technology for implementing SMCRA

Expectations for Geospatial Data Stewards

- Represent your organization
- Share your geospatial successes
- Help NCMGC identify geospatial technology needs and goals
- Communicate NCMGC vision, goals, and plans to your management
- Help advance the use of geospatial technology in the SMCRA business processes of your organization

Next

Results of SMCRA Geospatial Technology Development Questionnaire

Rick Koehler
New Mexico Mining and Minerals Division
Western Interstate Energy Board