SECTION IX: Mining Effects on Wetlands - Recent Progress

IX.A – Overview

The PA DEP tasked the University with analyzing of the number, type and size of wetlands undermined during the 3rd assessment period. PA DEP originally intended for the University to analyze the number, types and sizes of wetlands that were impacted by mining operations using information from permit applications, operator reports, stream loss investigation files, wetland loss investigation files, and wetland impact reports submitted by the CDMO to the Bureau of Watershed Management. However, for two reasons this was not, in general, possible. First, very little documentation from these sources was provided during the seven months of document gathering by the University at CDMO. There were two documented mining related wetland impacts and subsequent investigations carried out by the CDMO during the 3rd assessment period: the wetlands over the 4B panel of Mine Eighty-Four and the wetlands over the 4R panel of the Blacksville No.2 Mine. Second, detailed information established through field surveys was only available in permit applications submitted after October 2007, and the wetlands identified in those permit applications were not yet undermined at the close of the 3rd assessment period. Since the availability of this information is crucial to future assessments of mining related effects on wetlands, this study had the following goals:

- Provide an inventory of known wetlands undermined during the 3rd assessment period.
- Evaluate the extent to which detailed and appropriate information was present in permit applications submitted after October 2007.

Wetlands provide a wide variety of human and ecosystem services. These include flood control, water purification through chemical transformations, chemical absorption and adsorption, sedimentation of particulate matter, groundwater infiltration and prevention of excessive runoff, diminution of surface flow velocity and consequent reduction in erosion, enhancement of biodiversity through provision of water, food and nesting habitat and habitat for fish, wildlife, and plants, many of which occur only in wetland habitats, as well as providing important services for domesticated animals (Committee on Characterization of Wetlands, 1995). As a consequence of the myriad values they provide, wetlands were protected by federal law from degradation or destruction through the Federal Water Pollution Control Amendments of 1972 (P.L. 92-500), commonly known as the Clean Water Act, amended in the Clean Water Act of 1977 and the Water Quality Act of 1987.

The Clean Water Act defined wetlands as -

> *"Those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas."*

The predominance of longwall mining and the low prevalence of subsidence-associated surface water effects associated with room-and-pillar mining together resulted in wetland effects being associated entirely with longwall mining during the 3rd assessment period. As discussed in Section III, IV, and V, the greatest vertical subsidence basin occurs in the center of the mined panel, rising to the historical surface elevation over the adjacent gate road entries. The formation of a subsidence basin can affect wetlands in the following ways:

- Creation of new wetlands
  - First, the areas of greatest subsidence can be flooded by associated stream pooling, and low areas in the riparian zone can become wetlands as a result of associated flooding and/or shallower depths of soil saturation.
  - Second, even away from riparian zones, soils in subsidence areas can become saturated or inundated for all or part of the year because of the new proximity of the surface to the water table, and both hydric soils and typical wetland vegetation will subsequently develop.
- Loss of existing wetlands
  - The presence of elevated gateways and compression features, i.e. heaves and ridges, in areas that previously harbored wetlands.
  - The loss of groundwater through tension cracks resulting from the extension of bedrock layers during subsidence.

Until October 2005, reporting on wetlands in mining company permit applications lacked clear guidelines. As a result, mining companies and their environmental consultants used a variety of standards and approaches, making standardized assessment of the types, size and number of undermined wetlands difficult, as well as hampering the ability to determine the effects of undermining on wetlands.

In response to the difficulty of ensuring wetlands protection without clear regulation and policy, the PA DEP included guidance for wetland identification, assessment of damage to wetlands, and procedures for mitigation or replacement in the TGD-655 (PA DEP, 2005). This document stipulated the following responsibilities on the mining companies for wetlands protection:

- All mining must be planned to ensure that no net loss of wetlands will occur,
- Any adverse effects on wetlands must be mitigated in accord with the guidance provided by the Technical Guidance Document 363-0300-001 (PA DEP, 1997),
- Wetlands above the area to be mined must be delineated and monitored as a part of the permitting and re-permitting process.

In addition, the PA DEP responsibilities can be briefly summarized as follows:

- Verify mining company predictions regarding wetland delineation and prediction of adverse effects,
- Ensure requirements for pre- and post-mining assessments are included in the permit applications,
- Make sure that requisite monitoring and reporting of wetland conditions occurs during and post mining by the mining companies,
- Make certain that mitigation plans are adequate and all mitigation obligations are adequately carried out, and
- Consult with other state and federal regulatory and management agencies where appropriate.

The TGD-655 specifies that mining companies must follow the wetlands guidelines within 24 months after the official implementation of the TGD. Thus, mining permit applications and revisions submitted after October 8, 2007 were subject to the requirements contained therein. This date is only about 10 months prior to the end of the 3rd assessment period, so the mining that

took place during the 3rd assessment period was not subject to the TGD-655's requirements. There was therefore, as in the 2nd assessment period, little to report.

In the event that the mining company, a citizen, or a PA DEP agent had identified an apparent adverse effect on a wetland, the PA DEP followed much the same investigative procedure as with stream flow investigations. If underground mining was determined to be the likely cause of an adverse wetland impact, the mining company was required to submit a mitigation plan, if one was not included as a part of the mining permit. The mitigation plan must meet the criteria established in the TGD-655. A bond was also posted in association with the mitigation plan. The DEP was responsible to see that the stipulated post-mitigation monitoring indicated in the mitigation plan had been successfully completed. This monitoring was required by the Wetland TGD-655 to continue for five years following mitigation. The University found one case (4R panel, Blackville No.2) in which mitigation was conducted and the wetland investigation was resolved during the 3rd assessment period.

IX.B – Data Collection

IX.B.1 – Inventory of undermined wetlands during the 3rd assessment period

The University coverage of wetlands undermined during the third assessment period was entered into UGISdb. Data were gathered from multiple sources, but primarily from the National Wetland Inventory (NWI) (ttp://www.fws.gov/wetlands/Data/Mapper.html). Additional data was collected from mining companies and the associated environmental consulting firms, and from the Pennsylvania Environmental Council. All longwall mines, with the exception of the Shoemaker Mine where very little mining occurred within Pennsylvania, were assessed. Whenever possible, the acreage of the wetland and its U.S. Fish and Wildlife standard classification codes (Cowardin et al., 1979) were included.

A total of 79 undermined wetlands occupying 93.9 acres were identified across six of the largest active longwall mines (Appendix G1). Four extensive Riverine wetlands, varying in size from 7.0 to 16.7 acres, were all classified as R5UBH. Riverine defines a wetland type largely comprised of unclassified perennial vegetation with unconsolidated bottom and permanently flooded. All other classified wetlands were Palustrine. The Palustrine includes all nontidal wetlands dominated (> 30-pct) by trees, shrubs, emergent, mosses or lichens. Thirty-nine were classified as less than 30-pct vegetative cover and unconsolidated bottom (PUB), 21 were classified as showing emergent vegetation (PEM; Figure IX-1, one of these was a mix of emergent vegetation and scrub/shrub), five were forested (PFO), one was scrub/shrub (PSS), and nine were not classified (Table IX-1). The unclassified wetlands were very small, averaging 0.14 acres in size.

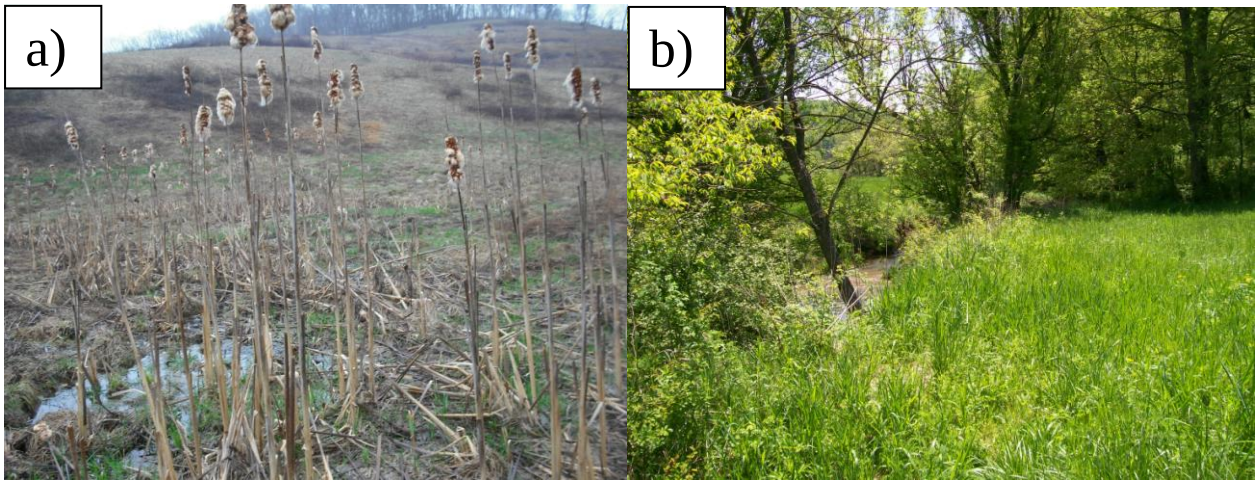

Figure IX-1 - Examples of palustrine emergent wetlands around two undermined streams:a) Unnamed tributary to Frosty Run over Emerald Mine and b) Dutch Run over Cumberland Mine. These wetlands are characterized by the dominance of rooted, herbaceous vegetation (Photographs courtesy of A. Hale).

Table IX-1 - Undermined wetlands, 3rd assessment period, sorted by type.

Wetland Type	Number	Total Acres	Percent	Average Size
PEM	21	24.13	25.7	1.14
PSS	1	0.54	0.6	-
PFO	5	8.78	9.3	1.76
PUB	39	16.44	17.5	0.42
R5UBH	4	42.72	45.5	10.68
Unknown	9	1.39	1.4	0.14
Total	79	93.9	100	

Caution should be used in comparing wetland data across mines. It is not clear that the same standards were used to delineate wetlands for all mines, and differing sources of data were available for the different mines. The information provided is meant only to provide a general picture of the frequency of wetlands, their major types and their sizes.

A single wetland loss investigation report was available to the University (PA DEP, 2009). The report was submitted to the CDMO compliance manager on June 15, 2009 by a PA DEP Water Pollution Biologist 2, based on his field and office research regarding a complaint by the landowner's family that a wetland and spring on their property had been diminished shortly after being undermined. The report was thoroughly documented. The DEP biologist who authored the report has made use of all available data, including the results of his own field investigations, together with his extensive experience, to reach his conclusions. He concluded that the wetland has been fed primarily by three small unnamed streams, the most important of which arose largely from a spring that has also served as the water supply for the landowner's home. The DEP biologist presented evidence that:

- The flow in the spring and the tributary was indeed diminished,
- The wetland had decreased in both its saturation and in the area inhabited by wetland indicator plant species, based on a comparison of pre-mining delineation and PA DEP delineation as a part of the investigation,
- The timing of the diminution of flow was coincident with undermining,
- This wetland was within an area where tensile stresses from the formation of the subsidence basin over the gate road entries / panel transition could have produced tensile cracking. These open fractures could be responsible for loss of surface and groundwater, and
- The adverse effects on the wetland were very likely to have been caused by undermining.

According to PA DEP officials, this investigation was closed. The Department had a Memorandum of Understanding with the Bureau of Water Quality protection (PA DEP, 2007) that allowed the operator to contribute funds to the Pennsylvania Wetland Replacement Project instead of conducting wetland mitigations (TGD 563-0200-003). The amount of the contribution was directly related to the size of the impact to the wetland. In regards to the previously identified wetland, the mine operator impacted 0.213 acres of the wetland area, so as per the MOU, they paid $2,500 into the fund.

A wetland gain investigation report over Blacksville No.2 was also available to the University. Prior to mining, a floodplain over the 4R panel near Roberts Run supported a hay field. While this area was likely inundated after large precipitation events due to high flow in Roberts Run, it did not support a wetland. However, after reports from a property owner were made to the PA DEP, a wetland delineation was conducted on July 12, 2003. After testing three separate test sites, consultants determined that the area now supported wetland vegetation, hydric soils, and was inundated. Thus, the former hayfield was designated as a wetland. To mitigate this wetland gain, the mining company proposed a regrading plan in a permit revision to restore the area to its former use. This plan included the following:

- Establishing proper drainage from a spring at the north end of the wetland into Roberts Run,
- Stripping the topsoil on the wetland and replacing it with fill from the Roberts Run restoration project to achieve a proper grade to prevent pooling,
- Stabilizing the Roberts Run stream banks to prevent future flooding of the wetland area, and
- Creating a ditch to catch run-off from the nearby road and prevent it from entering the wetland area.

The plan was approved on January 5, 2005 by the PA DEP and work began in April 2005. The area was inspected in July 2005 by PA DEP officials who were satisfied with the work and determined that the project was complete.

IX.B.2 – Increased rigor of wetland inventories since 2007

Since late 2007, permit revisions and new permits have included much more extensive and precise delineation of wetlands. Each permit application filed since that time included precise geo-referenced delineation of the geographic extent of all wetlands in a GIS coverage. While

these coverages were in digital form in the mining companies' records, PA DEP was unprepared to accept them in digital form and required that paper maps be submitted.

Since the permit applications submitted in late 2007 and beyond, were not undermined in the 3rd assessment period, the University did not include them in this report. However, one new permit application was investigated and the wetland coverages included in its permit maps were examined. These new applications were extraordinarily precise and thorough in their wetland delineations. The University collected data from the maps provided with this permit revision application for Enlow Fork Mine panels E12 to E18 and F12 to F18 as an illustration. In these 14 panels, 19.9 acres of wetlands were delineated, compared to the 11.0 acres identified for the entire undermined area from the 3rd reporting period (Appendix G2). Fifty-seven wetlands were identified in the permit revision application, whereas only 23 were identified for the entirety of the undermined part of Enlow Mine in the 3rd reporting period. The University also found a report of that meticulously assessed the size and location of wetlands at the Cumberland mine. This 2004 study estimated 63.6 acres of wetlands (Appendix G3). This new estimate showed a dramatic increase over the NWI generated 3.1 acres of wetlands for the Cumberland Mine (Appendix G1).

One reason for this significant increase in the number of wetlands identified was that the 3rd reporting period inventory of wetlands relied heavily on the NWI database of registered wetlands. It was well known that forested wetlands and small wetlands have often gone unrecorded in the NWI database. The University observed the flags and tapes used by mining company consultants to mark their spatial delineations in some areas. Wetlands, as small as a few hundredths of an acre, are now being delineated. These wetland data now being included in mining permits appear to identify every wetland no matter how small and are providing an accurate classification of wetland type. This should provide the necessary material to assess adverse effects of mining on wetland characteristics and function.

IX.C – Summary

While mining permits prior to 2007 contained very uneven data on wetland inventories in the areas to be undermined, both of the wetland reported effects did have pre-mining data. Using this data, newly gathered data, and other available information, the PA DEP was able to determine that the areas were impacted by underground mining.

A total of 93.9 acres of wetlands were identified as having been undermined during the 3rd assessment period. This total was largely based on the NWI. Since the NWI missed many of the smallest wetlands, University estimates of the number and total acreage of wetlands undermined during the 3rd reporting period are therefore conservative.

TGD-655 became effective in October of 2005. This document specified a sound and precise protocol for delineating all wetlands within an area of planned mining. All permit applications submitted 24 months after the effective implementation date of the TGD-655 were required to have used this protocol to supply the wetland information in the application. Thus all permit

applications submitted after October 2007 contained excellent wetlands pre-mining data that inventoried all wetlands down to sizes of a few hundredths of an acre.