

# Virginia's Approach

## Roundtable Discussion 1

### Acquiring and Preserving Map Images

**Intergovernmental  
Benchmarking Workshop on  
Underground Mine Mapping**

**October 15 & 16, 2003**

**Louisville, Kentucky**



# Acquiring Mine Maps

- Campaign launched through various media outlets requesting mine maps
- Maps & mine locations acquired through permitting process
- Private party donations
- Company archives
- Initiated communication with suspected map sources
- Accepted burden of acquiring maps & provided results to contributors

# Preserving Map Images

- Images are stored on a central server & can be accessed by all personnel
- Digitization of mine boundaries
- Use of GIS software for access
- Scanned image file formats



# Image File Format

- Standard format is tagged image file (.tif)
- Compatibility with multiple software packages and image viewing applications
- Upon request, images can be compressed into a Mr. SID file format
- Images compressed with Mr.SID can be used with a free downloadable viewer and is becoming more compatible with various software applications

# Scanning Solutions

- Portability of scanners are essential for on-site scanning of company mine map archives
- Large format decreases need to fold maps to scan = reduced image editing to merge images
- Associated scanner software allows manipulation of image files for increased image quality
- ColorTrac 5480 scanner will accept materials up to 12mm in thickness
- Ultimately the goal is to obtain the best scan possible at a file size that is manageable

# Large Format Scanners



Vidar – TruScan Titan



Action Imaging Solutions – ColorTrac 5480

# Cataloging

- Information derived from mine maps are put into a Microsoft sql database
- Creation of Index of map archive
- Data, images and vectorized outline are used to generate numerous products



Map Information Data Tables

Maps		
PK	DMMEID	varchar(10)
	CollName	varchar(50)
	CollID	int
	MapID	varchar(12)
	Map_Date	datetime
	Date_Type	varchar(20)
	Scale	int
	Company	varchar(50)
	Final	bit
	SM	bit
	OM	bit
	Auger	bit
	Thick	bit
	Elev	bit
	Corehole	bit
	Gas_Well	bit
	VVH	bit
	Portals	bit
	H2O_Hzd	bit
	Roof_Fall	bit
	Drains	bit
	SP_Coor	bit
	LL_Coor	bit
	Co_Coor	bit
	SP_Northing	numeric(18,0)
	SP_Easting	numeric(18,0)
	LL_Lat_Deg	smallint
	LL_Lat_Min	smallint
	LL_Lat_Sec	numeric(5,2)
	LL_Long_Deg	smallint
	LL_Long_Min	smallint
	LL_Long_Sec	numeric(5,2)
	DD_Lat	numeric(14,8)
	DD_Lon	numeric(16,8)
	Co_Coalbed	varchar(36)
	Map_Comments	text
	Entry_Date	datetime
	Entry_Who	varchar(50)
	Georef_Method	varchar(50)
	Map_Quality	varchar(4)
	Cert_Eng	varchar(50)
	HasScan	bit
	HasGeoRef	bit
	HasVector	bit
	Map_Status	varchar(11)
	Crop_Line	bit
	Map_Type	varchar(50)
	Date_Unknown	bit

Maps_Counties		
PK	keyMapsCounties	int identity
I1	DMMEID	varchar(10)
	TblCnCode	varchar(7)
	TblCnName	varchar(14)

Maps_Mines		
PK	keyMapsMines	int identity
I1	DMMEID	varchar(10)
I2	MineID	varchar(7)

Maps_Places		
PK	keyMapsPlaces	int identity
I1	DMMEID	varchar(10)
	PlacesID	int
	Feature_Name	varchar(50)

Maps_Quadrangles		
PK	keyMapsQuads	int identity
I1	DMMEID	varchar(10)
	TblQuCode	varchar(4)
	TblQuDesc	varchar(20)

Maps_StandardCoals		
PK	keyMapsStdCoals	int identity
I1	DMMEID	varchar(10)
	Std_Unit_ID	int
	Std_Unit_Name	varchar(30)

Scans		
	Scan_Name	varchar(50)
	Scan_Who	varchar(50)
	Scan_Date	datetime
	Scan_DPI	varchar(50)
	Scan_Fmt	varchar(50)
	Scan_Path	text
	DMMEID	varchar(7)

### Mine Information Data Tables

Mines		
PK	<u>MineID</u>	varchar(7)
	MineIndex	varchar(7)
	FedID	varchar(8)
	PrevID	varchar(7)
	DMME_Coal	varchar(36)
	Co_Coal	varchar(36)
	Mine_Name	varchar(50)
	Operator	varchar(50)
	Company	varchar(50)
	Mine_Comments	text
	<b>Vectorized</b>	<b>bit</b>
	<b>Unknown_License</b>	<b>bit</b>
	<b>License_Possible</b>	<b>bit</b>
	Mine_Size	varchar(6)
	Lessor	varchar(50)
	Mining_Method	varchar(24)
	<b>Roof_Falls</b>	<b>bit</b>
	<b>Flooded</b>	<b>bit</b>
	<b>Drainage</b>	<b>bit</b>
	Date_Start	datetime
	Date_Closed	datetime
	<b>Enter_Date</b>	<b>datetime</b>
	<b>Enter_Who</b>	<b>varchar(50)</b>

Mines_Counties		
PK	<u>keyMinesCounties</u>	int identity
I2	MineID	varchar(7)
I1	TblCnCode	varchar(7)
	TblCnName	varchar(14)

Mines_Quadrangles		
PK	<u>keyMinesQuads</u>	int identity
	MineID	varchar(7)
	TblQuCode	varchar(4)
	TblQuDesc	varchar(20)

Amendments		
PK	<u>AmendID</u>	int identity
I1	MineID	varchar(7)
	Amend_Date	datetime
	Amend_Who	varchar(3)
	Amend_What	varchar(255)

Reference Tables

Personnel		
<b>PK</b>	<u>Initials</u>	varchar(4)
	LastName	varchar(50)
	FirstName	varchar(50)
	Middleinit	varchar(50)

Collections		
<b>PK</b>	<u>keyCollections</u>	int identity
<b>U1</b>	CollAbbrev	varchar(3)
	CollName	varchar(50)

Places		
<b>PK</b>	<u>PlacesID</u>	int identity
I1	Feature_Name	varchar(51)
	Feature	varchar(20)
	County	varchar(20)
I2	Quadrangle	varchar(36)
	TblCnCode	varchar(7)
	TblCnName	varchar(14)
	TblQuCode	varchar(4)
	TblQuDesc	varchar(20)

CountyTbl		
<b>PK</b>	<u>TblCnCode</u>	varchar(7)
	TblCnName	varchar(14)
	TblCnZone	varchar(4)
	TblCoCode	varchar(2)
	TblCoArea	varchar(1)

QuadrangleTbl		
<b>PK</b>	<u>TblQuCode</u>	varchar(4)
	TblQuDesc	varchar(20)
	TblQuCnty	varchar(2)
	TblQuBegLat	int
	TblQuEndLat	int
	TblQuBegLong	int
	TblQuEndLong	int
	TblQuDmrCode	varchar(4)
	TblQuBegNorthing	decimal(18,4)
	TblQuEndNorthing	decimal(18,4)
	TblQuBegEasting	decimal(18,4)
	TblQuEndEasting	decimal(18,4)

StandardUnitsTbl		
<b>PK</b>	<u>Std_Unit_ID</u>	int
	Std_Unit_Name	varchar(30)
	Rock_Type	varchar(10)
	Std_Unit_Code	varchar(4)

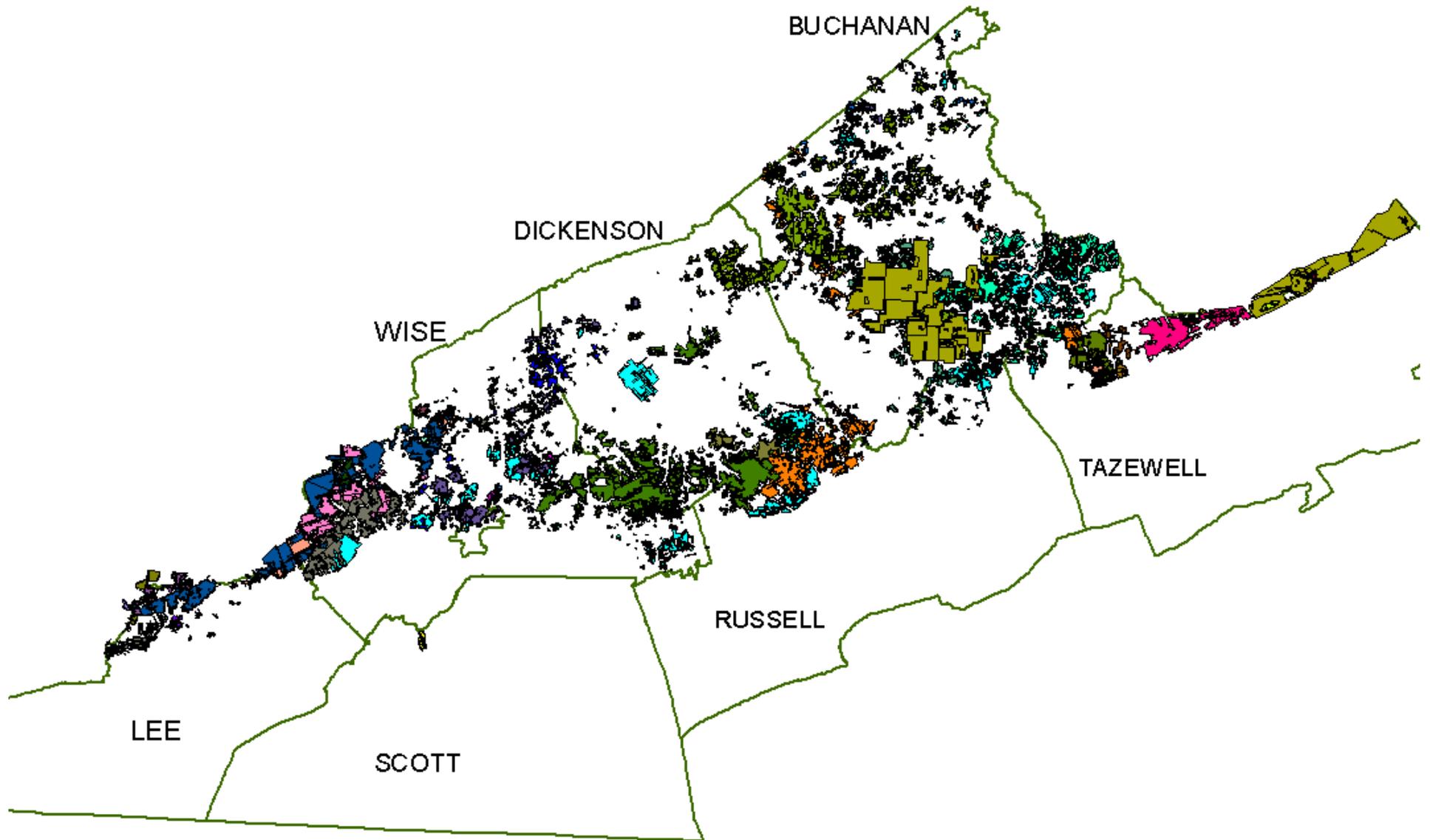
StdAliasTbl		
<b>PK</b>	<u>StdAlias_ID</u>	int
	Alias_Unit_ID	int
	Std_Unit_ID	int

AliasUnitsTbl		
<b>PK</b>	<u>Alias_Unit_ID</u>	int identity
	Alias_Unit_Name	nvarchar(50)

# Geo-referencing

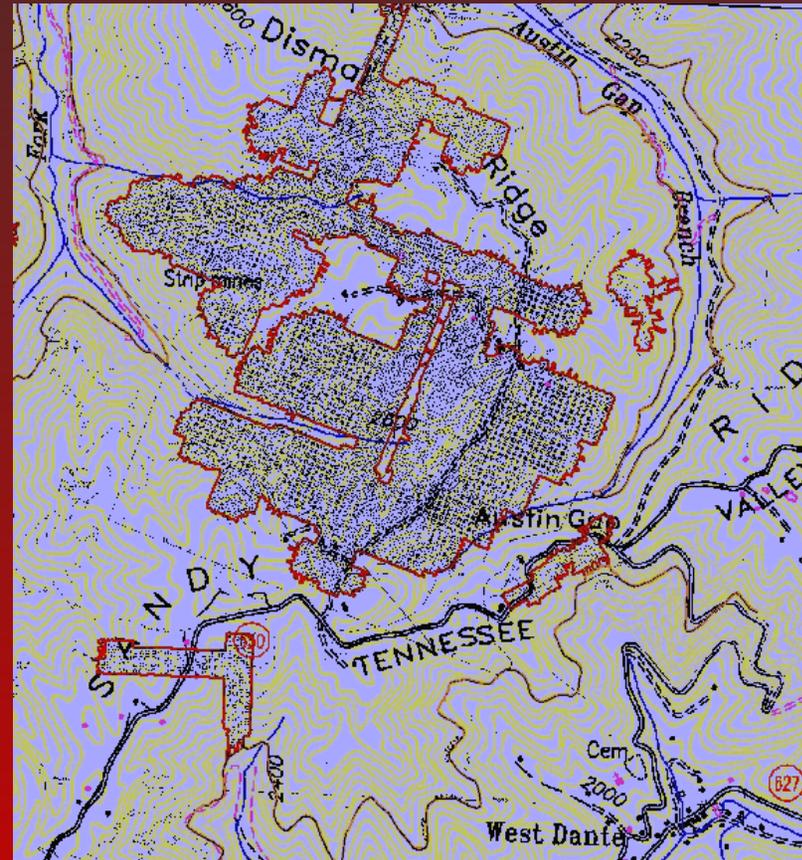
- Defining in real world coordinates how an area represented on the map fits on the earth's surface
- Maps geo-referenced into Virginia State Plane Coordinate System
- Information shown on the map such as coordinate grids, identifiable surface features, coal outcrop configuration, land tracts, etc., are used to place maps.
- Maps are geo-referenced using AutoDesk's AutoCAD Map

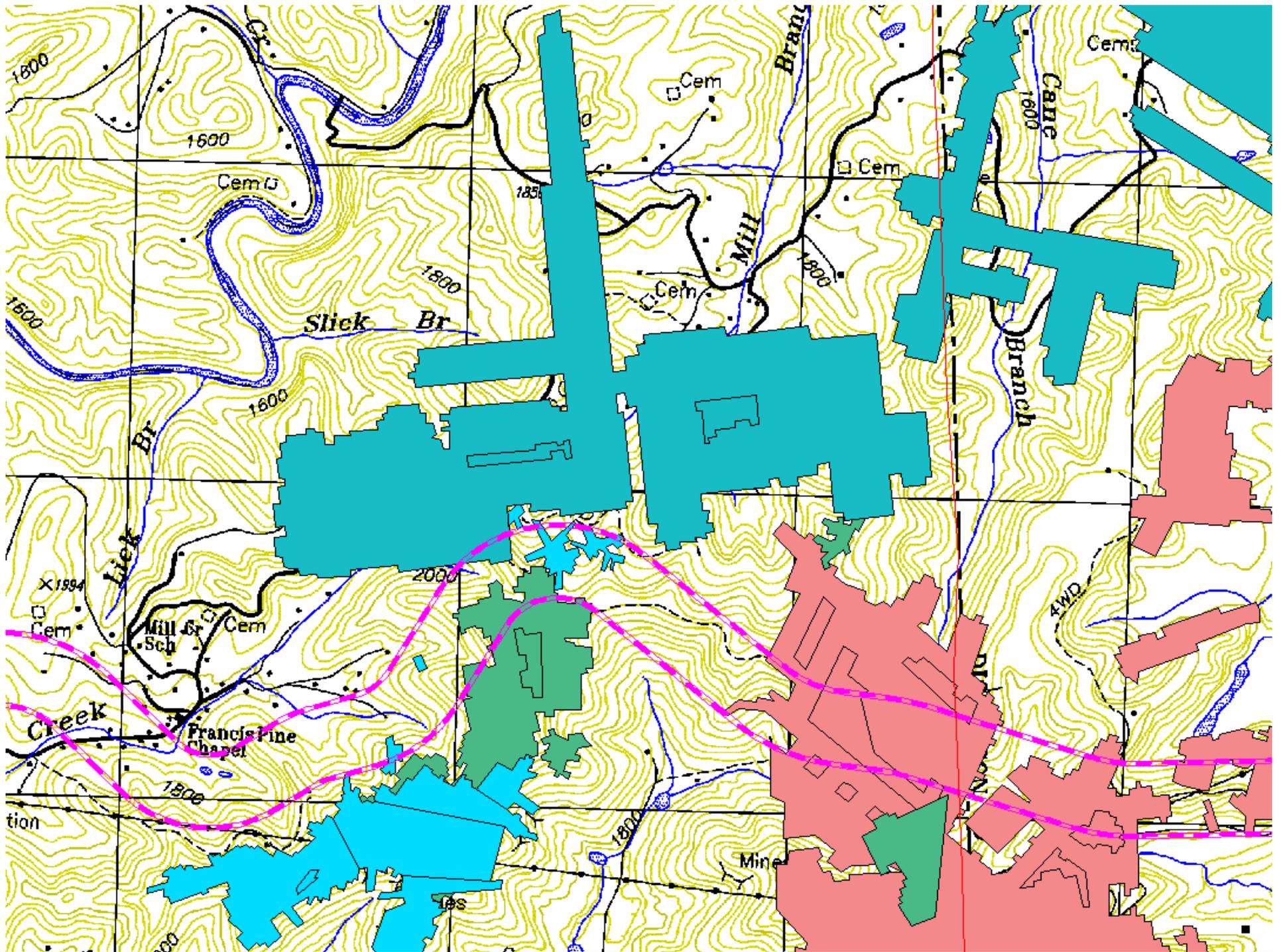
# Digitization



# Raster to Vector

- Image geo-referenced to Virginia State Plane Coordinate System
- Heads-up onscreen digitization
- Mine boundary linked to scanned image through index
- Mine boundaries are used with other DMME spatial data in GIS





# Spatial Data

- Regulatory Data
  - Water Monitoring
  - Permit Boundaries
  - Geologic Samples
  - Hollow Fills
  - PMU
- Basemap Elements
  - USGS Quad Index
  - Political Boundaries
- Easily Incorporated Features
  - Coalbed Mapping
  - Quad Maps
  - Orthophotography
  - Satellite Imagery

The screenshot displays a GIS application interface. On the left is a legend for 'View1' with layers like 'USGS\_MapGrid', 'Geologic\_data', 'Rainfall', 'Ground\_water', 'Npdes', 'Instream', 'Hollow\_Fills', 'Pending\_arcs', 'Permit\_Ed\_arcs', 'Permit\_poly', and 'County\_Boundaries'. The central map window shows a grid overlay on a map with various colored polygons. On the right, there are three windows: 'Attributes of Permit\_poly' (a table with columns: Shape, Area, Perimeter, Permit, PermitId, Permit, Color, count), 'Attributes of Hollow\_Fills' (a table with columns: Shape, Area, Perimeter, Fill\_poly, Fill\_polyId, Assoc), and 'Application\_PointData' (a code editor window containing VBA-like code for file operations and map view management). At the bottom right, a 'surface.apr' window shows a list of layers including 'Attributes of County\_Boundaries', 'Attributes of Geologic\_data', 'Attributes of Ground\_water', 'Attributes of Hollow\_Fills', 'Attributes of Instream', 'Attributes of Npdes', 'Attributes of Pending\_arcs', 'Attributes of Permit\_Ed\_arcs', 'Attributes of Permit\_poly', 'Attributes of Rainfall', 'Attributes of USGS\_MapGrid', and 'color.tbl'.

- npdes point
- instream point
- geologic\_data point
- WISE.dwg Polyline
- pillars
- DORCH\_WKS
- aband\_mnwks
- dorchester\_ug polygo
- blair\_ug polygon
- ortho\_index27.dxf Po
- VASTMG Polygon
- permitted polygon
- fill\_poly polygon
- permit polygon
- VASTCNTY Polygon
- 1200136.tif
- 09270ac.tif
- norton.sid
- wise1.sid

# Summary

- Proactive approach to obtaining mine maps
- Obtain the best scan possible at a file size that is manageable
- Have a system in place for indexing and cataloging
- Use images to create a usable digital product
- Use industry standard software, hardware and file formats for compatibility
- Implement methods & procedures for disseminating the data to the end user