Data Management for OSMRE Mine Pool Project at Ohio University: Lessons Learned

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Outline

• Project Overview
• Work Flow
• Data Entry
• Quality Assurance/Quality Control
• Data Tracking
• Digitizing Data & ArcGIS Online Map
• Continued Work & Lessons Learned
Project Overview

**Title**: ‘Tools to predict the hydrological response and mine pool formation in underground mines’

**Goal**: Produce an ArcGIS tool for prediction of post-mining water level

- Office of Surface Mining Reclamation and Enforcement (OSMRE) funded project with Ohio University Voinovich School & Department of Geological Sciences
- Coal companies lack a reliable method to predict a mine flooding post-closure
Goal for Data Collection

- To collect hydrologic, geologic, and existing mine data for development of database
- Use for better understanding of effects of underground mining
- Combined analysis of data to determine post-mining water levels
Work Flow

ODNR scans mine permit → ODNR redacts non-public info → Geology students select data from permit → Send data to Voinovich students for entry → QA/QC

Send data to OU OSM Team → Geology students select data from permit → Send data to Voinovich students for entry → Send data to Geology students for analysis

The best student-centered learning experience in America
Various Data Sources

• Ohio Department of Natural Resources (ODNR)
  – Online Mine Viewer
  – Online Well Viewer
  – Mineral Resources
  – Geologic Survey
  – Water Resources

• US Environmental Protection Agency (EPA)
  – National Pollutant Discharge Elimination System (NPDES) permits

• All of data obtained is public information
Initial Data Entry

- Well and borehole data are selected from permit file
  - Wells are selected that have static water level (SWL) values
  - Borehole data relevant to the study is selected
  - When possible, boreholes selected form an even geographic distribution

- Data is extracted to a standardized Excel sheet

- Data sheets go through QA/QC process
Secondary Data Entry

- Quarterly Monitoring Report (QMR) data is extracted
  - Only for post mining dates
  - Have static water level (SWL) and XY values
  - Standardized Excel sheet like previous wells
Quality Assurance/Quality Control

- Completed by student that did not select or enter data
- ~10% of the data is checked to find & correct mistakes
- Several methods for finding inconsistencies
  - Borehole lithology percentages are totaled to look for outliers, far from 100%
  - Elevations, SWL, depth from surface values are sorted to look for outliers
- New Qc'd Excel is uploaded, used for digitizing points
Data Tracking

• Needed for communication
  – Team members with differing schedules
  – Extensive amount of complex data to organize and format

• Tracking through shared Excel sheets

• Easy reference for:
  – Who is entering data and when they finish
  – Tracks stage of entry of each permit
*9 of 28 mines were used in full analysis:

Required complete data sets and non-active mines
Digitizing Data & ArcGIS Online

- QA/QC sheets are projected into ArcMap as a shapefile
  - Will be used for creating ArcGIS tool
- Added to ArcGIS Online for easy reference
- ArcGIS Online was used to make selections of boreholes and wells pulled from the permit files

http://ohiou.maps.arcgis.com/apps/presentation/index.html?webmap=c6c5d88d17744e85b131b9e465143747&slide=1
ArcGIS Produced Data

- Acreage of nearest mines within 1, 2, and 4 mile buffers
- Acreage of all mines
- Calculated buffer areas for both abandoned mines and other study mines
ArcGIS Produced Data

- Identified nearest borehole to each well
- Calculated distance to borehole
- Used for lithological reference for each well in analysis
### Data and Formats Provided

<table>
<thead>
<tr>
<th>Excel</th>
<th>Shapefile</th>
<th>ArcGIS</th>
<th>Misc. Uses for Analysis</th>
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</thead>
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<td>Borehole &amp; Well Data</td>
<td>Boreholes &amp; Wells</td>
<td>Borehole &amp; Well Study Area Layer</td>
<td>1000 Acre Grid</td>
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<tr>
<td>QA/QC Borehole &amp; Well Data</td>
<td>Water Withdrawal Points</td>
<td>Buffered &amp; Clipped Surrounding Mine Area</td>
<td>Points for Surfer Map</td>
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<tr>
<td>Entered QMR data</td>
<td>Selection of Mine Area Extents</td>
<td>Various Point Distance Calculations</td>
<td>Points for MODFLOW</td>
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<td>QA/QC of QMR</td>
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<td>ArcGIS Online map for viewing</td>
<td>Maps of Mines Analyzed</td>
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<td>Real-time Summary Sheets of Each Mine</td>
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Continued Work

- Determine format for files needed in tool creation
- Finish development of geodatabase of collected data
- Create GIS tool from analyses and distribute
- Maintain organization of data for future research and application
- Analyze abandoned underground mines
Lessons Learned

- Communication and organization are key
- Takes time to develop a method for management
- Make realistic timelines
- Priorities between team members can differ
- Exciting/rewarding to see everything coming together!
Questions?

• Thank you to OSMRE and steering committee

• And all team members at Ohio University:
  - Dr. Natalie Kruse
  - Dr. Dina Lopez
  - Jen Bowman
  - Nora Sullivan
  - Rob Delach
  - Lindsey Schafer
  - Fred Twumasi
  - Zack Matthews
  - Undergraduate Voinovich scholars