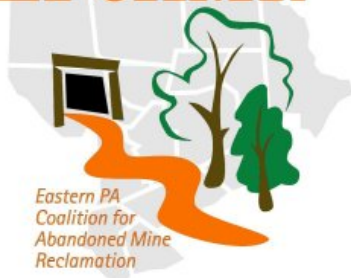


# EPCAMR



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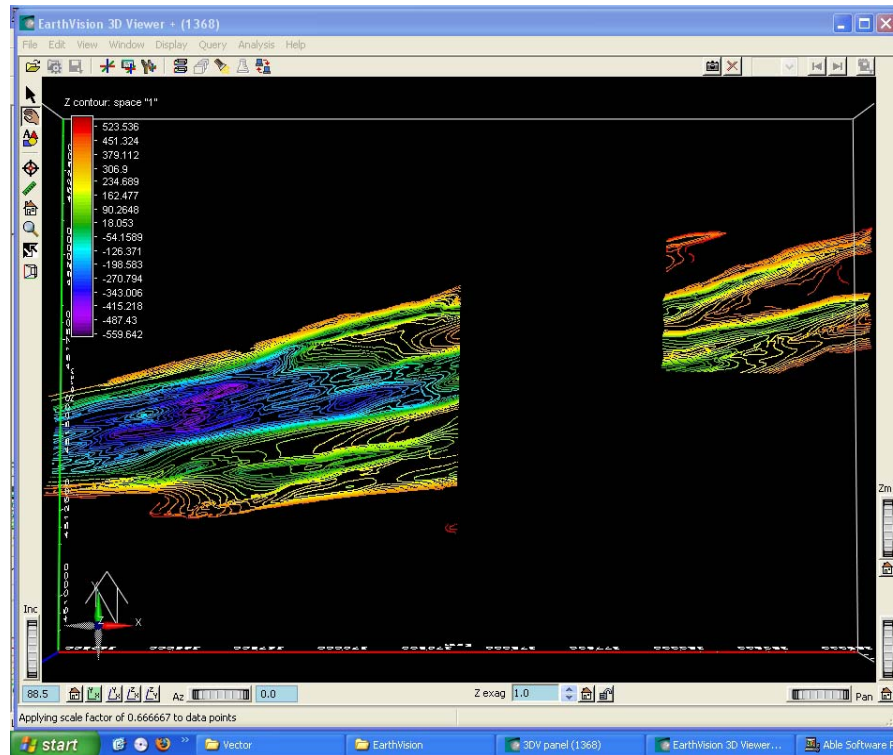
January 6, 2009

**Re: 3<sup>rd</sup> & 4<sup>th</sup> Qtr. 2008 Report of work done for Mine Pool Mapping Grant**

## **Mine Pool Mapping Update Work Progress Report (chronological)**

### August

- EPCAMR Staff participated in a conference call about the Mine Pool Mapping project
- Cleaned up and georeferenced the 5 Coal Investigations Series Maps provided by the Pottsville District Mining Office. The images needed to be adjusted for color and brightness using Adobe Photoshop. Then the maps were georeferenced in ArcGIS ArcMap using the Latitude / Longitude coordinates in the 4 corners of the maps and along the side.
- Autovectorized structural contours for C-48, C-19, C-10 and C-13 using R2V. This process recognizes and creates most of the contour vector lines from the raster map image, a very helpful and time saving tool. Connected lines and drew lines that the program missed to creates a complete contour map of the Buck Mountain Vein of coal (the lowest minable seam of coal in the region). Exported the raw data files from each map as a polyline .shp file for import into ArcGIS and a .dxf file for import into EarthVision. This process also merges the georeferenced coordinates, providing an X, Y and Z location for the resulting datasets. Once in EarthVision, the file was converted to scatter plot data and extra vertices were interpolated to reduce the "choppy" nature of the contour lines. A grid was also constructed in EarthVision from this dataset for each of the maps. Viewed these preliminary files in ArcGlobe, an ArcGIS extension for viewing 3D data. This program is less useful than EarthVision in viewing the data, but "fly around" movies can be easily produced as the 3D model is rotated.
- Received completed structure contours from Mike Dunn based on Copal investigation Series maps C-47 and C-25.
- Received additional C-series Maps at 400 dpi resolution from Kim Snyder, PA DEP BAMR Wilkes-Barre Office: C-3, C-7, C-12, C-13, C-14 and C-21. This completed the search for all the maps. Because these files were only 200 DPI the file size was readily accepted by Photoshop. The resolution was not as detailed as other maps, but with extra editing with advanced features in Photoshop, the images were still able to be autovectorized in R2V.
- On August 18, 2008, EPCAMR began plans to work on the entire Western Middle Anthracite Field (stretching from Trevorton to Delano); EPCAMR has entire section of the report that (EPCAMR & the DMO) can dedicate to mapping and 3D visualization; The raw data is being processed and can be turned into shapefiles as well as grids; EPCAMR is working with Roger to find inside tunnel elevations for 3D visualization purposes; Mike H. and Mike D. from OSM have been extracting structural contours and converting distances into meters on the C-Series Maps and given a UTM Zone 18 North projection (*draft image file below*); The Buck Mountain and Mammoth Veins have been digitized separately as marker beds; Participated in a conference call with PA DEP, USGS, OSM, and PA DEP DMO



- As a follow-up to the conference call, Dan Goode and Chuck Cravotta, USGS discussed the mine-pool water-level data provided by BAMR; They reviewed and edited the data for the Western Middle Field with a goal of associating the x-y-z information for each of the **48** boreholes; All boreholes had at least one value for monitoring point elevation (MP\_ELEV1); These values were used to compute water level elevation from the depth to water data. Only **29** of the **48** boreholes (**60 %** of the sites) had GPS coordinates and GPS elevation (MP\_ELEV2); The difference between the two elevation values (MP\_ELEV1 - MP\_ELEV2) is as great as **105** feet. Coordinates are needed for **19** sites and surface elevation data need to be checked against topographic contour data for all **48** sites; Chuck created a shapefile to display in ArcMap;
- The new boreholeswmf shape file has the same coordinates as the earlier boreholes file, but it now includes the surface and mine-pool water-level elevation data as attributes, and it includes all 48 boreholes (but only the 29 sites with x-y coordinates display in ArcMap); Coordinates are still needed for 40 % of the boreholes so they can be plotted with the topographic drg and other GIS layers; Because some mine discharges and boreholes are near one another (not the same site; eg. Henry Clay Sterling shaft and borehole, Packer 5 borehole and well), USGS did not attempt to fill in missing borehole information based on AMD site data; Effort is warranted to fill in the location data gaps, mainly x-y coordinates, and also to verify elevations for those borehole sites with large potential errors (differences in MP\_ELEV); At these boreholes, it may be helpful to get GPS readings (x-y-z) and, while at the site, measure depth to water; This will validate earlier monitoring; Chuck continued to work on this updating of information and provided additional updates through September 2008 on as much borehole information that he could find for the Western Middle Field; EPCAMR's impression is that the Pottsville DMO has the needed equipment for this work
- On August 19, 2008 EPCAMR requested that \$500 be moved from the Contractual Category to the Equipment Category to cover the remaining expenses that were over run in that category in our last request for reimbursement and to allow for a small cushion of funds in case there are any other unanticipated purchases that may be needed as we continue to work on the project

- On August 25, 2008 EPCAMR staff presented on our Mine Pool Mapping Efforts in Northeastern PA's Anthracite Coal Fields at the International ESRI 2008 GIS Conference in San Diego, CA which was well received and earned us a prime time spot in the Fall 2008 edition of ESRI's **ArcNews**
- On August 27, 2008, reviewed Roger's Chapter 5 Material on the Wyoming and Lackawanna Basin and provided comments on the document for inclusion with the PA Geological Survey Publication

#### September

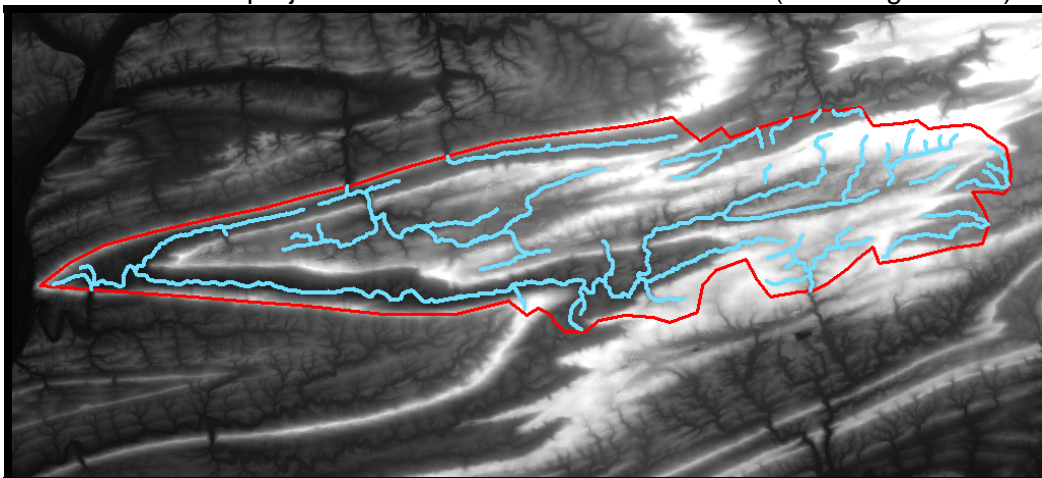
- Autovectorized structural contours for C-21, C-3 and C-7 using R2V. C-7, C-12, C-13, and C-14 not only had the Buck Mountain Vein, but also had areas where the lowest workable bed was the Mammoth Vein. These areas were treated separate from the buck mountain contours and a separate set of data was kept.
- Georeferenced the Bureau of Mines Report 538 series of maps for the Wyoming Valley to assess the reality of continuing this type of work in the northern anthracite coal fields.
- Created a layer of flooded strip pits based off the AMLIS inventory to show possible areas of mine pool water elevations manifesting themselves at the surface. Verified the location and existence of these water impoundments via DCNR's PA MAP color aerial photo and obvious errors were removed. Individual pits were classified as either a direct connection to the mine pool (water level fluctuates with mine pool like Commissioners Lake in near Shamokin) or indirect connection (AMD Discharge fills pit like the Excelsior Strip Pit near Shamokin).
- Posted the Mine Pool Mapping 2<sup>nd</sup> Quarter 2008 Report to the "Talking Timbers" section of the homepage.
- Adjusted the colliery boundaries and barrier pillar layers to the colliery boundaries and barrier pillars shown on the Coal Investigation Series maps. The original locations of these features were close, but probably less accurate. The georeferencing done on the original Bureau of Mines and Operation SCARLIFT maps was less accurate than the georeferencing done for the Coal Investigation Series Maps. Also, the Coal Investigation Series maps were drawn directly from OSM folio or similar detailed mine maps. Assigned an effective altitude and adjusted integrity values to the barrier pillars layer based on information found in Bureau of Mines Report 521: Barrier Pillars in the Western Middle Field. Assigned multi-colliery unit names to the colliery boundaries maps based on research done by Roger Hornberger and myself.

#### October

- Traveled to the OSM office in Pittsburgh to pick up a map digitizer and learn tips and tricks in EarthVision, ArcGIS and R2V.
- Created a spreadsheet of collieries based off 2 merged GIS layers that were available for the southern middle coal field. Roger will use this spreadsheet as he searches for the lowest bottom elevation from individual mine maps.
- Autovectorized structural contours for C-46, C-12 and C-14 using R2V to complete coverage for the entire western middle coal fields. Merged all the contours based on the buck mountain vein in ArcGIS and areas in C-7, C-12, C-13, and C-14 that only represented Mammoth vein to make 2 layers that represented the bottom bed of coal.
- Worked with Chuck Cravotta and another USGS staff member to find additional locations for boreholes in the USGS WRIR 85-4038 Report for the western middle anthracite coal field mine pools by L. A. Reed. The same was done for the southern anthracite coal field, except no WRIR report was present for this field. Chuck compared this information to points in an internal monitoring point database to fill in the data gaps. The data was then merged with the BAMR borehole locations into a spreadsheet and GIS shapefile for use in the project. Attributes were created including: the name of the borehole, the colliery in which it was sunk, X and Y coordinates, a surface elevation of the borehole, a bottom elevation of the borehole, an average

pool elevation, a standard deviation for the pool elevation, a maximum and a minimum for the pool elevation. Separate shapefiles were created for each of the coal fields.

- Began to research structural maps for the southern anthracite coal field. Discovered that there was a series of miscellaneous investigation maps, but structural contours were not available. Consulted Mike Dunn on the problem and he recommended that I speak with Skip Pack from Dynamic Graphics Inc. Skip mentioned that similar work had been done to show seismic zones in California, however unrelated, the steps to produce a tupe of model called a fault block model was similar. He offered to work up a series of steps to integrate plain view maps with lines of section and the cross sections like those present in the miscellaneous investigation maps: I-689, I-681, I-528, I-529, I-809 and I-737. This process may also work to make 3D models of OSM Folios in EarthVision. Digitized the line of sections (A-G) in the plan view map and 2 coal veins (5 and 8) from cross sections on the I-689 map and sent them to Skip for development.
- On October 1, 2008, Mike sent along 3 shapefiles to replace the colliery boundaries, barrier pillars and tunnels for the project; Going through the Coal Series Investigation maps, we were finding that the locations of these features were much better represented and Mike seems to trust their location much more since the C-Series Maps are products of original mine company maps; EPCAMR lined them up in Arc GIS based on tick marks on the maps with definite latitude / longitude coordinates;  
( Changes to note. In the colliery boundary layer EPCAMR added a few attributes to represent the multi colliery hydrologic units (MCU) that Roger and Mike have been building. The tunnels layer has a few more inside elevations and portal elevations filled out thanks to the CSIs. The barrier pillar layer has a new attribute from BOM 521 showing the effective altitude to help explain the integrity judgment. Just a note, the thickness of each bed and minimum barrier pillar width in the respective beds are also recorded in BOM 521, but not taken from the report and placed in the layer.)
- On October 2, 2008, Kim Snyder from PA DEP BAMR informed EPCAMR that they have a number of miscellaneous digital USGS maps of the Southern Anthracite Field, scanned from OSM's collection; These include C-43, GQ-689, GQ-690, GQ-691, GQ-1054, I-528, I-529 ("I" Series Maps) and PP-602; Mike met with Kim to pick them up and load them onto our Maxtor External hard drive
- On October 10, 2008 EPCAMR received and reviewed the USGS Quarterly Report from Jul 2008-September 2008 and corresponded with the Dauphin County Conservation District with regards to the billing; **See attached USGS Quarterly Report;** Chuck Cravotta provided EPCAMR and the DCCD with a quarterly progress report; USGS expects that they will begin data evaluation and development of the conceptual model for the Western Middle Field during the next two quarters
- On October 20, 2008, Dan Goode-USGS provided EPCAMR with a draft image of the model area of interest for the project area in the Western Middle Field (see image below)



- Mike is currently  $\frac{3}{4}$  of the way through creating the structure contours for the Western Middle Field, but took this little bunny trail to update files as requested by partners; EPCAMR has created individual structure contours and has completed a single merger structure contour shape file for the entire Field; The metadata is as complete as we can make it at this time
- Mike has been working with a technical support member from Dynamic Graphics, the makers of Earth Vision to work on a work flow that would allow EPCAMR to create 3-D graphics out of cross-sections on the maps that we have in-house
- Received and reviewed a copy of Roger Hornberger's Monthly Progress Reports; Reviewed reference documentation that was attached with the Reports; **See attached Progress Reports and Reference Documentation for August, September, October, November, & December 2008**; Submitted Invoices to EPCAMR for reimbursement
- Received and reviewed a copy of Ian Palmer's Monthly Progress Report's ( **See attached ICP 08 08,09,10,11 & 12 Progress Reports**; Submitted Invoices to EPCAMR for reimbursement
- EPCAMR was the recipient of one OSM's Altek 36" x 48" active area digitizers that they are going to be putting into surplus; EPCAMR picked up the piece of equipment valued at **\$4792.00** from the Pittsburgh Office over the summer

#### November

- Traveled to the PA DEP District Mining office in Pottsville for a meeting of the Mine Pool Mapping Project Team. USGS staff updated the team on their efforts and preliminary MODFLOW modeling of the western middle anthracite coal field.
- Worked with Chuck Cravotta and another USGS staff member to rectify locations for AMD Discharges in the western middle and southern anthracite coal fields in a GIS shapefile extracted from the USGS WRIR 83-4274 Report by D. J. Growitz. Attributes include: the local name of the discharge, the colliery from which it emanates, X and Y coordinates, flow in cubic feet per second (CFS), temperature in degrees Celsius, specific conductance, pH, sulfates, iron, alkalinity and acidity all in milligrams per liter, and iron and acid loadings in kilograms per year. Another iteration of this dataset was modified by EPCAMR to begin assigning surface elevations to the discharges, perhaps future work will be done to merge the elevations back into this dataset. Separate shapefiles were created for each of the coal fields.
- On November 6, 2008 Chuck provided EPCAMR with a reference document entitled, Use of Mine Pool Water for Power Plant Cooling Thomas J. Feeley, III Product Manager – Innovations for Existing Plants Program-U.S. Department of Energy-National Energy Technology Laboratory-Under contract W-31-109-Eng-38 from September 2003 for review
- On November 13, 2008 EPCAMR Staff participated in a meeting with the USGS, PA DEP BAMR, PA DEP DMO, DCCD, and USGS to review the work on the Mod-Flow Model of the Western Middle Field to date

#### December

- Mike Dunn calculated an offset of the mammoth vein for C-7, C-12, C-13, and C-14 to interpolate buck mountain vein and created a master layer of the buck mountain vein. He was able to use a formula to generate the new data with an offset of 100 meters lower in elevation. Mike also converted this layer into a grid in EarthVision and began to divide the contours into larger synclinal basins where common water would gather.
- Began writing the methods section for the final report that Roger Hornberger is compiling. The methods section will describe the different data layers and how they were created. This section will be very important to the integrity of the report.
- Received a polyline file from Mine Dunn which delineates mined and un-mined areas in the buck mountain vein from the Coal Investigation Series Maps. Surprisingly, the mined areas are

much smaller than expected. The areas may be much larger however, since underground mining continued for some time after the maps were produced in the 1950's – 1970's.

- Compiled reports and numbers for this 3<sup>rd</sup> Quarter Mine Pool Mapping Project Report.

January

- On January 6, 2009 EPCAMR Executive Director and EPCAMR Staff prepared GIS Mine Pool Mapping Report to keep everyone updated on the project from August 2008 thru December 31, 2008 and forwarded the Progress Report and Reimbursement to Dan Koury, Project Officer to be forwarded upon approval to the Growing Greener Grants Center

Respectfully Submitted,

A handwritten signature in black ink that reads "Robert E. Hughes". The signature is written in a cursive, flowing style with a long horizontal stroke at the end.

Robert E. Hughes  
EPCAMR Executive Director  
Luzerne Conservation District AML Program Manager