

# UNDERMINING TRUST:

## The COLLAPSE of Environmental Protection in Pennsylvania

A Review and Analysis of  
PADEP's 5<sup>th</sup> Act 54 Report  
and  
A 25-Year Summary

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**Cover photo:** July 2012 view of the breached dam on Ronald J. Duke Lake in Ryerson Station State Park (Greene County). The main area shown in this photo is the upstream section of North Fork Dunkard Fork where the 62-acre Duke Lake used to be. Cracks developed in the dam during summer 2005 and were attributed to nearby undermining by longwall methods at Bailey Mine. Concerns about the safety and stability of the dam structure led to the draining of this important recreational lake and the breach of its dam in August 2005. The “lake” remains dry to this day. The incident was investigated and described in a February 2010 report prepared by PADEP California District Mining Office entitled “Ryerson Station State Park, Ryerson Station Dam, Damage Claim Number SA1736, Interim Report”. (Photo by Terri Treacy)

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## EXECUTIVE SUMMARY

This report examines the findings, conclusions, and recommendations of the Pennsylvania Department of Environmental Protection's (PADEP's) 5<sup>th</sup> five-year assessment (covering 2013-2018) of the effects of bituminous coal mining subsidence, as mandated by Act 54. Such assessments are to inform the Governor, the General Assembly, and the Citizens Advisory Council in matters of public policy regarding underground coal mining.

In 1994, Act 54 amended Pennsylvania's 1966 coal mining law known as the Bituminous Mine Subsidence and Land Conservation Act (BMSLCA). The 1966 Law had been enacted because unpredictable subsidence damage to surface structures from abandoned and unregulated room-and-pillar mines was a widespread problem at that time. Consequently, the BMSLCA *prohibited* mine subsidence damage to existing homes and certain other structures. That prohibition led to gradual improvements in room-and-pillar mine designs with increased surface support and less subsidence.

In the 1970s and 1980s, some mine operators began to introduce a new, higher-extraction method called "longwall" into the Pennsylvania coalfields, but its inherent subsidence conflicted with the prohibition of the 1966 Law. After numerous attempts to invalidate the 1966 BMSLCA requirement for surface support, coal interests eventually succeeded in changing the law to allow longwall mining. In 1994, Act 54 removed the prohibition on structural damage, but required repair or replacement of damaged structures and water supplies. Act 54 did not, however, authorize any environmental damage. Act 54 was meant to provide a balance, on the one hand allowing the more damaging longwall method of coal mining, while promising that most damages to coalfield residents would be repaired promptly. The 5-year Reports, however, reveal that repair of damages is relatively rare. Furthermore, the Bureau of Mining Programs has allowed surface water and groundwater resources to become collateral damage to the structural damages allowed by Act 54. As a result, for the past 25 years coalfield residents have lost confidence in the ability of the PADEP to safeguard their property, their communities, and their public trust resources.

A fundamental feature of Act 54 was that damages authorized to structures and water supplies were supposed to be repaired. Yet "*Repair*" was the identified resolution for only 23 of 423 (5%) documented mine-liable impacts to structures and water supplies combined from mines active during the 5<sup>th</sup> Act 54 reporting period. The most common category of resolution during the period was "*Agreement*" (229 of 423, 54%) under which the outcome (repair or not) is unknown and which typically involves a non-disclosure clause. Resolutions of structure and water supply damages also are untimely, and take significantly longer for longwall damages (which on average require 363 days, compared with 94 days on average to resolve room-and-pillar damages). The 5-year Reports do not evaluate the *quality* of replacement water supplies, and the burden of water quality testing

falls on the landowner. The Reports also do not discuss impacts on residents of Environmental Justice Areas in the coalfields. Extensive, unrepaired damages shortchange not only individual homeowners, but also entire communities which may have their tax base impacted and their social fabric disrupted.

Dozens of miles of streams were reported as damaged by subsidence during the latest 5-year Act 54 period, most (90%) by unpredicted flow loss and the rest by pooling. All of the damages were associated with longwall mines, none with room-and-pillar or pillar recovery mines. Many dozens of miles of additional stream segments, damaged during previous Act 54 periods, continue to be in some stage of “restoration”. Some streams have been irreparably damaged. Yet Act 54 explicitly did not allow stream damage, nor in any other way change the protection of streams and other water resources with respect to the Pennsylvania Clean Streams Law or the State Constitution. The Bureau of Mining Programs does not require longwall mine operators to avoid and minimize damages to streams, wetlands, and groundwater as the laws and regulations direct be done. Attempts at restoration of damaged natural features are technically difficult, not timely, and often ineffective. Clearly, the Mining Programs’ continuing failure to protect the hydrologic balance erodes the public’s trust in that Bureau.

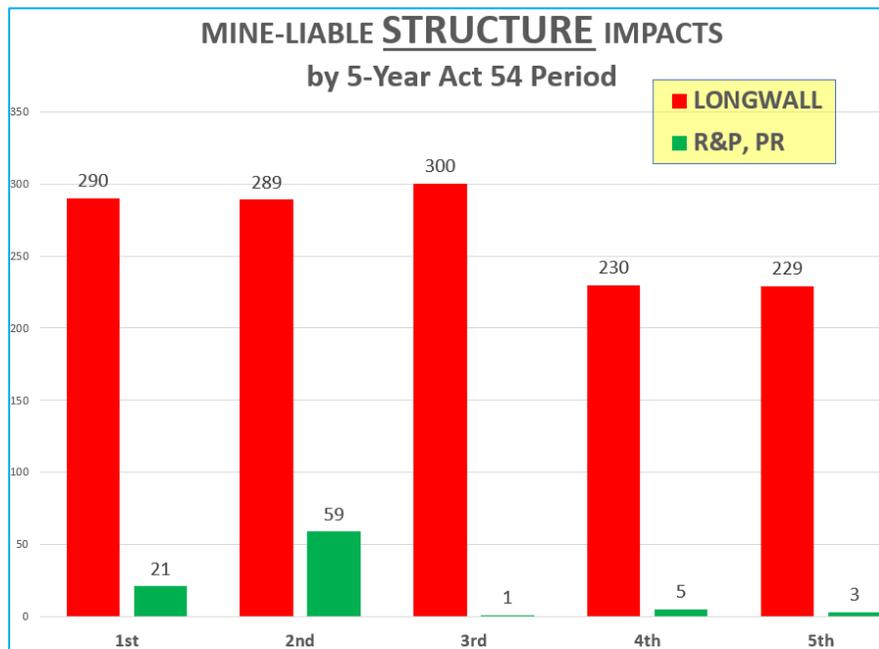
This report was prepared on behalf of the Citizens Coal Council (Washington PA), as were previous in-depth reviews of the 4<sup>th</sup> Act 54 Report (Schmid & Company, Inc. 2015) and the 3<sup>rd</sup> Act 54 Report (Schmid & Company, Inc. 2011). It evaluates the current state of affairs in the coalfields of Pennsylvania, juxtaposing the promises of Act 54 --- that impacts of longwall mining were predictable, were capable of remediation, and would be repaired promptly --- with the stark realities of the past 25+ years. With each five-year Act 54 Report specific numbers have changed regarding acres mined and impacts to structures, water supplies, and water resources (see “By the Numbers” graphs and summaries on the following pages), as have the number and types of resolutions or attempted restorations. Yet these fundamental issues have been consistently disregarded by the Department:

- Only one mining method (longwall) overwhelmingly is responsible for the greatest number and severity of all types of damages; yet room-and-pillar methods are always available, and there are other alternatives for minimizing impacts;
- Damages allowed to structures, and impacts to water supplies, are not being demonstrably repaired as required by Act 54; and
- Predictable damages are being allowed to streams, wetlands, and other elements of the hydrologic balance -- rather than avoided and minimized -- in violation of existing mining and environmental regulations, the Clean Streams Law, the Dam Safety and Encroachments Act, and the Pennsylvania Constitution.

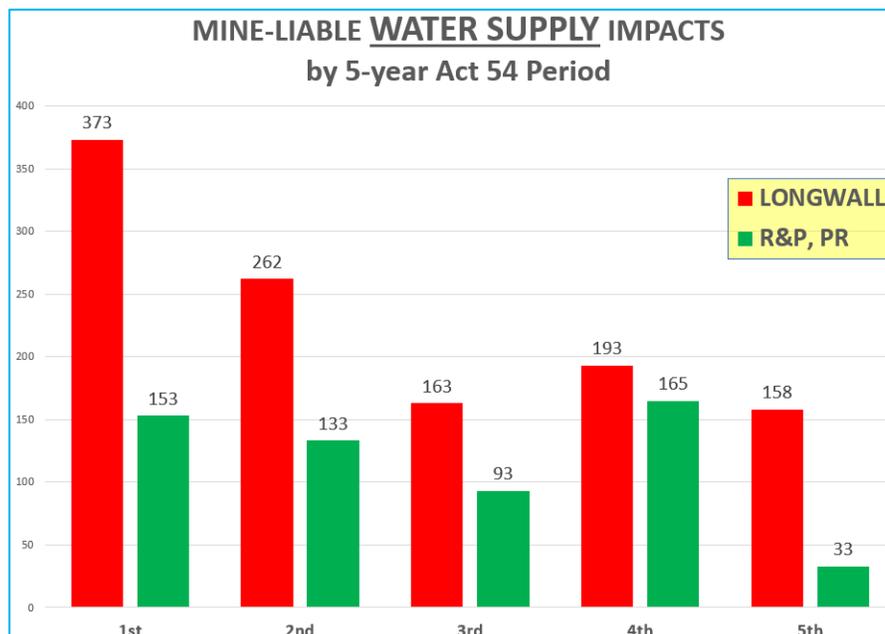
These fundamental disconnects with the intent of Act 54, other laws, regulations, and policies, and the continued failure of the Bureau of Mining Programs to address them, inexorably have undermined the public welfare and the public trust.

# BY THE NUMBERS: 25 Years of Act 54

As illustrated in the graphs below, the impacts from underground bituminous coal mining that were determined to be “mine-liable” number in the hundreds every 5-year Act 54 Period. Longwall mines are overwhelmingly responsible for all impacts. During the 25-year timeframe, a total of 3,905 mine-liable impacts was reported for structures, water supplies, land, and streams, with longwall mines associated with 3,199 (82%) and room-and-pillar (R&P) and pillar recovery (PR) mines together associated with the balance (706 impacts, 18%). The differences in numbers of impacts by mining method are particularly striking for structures, land, and streams. Following the graphs are selected statistics for each of the five 5-year Act 54 Periods.

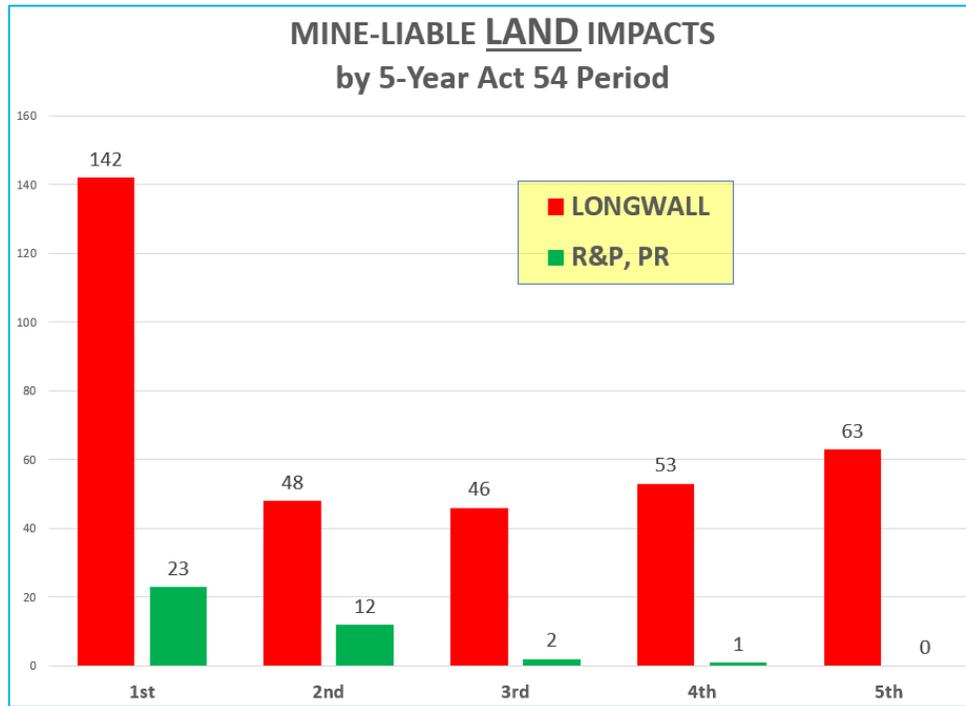


25-year **STRUCTURE** impacts: 1,427 **Percentage longwall: 94%**

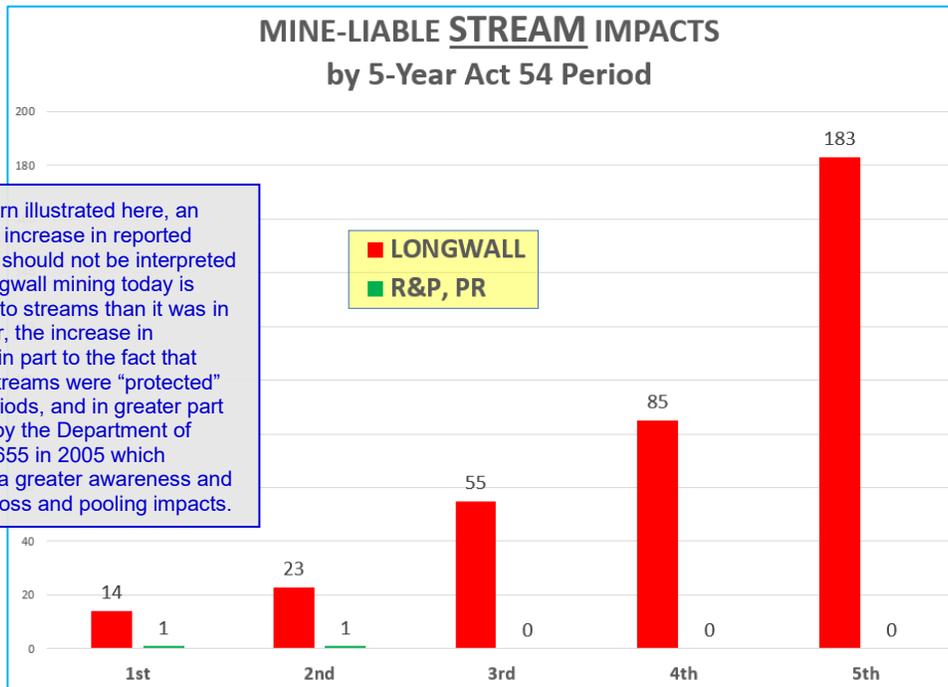


25-year **WATER SUPPLY** impacts: 1,726 **Percentage longwall: 67%**

# BY THE NUMBERS: 25 Years of Act 54



25-year LAND impacts: 390 Percentage longwall: 90%



Note: The pattern illustrated here, an apparent steady increase in reported stream impacts, should not be interpreted to mean that longwall mining today is more damaging to streams than it was in the past. Rather, the increase in numbers is due in part to the fact that only perennial streams were “protected” in the earlier periods, and in greater part to the adoption by the Department of TGD 563-2000-655 in 2005 which resulted in both a greater awareness and tracking of flow loss and pooling impacts.

25-year STREAM impacts: 362 Percentage longwall: 99%

# BY THE NUMBERS: 25 Years of Act 54

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## SUMMARY STATISTICS BY 5-YEAR PERIOD

### 1<sup>st</sup> Act 54 Report

Period covered: August 1993 to August 1998  
Prepared by: PADEP (in house)  
Date released: 1999 (Supplement: 2001)  
Report cost: *N/A*  
Report length: 169 pages (Supplement: 22 pages)  
Number of counties with active mining: 11  
Total number of active mines: 84  
    Longwall: 10  
    Room-and-pillar: 45  
    Pillar recovery: 29  
Total acreage undermined: 38,850  
    % acreage longwall: 63%  
Total properties undermined: 1,855  
Incidents of mine-liable damages\*: 1,002  
    Mine-liable damages, longwall: 805 (80%)  
    Mine-liable damages, R&P/PR: 197 (20%)  
Stream miles undermined: *NR (est.: 116)*  
Reported number of stream damages: 15

### 2<sup>nd</sup> Act 54 Report

Period covered: August 1998 to August 2003  
Prepared for PADEP by: California Univ. of PA  
Date released: 2005  
Report cost: \$200,000  
Report length: 453 pages  
Number of counties with active mining: 10  
Total number of active mines: 68  
    Longwall: 10  
    Room-and-pillar: 44  
    Pillar recovery: 14  
Total acreage undermined: 38,512  
    % acreage longwall: 71%  
Total properties undermined: 3,033  
Incidents of mine-liable damage\*: 803  
    Mine-liable damages, longwall: 599 (75%)  
    Mine-liable damages, R&P/PR: 204 (25%)  
Stream miles undermined: 115.5  
Reported number of stream damages: 24

### 3<sup>rd</sup> Act 54 Report

Period covered: August 2003 to August 2008  
Prepared for PADEP by: Univ. of Pittsburgh  
Date released: 2011  
Report cost: \$313,000  
Report length: 513 pages  
Number of counties with active mining:  
Total number of active mines: 50  
    Longwall: 8  
    Room-and-pillar: 36  
    Pillar recovery: 6  
Total acreage undermined: 38,256  
    % acreage longwall: 64%  
Total properties undermined: 3,587  
Incidents of mine-liable damage\*: 605  
    Mine-liable damages, longwall: 509 (84%)  
    Mine-liable damages, R&P/PR: 96 (16%)  
Stream miles undermined: 113.7  
Reported number of stream damages: 55

### 4<sup>th</sup> Act 54 Report

Period covered: August 2008 to August 2013  
Prepared for PADEP by: Univ. of Pittsburgh  
Date released: 2014  
Report cost: \$603,000  
Report length: 454 pages  
Number of counties with active mining:  
Total number of active mines: 46  
    Longwall: 5  
    Room-and-pillar: 34  
    Pillar recovery: 7  
Total acreage undermined: 31,343  
    % acreage longwall: 54%  
Total properties undermined: *NR (est.: 3,000)*  
Incidents of mine-liable damage\*: 647  
    Mine-liable damages, longwall: 476 (74%)  
    Mine-liable damages, R&P/PR: 171 (26%)  
Stream miles undermined: 96.1  
Reported number of stream damages: 85

*NR* = not reported

# BY THE NUMBERS: 25 Years of Act 54

## 5<sup>th</sup> Act 54 Report

Period covered: August 2013 to August 2018  
 Prepared for PADEP by: Univ. of Pittsburgh  
 Date released: 2019  
 Report cost: \$793,000  
 Report length: 995 pages  
 Number of counties with active mining: 10  
 Total number of active mines: 49  
     Longwall: 7  
     Room-and-pillar: 37  
     Pillar recovery: 5  
 Total acreage undermined: 28,854  
     % acreage longwall: 62%  
 Total properties undermined: 3,296  
 Incidents of mine-liable damage\*: 486  
     Mine-liable damages, longwall: 450 (93%)  
     Mine-liable damages, R&P/PR: 36 (7%)  
 Stream miles undermined: 86.2  
 Reported number of stream damages: 183



Cover of 5th Act 54 Report

NR = not reported

## 25 YEAR TOTALS

Period covered: August 1993 to August 2018  
 Total number of Act 54 Reports: 5  
 Total cost of Reports: \$1,909,000+  
 Total Report pages: 2,606  
 Total acreage undermined: 175,815  
     % acreage longwall: 63%  
 Total properties undermined: 14,771  
 Incidents of mine-liable damage\*: 3,543  
     Mine-liable damages, longwall: 2,839 (80%)  
     Mine-liable damages, R&P/PR: 704 (20%)  
 Stream miles undermined: 527.5+  
 Reported number of stream damages: 362  
 Stream impacts predicted: NR (est.: <30)

\* *Incidents of mine-liable damage* include damages to structures, water supplies, and land (but not streams, which are listed separately). Many properties experience more than one type of damage. Impacts to structures, water supplies, and land have been recorded and tracked for 25 years in BUMIS (Bituminous Underground Mine Information System). Stream impacts, by contrast, have not been routinely or consistently tracked in BUMIS. Indeed, the 4<sup>th</sup> Act 54 Report stated on page EX-3: “Because BUMIS was not designed to track the complexity of stream impacts, PADEP has struggled to develop a system for recording stream data.”

Also, the 2<sup>nd</sup> Act 54 Report disaggregated mine liability only for water supply impacts, so numbers for *structures* and *land* for that period are “total reported effects”.

# ACRONYMS

<b>Act 54</b>	Enacted 22 June 1994, Act 54 (Public Law 357, No. 54) amended the 1966 Pennsylvania mining law known as the Bituminous Mine Subsidence and Land Conservation Act.
<b>AMD</b>	Acid Mine Drainage. Acidic (low pH) water with high concentrations of toxic metals that forms when mined coal is exposed to air and water. AMD pollution from legacy mines continues to be the major cause of impairment for thousands of miles of Pennsylvania streams.
<b>BDWM</b>	Bureau of Dams and Waterways Management. A part of the Pennsylvania Department of Environmental Protection.
<b>BMP</b>	Bureau of Mining Programs. A part of the Pennsylvania Department of Environmental Protection.
<b>BMR</b>	Bureau of Mining and Reclamation. The former name of the PADEP Bureau of Mining Programs.
<b>BMSLCA</b>	Bituminous Mine Subsidence and Land Conservation Act. The original Pennsylvania underground coal mining law that was enacted in 1966. It was in effect for 28 years, until it was amended in 1994 by Act 54.
<b>BUMIS</b>	Bituminous Underground Mine Information System. This antiquated system built in Java in the 1990s is used by the PADEP Bureau of Mining Programs to track underground mining impacts and resolutions. Compilers of the Act 54 Reports have relied on information in BUMIS and created new GIS database systems to analyze data.
<b>CAC</b>	Citizens Advisory Council of the PADEP. Act 54 directs the PADEP to provide a copy of its 5-year assessments to the CAC.
<b>CCC</b>	Citizens Coal Council. A national advocacy group based in Washington PA which works with and on behalf of communities affected by the mining, processing, and use of coal.
<b>CDMO</b>	California District Mining Office. The office of PADEP-BMP that issues permits for underground bituminous coal mines.
<b>Chapter 86</b>	The PADEP regulations associated with Surface and Underground Coal Mining; sometimes written 25 Pa. Code §86.
<b>Chapter 89</b>	The PADEP regulations associated with Underground Mining of Coal and Coal Preparation Facilities; sometimes written 25 Pa. Code §89.
<b>Chapter 93</b>	The PADEP regulations associated with Pennsylvania's Water Quality Standards; sometimes written 25 Pa. Code §93.
<b>Chapter 94</b>	The PADEP regulations associated with Municipal Wasteload Management; sometimes written 25 Pa. Code §94.

<b>Chapter 96</b>	The PADEP regulations associated with Water Quality Standards Implementation; sometimes written 25 Pa. Code §96.
<b>Chapter 105</b>	The PADEP regulations associated with the Dam Safety and Encroachments Act; sometimes written 25 Pa. Code §105. Similar to a federal 404 permit, a Chapter 105 permit typically authorizes activities in waterways and/or wetlands.
<b>CHIA</b>	Cumulative Hydrologic Impact Assessment. A written determination to be made in accordance with 25 Pa. Code Chapter 86.37(a)(4) by the Department on every new or revised mine permit application to ensure the mine is designed to prevent damage to the hydrologic balance within and outside the permit area.
<b>Corps</b>	US Army Corps of Engineers. The lead federal agency responsible for issuing Section 404 permits under the Clean Water Act. The Pittsburgh District of the Corps has jurisdiction within the Ohio River Basin in western Pennsylvania.
<b>COVID-19</b>	Coronavirus disease 2019. An infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). It was first identified in December 2019 in Wuhan, China.
<b>CSL</b>	Clean Streams Law (Act of 1937, Public Law 1987, No. 394). A law enacted in 1937 to protect and preserve the quality and quantity of Commonwealth waters.
<b>CWA</b>	Clean Water Act (Public Law 92-500). The primary US federal law setting water quality standards and regulating water pollution. Originally known as the <i>Federal Water Pollution Control Act Amendments of 1972</i> , there were major amendments in 1977 (Public Law 95-217).
<b>DMMP</b>	Deep Mine Mediation Project. The stakeholders group, mediated by Thomas Beauduy, that met between 1986 and 1990 to draft revisions to the 1966 Mining Law. Those revisions eventually were incorporated into Act 54.
<b>DMR</b>	Discharge Monitoring Report. A self-monitoring report required by PADEP for certain permits that entail discharges of wastewater or stormwater.
<b>DSEA</b>	Dam Safety and Encroachments Act of 1978 (Public Law 1375).
<b>DWQ</b>	Division of Water Quality. A part of the Pennsylvania Department of Environmental Protection.
<b>EHB</b>	Environmental Hearing Board. The EHB hears appeals from actions of the PA Department of Environmental Protection.
<b>EIA</b>	Energy Information Administration. An independent agency within the US Department of Energy. EIA collects, analyzes, and disseminates data about coal and other energy resources.
<b>ERA</b>	Environmental Rights Amendment. A common name for Article 1, Section 27, of the Pennsylvania Constitution, adopted in 1971.

<b>EV</b>	Exceptional Value. The Chapter 93 water quality classification assigned to the most outstanding waters in the Commonwealth. EV is a “special protection” designation.
<b>HMR</b>	Hydrologic Monitoring Report. After a mining permit is issued, the PADEP typically provides an HMR form to the permittee on which to report quarterly monitoring of groundwater levels and water quality.
<b>HQ</b>	High Quality. The Chapter 93 water quality classification assigned to very high quality waters in the Commonwealth, second only to EV waters. HQ is a “special protection” designation.
<b>JD</b>	Jurisdictional Determination. The Corps will review an applicant's delineation of wetlands and other waters on a property or project site; once it has confirmed the accuracy of the delineation, it issues a JD, which can be relied upon for both state and federal regulatory and permitting purposes.
<b>LIDAR</b>	Light Detection And Ranging. A remote sensing technology that measures distances and computes topographic elevations using a laser and analyzing the reflected light.
<b>MSI</b>	Mine Subsidence Insurance. A program of the PADEP since 1961 that provides insurance coverage for subsidence damage to structures caused by abandoned coal or clay mines. The insurance covers damage which typically is not covered by regular homeowners’ insurance.
<b>NPDES</b>	National Pollutant Discharge Elimination System. A permit program associated with the federal Clean Water Act for direct discharges to streams. The NPDES permit typically is issued by the delegated State agency (in Pennsylvania, PADEP).
<b>NWI</b>	National Wetlands Inventory. NWI maps were prepared by the USFWS during the 1970s and 1980s from high-altitude aerial photographs to identify major wetland resources for nationwide planning and management of fish and wildlife habitat. Such maps occasionally are updated.
<b>OEA</b>	Office of Environmental Advocate, within the PADEP, precursor to OEJ.
<b>OEJ</b>	Office of Environmental Justice, within PADEP, organized in 2015.
<b>OSMRE</b>	Office of Surface Mining Reclamation and Enforcement. A federal agency within the US Department of the Interior. OSMRE is responsible for federal regulation of coal mining operations, for cleaning up abandoned mine lands, and for oversight of state-level coal mining programs.
<b>PADEP</b>	Pennsylvania Department of Environmental Protection.
<b>PASDA</b>	Pennsylvania Spatial Data Access. A website repository for spatial/digital data maintained by Pennsylvania State University.
<b>PR</b>	Pillar Recovery ( <i>a.k.a.</i> , pillar removal; <i>a.k.a.</i> , retreat mining). A variation of traditional room-and-pillar mining. A pillar recovery mine starts out like a traditional room-and-pillar mine, but then some of the coal pillars are selectively removed.

<b>R&amp;P</b>	Room-and-Pillar. A method of underground mining that has been practiced in Pennsylvania since the late 1700s and which continues to be used profitably today. Using a continuous miner, this method extracts about 40% to 60% of the coal in an area, but leaves enough coal in place (in the pillars) to support the mine roof, thereby preventing surface subsidence.
<b>RPZ</b>	Rebuttable Presumption Zone. Established by Act 54, it is a way to estimate the most probable area on the surface where water supplies may be affected by longwall mining subsidence.
<b>RTKL</b>	Right-to-Know Law (65 P.S. §§ 67.101 <i>et seq.</i> ). It provides Pennsylvania citizens access to public records concerning the activities of PA government, similar to the federal Freedom of Information Act.
<b>SMCRA</b>	Surface Mining Control and Reclamation Act. The federal SMCRA (Public Law 95-87) was enacted in 1977. The Pennsylvania SMCRA (Public Law 1198; 52 P.S. §1396.1 <i>et seq.</i> ) was enacted in 1945, although in the Commonwealth statute the “C” stands for Conservation.
<b>Special Protection Waters</b>	Surface waters in Pennsylvania that have been designated as either EV (Exceptional Value) or HQ (High Quality) per 25 Pa. Code Chapter 93. Because they are the best waters in the Commonwealth, proposed activities that might impact them ostensibly are subject to a higher standard of review than activities affecting other waters.
<b>SRE</b>	Stream Recovery Evaluation. A report prepared by a mine operator and submitted to the Department to demonstrate that a stream that had been damaged by mine subsidence has been successfully restored to its premining condition.
<b>SSA</b>	Surface Subsidence Agent. Also called a Shadow Inspector, it is an employee of the California District Mining Office within the PADEP Bureau of Mining Programs who investigates reported or apparent effects of underground coal mine subsidence.
<b>TBS</b>	Total Biological Score. A number representing the overall biological integrity of a stream which is used to compare pre-mining and post-mining conditions.
<b>TGD</b>	Technical Guidance Document. Written guidance prepared by the Department to provide direction to staff and to the regulated community regarding how to comply with existing requirements. TGDs provide guidance on policies and procedures and are not an adjudication nor do they have the weight accorded to regulations.
<b>USDA-NRCS</b>	United States Department of Agriculture, Natural Resources Conservation Service.
<b>USEPA</b>	United States Environmental Protection Agency.
<b>USFWS</b>	United State Fish and Wildlife Service. The federal agency within the US Department of Interior which, among other things, prepared the National Wetlands Inventory maps.
<b>USGS</b>	United States Geological Survey. A federal agency within the US Department of Interior.

# INTRODUCTION

On 20 December 2019, the Bureau of Mining Programs in the Pennsylvania Department of Environmental Protection posted on its website a contract report (PADEP 2019) written under its supervision by the University of Pittsburgh, entitled *"The Effects of Subsidence Resulting from Underground Bituminous Coal Mining in Pennsylvania, 2013-2018"*. That report was prepared in accordance with Section 18.1 of Act 54, which directs the Department to compile relevant data on an ongoing basis, to analyze the effects of underground mine subsidence, and to prepare an assessment report regarding those effects every five years. This latest report represents the fifth such five-year assessment, and the third in a row prepared by the University of Pittsburgh on behalf of the Department.

There were 49 underground bituminous coal mines active at some point during the period examined by the 5<sup>th</sup> Act 54 Report (August 2013 - August 2018). Of those, 7 were longwall mines, 37 were traditional room-and-pillar (R&P) mines, and 5 were room-and-pillar with pillar recovery (PR) mines<sup>1</sup>, a type of R&P mining whereby selected pillars of coal are removed later in the process (see [Appendix A](#) for a brief explanation of each mining method). The total number of each type of mine has remained relatively constant during the last 15 years (**Table 1** at right). The acreage undermined by longwall mines and pillar recovery mines increased marginally from the 4<sup>th</sup> to the 5<sup>th</sup> Act 54 periods. Overall acreage undermined has decreased, however, from 38,256 acres during the 3<sup>rd</sup> assessment period to 28,854 acres

**TABLE 1.** Number of mines and acreage undermined during each of the last three 5-year assessment periods (15 years).

<u>Mine Type</u>	<u>NUMBER OF MINES Active During Period</u>		
	<u>ACT 54 FIVE-YEAR ASSESSMENT PERIOD</u>		
	<u>3<sup>rd</sup></u>	<u>4<sup>th</sup></u>	<u>5<sup>th</sup></u>
Longwall	8	5	7
R&P*	36	34	37
PR**	6	7	5
Total	50	46	49
<u>Mine Type</u>	<u>ACRES UNDERMINED During Period</u>		
	<u>ACT 54 FIVE-YEAR ASSESSMENT PERIOD</u>		
	<u>3<sup>rd</sup></u>	<u>4<sup>th</sup></u>	<u>5<sup>th</sup></u>
Longwall	24,607	17,005	17,873
R&P*	11,582	12,353	8,487
PR**	2,067	1,985	2,494
Total	38,256	31,343	28,854

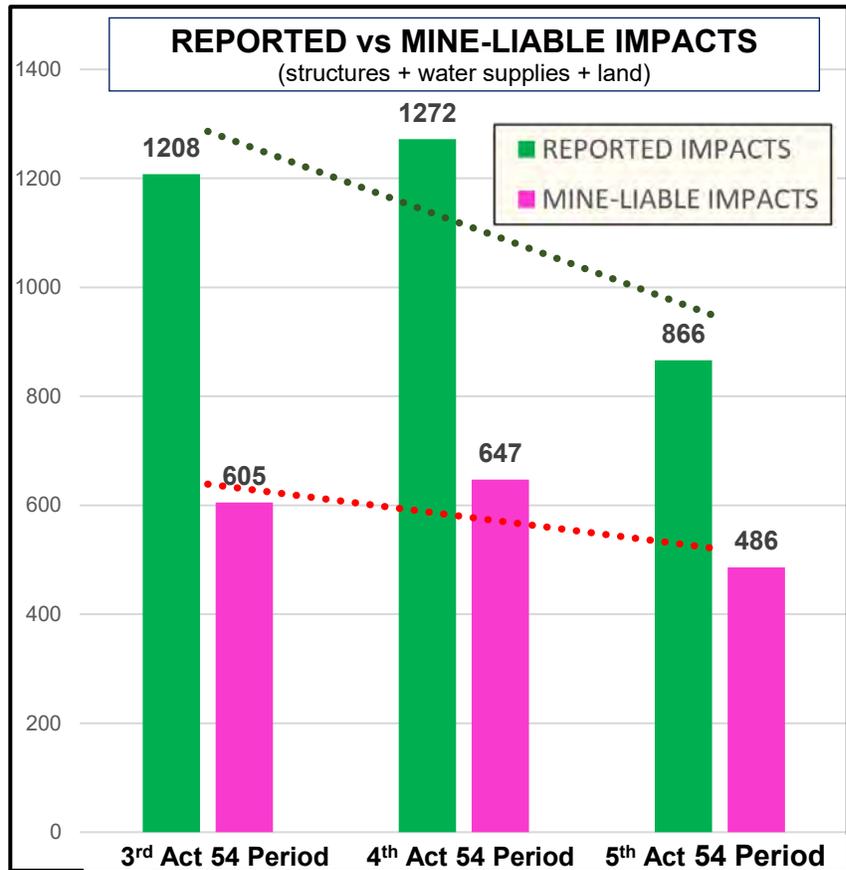
\* Room-and-Pillar  
 \*\* The "pillar recovery" (PR, or pillar removal) method is the least used of the three. Only 5 mines active during the 5<sup>th</sup> Assessment period used PR, and the actual pillar recovery method was used directly beneath only 275 acres (11% of the total 2,494 acres comprising those mines, less than 1% of the total area undermined during the 5-year period).

during the 5<sup>th</sup> assessment period, a 25% reduction. During the 5<sup>th</sup> period, 3,296 properties were undermined, with nearly 15,000 properties undermined since Act 54 was adopted.

<sup>1</sup> Pillar recovery and longwall are both considered "high-extraction" or "full-extraction" mining methods.

Impacts to structures, water supplies, and land (including surface cracks and landslides) are tracked for each mine in the Department's Bituminous Underground Mine Information System (BUMIS) and reported in the 5-year assessments. Whenever an impact is reported, it is investigated by the Department and followed through to its final resolution. In many cases, indeed almost half of the time (1,608 out of 3,346, or 48%, for the last 15 years), the "reported" impacts were determined to be *not* mine-related.

The **chart at right** identifies the number of "reported" impacts over each of the last three 5-year Act 54 assessment periods (15 years total) and compares them with the number of impacts determined by the Department to have been "mining-liable". In both cases, despite a slight up-tick in the 4<sup>th</sup>



**Mine-related impacts likely are higher than reported**

PADEP determined that nearly half of all "reported" impacts during the last 15 years were not mine-liable. However, many of those actually may be due to mining. If an impact occurs within a presumptive impact area (like the Rebuttable Presumption Zone [RPZ], discussed further below on page 40) then it is quite likely to be documented as mine-liable. But many impacts *outside* a presumption zone also have been documented to be mine-liable. The 4<sup>th</sup> Act 54 Report found that 50% (186 of 371) of mining-liable water supply damages had occurred outside the prescribed 35° RPZ. What could account for the large number of reported impacts that are determined to be not related to mining? Outside a presumption zone, it becomes more difficult to assign liability to a mine operation because: a) the damage is farther away from the center of mining; b) the mine operator does not need to conduct a pre-mining survey, so none exists unless the landowner took it upon herself to do so; and c) the burden of proof shifts from the coal operator to the landowner, and most landowners do not have the technical or financial resources to match and successfully challenge a mine operator. Thus, it is reasonable to assume that actual impacts from underground mining are more numerous than reported.

period, the number of impacts generally has been decreasing, which is good news. However, the rate of decline for mine-liable impacts is significantly slower than for total "reported" impacts, as indicated by the trendlines (dotted) in the chart above. For some reason, the Department's Act 54 Reports tend to emphasize "total reported" impacts, although that has the

effect of diluting or distorting the actual adverse effects of subsidence from mines --- as in the rate of decline in impacts. It is fine to identify how many *reported* impacts occurred during a

5-year period, but the analyses and evaluations should then highlight those impacts which actually were attributable to underground mining, which after all is the basic purpose of the Act 54 reporting. To the extent that the data have been disaggregated (the first two Act 54 Reports largely did not), this report emphasizes “mine-liable” impacts.

**Table 2** identifies the combined impacts, by type of mine, reported to the 3 features (structures, water supplies, and land) which are routinely tracked in BUMIS and which were determined by the Department to have been mine company-liable during each of the last three Act 54 assessment periods. The 5<sup>th</sup> period recorded the lowest total (486 impacts) following the highest total (647) recorded during the 4<sup>th</sup> period, a 25% decrease between those two periods. Most of the decline in impacts between the 4<sup>th</sup> and the 5<sup>th</sup> periods was associated with room-and-pillar mines, which recorded an 81% decrease; longwall mines recorded a 5%

decrease in impacts during the same time. Over the 15-year timeframe, active longwall mines were responsible for 83% of all impacts to those 3 features.

Trends in stream impacts over time are more difficult to determine due to the inconsistent way the Department tracks stream impacts, and the inconsistent ways that these 5-year

assessments report stream impacts. Stream impacts that occurred during the 5<sup>th</sup> Period are the most clearly articulated: 183 separate impacts reportedly occurred (153 due to flow loss, 30 due to pooling), affecting more than 27 miles of streams. The 4<sup>th</sup> Act 54 Report used an indirect metric to identify stream impacts, reporting 95 streams receiving augmentation (for flow loss impacts) and 28 streams needing gate cuts (for pooling impacts). Such restoration activities always occur *after* (sometimes many years after) a stream has been impacted by subsidence. Thus, it is unclear how many and what types of stream impacts actually occurred *during* the 4<sup>th</sup> assessment period. The 3<sup>rd</sup> Act 54 Report, like the 4<sup>th</sup>, identified streams where restoration efforts were underway, but which had been impacted at some time in the past. Although longwall mining impacts are purported to be “predictable”, and the mining regulations and the underground mine permit application ostensibly *require* predictions of adverse impacts to streams, there are no data presented in any of the 5-year Act 54 Reports comparing any stream impacts that may have been *predicted* by mine operators with the stream impacts that *actually occurred*.

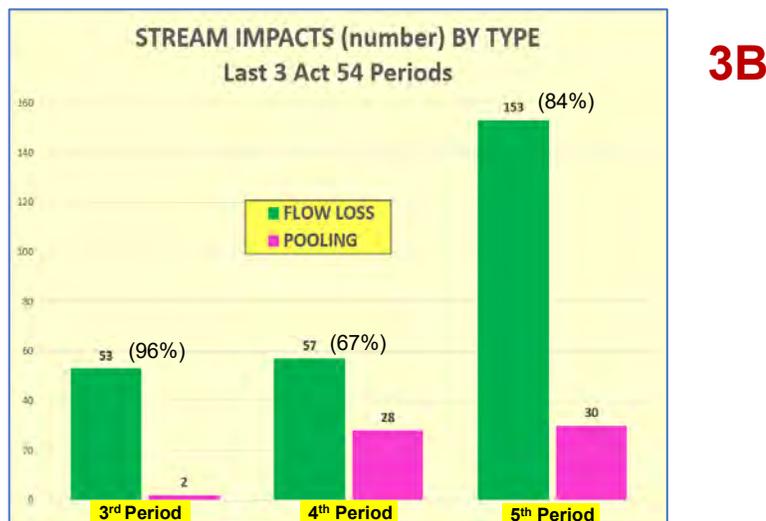
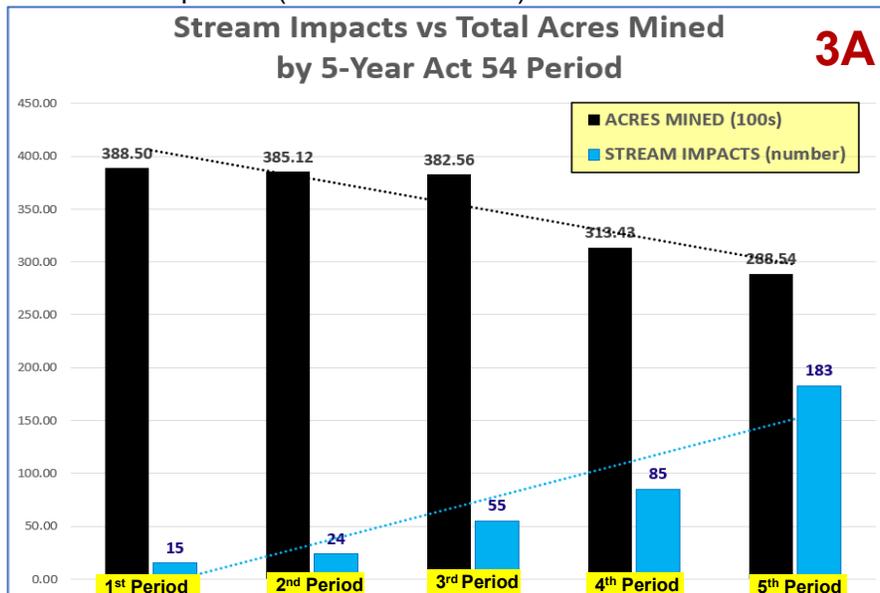
**TABLE 2.** Number of mine-liable impacts (to structures, water supplies, and land combined) from active mines during each of the last three 5-year assessment periods (15 years).

<u>Mine Type</u>	<b>NUMBER OF MINE-LIABLE IMPACTS**</b>			
	<b><u>From Mines Active During Period</u></b>			
	<b>ACT 54 FIVE-YEAR ASSESSMENT PERIOD</b>			
	<u>3<sup>rd</sup></u>	<u>4<sup>th</sup></u>	<u>5<sup>th</sup></u>	<u>Total (%)</u>
Longwall	509	476	450	<b>1,435</b> (83)
R&P	86	158	30	<b>274</b> (16)
PR	10	13	6	<b>29</b> (2)
Total	605	647	486	<b>1,738</b>

\*\* Structures + Water Supplies + Land

The charts in **Table 3** below show stream impacts as reported in the 5-year Act 54 Reports. It is clear that stream impacts have *increased* over time, even as total acreage mined has decreased. It also is clear that flow loss consistently has been the predominant type of impact. The data in the Act 54 Reports illustrate that most stream impacts were associated with longwall mines, which accounted for 100% of the stream impacts during the last 15 years (i.e., there were none for room-and-pillar or pillar recovery mines). As discussed further below, however, impacts to streams are not authorized by Act 54 (unlike impacts to structures and water supplies), even if an operator proposes to try to restore a damaged stream to pre-mining conditions. That widespread, intentional stream impacts are allowed to occur at all from mining, and that they are increasing over time, reflects the failure of the Bureau of Mining Programs to fulfill its public trust obligations under the Pennsylvania Constitution and to enforce the applicable statutes.

**TABLE 3.** Stream impacts vs. acreage mined during last 25 years (**3A**) and stream impacts by type of impact last 15 years (**3B**). Flow loss has consistently been the most significant impact to streams: during the 5<sup>th</sup> Period, 84% of the number of stream impacts and 90% of the miles of streams impacted (24.6 of 27.4 miles) were due to flow loss.



## BACKGROUND

To fully appreciate the current situation regarding impacts associated with underground coal mining, one must understand a little history. Coal mining was first recorded in Pennsylvania in 1759 (Ingram 1994). In 2019, according to the federal Energy Information Administration (EIA 2020), Pennsylvania was the third-largest coal-producing state (of 23) in the nation in total tonnage and the second-largest underground coal-producing state (of 15). Pennsylvania currently is home to two of the largest underground coal mines in the United States. Most of Pennsylvania’s coal comes from the southwestern section of the Commonwealth, where much of the coal produced is high-British thermal unit (Btu) bituminous coal that is used primarily for electricity generation and metal production.

Historically, most underground coal mining in Pennsylvania was done by room-and-pillar methods (see Appendix A for a summary of underground mining methods). Room-and-pillar coal mining in the Commonwealth was largely unregulated until the latter half of the twentieth century. Consequently, by the mid-1950s, subsidence damage from surface collapse, particularly from abandoned mines, was becoming recognized as a significant problem (US Bureau of Mines 1977).

Damage to homes and other structures in the coalfields was such a widespread problem that in 1961 Pennsylvania became the first state<sup>1</sup> to establish a Mine Subsidence Insurance (MSI) fund to help compensate landowners for structure damage attributed to subsidence, typically from abandoned room-and-pillar coal mines (see MSI discussion beginning on page 51 below). Extensive surface damage was occurring primarily because (a) room-and-pillar mines at that time were not designed or operated to the strict engineering standards that are in place today; pillars were inadequate to provide long-term support, (b) secondary robbing of coal pillars was uncontrolled, and (c) surface landowners generally were not aware of their rights, or lack of rights, to surface support. Subsidence problems were becoming “grave” and “widespread” as recited in the preamble to the 1961 Act that created the MSI (box at right).

The General Assembly of the Commonwealth of Pennsylvania hereby enacts as follows:

Section 1. Purposes.—Whereas, the anthracite and bituminous coal areas have been faced with the grave problems of subsidence for many years, and  
 Whereas, these problems are becoming more widespread, and  
 Whereas, these conditions cause undue hardship upon a multitude of persons, and  
 Whereas, studies reveal that the subsidence is traceable primarily to mining of thirty or more years ago and not necessarily to present day mining so that effective measures cannot readily be taken at this late date for the elimination of the problem,

Of particular interest in the box above is the perception at that time that subsidence problems were largely due to abandoned mines, and so effective measures to address them could not be taken. Yet, five years later in 1966, the subsidence problems were no better but measures in fact were taken to try to address the problem posed by ongoing mining.

<sup>1</sup> The second such state fund was not established until 18 years later, when Illinois did so in 1979.

Widespread subsidence damage in the coalfields led to enactment of the Bituminous Mine Subsidence and Land Conservation Act (BMSLCA) in 1966, five years after the MSI fund was established. The consequences of subsidence were reflected in Section 3 of the 1966 BMSLCA, which is excerpted below in part:

Section 3. It is hereby determined by the General Assembly of Pennsylvania and declared as a matter of legislative findings that:

- (1) Present mine subsidence legislation and coal mining laws have failed to protect the public interest in Pennsylvania in preserving our land.
- (2) Damage from mine subsidence has seriously impeded land development of the Commonwealth.
- (3) Damage from mine subsidence has caused a very clear and present danger to the health, safety and welfare of the people of Pennsylvania.
- (4) Damage by subsidence erodes the tax base of the affected municipalities.

It was the stated intention of the 1966 BMSLCA –*“to harmonize the protection of surface structures and the land supporting them”* with the *“continued growth and development of the bituminous coal industry in the Commonwealth.”* The 1966 Law offered a “balance”: it allowed the continued extraction of coal, but it prohibited damage to homes and structures built prior to 1966 (newer homes would be built, presumably, with the understanding that they were not so protected from ongoing and future mining).

In the 1970s and 1980s, mine design and engineering improved so as to comply with the 1966 BMSLCA and reduce surface damages from room-and-pillar mines. In part that entailed leaving sufficient support in place (in coal pillars) to prevent subsidence. At the same time, a newer technology that had been developed in Europe was being tried out in the Pennsylvania coalfields--- longwall mining methods. Because longwall mining removes enormous panels [blocks] of coal without providing surface support, it results in almost immediate and uneven surface subsidence. The damage from longwall subsidence was in direct conflict with the prohibitions in the 1966 BMSLCA. For a while longwall operators tried to locate mine panels to avoid significant surface damage to protected structures. However, as improved longwall methods allowed increasingly larger panels of coal to be extracted, longwall operators became frustrated by the 1966 BMSLCA prohibition on structural damage. That prohibition hampered their use of the emerging longwall technology which could remove a larger percentage of coal, faster, with less labor, and more profitably than traditional room-and-pillar methods.

During the 1980s, representatives of the coal industry challenged the 1966 Law, arguing that the requirement to leave coal in place for surface support constituted a “taking” of their property without compensation. After losing at every lower level and on every appeal, the case eventually was brought before the US Supreme Court<sup>2</sup>, where industry lost once again in a 5-4 decision. The Supreme Court found (a) that the 1966 Law’s requirement to keep a

<sup>2</sup> *Keystone Bituminous v. DeBenedictis*, 480 U.S. 470 (1987).

certain amount of coal in underground mines sufficient to support structures on the surface served a valid public purpose and (b) that the requirements of the Act did not make it impossible for operators to profitably conduct business, and thus did not amount to a “taking” of private property by the public.

### **Deep Mine Mediation Project (DMMP)**

Unable to overturn the 1966 Pennsylvania mining law, the coal industry then sought to change that law to allow the use of longwall technology. One argument put forward was that the 1966 Law only protected structures built *before* 1966. While that was true, the proposed “remedy” was somewhat disingenuous: allow all structures to be damaged, no matter when they were built, and then they could be repaired if damaged. It also was argued that the 1966 Law did not protect water supplies. This was a half-truth at best. The 1966 Law did not *specifically state* that subsidence damage to water supplies was prohibited. However, the 1966 prohibition on damage to structures provided significant indirect protection because it effectively kept mining from damaging other features in the near vicinity of protected structures, like springs and water supplies. As with structures, ironically, the proposed “remedy” of the coal industry was to allow all water supplies to be damaged with the promise that they too would be fixed.

In 1986 a group was formed to draft revised language to address subsidence damage from underground coal mining. Arthur A. Davis, then Professor of Forestry and Environmental Resources at Pennsylvania State University headed the group, which was known as the Deep Mine Mediation Project (DMMP). Its participants represented coal operators (including 3 of the 4 plaintiffs in the *Keystone Bituminous* case), farmers, sportsmen, and environmental interests. The DMMP met periodically over a three-year period. The group’s final draft was completed in March 1990 (Beauduy 1990), and it formed the basis of what was to become (almost verbatim) the adopted amendments to the 1966 mining law known as Act 54 (of 1994).

The Executive Summary accompanying that final draft, prepared by Thomas W. Beauduy, Esq. (Project Mediator), describes the goals and objectives of the DMMP. It includes several important points about stream protection in the context of Act 54 that apparently have been widely overlooked or ignored by the Bureau of Mining Programs during the last 25 years:

It was determined that the prevention of subsidence damage standard was in fact a structural damage standard, not an environmental protection one, and that the hydrologic balance requirements under both state and federal law may be adequate, on their face, to ensure protection of water resources if properly implemented.

In other words, the main focus of Act 54 was to address *structural* damage. It was never intended to protect streams or other environmental resources, because laws already were in place to protect such features and merely required proper implementation by regulators.

This same point was made again in the Executive Summary discussion regarding specific participants in the Mediation Project. One participant in particular – the Pennsylvania Federation of Sportsmen's Clubs (PFSC) --- reportedly was involved throughout the

process, but withdrew after the final draft was completed. As Mr. Beauduy explained:

The PFSC withdrew after determining that the final proposal represents a balancing of property rights, rather than environmental standards, which were its primary interest.

The participants in the Deep Mine Mediation Project apparently accepted at face value that streams and other environmental resources already were protected by existing state and federal laws and regulations, provided they were properly enforced, and so did not need to be addressed in the new legislation. The Executive Summary expanded on that point:

It was further determined that the effectiveness of the hydrologic balance requirements in extending that protection is directly dependent on their proper interpretation and administration by both state and federal regulators. Several of the participants felt that these provisions could in fact be more protectively and aggressively applied.

The Executive Summary went on to describe how Act 54 should address lingering concerns that existing water resource protection requirements were not being adequately enforced:

It was also felt that **additional knowledge about the long term impact of full extraction mining on water resources is desirable** to make public policy choices with confidence. **Therefore, to enhance our state of knowledge and better assess the long term impacts of underground mining on the Commonwealth's water resources,** (as well as on the subsidence of surface features and structures) **obligations are imposed on the Department of Environmental Resources to more comprehensively compile and analyze data being generated by mining activity** in Pennsylvania. [bold added]

Those “*obligations*” were spelled out in Section 18.1 of Act 54 which established the 5-year review and reporting provision regarding subsidence impacts (**box below**). This provision was important in maintaining the support of participant groups such as the PA League of Women Voters and the Pennsylvania Environmental Council.

**Section 18.1. Compilation and analysis of data.** [underline added]

(a) The department shall compile, on an ongoing basis, the information contained in deep mine permit applications, in monitoring reports and other data submitted by operators, from enforcement actions and from any other appropriate source for the purposes set forth below.

(b) Such data shall be analyzed by the department, utilizing the services of professionals or institutions recognized in the field, for the purpose of determining, to the extent possible, the effects of deep mining on subsidence of surface structures and features and on water resources, including sources of public and private water supplies.

(c) The analysis of such data and any relevant findings shall be presented in report form to the Governor, the General Assembly and to the Citizens Advisory Council of the department at five-year intervals commencing in 1993.

(d) Nothing contained herein shall be construed as authorizing the department to require a mine operator to submit additional information or data, except that it shall require reporting of all water loss incidents or claims of water loss.

Section 18.1 (above) is the basis for the five-year Act 54 Reports, which are meant to identify and analyze the impacts that actually occurred as a result of underground bituminous coal mining during each previous 5-year period for consideration by legislators, policymakers, and the general public. The *need* for these assessments is based on the fact that **Act 54**, in 1994 for the first time, specifically **allowed intentional, foreseeable damages** to occur at the land surface as a consequence of underground coal mining. Act 54 changed crucial language in the 1966 Mining Law. Where previously the “*prevention of damage from mine subsidence*” was mandated, Act 54 required only the “*prevention or restoration of damage from mine subsidence*”. Previously, subsidence damage to homes built prior to 1966 was prohibited, but under Act 54 all homes could be damaged, no matter when they were built, provided they were repaired or replaced, or the owner was compensated monetarily. This was a fundamental change. Act 54 also required the restoration or replacement of any water supplies damaged by subsidence.

**No such fundamental change in stream protection occurred with Act 54.** Unlike the revision for homes, Act 54 does not say that henceforth all streams may be damaged provided they are restored. In fact, rather than providing any such loophole, Section 9.1(d) of Act 54 specifically says it is **not** changing the status quo with respect to the protection of streams and other elements of the hydrologic balance:

(d) **Nothing in this act shall be construed to amend, modify or otherwise supersede standards related to prevailing hydrologic balance contained in the Surface Mining Control and Reclamation Act of 1977 (Public Law 95-87, 30 U.S.C. §1201 et seq.) and regulations promulgated by the Environmental Quality Board for the purpose of obtaining or maintaining primary jurisdiction over the enforcement and administration of that act nor any standard contained in the act of June 22, 1937 (P. L. 19B7, No. 394), known as "The Clean Streams Law," or any regulation promulgated thereunder** by the Environmental Quality Board. [boldface added]

For environmental resources Act 54 clearly states that the existing laws and regulations (and, though not mentioned, the Article 1, Section 27, Constitutional provision) --- if properly enforced --- would be adequate. Just to be sure, though, the drafters of Act 54 inserted the Section 18.1 requirement for status reports to be prepared every 5 years so that elected officials and the public could learn the actual consequences to structures, water supplies, and water resources. Such data and information then could inform any need for changes in the law, regulations, or policies. The 5-year reporting requirement ultimately may be the most important aspect of Act 54 for water resource protection.

Intentional subsidence damage to structures and water supplies was a fundamental policy change created by Act 54. No such change in policy was created by Act 54 with regard to streams. What apparently *did* change under Act 54 was that the Department administered its Mining Program as if Act 54 had allowed damage to streams (just like it did for homes and water supplies), and as if it was now acceptable to damage a stream if the mine operator proposed to try to restore it. The common (mis)perception at the time was that *any damage* associated with underground coal mining was allowed, but would need to be repaired,

inasmuch as Act 54 was promoted by the Department as a "*you break it, you fix it*" law<sup>3</sup>. The problem is that **streams were never meant to be part of that equation**.

Act 54 does **not** allow any foreseeable subsidence damage to streams like it does to homes and structures, even if a mine operator might propose to mitigate stream damage in some way. Act 54 directly addresses environmental resource protections only minimally, but what it says is vitally important. With respect to the protection of water resources such as streams, Act 54 makes 3 major points:

- Existing federal laws (including the federal Surface Mining Control and Reclamation Act [SMCRA]) and state laws (including the Pennsylvania Clean Streams Law [CSL]) and regulations adopted under them still fully apply to all underground coal mining activities,
- Certain water supplies (including all streams used for industrial, agricultural, or recreational purposes) became subject to specific new protection and restoration requirements if damaged by underground coal mining, and
- The Department must consistently monitor mine subsidence impacts to water supplies and other water resources and report on those effects at 5-year intervals.

If all of these three provisions had been followed faithfully this past quarter of a century, Act 54 might actually have strengthened water resource protection. Instead, as data set forth in each of the 5-year Act 54 reports confirm, the opposite has occurred.

To summarize: Surface subsidence damage was a significant problem associated with unregulated room-and-pillar coal mines in the mid-twentieth century. The MSI program was established in 1961 to help compensate homeowners for structural damage caused by subsidence from abandoned mines. As subsidence problems continued, the BMSLCA was enacted in 1966 to prohibit damage to all homes in place as of that year. As the design of room-and-pillar mines began to improve to prevent subsidence in the 1970s and 1980s, a newer mining method (longwall) was emerging. However, the longwall method conflicted with the 1966 Law's prohibition on structural damage. After numerous unsuccessful attempts to legally invalidate the 1966 BMSLCA requirement for surface support, coal interests sought to change the law to allow longwall mining. In 1994, Act 54 amended the 1966 Law, allowing damage to all homes but requiring repair or replacement of damaged structures and water supplies. **Act 54 did not weaken or otherwise change the legal protections afforded to streams, wetlands, or other water resources.** In accordance with Section 18.1 of Act 54, data collected over 25 years have been analyzed in five 5-year Act 54 Reports that address the effects of mine subsidence on structures, water supplies, and water resources. The data clearly demonstrate that the Department's Bureau of Mining Programs has unlawfully allowed surface waters and groundwater to become collateral damage to the structural damage permitted by Act 54. Not surprisingly, repair of damages to streams, wetlands, and other elements of the complex natural hydrologic balance is not so easy as repair of man-made features, which themselves are not being repaired or restored as envisioned by Act 54.

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<sup>3</sup> "*The act .... put in place a 'you break it, you fix it' rule for many types of structures that could be damaged by deep mining...*" per the June 1999 letter of PADEP Secretary James Seif transmitting the first Act 54 Five-Year Assessment to Governor Tom Ridge, the General Assembly, the Citizens Advisory Council, and the Environmental Quality Board.

## PENNSYLVANIA CONSTITUTION (Article 1, Section 27)

Amendments to the Pennsylvania State Constitution are not easily made. They must be approved by each house of the General Assembly in two successive legislative sessions, and then approved by a majority of voters in a public referendum. Article I, Section 27 (see below), was unanimously approved in the 1969-1970 and 1970-1971 sessions of the General Assembly, and then approved by voters on 18 May 1971 by a statewide margin of nearly 4:1 (Kury 2011). On 23 July 1971, Governor Milton Shapp signed a proclamation declaring that Article I, Section 27, had been adopted as part of the Pennsylvania Constitution.

*The people have a right to clean air, pure water, and to the preservation of the natural, scenic, historic and esthetic values of the environment. Pennsylvania's public natural resources are the common property of all the people, including generations yet to come. As trustee of these resources, the Commonwealth shall conserve and maintain them for the benefit of all the people.*

### **Pennsylvania's Environmental Rights Amendment (ERA)**

Decades before this Constitutional amendment, in 1937, the Commonwealth had enacted the Clean Streams Law (CSL). That legislation was the benchmark for water resource protection in Pennsylvania. Even at that time, more than 80 years ago, the adverse impacts of coal mining were clearly recognized. The preamble to the CSL states its objectives:

To preserve and improve the purity of the waters of the Commonwealth for the protection of public health, animal and aquatic life, and for industrial consumption, and recreation; ... providing protection of water supply and water quality; ... **regulating the operation of mines and regulating the impact of mining on water quality, supply, and quantity;** ... [bold added]

The Pennsylvania CSL preceded by 11 years the original federal Clean Water Act, which was adopted in 1948, and at the time was called the Federal Water Pollution Control Act. Both the PA Clean Streams Law and the federal Clean Water Act (CWA) recognize the fundamental importance of clean water to public health and welfare, and their implementing regulations seek to protect the uses and functions of waterways and wetlands. Unlike the federal CWA, Pennsylvania's Clean Streams Law protects groundwater as well as surface waters.

Sections of the CSL specifically address mines and direct the Department to assess the cumulative hydrologic impacts of mining activities with each permit issued (see CHIA discussion beginning on page 20 below). According to CSL Article III, Section 315(c):

The application for a permit to operate a mine shall include a determination of the probable hydrologic consequences of the operation, both on and off the site of the operation, with respect to the hydrologic regime, quantity and quality of water in surface and ground water systems including the dissolved and suspended solids under seasonal flow conditions and the collection of sufficient data for the site of the operations and surrounding areas so that an assessment can be made by the department of the probable cumulative impacts of all anticipated mining in the area upon the hydrology of the area and particularly upon water availability.

The two landmark directives, the CSL and the ERA of the Pennsylvania Constitution, firmly establish the legal basis for the protection of water resources in the Commonwealth. **They were not altered by Act 54; rather, Act 54 itself highlighted the fact that existing environmental protections were still fully applicable to underground mining activities.**

Article 1, Section 27, is *quoted* in part (but not specifically cited) on page 8-4 of the 5<sup>th</sup> Act 54 Report, where, in discussing the widespread use of groundwater and surface waters to augment longwall mining-damaged streams, it properly warns:

...they represent a case where the hydrologic balance may not be preserved and therefore “the natural, scenic, historic and esthetic values of the environment” may not be preserved.

It is unfortunate that the 5<sup>th</sup> Report does not mention the source of that quote or make additional references to the Environmental Rights Amendment of the PA Constitution. Such a reference would have been warranted in Section 8, as well as in numerous other places throughout the Report, if only to remind the reader that the Department is obligated to act as the *trustee*, not merely a proprietor, of the Commonwealth’s public natural resources.

One place in the 5<sup>th</sup> Act 54 Report that would have been appropriate to mention the ERA was in its Introduction (Section 1), and specifically in the Section 1.B summaries of environmental laws relevant to coal mining in Pennsylvania. The Constitution is not a law, but it supersedes all laws and sets the framework within which our environmental laws are to be implemented. The summary in Section 1.B of the 5<sup>th</sup> Act 54 Report *mentions* the Clean Streams Law, which is good, but it fails to note that the CSL was passed in large part *because of* impacts and pollution from coal mining, as was the Environmental Rights Amendment itself.

In *Robinson Township v. Commonwealth of Pennsylvania*<sup>1</sup>, the Pennsylvania Supreme Court held unconstitutional major parts of a 2012 law (Act 13) designed to facilitate the development of a high-extraction method of producing natural gas from Marcellus Shale. The 162-page plurality opinion in that case, written by Chief Justice Ronald Castille, was grounded on Article I, Section 27, of the Pennsylvania Constitution, which Mr. Castille noted had been drafted in part to correct abuses inflicted on the environment by past coal mining (see passage in **box, right**).

When coal was “King,” there was no Environmental Rights Amendment to constrain exploitation of the resource, to protect the people and the environment, or to impose the sort of specific duty as trustee upon the Commonwealth as is found in the Amendment. ... the riverways remain, not as pure as when William Penn first laid eyes upon his colonial charter, but cleaner and better than they were in a relatively recent past, when the citizenry was less attuned to the environmental effects of the exploitation of subsurface natural resources. ... the landscape bears visible scars, too, as reminders of the past efforts of man to exploit Pennsylvania’s natural assets. Pennsylvania’s past is the necessary prologue here: the reserved rights, and the concomitant duties and constraints, embraced by the Environmental Rights Amendment, are a product of our unique history. ... By any responsible account, the exploitation of the Marcellus Shale Formation will produce a detrimental effect on the environment, on the people, their children, and future generations, and potentially on the public purse, perhaps rivaling the environmental effects of coal extraction.

<sup>1</sup> *Robinson Township et al. v. Commonwealth et al.*, Nos. 63 MAP 2012, 64 MAP 2012, 72 MAP 2012, 73 MAP 2012, 2013 WL 6687290 (Pa. Dec. 19, 2013).

## STREAM PROTECTION

In Section 1 of the 5<sup>th</sup> Act 54 Report, both the applicability of the Clean Streams Law (CSL) and the need to protect aquatic resources in the context of Commonwealth mining regulations (Chapters 86 and 89) and water protection regulations (notably Chapters 93 and 105) are highlighted in the context of Act 54:

Act 54 also explicitly acknowledges the Commonwealth’s responsibility to protect the surface waters of the Commonwealth, as codified in the Clean Streams Law, [and] PA Code Title 25 Chapters 89, 93, 94, 96, and 105. Consequently, **underground mine operators are required to demonstrate that their activities will prevent damage to aquifers and perennial streams.** - page 1-5 [bold added]

Under the authority of the Pennsylvania Clean Streams Law (35 P.S. §691.1 et seq.) and regulations in PA Code Title 25, including Chapters 86, 89, 93, 96 and 105, the PADEP “will **ensure that underground mining activities are designed to protect and maintain the existing and designated uses** of perennial and intermittent streams”. - page 1-8 [bold added]

In Section 8, the 5<sup>th</sup> Act 54 Report further states:

To comply with the Pennsylvania Clean Streams Law, the mining regulations require “measures to be taken to ensure the protection of the hydrologic balance and to prevent adverse hydrologic consequences”.

The above passages acknowledge the requirements to **prevent** damage to streams and to the hydrologic balance in the context of underground mining. Many hundreds of instances of stream impact reported in the five-year assessments show that prevention of damage is not being achieved nor required by the Bureau of Mining Programs.

As mentioned previously, Act 54 did not in any way change or weaken existing stream or other environmental protections, such as those imposed by the Clean Streams Law (CSL) or the Dam Safety and Encroachments Act (DSEA) of 1978. The main focus of the CSL is the prevention and control of *pollution*, which includes physical changes in watercourses.

According to the definition in the CSL, “pollution” includes:

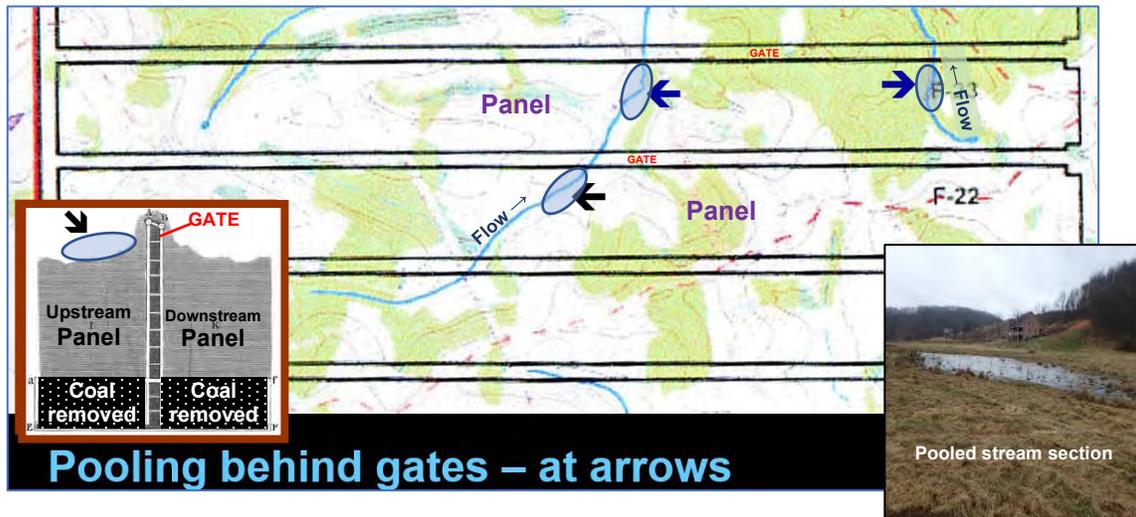
.... alteration of the physical, chemical or biological properties of such waters [of the Commonwealth], or change in temperature, taste, color or odor thereof.....

The provisions of the DSEA are implemented by the Department’s regulations at 25 Pa. Code Chapter 105. Accordingly, any activity which entails an “encroachment” into a stream, wetland, or other regulated water must first receive approval from the Department.

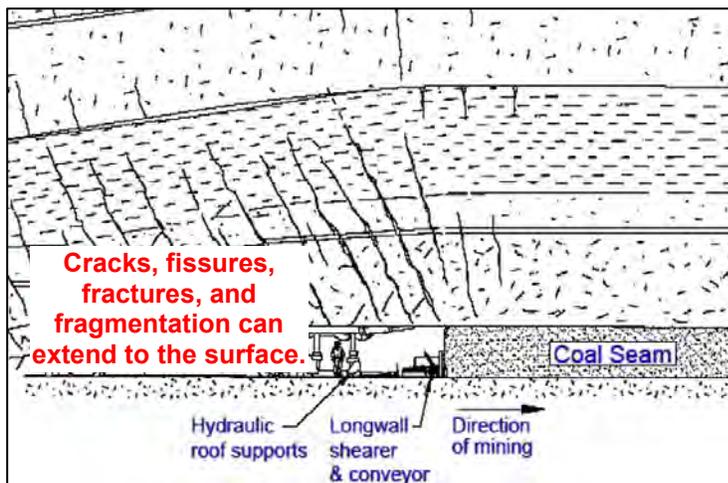
According to the definition in Chapter 105, an “encroachment” is defined as:

A structure or activity which changes, expands or diminishes the course, current or cross section of a watercourse, floodway or body of water.

Subsidence of a streambed clearly represents a physical change in the stream, one that radically alters the cross-section of that watercourse. One example of stream damage from subsidence is **pooling** (see figure below), which results where a stream extends across two adjacent longwall panels which both subside while the gate between them does not. This creates pooling in the subsided section of the waterway upstream from the gate. The typical “fix” for this type of impact is to excavate the streambed where it crosses the gate down to the level of the subsided streambed on either side.



Longwall mine subsidence often causes fissures and fractures in the layers of rock above the mine, which can extend all the way to the surface. This can result in heaves and cracks in the streambed itself, causing **flow loss** as the water drains away (see figures below). The typical “fix” for this type of impact is to shave down the heaves, inject grout into the cracked sections, and in extreme cases, install an impervious liner so the streambed might once again convey water.



In cases of both pooling and flow loss, not only is there an “encroachment” when the stream cross-section is changed due to subsidence, but there is a second “encroachment” when the stream “restoration” requires physical intervention. Although approximately-normal pre-mining flow ultimately may be “restored” in the streambed, the post-mining stream typically is no longer the same physically or biologically as it was prior to disturbance. In some streams successful “restoration” has proven to be impossible.

Throughout Pennsylvania, projects that involve an encroachment into regulated waters of the Commonwealth must first obtain DSEA/Chapter 105 approval from the Department, typically from one of six regional offices depending upon where the activity is proposed. In the context of underground coal mining, however, approval for such encroachments is supposed to be incorporated into the review and approval of the underground mining permit. The Clean Streams Law, as amended in 1980 (14 years *prior* to adoption of Act 54), directs the Department to require mine permit applicants to comply with the substantive provisions of the DSEA (which includes wetland protection) and to apply those provisions in a “coordinated manner”. Section 315 of the CSL (entitled “Operation of Mines”) describes what is to be included in a mine permit application. CSL Section 315(f) is clear that the provisions of the DSEA must be complied with, or else the mine permit can be revoked:

*(f) The [mine permit] application shall also set forth the manner in which the operator plans to comply with the requirements of the act of November 26, 1978 (P.L.1375, No.325), known as the "Dam Safety and Encroachments Act," ..... [other Acts then listed] ..... No approval shall be granted unless the plan provides for compliance with the statutes hereinabove enumerated, and failure to comply with the statutes hereinabove enumerated during mining or thereafter shall render the operator liable to the sanctions and penalties provided in this act for violations of this act and to the sanctions and penalties provided in the statutes hereinabove enumerated for violations of such statutes. Such failure to comply shall be cause for revocation of any approval or permit issued by the department to the operator ..... [N]othing in this subsection shall be read to limit the Department's authority to regulate activities in a coordinated manner.*

In an effort to coordinate regulation, on 5 October 1981, an agreement was formalized between the PADEP Bureau of Mining and Reclamation (BMR) and the PADEP Bureau of Dams and Waterways Management (BDWM). Under the agreement, responsibility for the administration and enforcement of the DSEA was delegated to the Mining Bureau for all mine-related operations (Schmid & Company, Inc. 2000), with the exception of certain mine-related dams which remained the responsibility of the BDWM.

The Bureau of Mining Programs has been applying the provisions of the Chapter 105 regulations only to encroachments associated with stream restoration/mitigation activities, but **not** to the longwall subsidence that caused the pooling or flow loss damages in the first place. In recent years the Department has pointed to a 2002 Environmental Hearing Board decision (*Consol Pennsylvania Coal Co. v. DEP, et al.*, EHB Docket No. 2002-112-L; opinion issued 31 December 2002) to try to justify not protecting streams from longwall mine subsidence damage. The BMP claims that it does not have the authority to require a longwall mine operator to

obtain a separate Chapter 105 permit for subsidence damage to waters of the Commonwealth (PADEP 2005b). As noted above, however, the Clean Streams Law directly relates the requirements of the DSEA to every mining approval, and enforcement of the provisions of the DSEA was specifically delegated to the BMR in 1981. While a separate Chapter 105 *permit* for subsidence damage to streams might be unnecessary and redundant, clearly the requirements of the DSEA must be applied in any event.

As discussed further below, stream pooling damage due to longwall subsidence routinely does not get “repaired” for many years, during which time the pooled section of a stream may experience increased surface temperature and sedimentation, both of which constitute “pollution” under the Clean Streams Law. In accordance with Section 611 of the CSL, it is unlawful to cause pollution of waters of the Commonwealth.

Loss of flow also has been determined to meet the definition of “pollution” and to constitute a violation of both federal and state laws. Writing for the majority of the U.S. Supreme Court in *Jefferson County Public Utility District v. Washington Department of Ecology*<sup>5</sup>, Justice Sandra Day O’Connor declared that reducing water quantity or flow was capable of destroying all designated uses for a given body of water, and that the federal Clean Water Act’s definition of pollution was broad enough to encompass the effects of reduced water flow, not merely the release (discharge) of polluting substances. The Pennsylvania Environmental Hearing Board made a similar determination<sup>6</sup> when it found that the Department has an obligation under the Clean Streams Law to make an affirmative determination concerning the effect, if any, on any adjacent aquatic resources of projects involving water withdrawals. Streams subjected to subsidence-induced flow loss often exhibit changes in water chemistry, temperature, and biological functioning as well, which may continue for many years before approximate pre-mining conditions are restored. The CSL and the Chapter 86 mining regulations explicitly prohibit permit issuance if there is any “*presumptive evidence of potential pollution*”.

Prevention of stream damage requires *avoidance* of damage. Instead, the Bureau of Mining Programs has been *allowing* streams to be damaged, apparently under the mistaken notion that the damages allowed by Act 54 also apply to streams, or under the misguided belief that promises of partial mitigation measures (such as post-subsidence grouting and flow augmentation) constitute damage “prevention” and stream “protection”. (To put this in current public health terms: *prevention* of a fatal, viral disease like COVID-19 requires the use of a vaccine which allows people to avoid contracting the disease in the first place, whereas treatments of the disease are like after-the-fact mitigation measures. Just because one may have an ability to treat a disease or some of its symptoms does not mean it is good public policy to forego the use of an available vaccine and allow everyone to contract the disease.) It is a misconception, if not outright deception, for the Department to operate as if Act 54 *allows* damage to streams (as it does to structures and water supplies) provided

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<sup>5</sup> PUD No. 1 of Jefferson County v. Washington Department of Ecology (92-1911), 511 U.S. 700 (31 May 1994)

<sup>6</sup> Oley Township v. DEP and Wissahickon Spring Water, Inc., 1996 EHB 1098

that the operator proposes to mitigate the damage later on. As discussed above, damage to Pennsylvania streams simply is not allowed by Act 54.

The Environmental Hearing Board has warned that mitigation is meant to be used for *unanticipated* stream damages from underground mining. For example, in the UMCO Energy, Inc. case (EHB Docket No. 2004-245-L, 5 September 2006), Judge Labuskes noted:

We cannot agree that a promise to perform repairs trumps everything else in the forgoing discussion. There is nothing in the law that specifically supports UMCO’s theory that it is acceptable, in UMCO’s words, to “destroy” streams so long as feasible repairs are promised. The Subsidence Act [*viz.*, Act 54 of 1994] contains no language supporting such a position, and the position flies in the face of the Clean Streams Law. Everything in the applicable laws points to the common sense notion that *prevention* of pollution and the *protection* and *maintenance* of values and uses [comprise the standard of protection]. [italics in original]

It is perfectly sensible when permitting, not only in the mining program but in virtually every program administered by the Department, to plan for unexpected contingencies. Applicants should be made to describe how they will handle a situation if things go bad. This is not to say that it is acceptable for things to go bad, or that it is expected that things will go bad. Quite the opposite. If it is known in advance that things will go bad, the permit cannot be issued in the first place. The fact that the Department requires deep mining permit applicants to describe how they will repair streams *if* they are damaged does not mean that it is acceptable to damage the streams. Stream mitigation plans are designed to address *unanticipated* damage, not to excuse or approve damage in advance. [italics in original]

Act 54 **does not allow** damage to streams based on proposed repair or restoration afterwards (as it does for structures). Act 54 **did not change** the Department’s longstanding paradigm of environmental protection that involves *avoidance* and *minimization* of impacts. Stream damage *predictions* are required by the State mining regulations at 25 Pa. Code Chapter 89 and must be provided in each mine permit application. Those predictions are supposed to be reliable and used “to prevent or minimize adverse hydrologic consequences” (§89.36). 25 Pa. Code Chapter 89 further states that, if the applicant’s required *pre-mining groundwater monitoring* indicates possible adverse impacts to the hydrologic balance by the proposed mining activity, “the mine development plan or method of mining” may need to be altered to prevent those impacts. None of the five-year Act 54 Reports records that stream damage predictions or monitoring results have ever been used by the Department to require a change in a mining plan or method. As discussed further below, stream damage predictions, when made at all, generally are not credible because the models and assumptions upon which they are based are outdated, are generally unevaluated, and rely on inadequate baseline data. Whenever stream damage actually occurs, whether predicted or not, a mine operator is obligated to implement mitigation measures “as expeditiously as possible”, and to restore the damaged stream to its pre-mining conditions, including its normal range of pre-mining flow and its pre-mining physical and biological attributes. The five-year Act 54 Reports clearly document that prompt restoration to pre-mining stream conditions routinely does not occur.

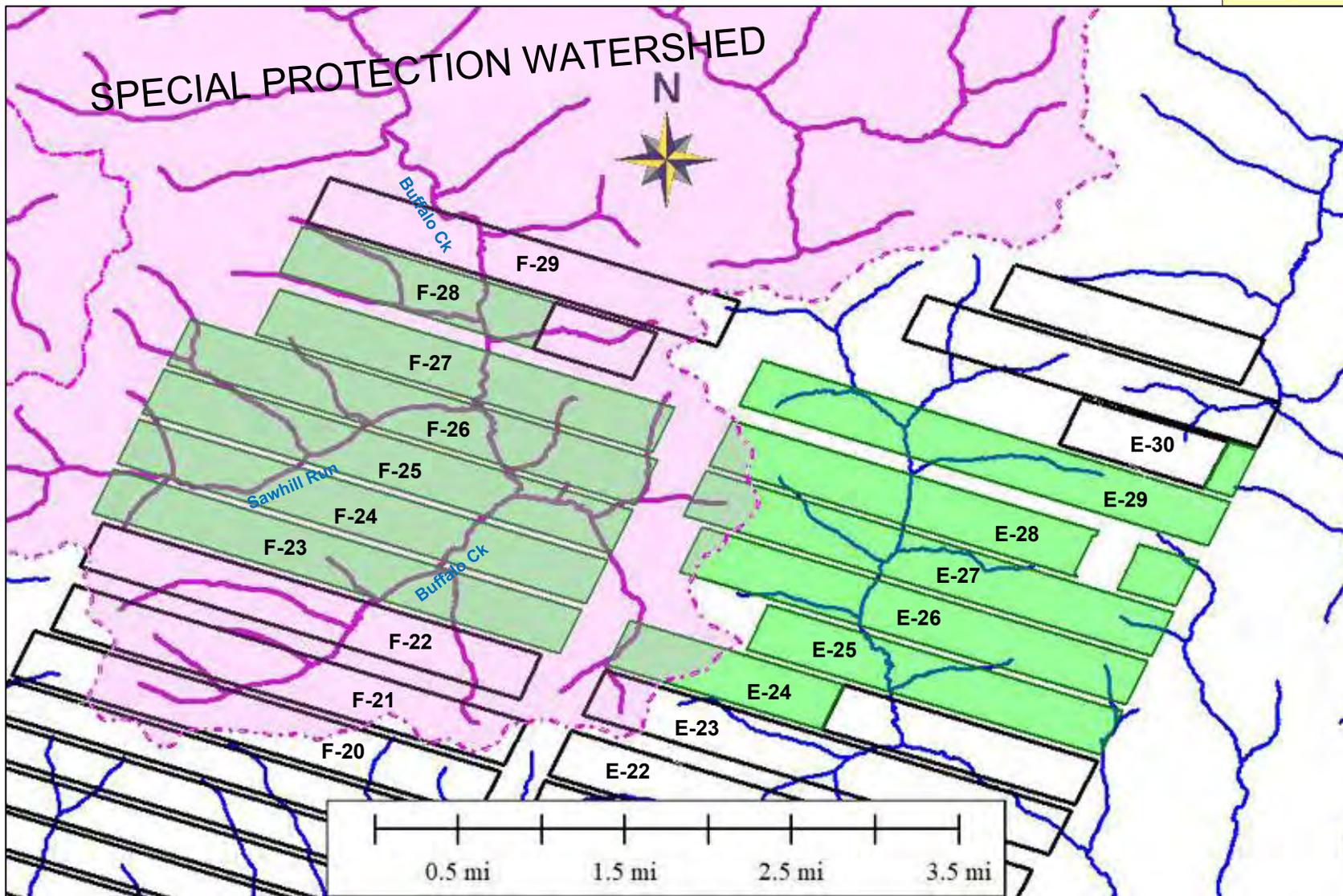
## SPECIAL PROTECTION WATERS

As stated previously, Act 54 did not in any way diminish the protections afforded to Pennsylvania streams under the Clean Streams Law, the ERA of the Constitution, or the existing mining laws and regulations pertaining to the hydrologic balance. All streams remained fully protected, and Act 54 did not allow mine operators to damage them when conditioned on promises of restoration. While the basic protections of Commonwealth laws and regulations apply to *all* streams, one class of streams in particular merits a higher level of protection. The Pennsylvania Water Quality Standards embodied in 25 Pa. Code Chapter 93 designate certain waters that meet specific threshold criteria for special protection. Waters identified as having either Exceptional Value (EV) or High Quality (HQ) uses are defined as Special Protection waters. Once recognized as such, EV and HQ waters are subject to specific antidegradation requirements per §93.4a-4d and the federal Clean Water Act. For nearly two decades Pennsylvania's antidegradation protections have applied to any activity (not only discharges) that may adversely affect a surface water use, including underground mining.

The 5<sup>th</sup> Report authors appear to be aware of Pennsylvania's antidegradation requirements because they include: a reference to its Technical Guidance Document 391-0300-002 (PADEP 2003) in their Acronyms and Abbreviations (page vi), a one-sentence mention of it on page 1-8, and a citation to it in their References (page 1-11). Other than those brief mentions, however, there is no further discussion or evaluation in the 5<sup>th</sup> Act 54 Report regarding the significant extent to which Special Protection waterways are at present being impacted, and in future increasingly will be impacted, by high-extraction underground coal mining activities. In contrast, both the 3<sup>rd</sup> and 4<sup>th</sup> Act 54 Reports at least identified the designated use classification (including EV or HQ as appropriate) in their lists of streams damaged or undergoing restoration activities during those respective periods.

Nowhere does the 5<sup>th</sup> Report identify any Special Protection streams that have been damaged by, or are at risk of damage from, longwall mining subsidence. Large areas of the Sawhill Run and Buffalo Creek watersheds (both HQ), however, were undermined by the Enlow Fork Mine during the 4<sup>th</sup> and 5<sup>th</sup> Act 54 reporting periods (**Figure 1**). Indeed, more than half of the area undermined by Enlow Fork Mine during the 5<sup>th</sup> period was in Special Protection watersheds, including sections of 43 streams (5.5 miles) impacted by flow loss and sections of 6 streams (0.9 mile) impacted by pooling. For Harvey Mine, 98% of the area undermined by longwall panels during the 5<sup>th</sup> Period was in the Special Protection watersheds of either Browns Creek or Patterson Creek, including sections of 13 streams (3.4 miles) damaged by flow loss and part of one stream (104 linear feet) damaged by pooling. The fact that all of these damaged waters are designated Special Protection waters is nowhere mentioned in the 5<sup>th</sup> Act 54 Report.

According to 5<sup>th</sup> Report Table 8-1, 92 streams that had experienced flow loss were being augmented during the 5<sup>th</sup> period. (Some of these may have been damaged during previous 5-year periods). The 92 damaged streams (specific lengths were not reported) include at least 35 (38%) that have High Quality designated uses per Chapter 93, but no mention of their Special Protection status or uses is made in the Report. Similarly, the 82 Stream Recovery Evaluations (SREs; discussed further below) listed in 5<sup>th</sup> Report Table 9-6 and Appendix F do not identify the nature (or length) of the individual streams impacted, and specifically do not identify which streams had designated or existing EV or HQ uses prior to being damaged. A



**FIGURE 1.** Special Protection watersheds undermined by Enlow Fork Mine during the 5<sup>th</sup> Act 54 Period. Longwall panels actively mined during the 5<sup>th</sup> period are shaded green. Dark purple streams (Sawhill Run, Buffalo Creek, and their tributaries; per PASDA “networked streams of PA”) are designated “High Quality”, and their watersheds are shaded light purple. Approximately 2,421 acres (55%) of the 4,396 acres undermined by Enlow Fork Mine during this period were in Special Protection watersheds, something not mentioned or evaluated at all in the 5<sup>th</sup> Act 54 Report. For Harvey Mine (not shown), 98% of the area undermined by longwall panels during the 5<sup>th</sup> Period was in Special Protection watersheds.

simple map showing all streams that were damaged during the 5<sup>th</sup> period, together with their designated uses, would have been very informative in the context of Act 54. Another useful map would have been one showing Special Protection streams that were damaged during previous periods and which still are being augmented or otherwise have yet to be restored. Finally, a map showing the Special Protection watersheds that encompass more than half of the remaining unmined Pittsburgh coal seam (see *Moving Forward*, page 63 below) would have been most useful. That none of these maps was included in the 5<sup>th</sup> Act 54 Report suggests that the Special Protection status of damaged streams is being ignored by the Bureau of Mining Programs and by the University of Pittsburgh. Important and relevant information regarding the large-scale damage intentionally being inflicted on Special Protection waterways by longwall mine subsidence, and the resultant loss of stream uses, has not been provided to policymakers or the public in the 5<sup>th</sup> Report, even to the minor extent that it was recognized in the 3<sup>rd</sup> and 4<sup>th</sup> Act 54 Reports.

## HYDROLOGIC BALANCE

In contrast to the first four Act 54 Reports, there is an entire section (#7) in the 5<sup>th</sup> Report devoted to the Hydrologic Balance, which is followed by sections on Groundwater (#8), Streams (#9), and Wetlands (#10). That is a refreshing change. Section 7 acknowledges the direct relationship between Act 54, groundwater, and surface water. Per page 7-2:

Underground longwall coal mining affects the hydrologic balance through several fundamental mechanisms... impeded flow...(pooling)... rerouted surface water ... (flow loss)...and altered aquifer systems that change groundwater dynamics.

On page 7-3 the connection with Act 54 is acknowledged (if somewhat overstated):

Protection of the hydrologic balance is fundamental to the Act 54 legislation.

Thus the 5<sup>th</sup> Act 54 Report frames the issues regarding underground mining and potential effects on the hydrologic balance. Then, but without making an explicit connection, it indirectly mentions how the Department fails to identify and protect the hydrologic balance in the context of Act 54. On page 7-3 it notes:

...there is not a consistent body of data the PADEP appears to use to evaluate regional changes to groundwater conditions. Groundwater impacts are not tracked in BUMIS and groundwater hydrologic monitoring and water supply loss data are not formally included in examination of stream recovery.

The above conclusions from the 5<sup>th</sup> Report about incomplete monitoring and tracking of groundwater are not new; they are quite similar to those in the 4<sup>th</sup> Report, which found:

...observations of groundwater are limited to relatively few and spatially limited points (i.e., wells). In general, HMR data is collected from a subset of existing wells and nests of piezometers... Analysis of affected water supplies relative to lowered water tables is challenging given the existing data is limited in spatial and temporal density. ... Few piezometer, spring, or well HMR points were in close proximity to most of the reported effects. (pages VI-27 to VI-29)

Five years later the 5<sup>th</sup> Act 54 Report acknowledges that the Bureau of Mining Programs has done nothing to improve pre-mining or post-mining groundwater data collection to enable either prediction or after-the-fact analysis of underground coal mining impacts on the hydrologic balance.

Complete and accurate monitoring data remain essential to assess hydrologic impacts relating to mine subsidence. The Bureau of Mining Programs has repeatedly expressed great expectations regarding a recently-completed US Geological Survey study (Hittle and Risser 2019) and its potential use in evaluating whether observed streamflow changes following undermining are a result of mine subsidence or simply a reflection of natural hydrologic variability. The discussion in Section 7 of the 5<sup>th</sup> Report on the hydrologic balance and existing streamflow monitoring included by mine operators in their stream recovery evaluations (SREs) warns, however, that this USGS study methodology will not be a “silver bullet” so long as inadequate and incomplete monitoring data continue to be compiled by mine operators and provided to (and accepted by) the Department’s Bureau of Mining Programs:

The incomplete reported hydrologic data in the SRE reports can undermine the accuracy of flow comparisons and will cause problems in potential new flow monitoring schedules based on statistical methods (Hittle and Risser, 2019). **At present, determination of recovery based on incomplete data sets occurs too often, and when it occurs the circumstances are often not documented.** The data gaps are not small or infrequent (i.e., this is not a case where one week is missed during the six-month period or the longwall moves a little faster than anticipated during daily sampling). Fundamentally, **assuring data completeness is vital to assessment** of hydrologic recovery and therefore protection of the hydrologic balance. [p. 7-16; bold added]

One obvious way to fill the gaps in reported hydrologic data is through the use of Cumulative Hydrologic Impact Assessments (CHIAs). A CHIA is to be prepared by the Department whenever it reviews an application for a new underground mine permit or a mine permit revision. CHIAs are required pursuant to SMCRA, but also in accordance with the explicit directives of the Clean Streams Law (see quote at bottom of page 11, above). The requirements to protect hydrologic resources and predict hydrologic consequences are directly incorporated in current Pennsylvania Surface and Underground Coal Mining regulations (§86.37) and the regulations for Underground Mining of Coal and Coal Preparation Facilities (§89.35-36).

The Department’s CHIA determination is to be based on information provided by a mine operator in the permit application. There is a 5-page form (5600-FM-MR0017) to be used to make this assessment and a 5-page guidance document (TGD 563-2112-219) which describes what a CHIA is supposed to accomplish. According to the TGD, “the Department will determine the cumulative hydrologic impacts of the proposed mining activities on the designated watershed and will make a written finding that the proposed activities have been designed to prevent damage to the hydrologic balance within and outside the permit area.” **In fact, the numerous CHIAs we have reviewed over the years in mining applications are not comprehensive --- rather, they tend to consist merely of perfunctory box checkoffs with little substantive data and no analysis at all.**

The hydrologic data to be gathered pre- and post-mining per TGD 563-2000-655 are not being provided to the Department or incorporated into its CHIAs.

There is no mention at all of CHIAs in the 5<sup>th</sup> Act 54 Report, just as there was none in any of the past four Act 54 Reports. This seems to be an odd omission, because CHIAs as described by TGD 563-2112-219 would appear to be among the more relevant sources of information developed specifically by the Department to monitor the individual and cumulative impacts of underground mining activities on surface water and groundwater resources. Furthermore, many hundreds of CHIAs should have been prepared by now, inasmuch as one is required for every new mine permit or revision. Together, those hundreds of substantive CHIAs should represent a huge database of information, and since they are prepared by the Department itself, they should be readily available and consistent from one to another.

The Citizens Advisory Council (CAC) and others have long recognized the inherent potential importance of CHIAs in gaining a fuller understanding of the impacts of underground mining on streams, wetlands, and groundwater, and to evaluate different mining methods in terms of the severity of those effects. In its comments on the 3<sup>rd</sup> Act 54 Report 8 years ago, the CAC said this about cumulative hydrologic impacts:

The cumulative impacts question is critical to assessing the effects of deep mining. .... Regarding water impacts, the focus in the reports has been on water supplies and stream segments, rather than an assessment of cumulative hydrological impacts. .... Do we now understand the geological and hydrogeological systems well enough to predict impacts and act to prevent/minimize them?

Those questions and concerns never were addressed by the Department. Subsequently, after reviewing the 4<sup>th</sup> Act 54 Report, the CAC in 2015 again raised questions about cumulative hydrologic impacts:

The CAC recommends DEP revise its permitting procedures that allow mining companies to expand existing operations without updating the baseline hydrological information associated with the cumulative permit area.

The CAC notes the observations in the Act 54 Report which indicate improvements are necessary in how DEP assesses the hydrologic effects of underground coal mining.

What additional resources or data are needed by DEP to perform a comprehensive Cumulative Hydrologic Impact Analysis?

When the Department put together a multi-Bureau workgroup (PADEP 2015) to review its 4<sup>th</sup> Act 54 Report, including the comments/recommendations of CAC and others, that workgroup acknowledged the need to address CHIAs with the following recommendation:

The workgroup recommends DEP focus on the Cumulative Hydrologic Impact Assessments (CHIA) to ensure that they are comprehensive and complete and reflect a true assessment of all the competing interests in the area proposed for mining.

The original progress table of that workgroup (PADEP 2016a) stated that the recommended CHIA changes were “underway”. The fourth (final) progress table (PADEP 2017) listed this

matter as “completed”. Nevertheless, and despite all the lip service devoted to CHIAs as an important element in understanding mining impacts on groundwater and the broader hydrologic balance, there is --- yet again --- not a single mention of CHIAs in the 5<sup>th</sup> Act 54 Report. Clearly, CHIAs remain a low priority to the Bureau of Mining Programs, and so hydrologic impacts remain impossible to assess, given the absence of data and analysis, despite the legislative mandates of Act 54 and the CSL, SMCRA, and the ERA.

Longwall mine subsidence clearly can and does cause damage to wells and piezometers specifically established in the ground to monitor hydrologic changes. If pre-mining groundwater data are collected, but then the measuring equipment is damaged during undermining, the post-mining levels and patterns of groundwater flow cannot be documented. Therefore the effects on the hydrologic balance cannot be determined. The 5<sup>th</sup> Report acknowledges that this is happening routinely, and makes the following common-sense recommendation (on page 12-7):

The University recommends that PADEP require replacement of groundwater monitoring equipment if this equipment is destroyed during undermining and enforce this requirement.

In the section on Groundwater (page 8-4), the 5<sup>th</sup> Report makes this observation about how current stream restoration measures may themselves be having adverse hydrologic consequences:

When stream flow loss occurs, augmentation of streams commences generally from ground water or local public waters sources. Removal of substantial amounts of water to preserve flow can deplete groundwater aquifers and disrupt the hydrologic balance.

On the same page the 5<sup>th</sup> Report continues:

In addition to the cases of augmentation with stream water, there are examples ..... of water being pumped from streams to tanks to later serve as augmentation ..... these cases ..... represent a case where the hydrologic balance may not be preserved and therefore “the natural, scenic, historic and esthetic values of the environment” may not be preserved.

The phrase in quotation marks in the box immediately above [“the natural, scenic, historic and esthetic values of the environment”] is quoted directly from Article 1, Section 27, of the Pennsylvania Constitution. The quote is entirely appropriate to the point being made, but by failing to cite the Environmental Rights Amendment, its significance in the context of Act 54 is easily overlooked. If indeed “protection of the hydrologic balance is fundamental to the Act 54 legislation” as the 5<sup>th</sup> Report noted (see page 19 above), this Act 54 Report should have been more forthright when informing policymakers and the general public about how the Bureau of Mining Programs operates without regard to that connection and how the Department thereby consistently fails to fulfil its mandatory Constitutional Trust obligation.

## STREAM IMPACTS FROM MINING

Section 9 in the 5<sup>th</sup> Act 54 Report (“Effects of Mine Subsidence on Streams”) provides considerable information about streams, but not all of it is relevant to an Act 54 assessment because it does not focus on the most important issues. To understand the effects of underground mine subsidence on streams during any given five-year period, one must know certain facts. Here are certain important facts regarding stream impacts that can be derived from the 5<sup>th</sup> Report:

- **All stream impacts during the period were associated with six of the active longwall mines** (see Appendix A). (The 7<sup>th</sup> longwall mine active during this period --- Tunnel Ridge --- had only conducted room-and-pillar development mining and no longwall mining in Pennsylvania.) No stream impacts during the 5<sup>th</sup> period were reported to be associated with any of the 37 active room-and-pillar mines or the 5 pillar recovery mines.
- **There were 183 documented instances of stream impacts from longwall mine subsidence** (per Tables 9-3 and 9-4, and Appendix I) which reportedly damaged a total of at least **27.4 miles of streams during the 5<sup>th</sup> Act 54 period. The affected stream segments represent 44% of the total length (62.5 miles) of all streams reportedly undermined by those 6 longwall mines.** Most of these 183 stream impacts have not been resolved or released (per page 9-27).
- **There are two types of reported impacts to streams that are associated with longwall mining: flow loss and pooling. Most (24.6 miles, or 90%) of the 27.4 miles of reported stream impacts occurring during the 5<sup>th</sup> period were flow loss.** Of the two types of impact, pooling may be a technically easier problem to alleviate than flow loss because the water is still there --- its flow is dammed by the gates where the surface did not subside. On the other hand, restoring flow to a stream where subsidence has cracked the streambed and drained away the groundwater, springs, and other hydrologic inputs is much more complicated.
- **98 (64%) of the 153 flow loss incidents and 12 (40%) of the 30 pooling incidents each impacted more than 500 linear feet of a stream.** Flow loss incidents *averaged* 850 feet in length, with the longest being 1 mile long.

Other important facts that would be significant for policymakers regarding stream impacts are simply missing from the 5<sup>th</sup> Report:

- There is **no information about how many of the stream impacts had been predicted** in applications, and **no information on whether the extent and severity of any predicted impacts were accurate.**
- There is **no information in the 5<sup>th</sup> Report about *when* during the current period each of the 183 stream impacts was first reported.** Thus it is unknown how long the streams have remained in damaged condition.
- There is **no information about the *status* of each of the 183 stream impacts as of the end of the assessment period, *i.e.*, how many had recovered or been restored, or when restoration activities began.**

The 5<sup>th</sup> Act 54 Report presents a lot of stream information that *appears* to be relevant, but in fact is not, making it difficult to understand or evaluate stream damage that occurred during the 5<sup>th</sup> 5-year period. For example:

- **Table 9-2 presents many details about stream “reaches”** where flow loss, pooling, both, or neither occurred, broken down by longwall mine. This information is misleading and confusing because a stream “reach” affected is different from the stream “length” actually affected (as conceded in the Report), so the total affected “reaches” (51.98 miles) do not add up to the 27.4 miles reported as actually impacted. Readers cannot resolve this discrepancy.

- **Table 9-2 presents many details about where flow loss or pooling occurred**, whether it was above a longwall panel, above a section of a longwall mine where development (room-and-pillar) mining occurred, or above areas in a 200-foot exterior buffer. These details are irrelevant and misleading. Whether a damaged stream is directly above the longwall panel footprint or is several hundred feet away horizontally from the panel’s vertical footprint (and thus is directly above an adjacent area where development mining may have occurred), the impact almost certainly was a result of hydrogeologic disruption associated with the longwall methods used in the panels and not the room-and-pillar methods used in the gates. The angle of influence of a longwall panel extends a significant distance horizontally from the edge of a panel’s vertical footprint, and panels adjacent to a common gate will have overlapping angles of influence. Thus, reporting stream impacts above the room-and-pillar sections of a longwall mine suggests that the impacts are related to room-and-pillar methods, when in fact they are related to the longwall methods employed in the adjacent panels.

- **Table 9-6 lists 82 SREs** (stream recovery evaluations) submitted during the 5<sup>th</sup> period, but they mainly address stream impacts that had occurred during previous 5-year periods, not the 5<sup>th</sup> period. SRE data could be useful in following-up on stream impacts that occurred in the past, but for various reasons (as discussed in greater detail below), the Table 9-6 statistics fail to do even that. For 42 (of 82) SREs that were released by the Department during the 5<sup>th</sup> period, the table lists the number of days from SRE *submission* to release, which says nothing about the length of time the stream was damaged, but only the time the Department took to approve release from further monitoring after receiving the operator’s report.

- **Appendix F lists 126 stream segments where an SRE either was released (50) or not released (76)** during the 5<sup>th</sup> period, but most of the impacts had begun during previous assessment periods, and the dates of initial impact are not provided for context.

- **Table 9-12 lists 56 gate cuts** performed or monitored during the 5<sup>th</sup> period, 49 (88%) of which were for subsidence-induced pooling impacts that had resulted from longwall mining during previous assessment periods.

- **Table 9-14 lists 60 stream segments**, totaling 9.92 miles (incorrectly reported as 8.65 miles on page 9-22), **where grouting was performed** during the 5<sup>th</sup> period. *When* the actual flow loss occurred in each of these 60 cases is not reported, but presumably, as with the gate cuts, most of these flow losses had begun years before, during previous assessment periods.

- **Table 9-16 lists 9 instances where liners were installed** in streambeds to attempt to alleviate flow loss impacts, but many or all of these flow losses apparently had begun during previous periods.

- **Table 8-1 lists 92 stream segments where flow augmentation was being used** to attempt to alleviate flow loss impacts from longwall subsidence. The date of impact is not given, so it is impossible to determine how many of these subsidence damages actually occurred during the 5<sup>th</sup> period. The volumes of augmentation water also are nowhere reported.

### **Follow-Up on Stream Impacts from Prior 5-Year Periods**

To fulfill its obligations to protect streams in accordance with the Clean Streams Law and the Constitution, the Department should monitor and document (or have mine operators monitor and document) not only how many streams (and lengths of streams) are damaged by longwall subsidence but also how much time each stream segment remains damaged before it either recovers naturally or has been successfully restored to its pre-mining conditions. The 4<sup>th</sup> Act 54 Report (PADEP 2014) devoted an entire section (Section VIII, 24 pages) to discussions and follow-up evaluations of streams that had been impacted during the 3<sup>rd</sup> Act 54 period but had not been resolved more than five years later. Indeed, the 4<sup>th</sup> Report highlighted the fact that 6 separate streams had been declared by the Department to be irreparably damaged and thus supposedly required alternative mitigation (Note: there has been no follow-up to identify *what* alternative mitigation actually may have been proposed by the permittee in any of those situations, or *whether* it was ever approved or implemented). The 5<sup>th</sup> Report provides no direct discussions about past stream impacts or follow-up regarding their current restoration status.

As mentioned in the previous section, much of the information presented in the 5<sup>th</sup> Report regarding gate cuts, grouting, liners, and SREs is relevant to evaluating longwall-subsidence stream impacts that resulted from mining during previous Act 54 assessment periods. What is never specifically mentioned, however, is when each of these stream segments first was damaged. That information could, and should, have been used to track the current status of streams which had not recovered or been restored as of the end of each assessment period, and to report on the total length of time which those streams remained (and in some cases, still remain) damaged.

Table 9-6 in the 5<sup>th</sup> Report identifies 82 SREs which reportedly were submitted *during* the 5<sup>th</sup> period. Of those 82 SREs, 40 streams had not been restored/released as of the end of the period. One stream listed in Table 9-6 is Stream 32596, an unnamed tributary to North Fork Dunkard Fork (Wheeling Creek, Ohio River basin) in Greene County. Table 9-6 notes that Stream 32596 was damaged by the I-I to 4-I longwall panels of Bailey Mine, and that it had not been released as of the end of the 5<sup>th</sup> period (SRE #1604). What is not mentioned in the 5<sup>th</sup> Act 54 Report is that Stream 32596 was undermined and first experienced flow loss in 2004-2005 (according to PASDA<sup>7</sup>), that is, during the 3<sup>rd</sup>

<sup>7</sup> PASDA (the Pennsylvania Spatial Data Access website) provides spatial/digital data on many subjects, including up-to-date data regarding the year that mining of individual longwall panels was completed (per PADEP-BMP).

assessment period. Thus, Stream 32596 now has remained damaged for **15 years** and apparently still has not been restored to pre-mining conditions. That is significant information about what is actually happening in that stream, but it cannot be determined from any of the data presented in the 5<sup>th</sup> Act 54 Report.

Stream 32596 is not the only stream to have remained damaged without recovery for many years (although it may be one of the longest). Of the 40 streams listed in Table 9-6 which had not been restored/released by the end of the 5<sup>th</sup> Period, at least 30 (75%) had been undermined/damaged more than 5 years earlier, and thus had already exceeded the ostensible Technical Guidance Document time “limit” allowed for restoration (as discussed further in the next section below). However, the reader is unable to determine *when* or *where* individual streams were damaged, or how long they have remained damaged, from the tables or from any discussion in the 5<sup>th</sup> Report. This kind of omission represents a significant failure on the part of the Department to comply with the directive of Act 54 to analyze and report on the effects of mine subsidence on water resources meaningfully for policymakers.

Unlike with flow loss impacts, the 5<sup>th</sup> Act 54 Report does try to evaluate time periods associated with streams impacted by pooling during the 5-year period. (Why pooling and flow loss impacts are so differently reported is nowhere explained.) Table 9-12 identifies 56 gate cuts which were performed or monitored during the 5<sup>th</sup> period to try to restore natural conditions in subsided stream segments that became pooled. The Table identifies both the date of reported pooling damage and the date of gate cut completion. That interval *averaged* 3.4 years, and the longest was more than 9 years.

After completion of a gate cut, especially where a once free-flowing stream has been pooled for many years, additional time often is needed<sup>8</sup> before monitoring data may document that the stream has been restored to its pre-mining biological condition (*i.e.*, that its post-mining TBS [total biological score] is at least 88% of its pre-mining TBS). Page 9-19 in the 5<sup>th</sup> Report notes that the *average* time from pooling damage to “biological release” was 7 years 11 months for the 42 gate-cut projects released during the 5<sup>th</sup> period. It further notes that the longest was 13 years 10 months. Only one was released quicker than 4.25 years. These timeframes suggest that pooled sections of streams routinely remain polluted by sedimentation, increased temperature, and decreased oxygen content for periods well beyond the 5-year “limit” prescribed in the TGD (PADEP 2005b) discussed below.

### **“Allowable” Duration of Stream Impacts**

How long a stream can remain damaged by flow loss or pooling before the Department recognizes a stream-impairment violation is not clear. In a recent Environmental Hearing Board (EHB) case (Docket No. 2014-072-B, 15 August 2017), Judge Beckman noted that the Department may be justified in allowing stream damage to occur if the damage is minor and

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<sup>8</sup> For example, pooling in Templeton Fork (Wheeling Creek, Ohio River basin) above Enlow Fork Panel F-13 occurred during November 2006. The gate cutting restoration work took place during February 2010, and the Department approved release of the stream from further monitoring during March 2016 (6 years after gate cutting, and 9.33 years after it was damaged).

temporary, but that, as the EHB previously had found in the UMC Energy case, “*permission to longwall mine is not absolute but remains subject to proper conditions.*” Judge Beckman then wrote:

The scope and duration of the anticipated and actual impacts to the streams ... are important to determining whether the impacts constitute impairment of the streams and pollution.... Impairment clearly violates the Clean Streams Law and its regulations and if the Department determines that the longwall mining will impair streams ... it should deny the permit... It also violates the Mine Subsidence Act [Act 54 of 1994] and its regulations.

This EHB case is mentioned in the 5<sup>th</sup> Act 54 Report (page 9-25). Regarding the “scope” of an impact, Judge Beckman concluded that stream restoration which requires recontouring a streambed and the installation of an impervious synthetic liner has the effect of eliminating the natural stream as it existed prior to undermining and thus is an impermissible impact that (if predicted) cannot be authorized by permit.

Regarding the “duration” of an impact, Judge Beckman unfortunately did not determine how long a stream could remain damaged before it would constitute impairment of the stream’s uses. Furthermore, Judge Beckman appeared to have focused more on the time during which stream restoration activities themselves were being conducted, rather than the full time elapsed between when stream damage occurred and when completed restoration work was determined to be successful:

The heave removal and surface fracture sealing restoration activities ... are generally completed in a day (or two)....  
The testimony was that gate cutting generally takes two weeks ... possibly up to a month depending on conditions.

Focus on the duration of the gate cutting activity itself (2-4 weeks) ignores the time periods: (a) between when pooling damage occurred and gate cutting efforts begin, and (b) after gate cutting until the stream is deemed to have achieved its pre-mining flow and biology. The 4<sup>th</sup> Act 54 Report noted that *on average* nearly 2 years elapse after pooling occurs before any gate cutting restoration work *begins* (PADEP 2015, page VII-40). As previously noted, during the 5<sup>th</sup> Act 54 period the time from pooling damage to gate cutting reportedly *averaged* 3.4 years. The time from pooling damage to the operator’s “release” by the Department from further monitoring *averaged* 7 years 11 months, with the longest being nearly 14 years. Clearly, pooling impacts to streams last for significant periods of time and the duration of gate cutting activities is a very small part of that time.

Judge Beckman raised, but did not resolve, another important consideration. At some point in time unrepaired stream damage no longer qualifies as “temporary” and crosses the duration threshold into what would constitute essentially permanent impairment. The Department has viewed temporary impacts to water resources in different ways in its permit programs, and the duration of what qualifies as “temporary” varies greatly. Often, the term “temporary” is simply regarded as “not permanent”, or it includes all impacts that are expected to be fully restored some day upon the completion of project construction, operation, or decommissioning, no matter how long that may take.

In its 25 Pa. Code Chapter 105 Program, the Department has a General Permit for “temporary road crossings” which are defined as restorable impacts to a stream or wetland

lasting **1 year or less**. Longwall mine subsidence damage to streams lasts much longer than one year before restoration work even begins. Typically, many years more elapse before restoration is deemed to be successful, if ever.

Section 5.2 in Act 54 (*Procedures for securing restoration or replacement of affected water supplies*) states that:

If an affected water supply is not restored or reestablished or a permanent alternate source is not provided **within three years**, the mine operator may be relieved of further responsibility by entering into a written agreement providing compensation acceptable to the landowner.

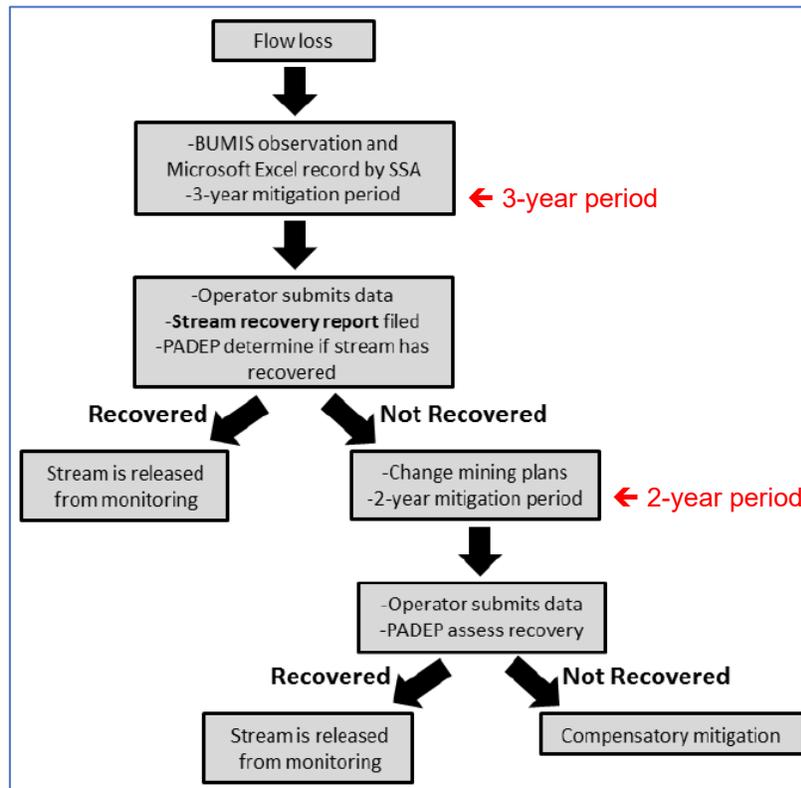
That provision applies to “water supplies” which commonly is interpreted to mean people’s *drinking* water. However, Act 54 [Section 5.1(a)(3)] articulates a more expansive definition of “water supply” which specifically includes streams that are used for agricultural uses (such as irrigation or watering for farm animals), commercial or industrial uses, or recreational uses. Thus, the above passage, taken directly from Act 54, suggests that streams with certain water supply uses such as recreational fishing must be permanently restored **within 3 years**. That time limit clearly is not being met in most, if any, streams damaged by longwall mine subsidence. Few stream restorations even *begin* within three years of subsidence. (It is another matter entirely as to whether the Department may consider financial compensation to a private landowner as adequate mitigation for damage to a water of the Commonwealth.)

Technical Guidance Document (TGD) 563-2000-655 (*Surface Water Protection – Underground Bituminous Coal Mining Operations*; PADEP 2005b) suggests several different time limits for stream damages: one year, two years, 2.3 years, and five years:

- (iii) Mining plans that are likely to result in mining induced flow loss should be supported by the following information:
  - (A) Information demonstrating that flow will recover or be restored to the normal range of conditions either **within one year or within a specific time period**,\*\* without the need for continued supplementation by a maintenance dependent augmentation source. Inability to make such a demonstration will normally be considered presumptive evidence of potential pollution.
  - \*\*Observations indicate that, in some cases, recovery may take **up to 2.3 years**.
- (iv) Mining plans that have the potential to cause mining induced flow loss but do not pose a high probability of causing flow loss should be supported by the following information: .....
  - (B) A flow augmentation plan for providing water of sufficient quality and quantity to maintain an affected stream’s existing and designated water uses for a period of **at least two years**.
- (x) If a stream cannot be fully restored **within five years** using mitigation measures that are technologically and economically feasible, the operator may be required to perform compensatory restoration or enhancement of an equivalent length of another stream in the same watershed or a nearby watershed. [underline and boldface added]

In accordance with this TGD, although recovery/restoration of a damaged stream is generally expected to occur more expeditiously, **5 years** apparently is the upper time limit prescribed for successful stream restoration (including biological restoration). Beyond that, further efforts are to be deemed futile and an alternative restoration measure on another stream in the same watershed should be pursued to compensate for the permanent loss of a water of the Commonwealth.

This TGD-recommended process and its timeline for flow loss impacts were clearly illustrated in a flow chart included in the 4<sup>th</sup> Act 54 Report (right, from page VII-24). It shows that mine operators are allowed a **3-year period** to initially try to restore a stream damaged by subsidence-induced flow loss. They then are to submit a Stream Recovery Evaluation (SRE) Report, and if the Department agrees that the stream has been successfully restored, operator monitoring is “released”. If it has not recovered after 3 years, the Department is supposed to require the operator to



change future mining plans to avoid similar stream damages under similar settings (there is no suggestion in any 5-year Act 54 Report that such has *ever* happened) and the operator then has **2 more years** to try to restore the damaged stream to pre-mining conditions. After a total of **5 years**, according to the TGD, if the stream has not recovered, alternative compensatory mitigation is to be done on another stream elsewhere. Again, there is no suggestion in this or any previous Act 54 Report that such alternative mitigation has ever been proposed by a permittee or required by the Department after 5+ years.

The 5<sup>th</sup> Act 54 Report points out that this 5-year TGD directive regarding alternative mitigation is **not** being followed by the Department. On page 12-7, it states:

The University identified streams that, according to PADEP records, have not met the criteria for attaining use and have not been released after five years. In materials provided to the University, **there exists no evidence of additional mitigation or compensatory stream rehabilitation** having been required by PADEP when a stream had not met attainment standards after five years. [boldface added]

The 5<sup>th</sup> Report does not discuss details pertaining to any of the 6 streams which had been identified in the 4<sup>th</sup> Report as having been declared in 2012 to be irreparably damaged after exceeding the 5-year limit. The 5<sup>th</sup> Report also fails to document the numerous additional streams that have passed that limit more recently (as discussed previously in the section on “Follow-Up”, and also in the next section below).

### **Stream Recovery Evaluation Reports**

Stream Recovery Evaluations (SREs) have been mentioned briefly in some of the previous sections, but are discussed in more detail here. An SRE report is submitted to the Department after mitigation measures have been implemented on an impacted stream for several years and when the mine operator believes on the basis of monitoring data that the stream has been successfully restored to pre-mining conditions. The 5<sup>th</sup> Report notes that 82 SRE reports were submitted during the 5<sup>th</sup> Act 54 period. The 82 SREs are claimed to represent a significant increase from the 4<sup>th</sup> period, when only 14 SREs reportedly were submitted. Five of those 14 SREs from the 4<sup>th</sup> period had not recovered or been released by the end of that period, but the 5<sup>th</sup> Report does not specifically identify them, nor discuss and evaluate their current status or the overall time each stream has remained damaged.

Of the 82 SREs<sup>9</sup> submitted during the 5<sup>th</sup> period, 42 were “released” by the Department during the period, meaning the Department agreed with the operator that the impacted stream had recovered and no longer required monitoring or further restoration work. The other 40 SREs had not been released, and in no case was the reason for non-release explained.

According to TGD 563-2000-655 (regarding stream protection from underground coal mining), mine operators are expected to demonstrate that both the streamflow and the biological diversity of a stream have returned to pre-mining conditions in order to qualify for “release” of liability. The 5<sup>th</sup> Act 54 Report notes that pre- and post-mining total biological scores (TBS) are *sometimes* documented in SREs, but apparently not in all cases (*e.g.*, page 9-11 states that there were no TBS data in any of the seven SREs submitted during the 5<sup>th</sup> period for Monongalia County Mine). How many streams with an SRE report were released without the appropriate biological data is not mentioned or evaluated in the 5<sup>th</sup> Report. It is alarming that adherence by mine operators to TGD directives apparently is not a major concern of the Bureau of Mining Programs.

The information about SREs in Section 9 and Appendix F of the 5<sup>th</sup> Act 54 Report, although extensive, nevertheless fails to identify how each stream was damaged in the first place --- whether it was due to subsidence-induced pooling, flow loss, or both. Presumably most of the SREs are associated with streams that were damaged by subsidence-induced flow loss, because as noted above, 90% of the miles of streams impacted by longwall mining during the 5<sup>th</sup> period reportedly were damaged by flow loss. This additional piece of information about the nature of the reported stream impacts would have been useful to policymakers and to the public.

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<sup>9</sup> Only 1 of the 82 involved a R&P mine, but the PADEP later determined that any stream impact in that incident had not been a result of mining; thus, no R&P mine has been found liable for stream damage in the last 15 years.

Table 9-6 in the 5<sup>th</sup> Report lists all 82 SREs by mine, stream, longwall panel(s), SRE report number, and release status (yes or no). It also has a column for “Days from Submission to Release”, which ranges from 3 days to 713 days (average: 258 days --- nearly 9 months) for streams that actually were released during the 5<sup>th</sup> assessment period. This table is not particularly informative (except perhaps to show that many coal mine operators are overly optimistic about a stream’s recovery status and their having accurately documented that recovery in their SREs). Some streams may not have been released by the end of the 5<sup>th</sup> period simply because the SRE was submitted very late in the period, but one cannot determine that from the table because no dates (of impact, of SRE “submission”, or of SRE release) are provided.

In the context of Act 54, where the objective is to understand the impacts to streams from longwall mine subsidence, the major question that leaps to mind is not how long it takes the Department to agree with a mine operator that a damaged stream has been restored. What people chiefly want to know is, how long *after* a stream is damaged does it take for a mine operator to restore it to its pre-mining conditions? That question is not addressed at all in the 5<sup>th</sup> Act 54 Report, for streams impacted either during the 5<sup>th</sup> period or during previous periods.

Much more relevant to an Act 54 analysis than time from *submission* of an SRE until Department release would be the elapsed time from actual *damage* of a stream to its release (or to the end of the assessment period if it has not yet been released). Unfortunately, the 5<sup>th</sup> Report does not provide the *date* of stream damage or the time elapsed since the stream damage occurred --- crucial information which presumably was provided by mine operators in every SRE.

The following example illustrates how stream damage/recovery data as presented in the SRE discussions in the 5<sup>th</sup> Act 54 Report systematically fail to provide meaningful information. Table 9-6 notes that SRE #1516 addresses longwall subsidence damage to South Fork 2R (Ohio River basin) by Bailey Mine Panel 8I. According to Table 9-6, the stream was released by the Department 96 days after the SRE was submitted, which does not seem unreasonable on the face of it (and in fact is much quicker than the reported 258-day average). What is *not* mentioned, however, and what would have been much more informative in the context of Act 54, is knowing that this particular stream was damaged by flow loss during mid-2007, and so it actually had been **at least 8 years** from the time of its damage to the time the Department confirmed it had been restored and “released” it. (Note: Appendix F identifies this stream/SRE as “not released”, so it is unclear which part of the 5<sup>th</sup> Report is to be believed regarding the recovery status of this stream.)

Another example is Unnamed Tributary 40942 to Crafts Creek (Monongahela River basin) associated with Enlow Fork Mine SRE #1728. Stream 40942 was undermined by Panels E17-E19, according to Table 9-6 in the 5<sup>th</sup> Report. According to PASDA, mining of Panels E17-E19 of Enlow Fork Mine was completed in 2008-2009, which presumably is approximately when flow loss damage to the stream first occurred. Accordingly, this stream, which had not been restored/released by the end of the 5<sup>th</sup> Period, already had remained **damaged for 9 to 10 years**, well beyond the 5-year TGD outer limit for

restoration discussed above in the previous section. Apparently there is no penalty for such extended periods of stream damage, and so the TGD time “limit” appears to have little if any meaning and is not applied by the Department’s Bureau of Mining Programs.

The Act 54 report data document that there are many streams that have been impacted by longwall mine subsidence during the last 15 years or so, and which currently are in some stage of restoration. Even if the Department were to assume that all of those streams are only “temporarily” damaged because it believes that they all eventually will be fully restored to their pre-mining conditions (an assumption that is not supported by any evidence), the cumulative impact of having so many dozens of miles of streams currently unable to meet their “protected” uses for aquatic life, water supply, or recreation must be taken into consideration. However, there is no indication that the Bureau of Mining Programs has done so.

### **Water Quality Impacts**

Historically, the principal impact to streams from underground coal mining was acid mine drainage (AMD). Mine drainage forms when pyrite, an iron sulfide mineral in coal, is exposed to and reacts with air and water to form sulfuric acid and dissolved iron. The acidic (low pH) runoff further dissolves other heavy metals such as copper, lead, and mercury which leach into groundwater or surface waters. This acidic water with high concentrations of toxic metals is harmful to aquatic life, vegetation, and wildlife. Regulation and treatment of mine discharges in recent decades has largely eliminated new sources of AMD. However, thousands of miles of Pennsylvania streams remain contaminated from legacy AMD pollution, and their cleanup is slow and expensive.

The Department’s Division of Water Quality (DWQ) is responsible for conducting assessments to determine whether streams are attaining their designated uses. Stream assessments are done on a rolling, continuous basis, and a statewide report must be provided to the US Environmental Protection Agency (EPA) and the public every two years in accordance with sections 305(b) and 303(d) of the federal Clean Water Act. If a stream is found not to be attaining its protected uses, it is listed as “impaired”, and the cause(s) of impairment is noted. According to the Department’s draft 2020 Integrated Water Quality Monitoring and Assessment Report (PADEP 2020b), 25,468 miles of streams throughout Pennsylvania -- about 30 percent -- have impaired water quality for one or more uses. “Abandoned mine runoff”, accounting for 5,559 impaired miles (down slightly from 5,576 miles in 2018, and 5,595 miles in 2016) was the second highest cause of impairment listed (behind “agricultural runoff” at 5,765 miles).

To their credit, each of the last three Act 54 Reports raised the issue of water quality impacts from underground mining (and longwall mine subsidence specifically). The 3<sup>rd</sup> Report noted that longwall mines can result in:

... variation of flow altering the biological properties of the streams, changing sediment load, oxygen content and habitat availability and quality. This can result in non-attainment of the designated use, either through direct stresses on the fish species, or by altering food and habitat availability. (page VIII-2)

The 4<sup>th</sup> Report also mentioned water quality issues and made this recommendation:

The University suggests that PADEP and future Act 54 reports further investigate the impacts of longwall mining on stream water quality in the Commonwealth. (page VII-27)

The 5<sup>th</sup> Report also attempts to make a connection between mining and water quality issues. For the first time ever, the 5<sup>th</sup> Report mentions the CWA 303(d) listings, noting that:

While streams impacted by subsurface mining have continued to be listed over the last decade, few streams that were listed as impacted by mining have been removed from 303(d) listing. [page 11-6]

The 5<sup>th</sup> Report further notes that:

.... in the 5<sup>th</sup> [Act 54] assessment period there were 153 cases of flow loss impacts on 24.6 miles of stream but very few [in fact, none] reaches of stream over panels mined during this period were listed. [page 11-6]

These passages suggest that mine subsidence damage to streams is not being recognized or accounted in the DWQ assessment process, perhaps because of a lack of communication between the Bureau of Mining Programs and the DWQ.

Underground coal mines also affect water quality with their wastewater discharges. Like all previous Act 54 Reports, this one did not review any of the numerous DMR (discharge monitoring report) records for underground mines. Such DMRs often document exceedances of pollutant limitations or other permit conditions -- some acknowledged by permittees, many not -- and that there are many inconsistencies between “required” monitoring and the data actually being reported to PADEP (Schmid & Company, Inc. 2010b). The lack of any analysis of available DMR information is significant: not only were there likely hundreds, even thousands, of violations when so-called discharge “limits” were exceeded during the review periods, but enforcement of those violations by Bureau of Mining Programs likely was minimal, if they were noticed at all (Schmid & Company, Inc. 2011).

While it is commendable that any attention at all has been focused on stream impairment from underground mining activities in these Act 54 Reports, there continues to be a lack of any concerted data collection or analysis by the Bureau of Mining Programs to identify or address water quality issues associated with underground coal mining. Consequently, the water quality impacts to streams and other elements of the hydrologic balance from underground mining continue to be overlooked.

### **Stream Flow Monitoring**

Mine permit applicants are supposed to document the normal range of pre-mining flow in all streams proposed to be undermined (a) to establish a baseline for later determining whether the stream has been adversely affected by mining, and (b) if impacted, to set the standard to be used to determine whether any required restoration measures have been successful. In

accordance with TGD 563-2000-655 directives, streamflow is supposed to be monitored for at least 2 years (typically on a monthly basis) prior to undermining, then measured weekly beginning 6 months before undermining, and then daily for 2 weeks prior to undermining. Baseline pre-mining information on fish and macroinvertebrate communities also is supposed to be documented per the TGD, although flow and biology are not required to be monitored at the same locations. Daily stream flow measurements are to continue until the longwall face has progressed beyond the stream a distance equal to the overburden thickness. If flow loss occurs, daily measurements are supposed to continue until stream flow fully recovers or is fully restored, or until mining is determined by the Department not to be the cause of the flow loss.

The authors of the 5<sup>th</sup> Report point out the potential for certain biases being introduced into pre-mining and post-mining stream flow monitoring. For example, on page 7-14 they warn:

If late summer/early fall is over sampled, then the range of flows will be artificially low. If late winter/early spring is over sampled, then the range of flows will be artificially high.

Indeed, in at least one case, the 5<sup>th</sup> Report determined this exact monitoring bias had actually occurred. For unnamed tributary (UT) 40410 above Emerald Mine, the pre-mining sampling was heavily weighted toward dates in the low-flow summer months, while the post-restoration sampling was heavily weighted towards dates outside the low-flow summer period. As a result, the pre-mining “baseline” flows appear lower and the post-restoration flows appear higher than actually experienced in the waterway. The illustration for this stream (see below) is excerpted from the 5<sup>th</sup> Act 54 Report.

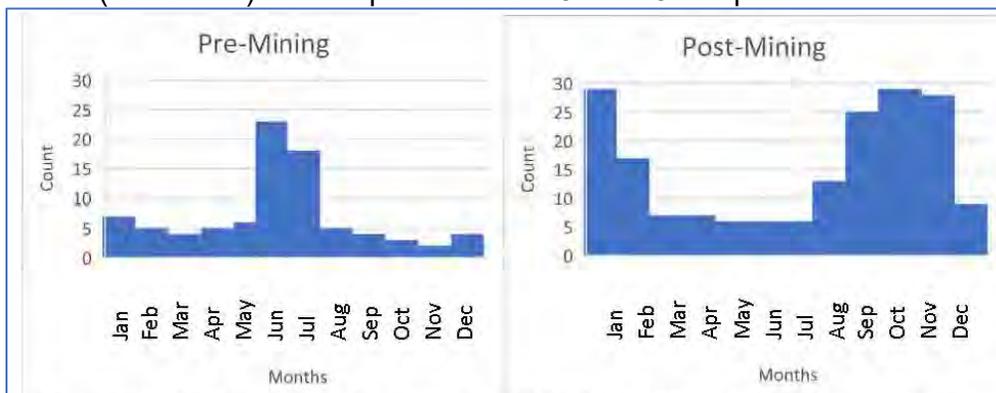


Figure 7-8. Distribution of sampling dates in UT 40410 (SRE 1632) for both pre- and post-mining sampling periods.

In the case of UT 40410, sampling prior to mining seems to be biased toward the summer months and sampling post mining is biased away from this summer period (Figure 7-8).

The 5<sup>th</sup> Report notes that SRE #1632 for this stream was “released” by the Department 99 days after it was submitted. It does not state whether the Department was aware of the bias in the monitoring when the stream was released, or whether any additional, less biased flow and/or biological data were used to document recovery of UT 40410 before release.

Appendix F in the 5<sup>th</sup> Report provides summary data for 126 stream segments which either were “released” (N=50) or “not released” (N=76) following Department review and

evaluation of their SREs during the 5<sup>th</sup> period (note: many of these streams were damaged *prior to* the 5<sup>th</sup> period). Appendix F identifies whether (yes or no) pre-mining monitoring of each of the 126 impacted stream segments faithfully complied with the monthly, weekly, and daily stream flow measurement directives of the TGD. It shows that in only 1 instance of 50 were all 3 time-period requirements faithfully followed; in most cases, streams that met some but not all of the pre-mining monitoring requirements were released anyway. In many cases streams were released despite not meeting *any* of the three pre-mining time-period monitoring requirements. This pattern unfortunately is consistent with what Schmid & Company has found in mine streamflow and discharge monitoring data we have had an opportunity to examine over the past 20+ years. Compliance by longwall mine operators with TGD 563-2000-655 directives apparently is not being required.

Issues with incomplete monitoring data in the SREs, and the Department’s handling of them, were mentioned in the 5<sup>th</sup> Act 54 Report:

However, these [SRE request] forms do not completely justify decisions. The widespread deviations from stipulated monitoring periods are very rarely mentioned. In cases where pre-mining data do not exist, documentation of the argument and rationale for release was often cursory. Most important, the forms document disagreement among PADEP staff that is left unaddressed. [p. 7-16]

As **Table 4** (below) shows, only 1 out of 50 (2%) of the stream segments released by the Department during the 5<sup>th</sup> Act 54 period met all 3 pre-mining monitoring requirements, and 11 out of 50 (22%) met *none* of the 3 monitoring requirements. Only 1 out of 76 (1%) of the non-released segments met all 3 requirements, and 12 out of 76 (16%) met none. In all 126 cases, only 2 (2%) met all 3 of the TGD monitoring directives. The 5<sup>th</sup> Act 54 Report authors emphasize how incomplete monitoring data frustrate hydrologic analysis.

**TABLE 4.** Compliance with pre-mining streamflow monitoring directives of the TGD, by mine, for stream segments released by the Department (and stream segments not released), based on Appendix F in the 5<sup>th</sup> Act 54 Report.

<b>Mine</b>	<b># Released</b>	<b>Monitoring Directives</b>		<b># Not Released</b>	<b>Monitoring Directives</b>		<b>TOTAL</b>
		<b>Met all 3</b>	<b>Met None</b>		<b>Met all 3</b>	<b>Met None</b>	
Bailey	15	0	1	13	0	3	28
Cumberland	11	1	4	1	0	0	12
Emerald	4	0	2	2	0	2	6
Enlow Fork	18	0	3	37	1	5	55
Mine 84	2	0	1	4	0	1	6
Harmony (R&P)	0	n/a	n/a	1	0	0	1
Monongalia Co.	0	n/a	n/a	18	0	1	18
<b>TOTALS</b>	<b>50</b>	<b>1</b>	<b>11</b>	<b>76</b>	<b>1</b>	<b>12</b>	<b>126</b>

Appendix F of the 5<sup>th</sup> Report identifies 12 stream segments damaged above longwall panels of Cumberland Mine for which SREs were evaluated by the Department, 11 of which had

been “released”. Of the 11 streams released, only one met all three (monthly, weekly, daily) of the TGD pre-mining flow monitoring requirements (that one stream was released by the Department 3 days after receipt of the SRE); 4 of the released streams met none of the 3 TGD pre-mining flow monitoring requirements. For the 7 other mines reported in Appendix F, 39 streams had been released (and 75 had not been released). None of the 39 that were released satisfied all 3 TGD monitoring requirements, and 7 met none of the TGD monitoring requirements. These data demonstrate that monitoring in accordance with the TGD directives is unnecessary for release by the Department and apparently is not taken seriously.

Like Appendix F, Table 9-6 presents data from SRE reports regarding release or non-release of streams; however, there are some unexplained conflicts between the two sources. As mentioned previously, Table 9-6 reports that SRE #1516 for a stream (South Fork 2R) above panel 8I of Bailey Mine was released 96 days after the SRE was submitted to the Department. Appendix F reports that SRE #1516 for that same stream (which it splits into 2 segments: South Fork 2R-01 and South Fork 2R-02) above panel 8I of Bailey Mine was not released for either segment. Furthermore, Appendix F reports that neither of those two segments of the stream met any of the 3 TGD flow monitoring directives (although it concluded that one of the stream segments met the weekly requirement, having had only 22 of the 26 required samples [which does not meet the standard], while the other segment which likewise had only 22 of 26 samples, did not --- apparently neither the University nor the Department sought to identify or resolve such contradictions). Whether released or not, this stream was damaged in mid-2007, and had remained damaged for **more than 10 years**.

As noted above, TGD 563-2000-655 directs mine operators to continue to monitor stream flow daily if a stream suffers flow loss from undermining, and to continue daily monitoring until normal pre-mining flow returns. That information is important to document how long an impacted stream remains without normal flow. Inasmuch as flow augmentation is supposed to begin within 24 hours (if the flow loss was predicted) or within 15 days (if the loss was not predicted), augmentation flow logically should be distinguished from non-augmentation flow. Precipitation events also should be taken into account in post-mining flow monitoring, but accounting for the effects of precipitation and augmentation is not specified in the TGD (and they are not always or consistently measured or reported separately) for post-mining monitoring.

Missing from Appendix F of the 5<sup>th</sup> Report is any indication as to whether any of the damaged streams was monitored after flow loss first occurred as a result of undermining, as directed by the TGD. One cannot determine whether this TGD monitoring directive is *ever* being followed, because no information regarding monitoring after the date of observed flow loss is presented or evaluated in the 5<sup>th</sup> Report. The length of time a stream remains without water after subsidence-induced flow loss is important in determining the overall impact to the stream. In our experience reviewing Department mining records, including SREs, we have never seen daily flow monitoring reported for the days or weeks (oftentimes, months) immediately after flow loss first occurred. Typically stream flow monitoring ends as soon as, or even shortly before, a stream is undermined, and “post-mining monitoring” does not begin for at least several months thereafter. Importantly, **streamflow monitoring is not being used for early detection of stream impacts** so operators might stop and evaluate how best to avoid or minimize more serious impacts before advancing the longwall panel beneath a stream.

### Augmentation in Inaccessible Streams

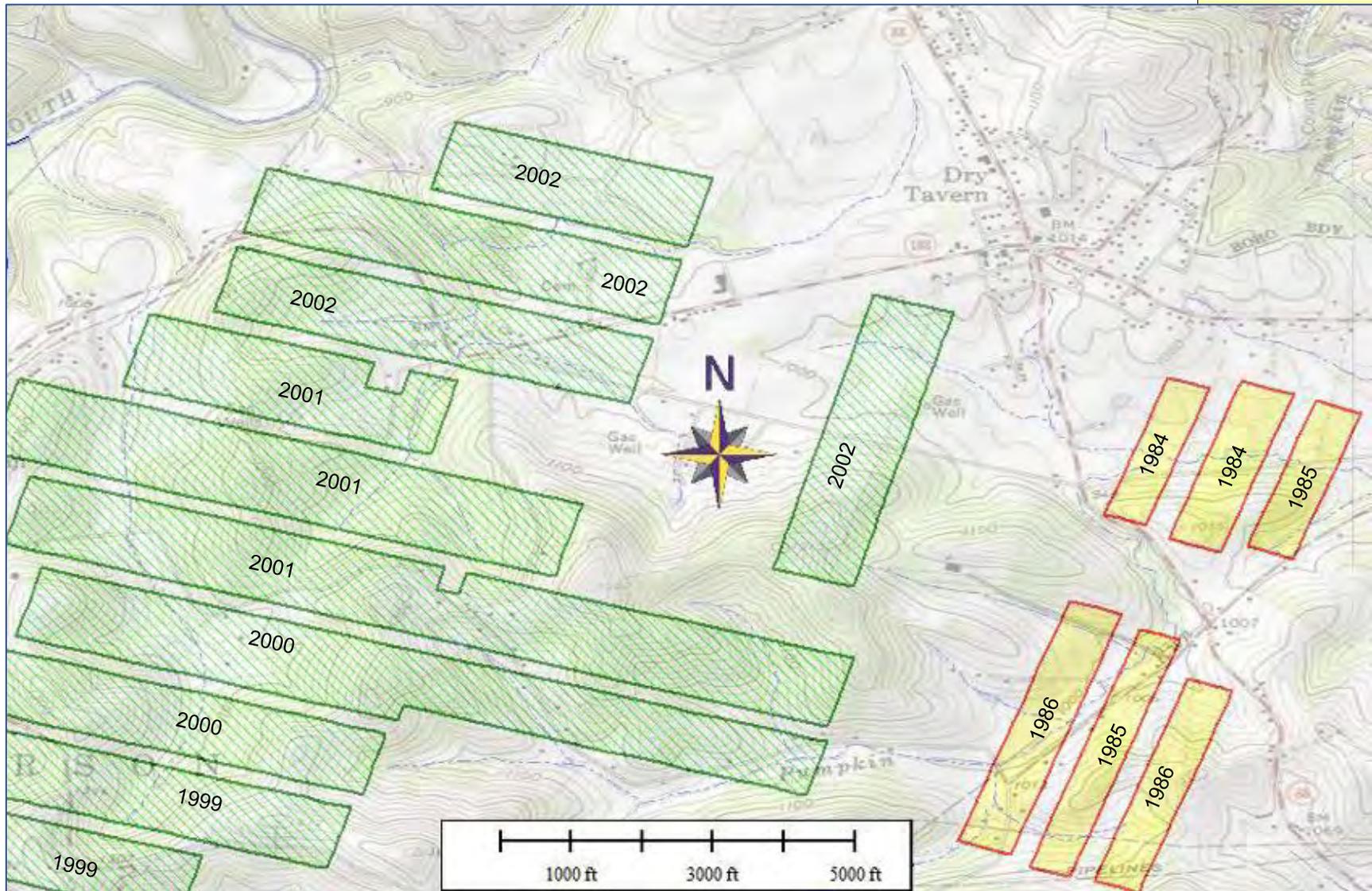
Section 8 of the 5<sup>th</sup> Act 54 Report raises an interesting (and somewhat ironic) issue that has not previously been raised in these reports. Apparently, some landowners refuse to grant access to their lands for stream restoration work. The Report authors “*recognize*” that lack of legal access creates “*substantial challenges in the operator’s effective and economic planning of mining,*” and they speculate that lack of such access may be an acceptable reason to not fully mitigate stream impacts. They do not say how many instances of this they encountered, but the 5<sup>th</sup> Report authors recommend that the Department develop a policy to address such situations. They also suggest that mine operators could attempt stream restoration without trespassing by augmenting flow from a neighboring property or from one further upstream. Such offsite measures would not allow heaves to be shaved and cracks to be filled in all portions of a damaged stream, and so it is doubtful whether simple augmentation from upstream or adjacent properties would be effective in achieving permanent recovery of flow or restoration of stream biota.

If the issue of lack of legal access were to be considered seriously from the perspective of environmental protection (such as would be expected from the Department), then perhaps mine operators should not be allowed to undermine/damage any section of a stream that they will not be able to restore without trespass. This, of course, would require careful and accurate predictions of which streams will be damaged by longwall subsidence (which is discussed in the next section below). Subsidence damage and resultant failure to maintain the existing uses of a stream possibly could be construed as a form of criminal trespass or criminal damage to property, if the longwall operator did not secure explicit permission for the damage and any necessary restoration to occur prior to gaining permit approval.

## **SUBSIDENCE PREDICTIONS, MODELS, AND ASSUMPTIONS**

A major benefit touted by the coal industry in favor of Act 54 was that subsidence at longwall mines is “planned” and “predictable”. “Planned” subsidence was promoted as being better than “unplanned” or unanticipated and long-delayed subsidence at legacy room-and-pillar mines because: (A) the longwall operator could take steps before and during undermining to minimize any predicted damage, and (B) the operator would be available to repair any damage that results from the almost immediate surface subsidence. Some predictable damages to homes or other man-made structures can be reduced by bracing or trenching ahead of time. Several measures are available to prevent subsidence damage to streams, such as leaving coal pillars in place and backstowing (backfilling) with coal waste material normally left on the surface. Use of such measures is stipulated at 25 Pa. Code 89.142a(c)(2)(D)(ii) for protecting certain structures, impoundments, and public water supply sources from “material damage”, and they could be used for protecting streams as well.

Inasmuch as stream damage was not “allowed” by Act 54, a prediction of longwall subsidence damage presumably should be used to avoid longwall mining beneath or near a stream, re-sizing or re-orienting the longwall panels (see **Figure 2**), backfilling, or using room-and-pillar methods instead. Longwall operators who follow the TGD monitoring protocol should know immediately when stream hydrology begins to be disrupted, and then a



**FIGURE 2.** Orientation and shapes of longwall panels at Dilworth Mine (Greene County) in the 1980s (yellow) and 1999-2002 (green). Year indicates when extraction from the panel was completed, per PASDA. Note that the newer panels typically are larger and in a different orientation, except for one in 2002 which is oriented the same as those in the 1980s. Reorientation of panels is one available method to avoid or minimize impacts, although it has rarely been done in the past 20 years. Shortening the length or width of a panel sometimes is done to avoid significant impacts. The reason for the notches in several of the panels is unclear, but could relate to another impact avoidance strategy.

change of technology or mining plans could be made to stop or avoid the damage (per the 25 Pa. Code Chapter 89 mining regulations). But that is not being done, and it is not being sought by the Bureau of Mining Programs. Thus, the predictable outcome of the removal of enormous panels of coal beneath streams by longwall methods during the 5<sup>th</sup> Act 54 period in essence was "premeditated" damage to nearly half of the stream-miles so undermined.

Stream damage *predictions* are "required" by the Pennsylvania mining regulations at 25 Pa. Code Chapter 89 and are to be provided in the mine permit application itself. Yet many of the models and assumptions used to predict impacts are outdated or of questionable accuracy. Furthermore, no attempt has been made in any of the Act 54 Five-Year Reports to quantify or track the number of predicted (versus unpredicted) stream impacts experienced at a longwall mine, or to evaluate whether any or all stream impacts that occurred were of the same kind, location, or to the same extent as predicted. Collection of data that would enable comparison of predicted vs. unpredicted impacts apparently has never been a priority for the Bureau of Mining Programs and effectively precludes improvements in prediction technology.

Impacts that occur beyond where they are expected to occur are sometimes referred to as "far field" effects. The lack of reliable subsidence prediction models is acknowledged in the 5<sup>th</sup> Act 54 Report. On page 11-4, the Report says:

...the location of heaves and fractures recorded during the 5th assessment period (Table 9-8) suggest that **stream subsidence effects can also occur at locations beyond those predicted by subsidence models. These far field effects would not have been forecasted from existing empirical and analytical subsidence models** and therefore rely solely on the expertise of agents analyzing these cases. Clarification of the causes of far field effects are necessary to improve predictions of subsidence impacts and advance policies designed to protect citizen's rights and environmental systems. [bold added]

The only model that has been developed to date to predict any type of stream impact involves pooling. Pooling occurs when the land surface above a longwall panel subsides, capturing the stream in a pool behind a dam formed by the unsubsidized gate. Stream pooling causes sediment to settle in and on streambed gravel, which degrades the aquatic habitat for fish and macroinvertebrates, and causes long-term instability in a stream (USFWS 2004). Adverse increases in water temperature and decreases in oxygen content also can occur in long-pooled areas. In the 1980s Dr. Syd S. Peng, a mine engineer at West Virginia University, developed a model to predict where longwall mining subsidence would most likely result in stream pooling. The Peng computer model<sup>10</sup> currently is used to predict which streams may experience pooling based on such factors as depth of mining, rock type, and stream gradient. The current underground mine permit application requires applicants to predict potential pooling, but only where the stream gradient is 2% or less, and then only requires submission of a mitigation/restoration plan for any stream where the subsidence-induced pool is *predicted* to be 1 foot or more in depth.

<sup>10</sup> Comprehensive and Integrated Subsidence Prediction Modeling (CISPM) was developed in the 1980s and early 1990s (Peng & Chiang 1984, Peng 1992, Peng & Luo 1994).

It is unclear what (if any) scientific basis was used to establish those 2% gradient and 1-foot depth thresholds for regulatory purposes. It is likely that significant impacts result if pooling occurs in a stream with a gradient steeper than 2%, or where the depth of pooling is less than 1 foot. Furthermore, the Peng model now is several decades old. No recent studies have been conducted to evaluate whether those thresholds continue to be relevant to subsidence damage from modern longwall mines where panel dimensions have grown significantly, or whether the thresholds should be made more stringent in certain situations (e.g., beneath Special Protection streams). The Peng model does not forecast or evaluate how predicted pooling will alter the biological condition of any stream, including its effects on the numbers, diversity, or kinds of fish, macroinvertebrates, and other stream biota present before mining. The model does not predict how long the pooling will last or how extensive will be the work necessary to repair the damage to the stream, if it can be remediated at all. All of these factors related to pooling must be examined if any genuine protection is ever to be provided by the Department in accordance with its Constitutional responsibility as trustee of these public resources.

The Peng model may be inadequate or inappropriate given modern longwall methods, but at least it provides an approximate tool for prediction of some pooling impacts. There is no comparable model or tool used to predict flow loss impacts, which as noted above, constituted 90% of all miles of streams damaged by subsidence during the 5<sup>th</sup> Act 54 period. Lacking any model, predictions of flow loss seldom are made; if they are “predicted”, there is little specificity. At best, coal operators may concede that flow loss is possible, even likely, in some streams, based on factors such as depth of cover, overburden geology, stream orientation, and percent of watershed undermined. But typically, permit applicants declare that any flow loss will be only temporary and that their proposed restoration measures will be effective, thereby gaining permit approvals.

When pooling is predicted in a stream, the mine operator must calculate the cost and post a stream restoration bond to ensure mitigation of the pooled stream segment is successfully carried out. Because there is no model to predict flow loss in streams, flow restoration bonds are not required to be posted, which is especially concerning these days given the weak economic viability of the coal industry. This makes no sense; in fact, it appears to be completely backwards. Flow loss is the impact that occurs in 90% of the miles of streams damaged by longwall mining, and it occurs because subsidence cracks cause widespread disruption to surface and groundwater hydrology locally. Flow loss can be more difficult to rectify, and it generally takes (many years) longer than pooling to repair. Stream damage by flow loss is not being predicted, and thus the mine operators are not required to post restoration bonds; consequently, the Bureau of Mining Programs cannot ensure that damaged stream resources will ever be successfully repaired.

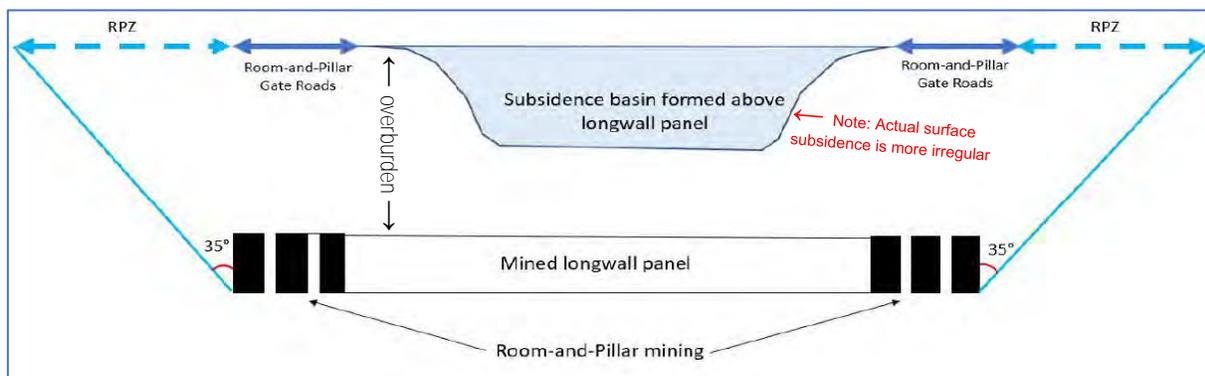
Coal companies apparently lack the ability or the incentive (or both) to accurately predict where specific streams will lose flow, and for how long. Yet flow loss occurs, and it occurs often. During the 5<sup>th</sup> Act 54 period, there were **153 reported incidences of flow loss**, and **98 of them (64%) involved more than 500 linear feet** of streams each. During the 4<sup>th</sup> period, more than 130 sections of streams required crack grouting and/or flow augmentation in attempts to address damage from subsidence-induced flow loss. In

allowing these numbers of impacts to streams to continue to occur time after time without any consequences, and with no guarantee that any specific incident of flow loss can be repaired successfully, the Department appears to be in violation of Act 54, the Clean Streams Law, and the Pennsylvania Constitution's ERA.

The mining regulations (25 Pa. Code Chapter 89) require prevention of adverse impacts to the hydrologic balance from mining operations. As mentioned, the somewhat dated Peng model is used to predict pooling impacts, but almost no attempts have been made to predict specific flow loss impacts. Furthermore, there has been no attempt to predict larger-scale hydrologic impacts. As stated in the 5<sup>th</sup> Report (page 7-3):

.... as part of the permitting process, subsidence models are prepared and compared with stream gradient to identify locations of likely pooling. There is no equivalent methodology for assessing groundwater changes. Further, there is not a consistent body of data the PADEP appears to use to evaluate regional changes to groundwater conditions. Groundwater impacts are not tracked in BUMIS and groundwater hydrologic monitoring and water supply loss data are not formally included in examination of stream recovery.

There are other guidelines and assumptions that the Department relies upon in operating its Mining Program, the bases for which also are of questionable utility. One is a **Rebuttable Presumption Zone (RPZ)** established by Act 54 in 1994 as a way to estimate the most probable area on the surface that may be affected by longwall mining subsidence. The RPZ, which also is mentioned in the Chapter 89 underground mining regulations, is the area within which a mine operator is presumed to be liable for any contamination, diminution, or interruption to a water supply. The RPZ is determined by projecting a **35-degree angle** from vertical from the outside of a coal removal area to the surface (see **below**: Figure 5-1 from the 5<sup>th</sup> Report). Since it is measured from the mined area, the size of the RPZ on the surface will vary depending on the depth of a specific mine panel (*i.e.*, the overburden).



The 2<sup>nd</sup> Act 54 Report prepared for the Department by California University of Pennsylvania (PADEP 2005a) suggested that the 35° RPZ angle may not be large enough to account for all mining-related water-supply impacts. It questioned the validity of the 35°-angle standard for the RPZ, recommending instead that a fixed horizontal distance (it suggested 100 meters, or 328 feet) from the edge of a longwall panel might be more realistic. The 4<sup>th</sup> Act 54 Report found that **50% (186 of 371) of mining-liable water supply damages had occurred**

**outside the prescribed 35° RPZ**, in one case at a distance equivalent to an 85° angle. The 5<sup>th</sup> Report (unlike the 4<sup>th</sup>) does not document the specific number of mine-liable water supply impacts which occurred outside the RPZ during the period, but the small-scale maps in its Appendix B suggest that there were numerous such occurrences. Figure B-Ef-5 in the 5<sup>th</sup> Report shows one mine-impacted water supply nearly 1 mile outside the RPZ of Enlow Fork Mine. The validity of the 35° RPZ clearly needs to be reevaluated in light of current longwall mine dimensions and practices --- panels today are significantly larger and more impactful than they were in the 1990s. The land area encompassed by the RPZ at the surface is important, because outside it a) there is no pre-mining water supply survey required by the operator, and b) the burden of proof shifts to each affected surface landowner to prove that any observed water supply damages are a consequence of the underground coal mining. The Bureau of Mining Programs apparently has not addressed the accuracy of the RPZ during the past 15 years, despite concerns repeatedly raised in its five-year Act 54 reports.

In addition to the RPZ for water supply impacts, the 5<sup>th</sup> Report identified two other buffer areas which reportedly (page 2-9) correspond “to PADEP regulatory boundaries”; however, where in the regulations these buffers are found is not explained. One is a 200-foot buffer outside the footprint of each mine (reportedly used to evaluate some observed structure and stream impacts); the other is a 1,000-foot buffer outside the footprint of each mine (reportedly used to identify certain features tracked in BUMIS). The 5<sup>th</sup> Report notes that impacts are being experienced well beyond the 200-foot buffer, as here for example (from page 11-4):

In one case, a property owner in Washington County experienced structure impacts when the longwall face was 690-ft from their residence. This distance was roughly 3.5 times further than the 200-ft buffer.

Although not specifically mentioned in the 5<sup>th</sup> Report, the underground mine permit application requires applicants to identify many different surface features within 1,000 feet of any proposed mine permit boundary, including wells, springs, and other sources of water supply. In most cases, this 1,000-foot buffer encompasses more surface land than the 35° RPZ discussed above, which typically appears to be no more than approximately 850 feet wide based on the maps provided in Appendix B of the 5<sup>th</sup> Report.

For certain other subsidence-related assessment purposes angles *smaller* than the 35° RPZ are utilized. In accordance with the 25 Pa. Code Chapter 89 underground mining regulations, a **30° "angle of draw"** is to be projected, from the coal seam to the surface, to define an area within which the mine permit applicant must describe which structures<sup>11</sup>, facilities, or features (including streams) may be materially damaged by mine subsidence. Mine operators must complete a pre-mining field survey of structures prior to the time that any structure falls within the 30° angle of draw. Per its regulations the Department may require an operator to install monitors within the 30° angle of draw to detect in advance surface movement resulting from

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<sup>11</sup> Possibly the most infamous incident of unpredicted damage occurred in 2005 when longwall mining at Consol’s Bailey Mine cracked the dam on Duke Lake in Ryerson Station State Park (PADEP 2010), necessitating its being intentionally breached and the lake permanently drained for safety reasons (see cover photos). The nearest mined longwall panel was almost 900 feet away at a 66° “angle of draw” (well beyond the prescribed 30°). That loss of a popular recreational facility in Greene County and similar incidents of “far field effects” demand that models and assumptions regarding the extent of potential subsidence damage be reevaluated.

the underground mining, so that if excessive subsidence begins to occur the mining can be stopped before structures or other features become damaged or until early mitigation measures can be installed. No information appears in any of the five-year Act 54 reports regarding whether such monitoring or impact avoidance with respect to the 30° angle of draw actually is performed, or ever has been required by the Department.

It is unclear (and not addressed in any of the Act 54 Reports) why there are two different angles of probable influence used by the Bureau of Mining Programs. If water supplies and other surface features are being routinely damaged at greater distances than would be determined by a 35° angle, then a 30° angle appears to be even less useful. It is perplexing why the Bureau of Mining Programs has not seen fit in the past 25 years to reevaluate the adequacy of the 30° or 35° angles.

Section 9 of the 5<sup>th</sup> Act 54 Report (Effects on Streams) discusses research conducted in Australia which found that fractures and heaving in streambeds can occur when the face of a longwall panel is between 1,300 feet and 1,950 feet away (Kay et al. 2006). That suggests that the distances and 2-week period of daily flow monitoring as prescribed by the TGD (discussed above) may not be long enough to detect the onset of flow losses. The 5<sup>th</sup> Report observed that stream heaving at Bailey Mine occurred at least 2 weeks prior to undermining in four streams, with the longest happening 6 weeks ahead, and that heaving was experienced at distances of 1,450 feet in one stream and 1,500 feet in another. Per the 5<sup>th</sup> report, page 9-13:

These observations suggest the period of daily monitoring of two weeks may not be adequate to capture impacts in advance of the longwall face.

The observations also strongly suggest that confining pre-mining stream and structure inventories to a 1,000-foot buffer beyond the edge of the mine permit area is not adequate to protect streams or the public.

The 5<sup>th</sup> Report notes that the stream protection TGD (563-2000-655 [PADEP 2005b], discussed in greater detail in the next section) makes certain assumptions about the likelihood of flow loss, but that it offers no practical way to make predictions. For example, on pages 8-3 to 8-4, the 5<sup>th</sup> Report notes:

The regulations and the technical guidance document do not specify a measurement threshold for evaluating and predicting when mining plans are likely to result in flow loss.

It then notes:

These determinations are made by the state on a case-by-case basis.

However, the 5<sup>th</sup> Report does not say what, if any, specific metrics the Department uses in evaluating the accuracy of predictions of flow loss. While it may be true that the TGD and the regulations do not prescribe clear formulas for making hydrologic predictions, that does not mean that such predictions do not have to be made, and it does not excuse the Department

from insisting that mine operators do so prior to being granted permits, or from imposing consequences on mine operators whose predictions turn out to be wrong. Nothing less than the public trust, and specifically the public's trust that the Department is protecting our natural resources, are at stake.

## TECHNICAL GUIDANCE DOCUMENT (Surface Water Protection)

Technical Guidance Document (TGD) 563-2000-655 (PADEP 2005b), entitled "Surface Water Protection - Underground Bituminous Coal Mining Operations", has been mentioned numerous times in the sections above. TGDs are issued by the Department to provide practical and specialized technical direction, for the benefit of both regulatory agency staff and the regulated public, with regard to a specific issue or regulation. TGDs are used to explain acceptable technical or administrative procedures and requirements, to provide assistance in compliance with statutes or regulations, and to establish policies or procedures. TGDs are not meant to be a substitute for regulations. If a TGD is not being followed, then the burden ostensibly lies with the permit applicant to justify methods alternative to TGD guidance for making demonstrations required by regulation.

The 2005 TGD 563-2000-655 includes detailed methods for identifying and assessing streams and wetlands, for determining whether and when subsidence-induced changes have caused adverse effects, and for determining whether and when a mine-damaged stream has recovered or been restored approximately to its normal pre-mining range of conditions. This 2005 TGD was one of the most significant policy changes to address stream protection that the Bureau of Mining Programs adopted since the enactment of Act 54 in 1994. However, its implementation was very slow, and sections of it still are not being followed.

One of the more constructive aspects of the surface water protection TGD is that it establishes methods and procedures for identifying and characterizing streams. Its methods are based on biological criteria and identify many smaller streams that are recognized by the Department as "regulated waters of the Commonwealth", but which are not shown on widely-available maps such as the "Networked Streams of Pennsylvania" (**Figure 3**). The 5<sup>th</sup> Report acknowledges the shortcomings of using the *Networked Streams* maps (which it did use nevertheless), as stated here on page 9-2:

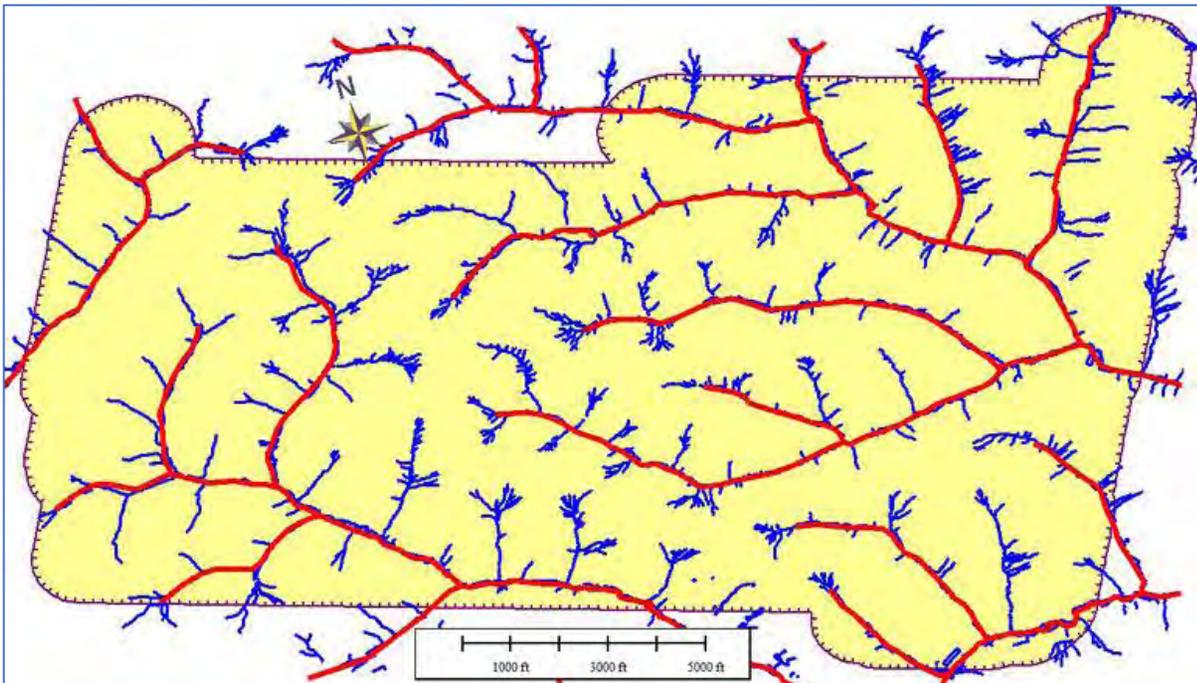
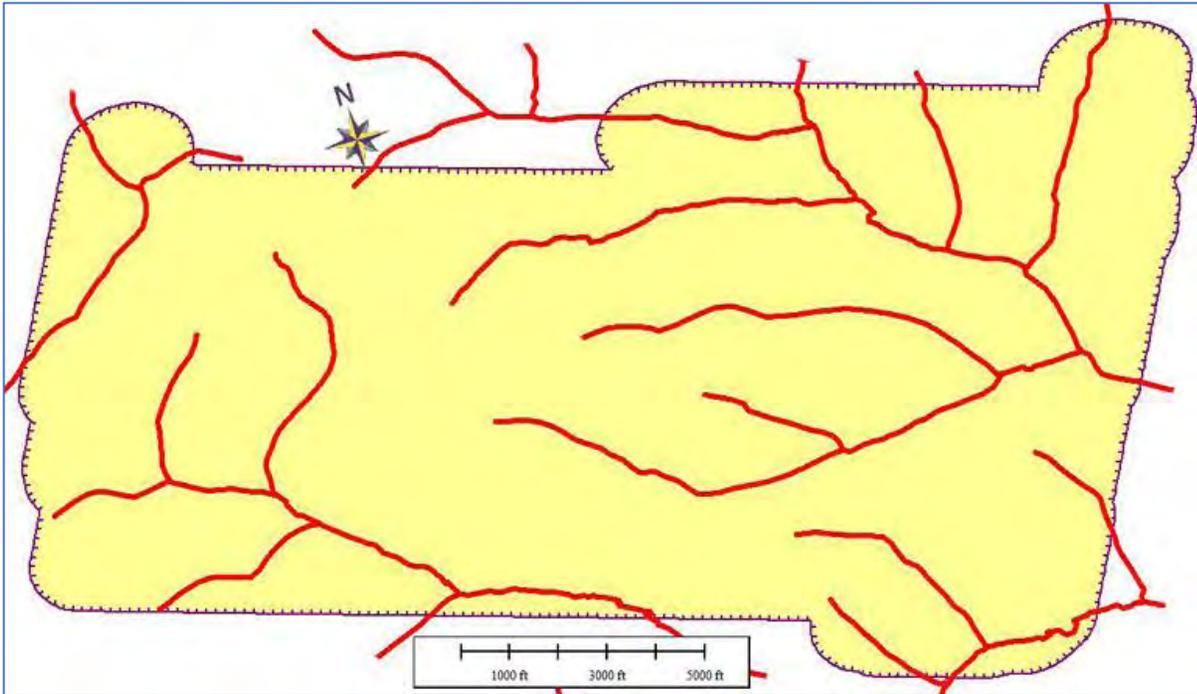
The "Networked Streams of PA" layer available on PASDA was the source of the stream layer, as in previous reports. This layer **does not include all small-order streams**, particularly intermittent reaches, **so the total length of undermined streams is an underestimation of the actual length undermined**. Some of mine operators provided more detailed stream layers in environmental resource mapping, therefore the level of resolution among mines was inconsistent. [boldface added]

The situation acknowledged in the box above identifies two problems: (1) the lengths of streams at risk (and actually damaged) are not being accurately reported and likely are significantly under-reported in the Act 54 assessments, and (2) all mine operators

← “Networked Streams of PA” identifies about **17.5 miles** of streams (red) at Harvey Mine.

**FIGURE 3.** Comparison of streams per “Networked Streams of PA” mapping (left top) with streams delineated per the TGD (left bottom) at the section of Harvey Mine active during the 5<sup>th</sup> Act 54 Period. Yellow (4,207 acres total) indicates the mine permit area during the 2013-2018 period plus a 1,000-foot buffer.

← Streams delineated by mine operator per the TGD identifies about **50 miles** of streams (red plus blue) in the same area (yellow) at Harvey Mine.



apparently are not being consistently held to the same standards of stream mapping. That the Department is aware of these problems, yet continues to condone them, undermines public trust in the Mining Program operations and the Department’s Act 54 evaluations.

The 3<sup>rd</sup> Act 54 Report took note of the surface water protection TGD, which was adopted during that 2003-2008 Act 54 assessment period, and suggested that if mine operators follow its monitoring schedules it “*may allow for more robust accounts of flow impacts on undermined streams*”. The 4<sup>th</sup> Act 54 Report noted that the TGD had begun to be implemented at some mines during that reporting period (2008-2013), but its directives were inconsistently applied by both the mine operators and the Department. The 5<sup>th</sup> Report likewise noted that the monitoring directives of the TGD still are not being followed consistently, and also that there are technical shortcomings in the TGD itself that reduce its utility even if it were to be fully followed. The 5<sup>th</sup> Report states in Section 7:

Current stream monitoring is not gathering flow data that are consistent with TGD recommended monitoring. Identification of the reasons for the consistent gaps in monitoring data is beyond the University’s scope of work. However, the data are not complete as reported.

The TGD sampling specifications include a set schedule that does not account for precipitation.

Following the release of the 4<sup>th</sup> Act 54 Report, the Department proposed to make changes to the 2005 TGD. A post-release assessment (PADEP 2015) conducted by a multi-Bureau workgroup within the Department stated at that time:

There were several issues identified with the [TGD] policy and how it has been implemented. Many suggestions for improvements to the program made in the Report may require major revisions to this policy, including those regarding data collection that is a primary concern of the researchers and public.

The streams policy should be reviewed to assure it is up-to-date regarding the best science available and that it reflects the findings of the Report and subsequent comments.

However, no significant review or changes to the TGD appear to have even begun during the five years since release of the 4<sup>th</sup> Act 54 Report. The 2005 TGD, even if it were faithfully followed, comes nowhere close to producing the hydrologic data needed to use statistical analysis for small watershed hydrology as discussed by USGS (Hittle & Risser 2019) and by the industry (Silvis *et al.* 2019).

Following the release of the 5<sup>th</sup> Act 54 Report, the Department again has proposed to make changes to the 2005 TGD. Changes certainly are needed in the now 15-year-old surface water protection guidance. However, the process itself for adopting TGD changes can take several years; and given past experience with the 2005 TGD, an Act 54 evaluation of the effectiveness of any *new* TGD changes is likely to take a decade or more.

Even the most scientifically based and rational changes to the TGD will never be effective, however, if they are not consistently followed by mine operators or implemented and

enforced by the Department, as has been the problem during the last 15 years with the 2005 TGD. The PADEP Citizens Advisory Council (CAC) made an excellent recommendation in that regard in its formal comments in July 2015 on the 4<sup>th</sup> Act 54 Report:

Since Technical Guidance issued by DEP does not have the full force or effect of law or regulations, the CAC recommends DEP analyze what elements of [the TGD] need to be incorporated into regulations so that those standards and provisions required of the underground coal mining industry can be enforced uniformly by DEP.

As CAC first recommended five years ago, the best aspects of the 2005 TGD (or any revised TGD) should be incorporated into regulations so they can be applied consistently and perhaps be taken more seriously by both the mine operators and the Department. Unfortunately, as noted above, neither this recommendation nor others relating to the TGD have been acted upon during the last five years.

On page 13-7, the 5<sup>th</sup> Report evaluates progress that has been made over the last 25+ years regarding stream protection under Act 54, particularly in light of the TGD:

Consider the evolution of Act 54 provisions over the last twenty-five years. When the legislation was passed, impacts to surface water systems were addressed with generalities. Since, PADEP has created policy (e.g., **technical guidance documents**) to protect surface water systems and define measures of system recovery. Yet, **this guidance continues to evolve** as the PADEP explores methods to document changes in flow following undermining (Hittle and Risser 2019). [boldface added]

One must question why the Department’s protection of streams from mining still is merely “evolving” after more than 25 years, especially since stream protection was not changed by Act 54. Clearly enough data have been compiled in these Act 54 Reports to recognize that dozens of miles of streams are being damaged every five years, that the damage is virtually all from longwall mining beneath and near streams, and that unsuccessful restoration measures continue to be applied to damaged streams far beyond the generous 5-year time-limit prescribed in the TGD 15 years ago. The Department does not need merely to refine its methods to better track and document these damages --- the urgent and long-overdue need is for the Department to actually *protect* streams from longwall subsidence damage in accordance with Act 54, the Clean Streams Law, the Dam Safety and Encroachments Act, SMCRA, and the Pennsylvania Constitution’s ERA.

## WETLANDS

In Pennsylvania, wetlands are recognized as a special subset of a larger class of surface water resources known as "regulated Waters of the Commonwealth". According to 25 Pa. Code Chapter 105 (§105.17): "*Wetlands are a valuable public natural resource. This chapter will be construed broadly to protect this valuable resource.*" Thus, when Act 54

directs the Department to analyze and report on the effects of underground mine subsidence on water resources, that includes wetlands.

The most important way to protect wetlands (or any other resource) in a regulatory process is to ensure that they are accurately identified upfront. If no one knows that a wetland exists, where it is, or how big it is, it cannot be protected. Wetlands are defined by three parameters (hydrophytic vegetation, hydric soils, and wetland hydrology). Regulated wetlands are identified by *field* indicators of each of those three parameters, applying technical procedures and methodologies developed specifically for that purpose (US Department of the Army 1987, US Army Corps of Engineers 2012) and adopted by the Department (25 Pa. Code 105.451). There are several desktop resources that can be used to identify the *approximate* location of some of the larger and more conspicuous wetlands in Pennsylvania, but none is accurate enough for regulatory purposes.

One set of maps that has long been used as an offsite resource for locating possible wetlands is the National Wetlands Inventory. NWI maps originally were compiled during the 1970s and 1980s from high-altitude aerial photographs by the US Fish and Wildlife Service (USFWS). They were used as overlays to US Geological Survey (USGS) topographic quadrangles with the intent of identifying habitat types for the management of migratory waterfowl and other wildlife resources nationwide. It is widely recognized that NWI maps are not accurate for site-specific wetland regulatory purposes, and they state as much on each one. However, mine permit applicants in Pennsylvania often have used NWI maps (and the Department has accepted their use) as the sole basis for wetland inventory purposes (Schmid & Company 2000, 2010b, 2011, 2014, 2015).

Another source of information that is useful in approximating wetlands prior to field investigation is the county soil survey. Prepared by the US Department of Agriculture - Natural Resources Conservation Service (NRCS), soil survey maps provide moderately detailed information about many soil types and characteristics. The most useful characteristic with particular relevance to wetlands as reported in county soil surveys and the online Web Soil Survey (USDA 2020) is “drainage classification”. Soils in map units classified as “poorly drained” or “very poorly drained” tend to exhibit the characteristics indicative of hydric soils and thus often approximate wetland conditions.

In mid-2019, the Department released a new digital map of potential wetlands statewide based on LiDAR and object-based modeling methods. This new mapping resource (MacFaden *et al.* 2019) represents conditions as of about 2013. Although it has not been ground-truthed, it is intended to provide greater accuracy than the NWI maps, and that appears to be the case. When NWI, hydric soils, and MacFaden mapping are considered together, they can provide a good tool for screening *where* regulated wetlands are likely to be found during follow-up field investigation. However, no maps based solely on remote or offsite resource information, including the newer MacFaden mapping, provide a reliable substitute for onsite wetland delineation guided by field indicators of vegetation, soil, and hydrology.

Accurate and reliable pre-mining wetland identification continues to be missing from the Pennsylvania underground mine permit application process. Lacking an accurate and comprehensive delineation of wetlands prior to undermining, the Department cannot determine the extent of impacts to those wetlands, nor can it confirm whether any wetlands were created where they did not exist prior to mining. The most accurate way to identify wetlands in the context of mining is (1) to field delineate all wetlands within a mine permit area (and its surrounding 1,000-foot wide buffer) in accordance with the methodology and procedures adopted by both the Department and the Army Corps of Engineers, and then (2) to invite the Corps to review and field-verify the wetland delineations in accordance with their long-established no-fee Jurisdictional Determination (JD) process.

As professional wetland consultants with more than four decades of experience, at Schmid & Company we are well aware of the crucial importance to wetland protection of this two-part process for identifying wetland resources. Unless wetlands are accurately delineated, characterized, and then field-verified, the reliability of pre- and post-mining wetland delineations offered by mine applicants cannot be assured.

The Department's Citizens Advisory Council made an important recommendation in this regard in its July 2015 comments on the 4<sup>th</sup> Act 54 Report:

The DEP should revise its permitting processes to ensure a permit applicant provides sufficient detailed information on wetlands located within the scope of the permit area, including verifying the presence of wetlands in coordination with the U.S. Army Corps of Engineers and incorporating appropriate measures into the permit to avoid impacts to wetlands.

Unfortunately, the Department has never adopted the above recommendation.

Here is a brief, real-world example of why accurate wetland delineation and Corps verification is so important in the context of mining: In 2010, a new longwall mine was proposed in Greene County by Alpha Natural Resources. Within the 1,867-acre surface facilities disturbance area for that proposed mine, Alpha delineated 16 wetlands where the National Wetlands Inventory had mapped only 2. The consultant's delineation thus *seemed* plausibly more inclusive than the NWI mapping. As part of the permit application, a Corps JD prudently was requested by Alpha. During the Corps' JD field inspections, in addition to the 16 wetlands Alpha had delineated there, the Corps identified 28 others (a total of 44 wetlands was verified). Had the Corps not inspected the wetland delineations in the field, and had any of those additional 28 wetlands been adversely affected by subsequent mining activities, those impacts would not have been recognized. Furthermore, any or all of those additional 28 pre-mining wetlands might have been identified in a post-mining survey, in which case they would have been incorrectly counted as wetland "gains".

The onsite delineation of wetlands followed by field verification by the Corps is a routine procedure for most other kinds of development project sites in the Commonwealth, but it is not being done for underground coal mining projects. Consequently, accurate pre-mining wetland information is not being collected, which renders any evaluation of post-mining wetland conditions meaningless at best and deceptive at worst.

The 4<sup>th</sup> Act 54 Report five years ago recognized the inadequacy of wetland delineations in the Bureau of Mining Programs process, noting on page XI-7 as follows:

The analysis and reporting on underground mining effects on wetlands is still in its infancy. .... The permit applications ... do not contain sufficiently detailed wetlands inventories, if any wetland information is present at all.

It may be accurate that in 2015 the reporting of wetlands and wetland impacts in the context of underground mining was only “in its infancy”. Nevertheless, it is incomprehensible, inasmuch as the Department had been charged with regulating wetlands for more than 40 years in accordance with the Dam Safety and Encroachments Act of 1978 (P.L. 1375, No. 325). The inadequacy of wetland protection in the minefields of southwestern Pennsylvania was discussed at length twenty years ago (Schmid & Company, Inc. 2000). Although Act 54 does not mention *wetlands* specifically, they are part of the larger category of “water resources”, and their protection was not changed, and certainly not decreased, by the 1994 Act.

The wetland analyses in the 5<sup>th</sup> Act 54 Report are disappointing. The wetland discussion in Section 10, the shortest of all substantive sections in the 5<sup>th</sup> Report, notes:

The determination [of wetland acreage undermined] could not be fully accomplished due to incomplete data availability to the University. ....  
As a result of the incomplete and inconsistent data obtained for wetlands, the University could only report limited conclusions.

TGD 563-2000-655 directs mine operators “*where subsidence is likely to occur*” (i.e., all “full-extraction” mines plus room-and-pillar mines with less than 100 feet of overburden) to conduct a “*complete inventory of wetlands*” prior to mining, and to predict “*whether or not the wetland will be adversely affected*”. There is no indication in the 5<sup>th</sup> or previous Act 54 Reports that any adverse wetland impacts were ever predicted for any mine. There also is no information regarding any pre-mining inventory of wetlands associated with any of the 5 pillar recovery mines (which are considered full-extraction) or the 7 room-and-pillar mines where the minimum overburden reportedly was less than 100 feet (see Table 3-12 in the 5<sup>th</sup> Report).

Every inventoried wetland is supposed to be resurveyed 12 months after undermining, in accordance with TGD 563-2000-655 [PADEP 2005b]:

Post-mining evaluations of undermined wetlands  
Operators should generally be required to resurvey each inventoried wetland 12 months after it is undermined to:  
(i) Determine whether there have been any changes in overall size, Cowardin vegetative class, Chapter 105 designation, or wetland functions.  
(ii) Verify the correctness of the prediction regarding adverse effects.

There is no indication in the 5<sup>th</sup> or previous Act 54 Reports that *any* wetlands were resurveyed at any longwall mine 12 months after undermining per the TGD, whether any predictions of adverse wetland impacts (if any were made) were ever verified, or whether any subsidence-

induced wetland impacts were ever remediated. The only post-mining wetland data cited in the 5<sup>th</sup> Act 54 Report are those reportedly provided by some (but not all) longwall operators as part of their five-year permit renewals.

There is nothing in the 5<sup>th</sup> Act 54 Report to suggest that the University of Pittsburgh researchers understand the technical basis by which wetlands are to be identified for regulatory purposes. They appear to accept at face value any wetland data provided to them. For example, the size and character of almost all of the pre-mining wetlands listed in Appendix J reportedly changed when identified post-mining, but no dates of either the pre-mining or the post-mining delineations are provided. Thus, it cannot be determined how much time elapsed between the wetland delineations or in what season they were done. Just as with stream monitoring, delineation of pre-mining wetlands during the late summer can skew the results to fewer and smaller wetlands, and delineation of post-mining wetlands during the spring can skew the results toward more and larger wetlands. The lack of any agency review of the pre-mining and post-mining wetland delineations makes them that much less credible.

The University of Pittsburgh researchers also fail to recognize major discrepancies in the wetland data and maps they themselves present and try to evaluate in the 5<sup>th</sup> Report. For example, Table 10-1 lists the acreage of wetlands undermined by each of 7 longwall mines active during the 5<sup>th</sup> Period (totaling 90.7 acres, including within a 200-foot wide buffer around each mine). Table 10-2 also lists the pre-mining acreage of wetlands for each of the 7 longwall mines during the 5<sup>th</sup> Period (and compares that with the post-mining acreage), but the pre-mine acreage total in Table 10-2 is not 90.7 acres --- it is 166 acres. The largest discrepancy is for Enlow Fork Mine, which reportedly undermined 34.3 acres of wetlands per Table 10-1, but allegedly had 109 acres of pre-mining wetlands per Table 10-2.

It is difficult for the reader to discern individual wetlands on the small-scale maps provided in Appendix B<sup>12</sup> of the 5<sup>th</sup> Act 54 Report, and they cannot be reconciled with the lists of wetlands provided in Appendix J. The Appendix B maps do not include any of the wetland identification numbers given in Appendix J. Nevertheless, it is clear that the mine-specific maps in Appendix B conflict significantly with the data listed in Appendix J with respect to pre-mining and post-mining wetlands. The specific data for hundreds of individual wetlands listed in Appendix J appear to correspond with the totals given in Table 10-2, not Table 10-1, and the Table 10-2/Appendix J data for the most part do not correspond with the 5<sup>th</sup> Act 54 assessment period, but with prior periods. As noted above, no dates are given for any pre-mining or post-mining wetland delineations. So it is virtually impossible to determine the nature and extent of wetland impacts that actually occurred *during* the 5<sup>th</sup> assessment period.

According to the Appendix B maps, there were no post-mining wetland surveys completed during the 5<sup>th</sup> period for Enlow Fork, Harvey, Monongalia County, or Tunnel Ridge mines, and only partial post-mining wetland surveys for Bailey and Cumberland mines; Emerald Mine was the only one with operator surveys for pre- and post-mining wetlands. However,

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<sup>12</sup> If the digital geospatial data compiled for the 5<sup>th</sup> Act 54 Report were available to the public, or had been provided to us through our 2019 RTKL request (see Appendix B), we could have tried to more closely examine and evaluate the detailed pre-mining and post-mining wetland mapping.

Appendix J lists hundreds of post-mining wetlands for some of the mines at which Appendix B shows none were surveyed. Upon closer examination, the wetlands listed in Appendix J pertain in large part to 4<sup>th</sup> period mining rather than the 5<sup>th</sup>. For example, about half of the nearly 140 wetlands listed in Appendix J for Bailey Mine were above panels that were mined during the 4<sup>th</sup> period, not the 5<sup>th</sup>. Appendix J lists 284 pre-mining wetlands for Harvey Mine above 3 of the 4 panels active during the 5<sup>th</sup> period, but no post-mining wetland data at all, even though mining in two of the three Harvey Mine panels was completed by 2016 (and thus should have had their wetlands resurveyed 12 months later per the TGD). For Enlow Fork Mine, 417 pre-mining wetlands are listed in Appendix J: 27 of those were undermined during the 3<sup>rd</sup> period (in 2006), and 390 wetlands (94%) were undermined during the 4<sup>th</sup> period. None of the listed wetlands actually was undermined during the 5<sup>th</sup> period.

Without agency review and verification, the accuracy of all pre-mining and post-mining wetland delineations is suspect. For example, **Figure 4** shows pre-mining wetlands mapped above a section of Harvey Mine and compares them with potential wetlands in that same area according to a combination of available desktop resource data (NWI, MacFaden, and county-scale hydric soils mapping). Although these desktop maps are not accurate for regulatory purposes, and are not based on site-specific field investigations, we have found over the years that they are very useful in suggesting areas of possible wetlands, especially where two or more of these sources overlap. In Figure 4, there are large areas along the stream corridors that NWI/MacFaden/county soils mapping suggest are likely to be wetlands, but they were not identified as such in the Harvey Mine pre-mining wetland mapping. Just as at the new mine proposed by Alpha in 2010 mentioned above, the lack of field-verification by any agency of these pre-mining wetland delineations raises serious questions about their accuracy and any reliance on them for post-mining impact evaluation.

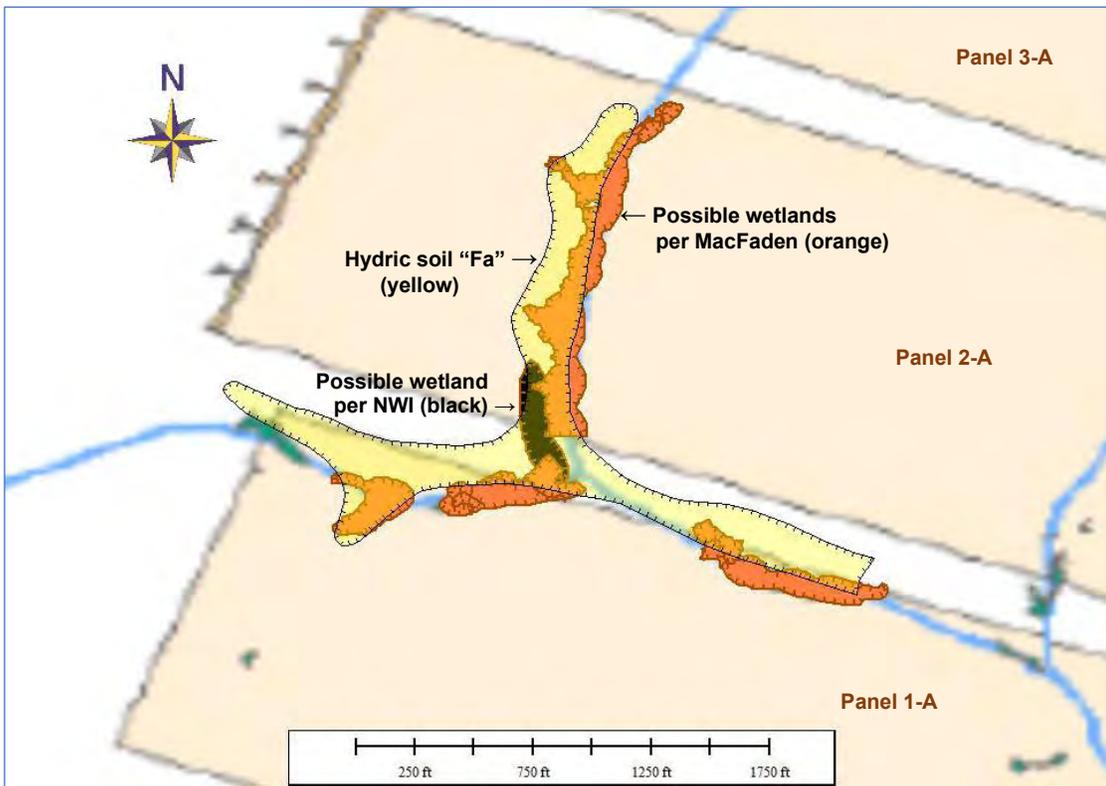
In the lists of pre-mining and post-mining wetlands for Cumberland Mine in Appendix J of the 5<sup>th</sup> Report, there reportedly are 6 pre-mining wetlands (totaling almost 7 acres), and 83 post-mining wetlands (totaling 14.7 acres). **Figure 5** shows pre-mining and post-mining wetlands mapped above a section of Cumberland Mine, and compares them with potential wetlands in the same area according to the MacFaden and hydric soil mapping. The MacFaden/hydric soil maps suggest numerous areas of possible wetlands (as of 2013) along the stream corridors which were claimed by Cumberland Mine to have been created sometime after mining of those panels was completed during 2016/2017. Again, without pre-mining agency review and field verification, it is likely that many or all of the reportedly “created” wetlands in fact already existed pre-mining, as suggested by the desktop mapping sources.

Assuming, for the sake of argument, that all of the identified “post-mining” wetlands actually were created by mine subsidence, they cannot be “credited” against any wetland losses unless the landowners agree to preserve them indefinitely with a formal conservation easement. Otherwise, it would not be unreasonable for a farmer, whose pasture subsided and became a muddy pond or wetland without their permission, to regrade and level the low spot (or demand that the mine operator do so). Lacking any pre- and post-subsidence Corps JDs, and any landowner agreement to perpetually retain any newly “created” wetlands (there has been no evidence of such an agreement *ever* mentioned in these Act 54 Reports), then

4A



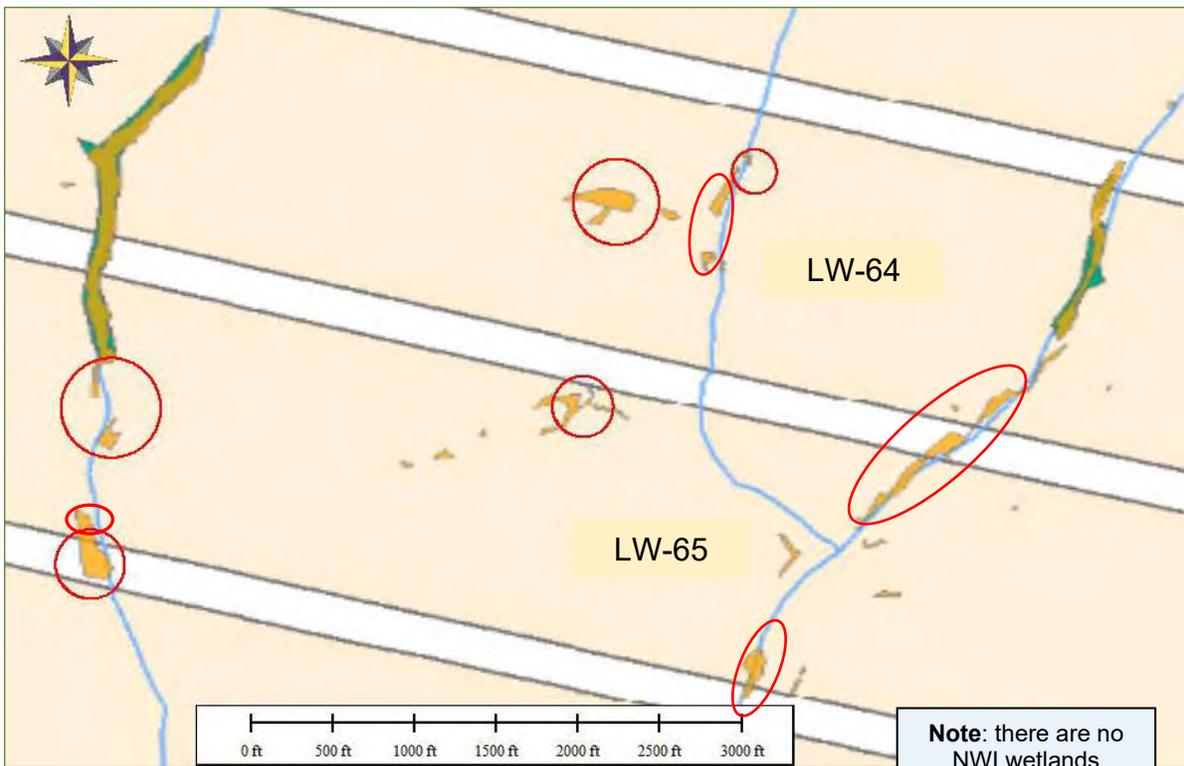
4B



**FIGURE 4.** Pre-mining wetlands mapped above a section of **Harvey Mine**. Top (**4A**) is from a figure in Appendix B\*\* of the 5<sup>th</sup> Act 54 Report (dark green areas are wetland, blue lines are streams). Bottom (**4B**) is same basemap as 4A but with wetlands as suggested by MacFaden (shaded orange), NWI (black, only one), and the poorly-drained hydric soil “Fa” (*Fluvaquents, loamy*, per the county soil survey; shaded yellow) added.

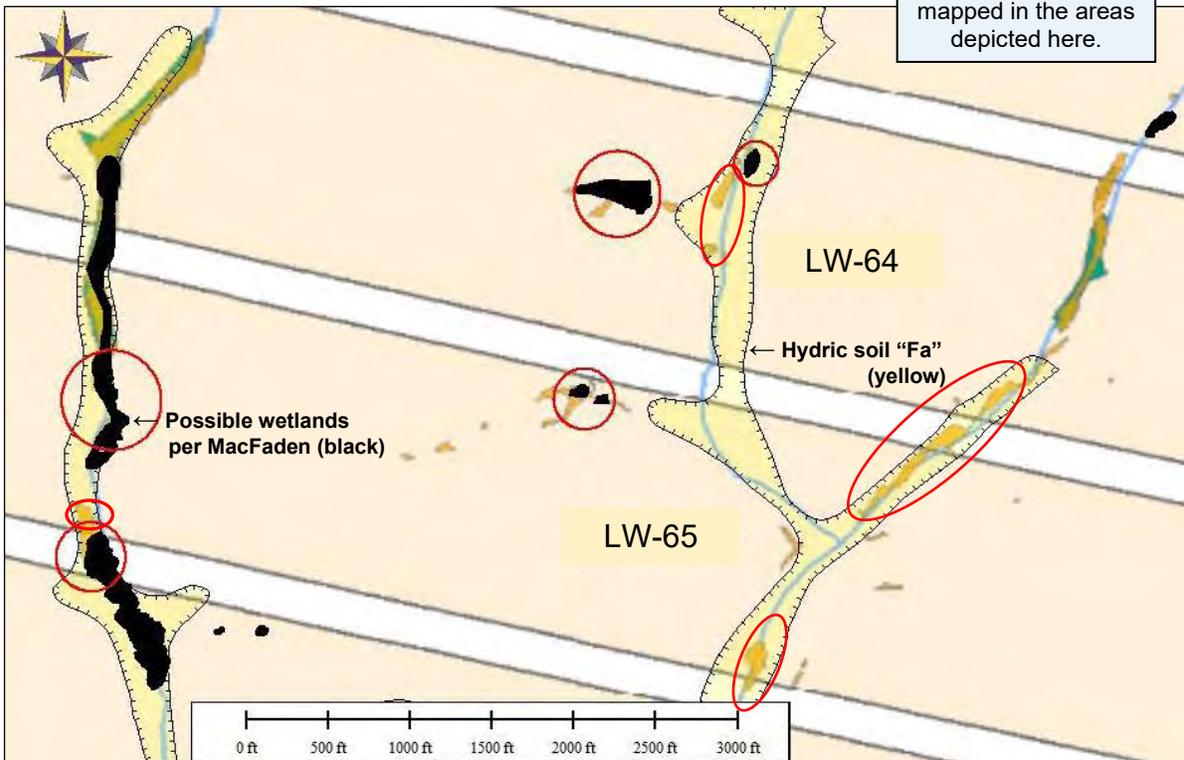
\*\*Note: The quality/resolution of the mapping of wetlands in Appendix B in the 5<sup>th</sup> Report is not very good, especially when enlarged, as here.

5A



Note: there are no NWI wetlands mapped in the areas depicted here.

5B



**FIGURE 5.** Pre-mining (green) and post-mining (orange) wetlands mapped above and near longwall panels 64 and 65 (where extraction was completed in 2016) of **Cumberland Mine**. Top (**5A**) shows wetlands as depicted in 5<sup>th</sup> Act 54 Report Appendix B. Bottom (**5B**) is the same as 5A but with MacFaden wetland mapping (solid black) and the poorly-drained hydric soil "Fa" (*Fluvaquents, loamy*, per the county soil survey; shaded yellow) added. Red circles and ovals (same in 5A and 5B) indicate areas where no pre-mining wetlands were delineated, but desktop mapping suggests there may have been wetlands in 2013. Agency review/verification could have resolved these questions. There is no guarantee that any post-mining wetlands will be preserved by the landowner.

the net change in wetland acreage reported in Table 10-2 must be entirely discounted. The Department cannot fulfill its Constitutional and statutory obligations to protect water resources, including wetlands, unless the resources are accurately identified. It is that simple.

Unfortunately, the discussions and evaluations of wetlands and wetland impacts in the 5<sup>th</sup> Act 54 Report are as feeble and meaningless as in prior Act 54 reports, a direct consequence of the failure of the Bureau of Mining Programs to require the collection of accurate and comprehensive wetland data. There is no information to lend any credence to any mine-operator wetland inventories conducted prior to or subsequent to undermining. The TGD directives regarding predictions of impacts and 12-month follow-up wetland identifications apparently are not being followed by applicants or required by the Bureau of Mining Programs. In its laws and regulations wetlands are claimed to be important water resources of the Commonwealth, but the Department has demonstrated no attempt to properly identify or protect them from the adverse impacts of underground coal mining subsidence. As with streams and other water resources, Act 54 did not change the legal and regulatory protections of wetlands. What changed, apparently, is that the Bureau of Mining Programs simply has failed to protect them from mine subsidence damage, allowing wetlands to become collateral damage to the impacts that Act 54 *did* allow to structures.

## MINE SUBSIDENCE INSURANCE PROGRAM

In 1961 Pennsylvania became the first coal mining State to institute a Mine Subsidence Insurance (MSI) Program to financially assist homeowners who experienced subsidence damage from abandoned coal mines. The insurance covers damages to structures caused by mine subsidence or mine water breakouts, which typically are not covered by regular homeowners' insurance. When the MSI Program was established in 1961, subsidence damage from abandoned room-and-pillar mines was a significant problem in the Commonwealth, primarily because the design and construction of underground mines were unregulated and largely uncontrolled. Following enactment of the 1966 BMSLCA, surface support increased as operators designed room-and-pillar mines to comply with the structural-damage prohibition that statute imposed. Subsidence from modern room-and-pillar mines is almost non-existent, because adherence to strict engineering standards prevents damage to structures and other surface features.

Act 54 allowed homes and other structures to be damaged by "*planned subsidence in a predictable and controlled manner*". Consequently, almost all recent damage to structures from underground mining is related to longwall mines. During the last 10 years, as reported in the past two Act 54 Reports, there were 467 mine-liable impacts to structures, but only 8 (2%) of them were attributed to active room-and-pillar mines while the rest (459, or 98%) were associated with longwall mines. No structure impacts were reported for any pillar recovery mines during that time. This represents a major positive reversal for room-and-pillar mines, which in the 1960s and 1970s caused so much damage that the MSI Fund and the BMSLCA were needed as remedies, but which have accounted for less than 2% of all structure impacts reported during the last 10 years per the Act 54 Reports. Structure damage is still a significant problem, but now it is almost entirely related to longwall mining methods.

The MSI Program had been in place for more than 30 years when Act 54 was passed in 1994. Act 54 specifically mentions mine subsidence insurance as an option to be considered by underground mine operators and permit reviewers in lieu of a liability bond for potential damage to surface structures. Section 6 of Act 54 states:

The department shall require the applicant to file a bond ... payable to the Commonwealth and conditioned upon the applicant's faithful performance of mining or mining operations..... In lieu of the bond required by this section, the department may require the operator of an underground mining operation to purchase subsidence insurance ..... for the benefit of all surface property owners who may be affected by damage caused by subsidence. The insurance coverage shall be in an amount determined by the department to be sufficient to remedy any and all damage.

Yet none of the five 5-year Act 54 Reports discusses the MSI Program at all. They do not mention whether mine operators ever opted to pay the subsidence insurance for homes to be undermined per the Act 54 provision in the box above in lieu of filing traditional bonds. Nevertheless, the 20 December 2019 Press Release issued by the Department to announce the availability of the 5<sup>th</sup> Act 54 Report devoted about one-third of its text to discussions of its mine subsidence insurance program, as if that were a relevant matter in the newly-released report. In fact, it is nowhere mentioned in the 5<sup>th</sup> Report.

According to the Master Agreement between the University of Pittsburgh and the Department for work on the 5<sup>th</sup> Act 54 Report (Appendix L in the 5<sup>th</sup> Report) "mine subsidence insurance records" (among other sources of information) were to be used in preparing the report. The same language was included in the Work Agreement for the 4<sup>th</sup> Act 54 Report (Appendix A in the 4<sup>th</sup> Report). In neither Report, however are "mine subsidence insurance records" or MSI discussed substantively. The 4<sup>th</sup> Report included "MSI" in its list of acronyms, and mentioned it once on page IV-6 where it notes that BUMIS classifies final resolutions for structure impacts into 7 categories, one of which it said was MSI. When actual structure resolutions were quantified in Table IV-2 of the 4<sup>th</sup> Report, however, MSI was not one of the resolution categories listed, and no further mention of mine subsidence insurance was included in that Report. No mention at all of MSI is found in the 5<sup>th</sup> Report aside from the Master Agreement.

The cost of an MSI policy is quite modest – currently, for a home worth \$225,000 the annual premium is \$120; the *average* premium paid by Pennsylvania minefield homeowners in FY 2018 was \$105. The MSI Program estimates that “millions of structures” statewide currently are at risk of damage from subsidence from abandoned mines<sup>13</sup>. During fiscal year 2018 (the most recent period for which MSI data are available) there were about 63,500 MSI policyholders in the bituminous and anthracite coal areas. If more than 1 million households are at risk (as PADEP Secretary Hanger asserted when releasing the 3<sup>rd</sup> Act 54 Report in January 2011), then only about 6% of Pennsylvania coalfield homeowners perceive their risk as great enough to motivate purchase of a low-cost MSI policy.

<sup>13</sup> PADEP website “Mine Subsidence Insurance”: <https://www.dep.pa.gov/Citizens/MSI/Pages/default.aspx>

The perceptions of homeowners regarding their risk may not be the best measure of how much actual subsidence damage to dwellings is occurring from abandoned coal mines in the 21<sup>st</sup> century. A more informative metric would be the number of MSI payouts for claims actually filed. On average during the last 10 years, only 11 claims filed by MSI policyholders in bituminous coal areas were determined to be valid each year and were compensated by the Fund. By comparison, during the same 10 years covered by the last two 5-year Act 54 Assessments, there was a total of 467 structure impacts attributed by the Department to active underground mines<sup>14</sup>. That total averages 47 structures per year damaged by active underground (mostly longwall) bituminous coal mines in southwestern Pennsylvania, more than four times as many as the 11 which were damaged annually by legacy abandoned bituminous mines statewide and which were covered by the MSI Program.

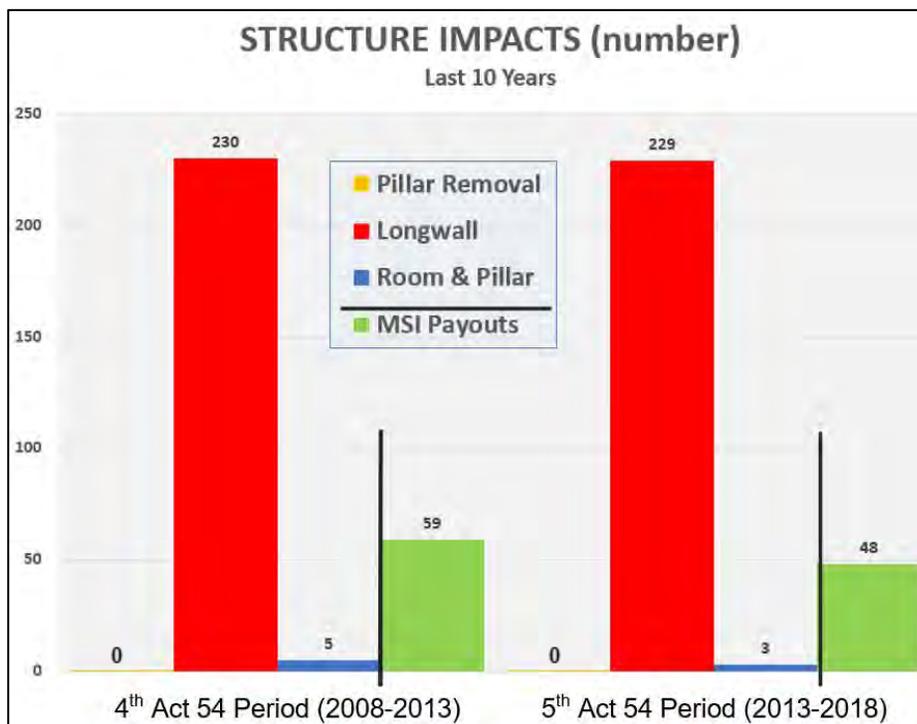


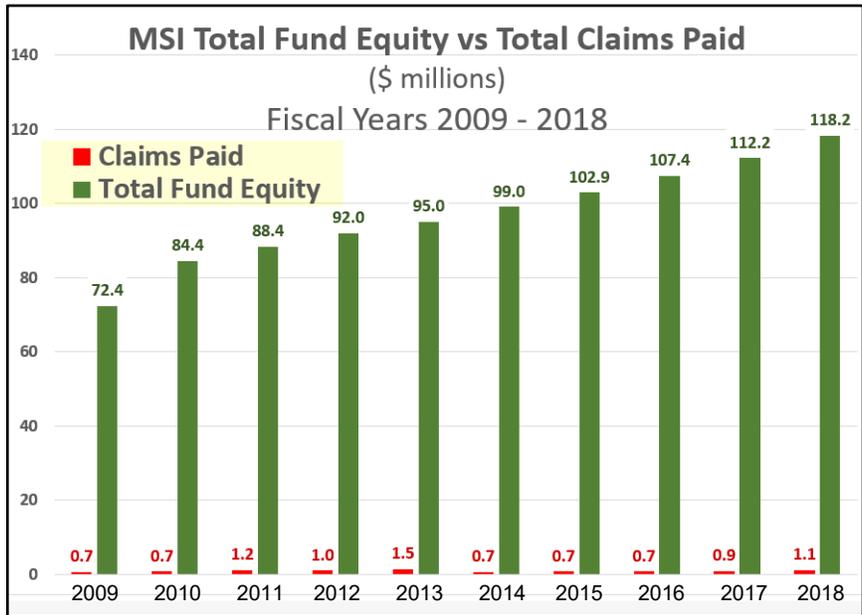
Chart (left) shows structure impacts attributed to underground bituminous coal mines active during each of the last two Act 54 Report periods, by mine type (there was none in either period for pillar removal mines, and only 8 total for R&P mines).

For comparison, the green bars indicate the much smaller total number of substantiated structure impacts from abandoned underground bituminous mines, based on actual MSI payouts during each 5-year period.

In recent decades the MSI Fund has been accumulating an ever-increasing balance because, in reality, subsidence damage to structures from long-abandoned room-and-pillar mines today is minimal across the Pennsylvania coalfields. Surface subsidence was a significant problem in the 1960s before the 1966 BMSLCA prohibited damage to structures built as of that year. Since then, stricter design of room-and-pillar mines has steadily decreased the number of room-and-pillar mines responsible for subsidence damage to surface structures.

<sup>14</sup> During that 10-year period, 459 of the 467 structure impacts (98%) were due to longwall mining.

As of the end of the 2018 fiscal year, the MSI Fund had a balance of approximately \$118 million (see **chart**, right). Total payouts for substantiated legacy subsidence damage claims averaged less than \$1 million per year for the past 10 years. During each of the last few years, interest on the Fund balance alone amounted to more than \$3 million per year, while policy premiums brought in more than \$6 million additional per year. After accounting for claim payments, administration, and other



expenses, the MSI Fund balance has grown about \$4 to \$5 million each of the last few years. Over its nearly 60 years of existence the MSI Program has paid out a total of just over \$30 million in claims. The current MSI Fund balance is almost 4 times that amount.

## DAMAGE FROM INACTIVE MINES

The 5<sup>th</sup> Act 54 Report highlights what it regards as an unusually high number of reported effects (to structures, water supplies, and land) from underground coal mines that were inactive (but presumably not abandoned) during the 5-year period. On page 11-4 it notes:

Another unexpected aspect of subsidence effects during the 5<sup>th</sup> assessment period was the substantial number of effects reported over mines that had been inactive for many years... This trend in subsidence impacts over inactive mines, if not examined, has the potential to impact property owners long after operator liability is expected to end.

Here again, by focusing on *reported* effects the Report makes these impacts appear to be more significant than they actually are in the context of Act 54. Indeed, of 64 “reported” effects to structures from six (incorrectly reported as “five” on page 4-18) inactive mines, only 15 were determined by the Department to be due to mining, so in fact those 15 structure impacts are the only ones relevant to the Act 54 discussion. All 15 of the 5th-period structure impacts were associated with a single inactive mine --- Maple Creek --- and they were clustered above an area that was room-and-pillar mined more than 25 years ago. Thus, this appears to represent an atypical situation isolated to one, not six, inactive mines. When evaluated in light of all mine-liable structure impacts during the 5<sup>th</sup> period, those 15 from one inactive mine represent only 6% of the total.

There was no determination in the 5<sup>th</sup> Act 54 Report as to *why* these effects from the inactive Maple Creek mine had occurred (further investigation was recommended, per page 4-19). Most (12 of 15) of the structure damages reportedly were resolved by “Agreement (unspecified)”, 2 others were “Compensated”, and 1 was simply “Resolved”. There was no discussion regarding whether mine subsidence insurance (see MSI section above) may have been used or considered in resolving any of the cases of structure damage from the inactive mine. Resolution of structure damages from inactive mines reported during the 3<sup>rd</sup> and 4<sup>th</sup> Act 54 periods likewise were not discussed in terms of whether MSI was used.

In fact, reported mine-liable damages from inactive mines have been relatively insignificant during the 3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> 5-year Act 54 Report periods (see **Table 5** below). Such damages in total represent only 3% of all such damages reported over the entire 15-year period.

**TABLE 5.** Damages (to structures, water supplies, and land) which were determined to be mine-liable during the last three 5-year Act 54 assessment periods, from inactive mines.

		<b>Damages from <i>Inactive Mines</i>, Determined to be Mine-Liable</b>			
<u>PERIOD</u>		<u>STRUCTURES</u>	<u>WATER SUPPLIES</u>	<u>LAND</u>	<u>TOTAL</u>
5 <sup>th</sup>	Total # of damages	247	192	67	506
	# from inactive mines	15	1	4	20
	<b>% from inactive mines</b>	<b>6%</b>	<b>&lt;1%</b>	<b>6%</b>	<b>4%</b>
4 <sup>th</sup>	Total # of damages	238	371	106	715
	# from inactive mines	3	13	5	21
	<b>% from inactive mines</b>	<b>1%</b>	<b>4%</b>	<b>5%</b>	<b>3%</b>
3 <sup>rd</sup>	Total # of damages	301	269	50	620
	# from inactive mines	0	13	2	15
	<b>% from inactive mines</b>	<b>0%</b>	<b>5%</b>	<b>4%</b>	<b>2%</b>
2003-2018	Total # of damages	786	832	223	1,841
	# from inactive mines	18	27	11	56
	<b>% from inactive mines</b>	<b>2%</b>	<b>3%</b>	<b>5%</b>	<b>3%</b>

## REPAIR OF DAMAGES

The principal intent of Act 54, as explained to and generally understood by the public, was that damages allowed by the 1994 law to structures and water supplies (but not to streams, which were *not* to be damaged) primarily were supposed to be repaired. The 5-year Reports identify several categories of impact resolution, and “repair” is one of them. One might expect, given the intent of Act 54, that “repair” would constitute the largest category of impact resolution. In fact, that is not the case --- repair comes out near the bottom, at least for longwall mine impacts.

According to the 5<sup>th</sup> Act 54 Report (page 6-4):

Between the three impact categories studied (structures, water supplies, and land), land impacts had the most final resolutions that ended up categorized as “Repaired” (17%).

The reported 17% figure actually is incorrect (too low), because it calculates the 16 repaired land impacts based on a total of 96 reported effects; however, that 96 includes 30 impacts that were determined by the Department to be not mining-liable. (Here again, using “reported effects” as the base number instead of “mine-liable effects” leads to misleading and irrelevant conclusions in the 5<sup>th</sup> Act 54 Report.) The 16 repairs actually represent 24% of the 66 total land impacts attributed to underground mining (active and inactive). Although 24% is a slightly better rate of repair than 17%, it still means that three-quarters of resolved land impacts during the 5<sup>th</sup> period were *not* repaired, but were addressed in some other manner. In most cases, that “other” manner is not clear.

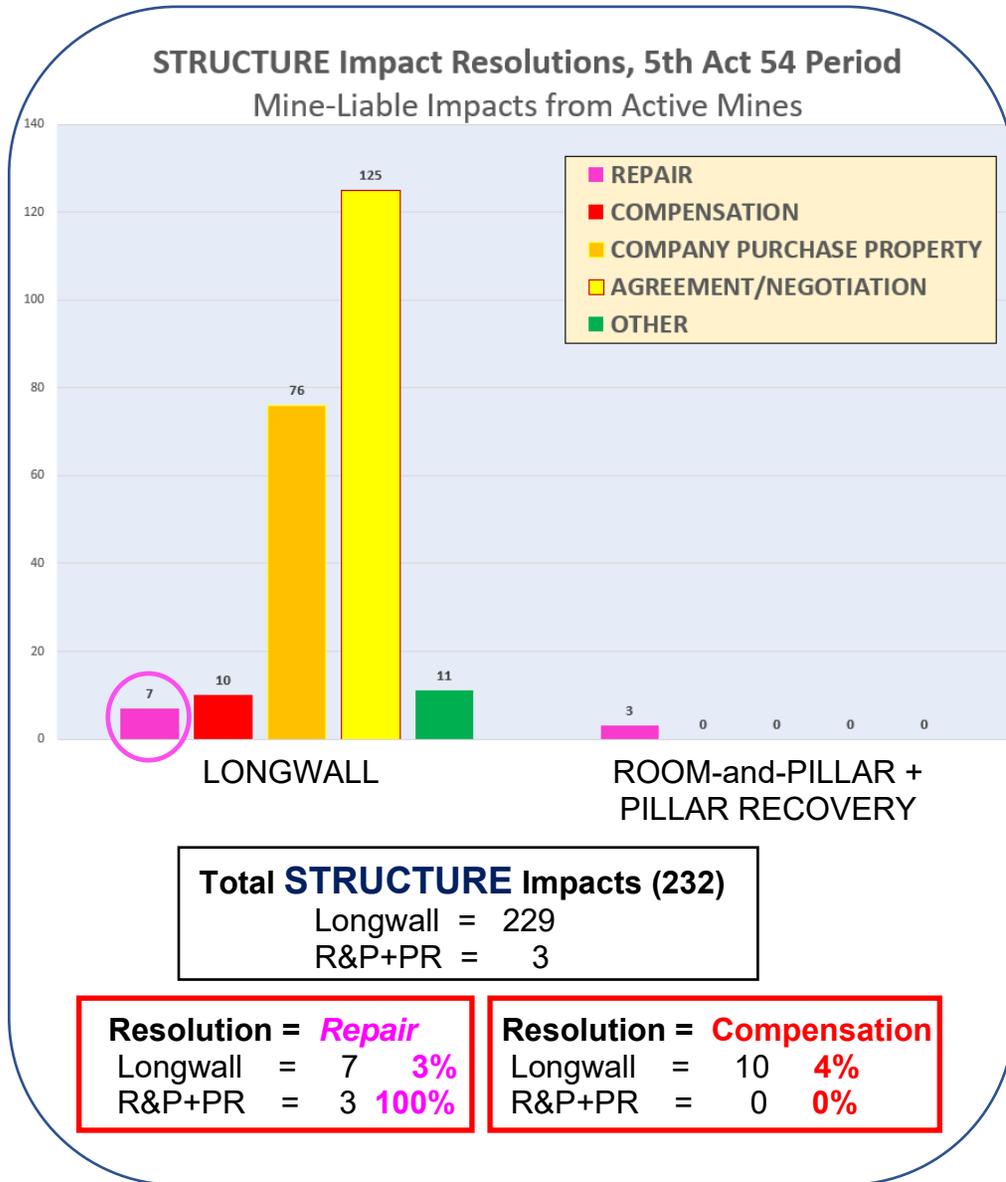
The 5<sup>th</sup> Report notes that 63 (95%) of the 66 mine-liable **land impacts** were from mines *active* during the five-year period, all of them longwall mines. Of those 63 impacts, 14 (22%) were repaired and 4 (6%) were resolved by “compensation”, so repair and compensation together (18) accounted for almost 29% of resolutions for mine-liable land impacts. The largest category of resolution for land effects was “Agreement” (either pre-mining or unspecified), which accounted for 23 (37%) of the 63 impacts from active mines. In 19 other instances (30%), the longwall mine company responsible for the land damage purchased the damaged property. Whether a landowner sells the damaged property to the mine operator or reaches some undisclosed “agreement” (which together occurred in 67% of the cases), there is no way to know whether *any repair* actually occurred, and most likely none did. Apparently the Bureau of Mining Programs does not ask or record those data.

There was also a very small percentage of actual documented “repair” for structure and water supply damages reported for the 5<sup>th</sup> Act 54 period (**Table 6**), as well as a lack of accurate information about the repair status related to other “resolutions”. The 5<sup>th</sup> Act 54 Report documents that “Repair” was the reported resolution for only 23 (5%) of 423 mine-liable impacts to structures and water supplies combined from active mines. These same patterns were documented during all previous Act 54 periods.

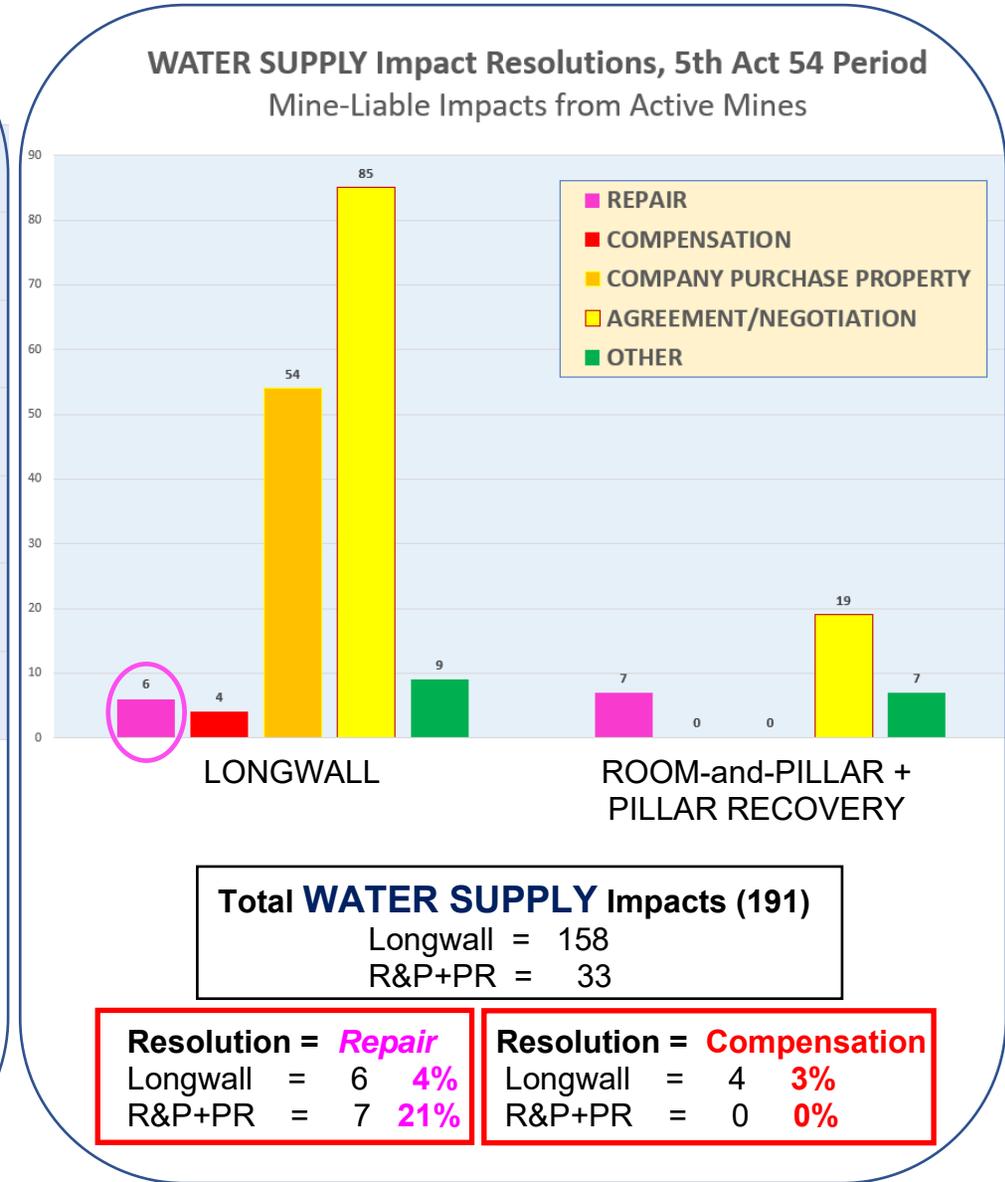
There were 232 **structure damages** that were determined by the Department to be mine-liable and associated with mines active during the 5<sup>th</sup> period --- 229 of them, or 99%, were caused by longwall mines. There were 3 structure impacts caused by room-and-pillar mines, and none caused by pillar recovery mines. Only 10 (4%) of the 232 impacts were listed as “repaired”, including all (3 of 3) of those damaged by room-and-pillar mines. However, for the 229 structure damages caused by longwall mines, only 7 (3%) were reported as “repaired”. (Fifteen structure impacts during the 5<sup>th</sup> period were associated with inactive mines; none of them was listed as “repaired”.) Direct “compensation” for structure impacts was the resolution in only 10 (4%) of the 232 instances. “Agreement” was the most common resolution, accounting for 125 (54%) of the 232 impacts. “Company purchase of the property” with the damaged structure also was common, accounting for 76 (33%) of the mine-liable structure impacts associated with active (longwall) mines. Again, reported resolutions of “agreement” and “company purchase of property” (87% of the total) do not indicate whether any *repair* actually occurred, and likely none did.

During the 5<sup>th</sup> period, there were 191 **water supply damages** that were determined by the Department to be mine-liable and associated with active mines (1 other was from an inactive

**TABLE 6.** Resolution of mine-liable impacts from mines active during the 5<sup>th</sup> Act 54 period (2013-2018).

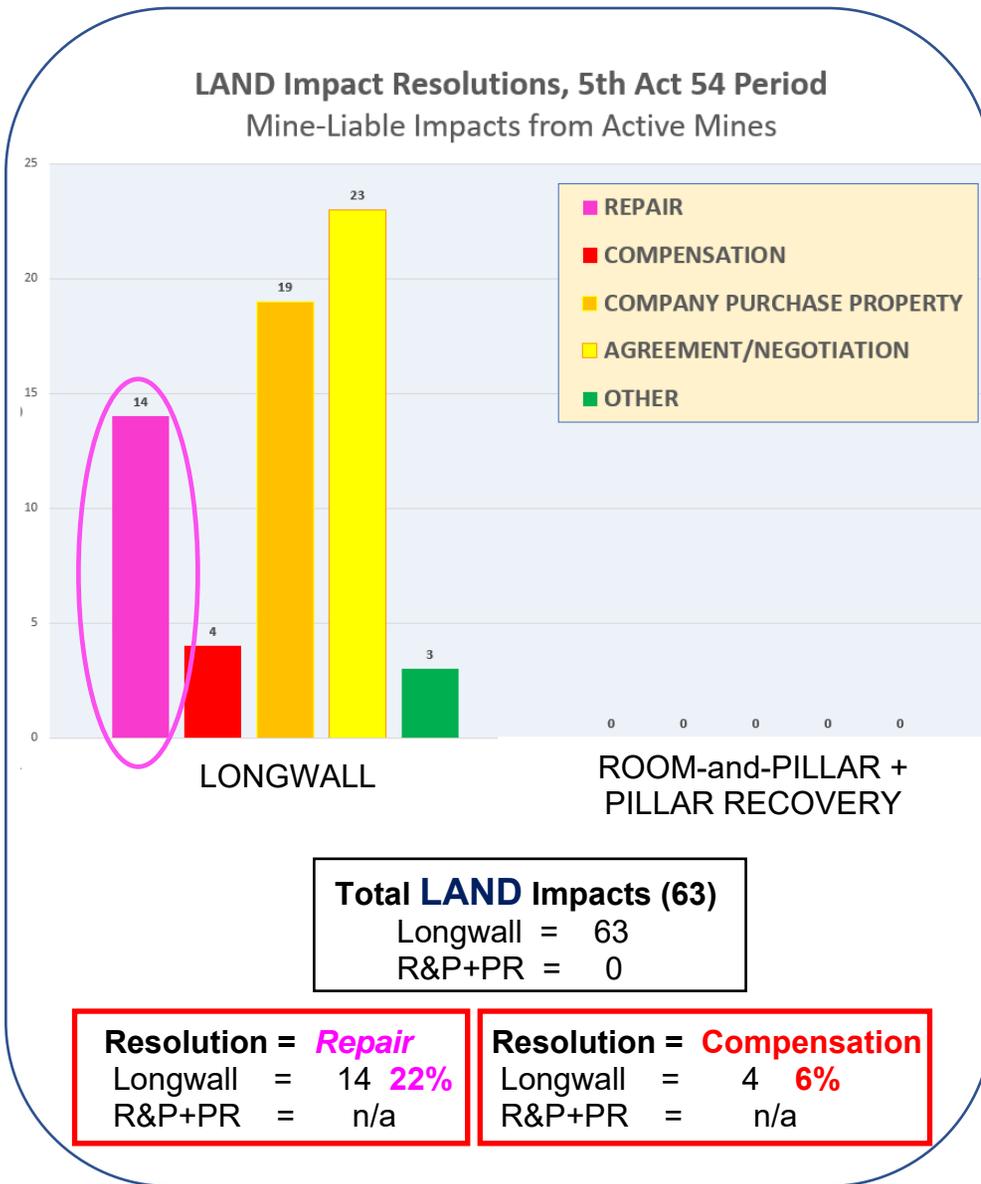


Only 7 of 229 longwall **structure** impacts (3%) were repaired.

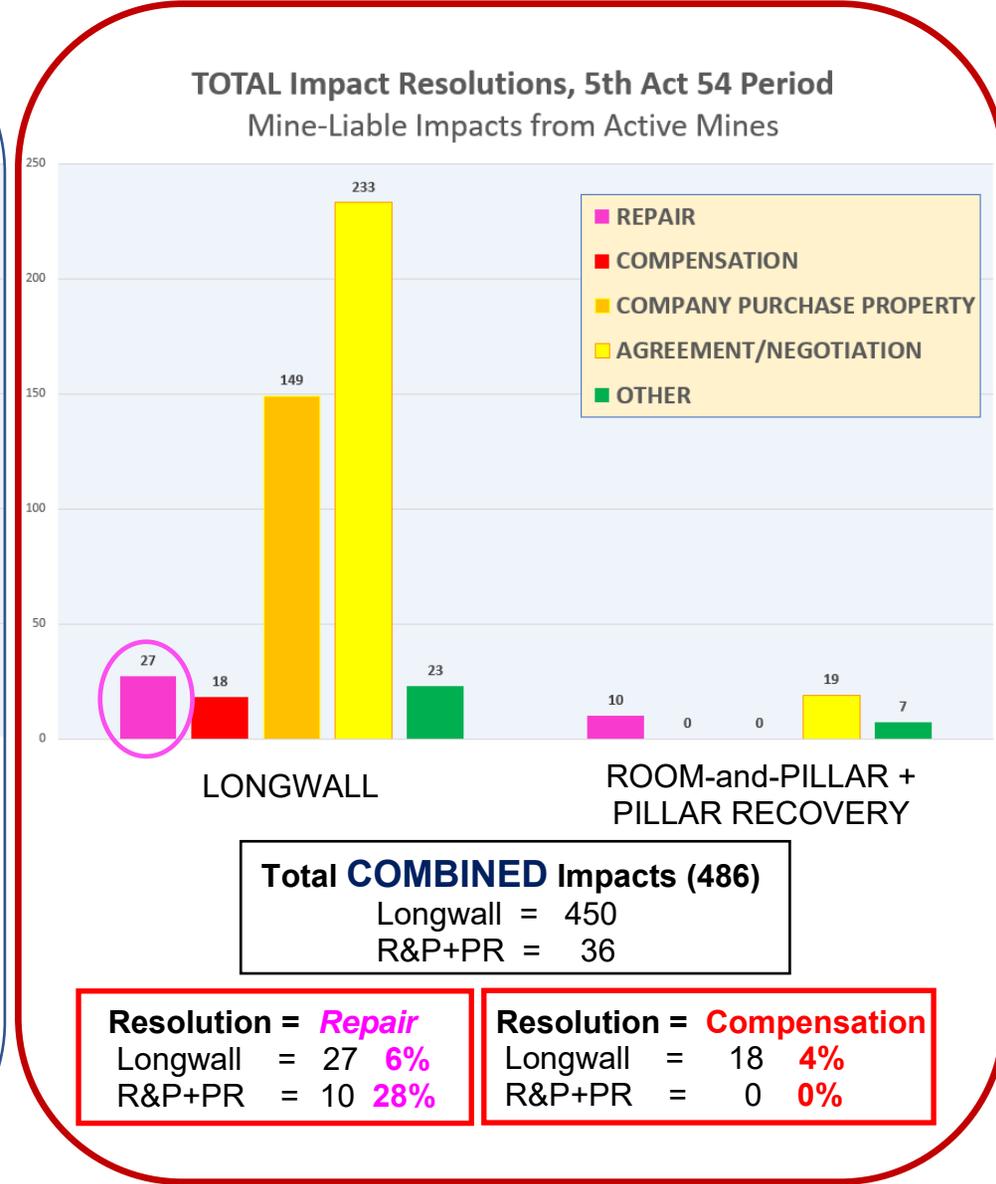


Only 6 of 158 longwall **water supply** impacts (4%) were repaired.

**Table 6.** Resolution of mine-liable impacts, concluded.



Only 14 of 63 longwall **land** impacts (22%) were repaired.



Only 27 of 450 longwall **combined** impacts (6%) were repaired.

mine). Only 13 (5%) of those 191 were listed as “repaired” (or replaced). Seven of the repaired/replaced water supplies were associated with room-and-pillar (6) or pillar recovery (1) mines, and six were associated with longwall mines (representing only 4% of all 158 longwall-related water supply damages). Direct monetary “compensation” for water supply impacts was the resolution in only 4 (2%) of the 191 instances. “Agreement” was the most common resolution, accounting for 104 (54%) of the 191 mine-liable water supply impacts. Company purchase of the damaged property was the reported resolution in 54 (28%) cases.

Overall, actual *repair* of mine-liable damage by active mines to the **3 features combined** (structures, water supplies, and land) was the documented resolution during the 5<sup>th</sup> period in only 37 (8%) of 486 cases. For damage from longwall mines only, repair was the reported resolution in 27 (6%) of 450 cases. Damage from active room-and-pillar and pillar recovery mines together was reported as repaired in 10 (28%) of 36 cases (Table 6).

Damages to structures, water supplies, and land most often are resolved by “agreement”. During the 5<sup>th</sup> period, of the total of 486 mine-liable damages from active mines, 252 (52%) were resolved by “agreement”. “Purchase of the damaged property” by the mine operator was the second most common resolution, occurring in 149 (31%) instances, all associated with longwall mines. Together, “agreement” and “purchase of property” accounted for 83% of the reported resolutions, with no indication whether *any repairs* occurred at all. Since repair of damages allowed by Act 54 was its clear intent, it is difficult to understand why the Bureau of Mining Programs has not been able or willing to track and categorize all resolutions (including those involving non-disclosure agreements) according to whether or not any repair took place. It should be feasible to accomplish and could easily be done without compromising confidentiality of agreement details.

According to the 5<sup>th</sup> Report, page 12-4:

The University was not able to determine reasons for post-mining property purchases, but it is logical to assume that these properties were impacted by subsidence. However, if a company purchases the property it is difficult to determine what the nature of the damage was or if there even was any damage.

The University researchers curiously label this an “*emerging trend in property transactions*”, but it actually has been a recognized issue for decades. More importantly for Act 54 purposes, a reported resolution of “property purchase” fails to shed any light on whether any damages on that property were repaired; presumably they were not.

The 5<sup>th</sup> Report raises a reasonable concern regarding the long-term economic strain on communities when damaged properties are not repaired. On page 11-2 it notes:

If these properties are impacted by subsidence during mining and the properties later sold “as-is”, these subsidence impacts can degrade the local tax base and negatively impact the local community. Demonstration of these processes are beyond the scope of the 5<sup>th</sup> Act 54 assessment but have the potential to create economic strain on communities living over active mines.

## Impact Resolution Duration

The Act 54 assessments report the considerable length of time it takes to repair, or otherwise permanently resolve, damages from underground coal mining. It is clear that damages associated with longwall mines take significantly longer to resolve than those of room-and-pillar or pillar recovery mines. Why that is the case is not discussed.

### Structures

For damage determined to be mining-liable, a total of 232 structures was damaged by active mines during the 5<sup>th</sup> period. Of those, 229 were due to longwall mines and 3 were due to room-and-pillar mines. No structures were damaged by pillar recovery mines.

- All 3 (100%) of the 3 structures damaged by room-and-pillar mines were “repaired” as required by Act 54, and the repairs took an average of 53 days.

- Of the 229 structures damaged by longwall mines, only 7 (3%) were reported as “repaired”, and those repairs took an average of 268 days.

Other resolutions for longwall-related structure damages that required significant time:

“Undisclosed settlement”	=	10 cases,	average:	283 days
“Unspecified agreement”	=	113 cases,	average:	263 days
“Compensation”	=	10 cases,	average:	197 days

In short: The few structures damaged by room-and-pillar mines all were repaired, and promptly (less than 2 months on average). Only 3% of the longwall mine structure damages were repaired, and their repair took five times longer (almost 9 months on average) than the repairs for room-and-pillar-damaged structures. Other resolutions for longwall structural damages that presumably did not result in repair also took a substantial amount of time. The significance for homeowners and businessowners of prolonged negotiations for longwall damage resolutions is not addressed in the Act 54 reports.

### Water Supplies

Damage determined to be mining-liable by active mines affected a total of 191 water supplies during the 5<sup>th</sup> period. Of those, 158 (83%) were due to longwall mines, 27 (14%) were due to room-and-pillar mines, and 6 (3%) were due to pillar recovery mines.

- Of the 158 water supplies damaged by longwall mines, only 5 (3%) were reported as “Repaired”, and those repairs took an average of 496 days. One other damaged water supply (an agricultural spring) received a permanent replacement, but that took 1,353 days (nearly 4 years!).

- Of the 27 water supplies damaged by room-and-pillar mines, 3 (11%) were “repaired”, and the repairs took an average of 134 days. Three others received a permanent replacement, and those took an average of 357 days.

- Of the 6 water supplies damaged by pillar recovery mines, none was “repaired”, but 1 received a permanent replacement supply that took 60 days.

For all underground mines combined, repair or permanent replacement<sup>15</sup> of the damaged water supplies occurred in only 13 (7%) of 191 cases.

Other water supply damage resolutions that did not involve repair or replacement that took significant times were as follows:

<u>Pillar recovery</u> :	“unspecified agreement”	=	4 cases,	average:	872 days
<u>Longwall</u> :	“unspecified resolved”	=	5 cases,	average:	733 days
	“undisclosed settlement”	=	4 cases,	average:	644 days
	“unspecified agreement”	=	72 cases,	average:	492 days

In sum: Permanent resolution of water supply damages has taken significantly longer overall than resolution of structure damages, but as with structures, the resolution of longwall-related water supply damages takes longer than for other mine types. The six cases involving repair or permanent replacement of water supplies damaged by longwall mines took 3.3 times longer on average to resolve than the seven cases involving repair or replacement of water supplies damaged by non-longwall mines. Other categories of resolution also took significant time (more than a year to several years, on average). Moreover, until a permanent resolution is achieved, residents typically are provided temporary water of indeterminate quality in the form of periodically-refilled water buffalos.

Land

There was a total of 63 land impacts from active mines during the 5<sup>th</sup> Period that were determined to be mine-company liable, all of them were associated with longwall mines. Fourteen of them (22%) were repaired, and repairs took an average of 449 days (1.23 years).

Act 54 specifically reversed the prohibition on structure damage that had been imposed by the 1966 BMSLCA, but it established formal requirements for the repair of damaged homes, other structures, and water supplies. The public was led to believe that Act 54 entailed a “*you break it --- you fix it*” process for subsidence damages. However, documented repair or replacement of damages seldom occurs (typically less than 10% of the incidents). Such resolutions for damages associated with longwall mines take significantly longer on average than for room-and-pillar or pillar recovery mines. The extremely low rates of documented repair or replacement and the lengthy times to any resolution, particularly with longwall-related damages, do not comport with the clear intent of Act 54. The Citizens Advisory Council over the years has heard many first-hand accounts regarding the considerable negative consequence that lengthy and costly negotiations have had for coalfield residents and their communities.

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<sup>15</sup> If damage to a water supply is determined to be mine-liable, the operator is supposed to provide a temporary replacement until there is a permanent resolution. The typical temporary replacement is a “water buffalo” --- a tank which is installed on a landowner’s property and periodically refilled. However, any testing of water quality is the burden of the landowner, and residents have informed us that there is no Departmental oversight to ensure that the quality of the temporary water is adequate or healthy. The Act 54 Reports do not address this matter.

## HISTORIC AND ARCHAEOLOGIC RESOURCES

The underground mining regulations at 25 Pa. Code Chapter 89, and the underground coal mine permit application itself, require applicants to identify any (a) cultural or historic resources listed on or eligible for inclusion on the National Register of Historic Places, or (b) known archaeological sites that are above or near the proposed mine area. Written coordination is required with the PA Historical and Museum Commission. Adverse effects to such historic or archaeological resources are supposed to be prevented.

Almost no consideration has been given in these Act 54 Reports to the impacts of underground mining on historic or archaeological resources. One brief mention is made in the 5<sup>th</sup> Report in the Section 4 discussion of mining effects on structures:

Surveys must describe the pre-mining condition of the structure. If the structure is historically or architecturally significant, special craftsmanship to restore or replace the structure must be identified.

An almost identical passage was included in both the 3<sup>rd</sup> and the 4<sup>th</sup> Act 54 Reports. In the 3<sup>rd</sup> Report, it was followed by photos and a brief discussion of impacts that had occurred to one historic farmhouse. There was no further mention of this matter in the 4<sup>th</sup> Report. In the 5<sup>th</sup> Report as in the 4<sup>th</sup>, having raised this important point, there unfortunately is no further mention or discussion regarding damages to historic structures. It would be of great interest to the public and to policymakers to learn how many historically or architecturally significant structures were undermined during each reporting period, how many experienced damage, what mining method was responsible for the damage, and whether any such damages were properly restored or replaced. It is entirely possible that some, perhaps many, structures that were damaged during the 25+ years since passage of Act 54 were either listed on or were eligible for listing on the National Register of Historic Places. If so, that information was not discussed or analyzed in any of the Act 54 Reports.

In its comments and recommendations to the Department regarding the 3<sup>rd</sup> Act 54 Report, the CAC in 2012 mentioned the issue of historic and archaeological resources:

Pennsylvania has significant archeological sites that are thousands of years old as well as significant historical resources. It is not possible for Native American cultural resources dating back as early as 7000 BC to be truly 'repaired' if they are harmed by longwall mining. Damage to prehistoric archaeological sites, or cracks in 18th century windows, are irreparable. ....

Should archeological and historic properties be given special consideration and/or protection given the potential for loss of historic value? Pennsylvania's Constitution requires that we protect natural, scenic, historic and aesthetic values of the environment. Should the goal for historic properties be protection (vs. reparation) since the historic value is compromised once it is damaged? ·

The CAC comments above appropriately were linked to the Commonwealth's obligations

under Article 1, Section 27 of the Pennsylvania Constitution.

No formal response or follow-up to those CAC questions and concerns was ever made by the Bureau of Mining Programs. In the passage above the CAC raises a fundamental point --- whether it is adequate or even appropriate for the Department to “protect” resources (in this case, historic/archaeological resources) merely by allowing them to be damaged and then hoping they can be repaired, as opposed to preventing the damage in the first place. This concern is relevant not only to historic/archaeological resources, but also to streams, wetlands, and other natural elements of the complex hydrologic balance. It appears that the Department views any proposed after-the-fact mitigation of mine subsidence damages to historic/archaeologic resources (and to water resources) as adequate *prevention* of adverse impacts. In doing so, however, the Department fails to uphold its Constitutional trustee obligations.

## ENVIRONMENTAL JUSTICE

Environmental Justice became a priority concern for the Department at the end of the 20<sup>th</sup> century. Governor Ridge established by Executive Order 1997-4 a 21<sup>st</sup> Century Environment Commission, to which he appointed both cabinet officials and outside members from across the Commonwealth (PA21<sup>st</sup> CEC 1998). Per the recommendation of that Commission regarding Environmental Justice, a Work Group was formed in 1999, consisting of Department staff and a broad-based group of outside stakeholders. The Work Group focused on the substance of Department permit processing and public participation. It issued its final report in June 2001. PADEP Secretaries James Seif and David Hess committed to implementing that Work Group’s consensus recommendations. Discussed in the following paragraphs are Environmental Justice concerns pertaining to the residents of Pennsylvania’s coalfields.

The Work Group recommended that certain of the more than 1,000 permits issued by the Department be designated as “Trigger Permits” that require an enhanced permit process, heightened scrutiny, and a “cautionary approach” because of a disparate history of excessive environmental damages experienced in communities of minority and/or impoverished residents in Pennsylvania and by residents of mining areas. The Department was requested to make full use of its permitting authority to foster community benefit and prevent community harm, not allowing lack of scientific certainty to prevent it from protecting and improving the quality of life in environmentally burdened communities. The Work Group also recommended creation of an Environmental Justice Advisory Board with members appointed by the Secretary to review implementation of its recommendations and address concerns such as compliance.

An Office of Environmental Advocate (OEA) was established in 2004 as liaison between the Department and the public, per Work Group recommendation, to implement formal policy as discussed below. The 2001 Work Group report pointed out that mining communities in Pennsylvania, even where not comprised of low-income or minority residents, struggle with

severe environmental, social, and economic problems from their long history of resource extraction. All three groups (low-income, minority, and mining area residents) traditionally experienced lack of a community voice in the Department's permit decisionmaking, as well as suffered from limited enforcement and monitoring of permit requirements by the Department. Increased use of injunctive procedures, revocation of permits, and closure orders was recommended. The Work Group considered the concerns of all coalfield residents and recommended that mine permits on its Trigger List be accorded priority by the proposed OEA in all mining and identified Environmental Justice Areas. (The Department also can treat unlisted permits as "opt-in" Trigger Permits on a case-by-case basis.) The OEA was requested to address specific issues related to the Mining Program: 1) public participation, 2) monitoring and enforcement, and 3) environmental impacts such as property damage, natural resource damage, and human health impacts. The 2001 report also urged the Department to review periodically the results of its Environmental Justice activities and make public its findings, but established no specific time frame for reports. The Department's OEA was reorganized as the Office of Environmental Justice (OEJ) in 2015.

According to the Work Group in 2001, impacts of mineral extraction on the environment, on private property, and on coalfield residents are major concerns in Pennsylvania that were inadequately addressed during the 20<sup>th</sup> century. Current underground coal mining laws such as Act 54 still allow impacts to occur, including subsidence impacts to homes and other structures, while requiring reclamation and restoration of such structure impacts as well as water loss damages. Maps of Environmental Justice Areas, defined as communities with significant "low-income" ( $\geq 20\%$  of residents below federal poverty level) or "minority" ( $\geq 30\%$  minority residents) areas, were prepared from federal census data and are updated from time to time. A proposed third Environmental Justice Area category consisting of rural coalfield residents (one of the three traditionally disadvantaged groups) was deleted from the 2001 Work Group's final report after its 6<sup>th</sup> draft had been published for public review and following recension of prior group consensus.

For each Trigger Permit application, the Work Group urged the Department and the applicant jointly to establish an Area of Concern extending at minimum 0.5 mile (2,640 feet) from the boundary of any new or modified permit involving additional mineral extraction intersecting with a low-income or minority Environmental Justice Area. The Area of Concern was to be increased beyond 0.5 mile wherever the Department is authorized to require additional analysis to address impacts, specifically including subsidence. Within each Area of Concern, following initial public participation, the Department is to identify potential impacts and either conduct or require an analysis of significant impacts. Not only is pollution prevention deemed to be an essential tool for consideration in all Trigger Permit applications, but adverse impacts including cumulative impacts from all sources within each Area of Concern are to be minimized, and the remaining harms formally identified and compared with anticipated benefits.

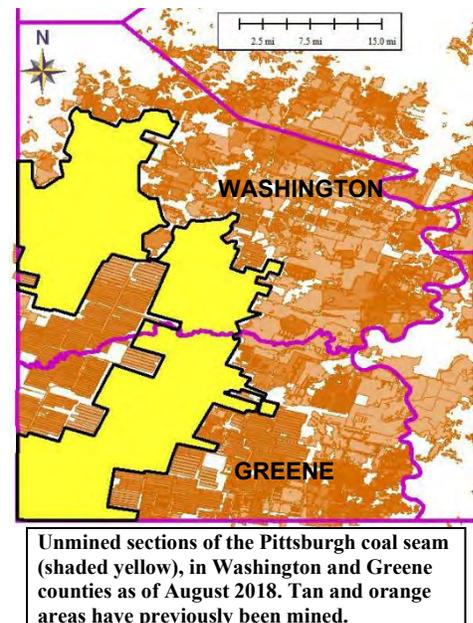
In 2004 a formal Public Participation Policy for permit processing (Technical Guidance Document 012-0501-002) was published to address the first two steps of the 2001 Work Group's recommended 10-step process for Trigger Permit review. That Policy is based on the authority of 18 specific statutes, including the CSL, BMSLCA, SMCRA, and DSEA,

although the policy is not a regulation or mandatory directive. It applies to all Trigger Permits that intersect low-income or minority Environmental Justice Areas.

None of the Department’s 5-year Act 54 Reports mentions the topic of Environmental Justice Areas as affected by underground mining. No reports exist on the number of times Environmental Justice public participation policy has been followed for mining permit applications since 2004. There is no evidence that any of the recommended, more stringent review steps for Trigger Permits beyond public participation has ever been performed for mining permits during the past 15 years. There are no public reports on periodic Department efforts to reevaluate the effects of its programs on Environmental Justice communities, as recommended in 2001. There are no OEA or OEJ reports of its recommendations on mining program issues or on the regulatory or statutory authorizations necessary to implement them. It is unknown whether the Department has ever asked applicants to assess concerns such as potential subsidence within the Areas of Concern that are to extend at minimum 2,640 feet outside every mine permit area. Subsidence damage, of course, can occur as much as 1 mile or more from the site of high-extraction mining. One-third of the remaining Pittsburgh seam coal subject to longwall mining during the next 40 years affects census tracts that have been identified by the Department as Environmental Justice Areas (see *Moving Forward*, below).

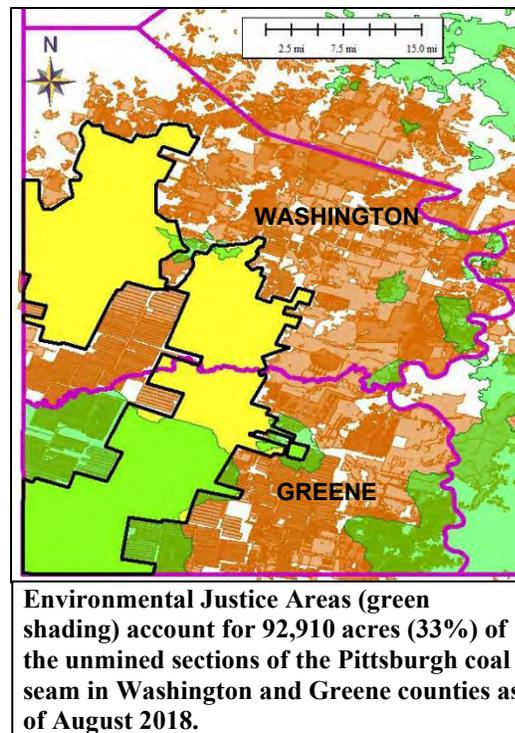
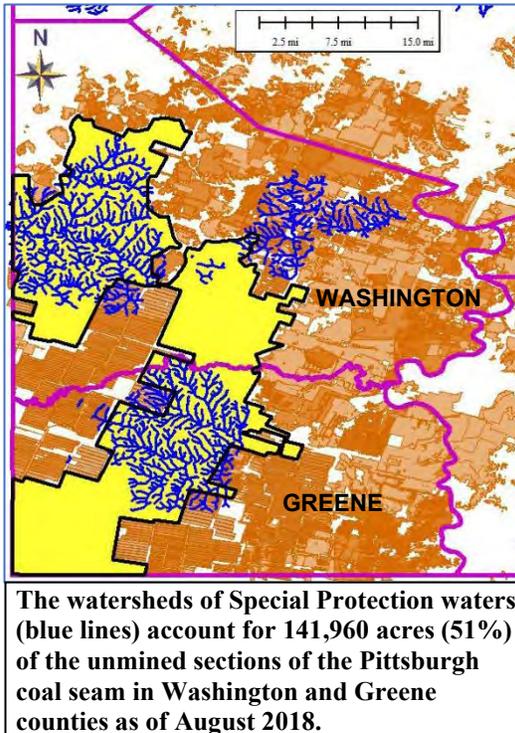
## MOVING FORWARD

According to the 5<sup>th</sup> Act 54 Report (page 3-24), longwall mining in the Pittsburgh coalbed of Pennsylvania is expected to continue another 40 years (beyond the August 2018 end of the 5<sup>th</sup> period) at current mining rates and conditions. That is slightly longer than the 37 years that had been estimated to remain as of the end of the 4<sup>th</sup> Act 54 period, and accounts for the more recent reduction in the pace of coal mining. Unlike the 4<sup>th</sup> Report, the 5<sup>th</sup> Report did not illustrate the remaining unmined coalfield areas. The figure at right is derived from Figure III-19 in the 4<sup>th</sup> Report, which showed unmined Pittsburgh coal in Washington and Greene counties at that time. It has been updated to reflect mining that occurred during the 5<sup>th</sup> Act 54 period; accordingly, the remaining unmined area (shaded yellow) encompasses approximately 277,415 acres.



The 5<sup>th</sup> Report provided no discussion or analysis regarding the *suitability* of any remaining unmined areas for future mining. (The 4<sup>th</sup> Report did not, either.) However, as applications for new or expanded longwall mines come under review, the Department should be cognizant of at least two types of sensitive features within those areas. Special Protection watersheds encompass just over half of the remaining unmined Pittsburgh coal areas (see figure below, left). Environmental Justice Areas encompass about one-third of the remaining unmined areas (see figure below, right). Past mining had

largely avoided these areas, but future mining will increasingly affect them. Combined, although with some overlap, these two potential constraints encompass 76% of the remaining unmined Pittsburgh coalfield.



## SUMMARY AND CONCLUSIONS

When Act 54 was passed in 1994, the Pennsylvania General Assembly understood that structural damages were being allowed that previously had been prohibited. Streams and other water resources, however, were not among the features which the new law suddenly allowed to be damaged, even with promises of restoration. Furthermore, Act 54 includes a special reporting provision that requires the Department to track damages that occur to structures, water supplies, and water resources, to analyze those impacts, and to formally report on them at 5-year intervals. By doing so, policymakers and the public are given the opportunity to determine whether the law is working as intended, and to take corrective actions if warranted.

The basic intent of Act 54 was to allow longwall mining, a more technologically advanced and capital-intensive method of underground mining than traditional room-and-pillar mining. The benefit of longwall mining is that it allows operators to extract a higher percentage of coal (up to about 75% of a mine permit area) quicker and with less manpower, and thereby to realize greater profits. The downside of the longwall method is that it results in inevitable subsidence of the land above the mine, unless the support from the coal is replaced by backstowing with some other material such as waste rock that otherwise may be piled on

the surface. The damage resulting from longwall subsidence indiscriminately affects structures, water supplies, and natural features at and near the surface.

Act 54 was promoted as an opportunity to provide a balance: it explicitly *allowed* certain structural damages from subsidence, but when damage did occur that was “planned and predictable” and almost immediate, mine operators would be available and were expected to fix it. Act 54 required the repair or restoration of damaged homes and structures, and the repair or permanent replacement of damaged water supplies. Yet actual repair cannot be documented in the 5-year reports for more than approximately 10% of those features. Mine operators have never asserted that the report statistics are incomplete or inaccurate.

Streams have physical, chemical, and biological characteristics which interact with one another and with other elements of the complex system known as the hydrologic balance (such as groundwater, springs, seeps, wetlands, etc.). Consequently, when streams or other elements of the hydrologic balance are physically damaged by mine subsidence, they cannot simply be re-manufactured or fixed like homes, highways, and other man-made features.

Act 54 explicitly did not authorize damage to streams, wetlands, groundwater, or other components of the hydrologic balance. Water resources previously (and subsequently) were required to be protected by avoiding and minimizing impacts to them to the greatest extent possible. No additional requirements were included in Act 54 for the restoration of streams and other natural features that might be damaged, because existing laws and regulations that already were in place to protect them from damage were not to be altered by Act 54.

With the Department’s release of its 5<sup>th</sup> Act 54 Report, we now have 25 years of data, reported at 5-year intervals, showing some of the impacts in the coalfields of Pennsylvania since 1994. The 5-year reporting requirement likely has been one of the most efficacious aspects of Act 54. The data in the 5-year Act 54 Reports demonstrate that when widespread structural damage from unfettered longwall mine subsidence was unleashed on the coalfield communities of southwestern Pennsylvania, streams and other water resources became unintended collateral damage. It is unclear why. Perhaps the Bureau of Mining Programs was more accustomed to dealing with the more-straightforward mine design and engineering considerations for room-and-pillar mines than with the more extensive and complicated environmental issues triggered by longwall mine subsidence. Perhaps the Bureau of Mining Programs mistakenly believed that the “*you break it – you fix it*” paradigm that Act 54 established for structures and water supplies also applied (or could be applied) to environmental resources. Perhaps the Bureau of Mining Programs believed the unsupported claims of longwall mine operators that damages to streams and groundwater can be fixed as easily as damages to man-made structures. Perhaps the Bureau of Mining Programs believes, now that data and monitoring have documented that some stream restoration efforts must continue for a decade or more, that damage lasting 10 or 15 years is just “temporary” and thus is insignificant.

Even if one believes that all underground mine operators have faithfully complied with all of the standards and requirements imposed on them by the Bureau of Mining Programs, then one must reach the inescapable conclusion that something is fundamentally wrong with a

PADEP program that results in such widespread water resource damage. The 25-year history of Act 54 reporting clearly demonstrates that streams and other water resources are being unlawfully damaged alongside structures and water supplies contrary to the Department's mining and environmental regulations, Act 54, the Clean Streams Law, the Dam Safety and Encroachments Act, and the Environmental Rights Amendment of the Pennsylvania Constitution. These unlawful damages continue to be permitted by the Bureau of Mining Programs. That being the case, the question becomes: what is to be done to rectify the situation?

## RECOMMENDATIONS

In this section specific recommendations normally would be made regarding how the Department could improve its oversight and evaluation of underground coal mining, for example, by requiring more extensive networks of surface or groundwater monitoring or by requiring more details about repair or non-repair of damaged features. One might recommend that all models and presumptions (like the RPZ) regarding the potential extent of longwall mine subsidence damage be reevaluated in accordance with current scientific and engineering principles, current mining technology, and actual experience of damage in Pennsylvania coalfields. One could recommend that very specific predictions of stream flow loss, pooling, and other damages to the hydrologic balance be consistently required in permit applications, and that predicted damage be avoided by a change in mining plans or methods. One could suggest that a clear and specific time limit be established for stream restoration. One could recommend that if a mine operator fails to predict a stream or wetland impact, or cannot demonstrate full recovery within the established timeframe, that coal extraction be suspended and the mine permit revoked until the impact has been successfully mitigated. One could recommend that the Pennsylvania Mine Subsidence Insurance Program be incorporated more directly into the process for repairing longwall damages to structures. One might recommend that bonding requirements be expanded to cover likely, possible, and observed incidents of stream flow loss, and to cover the many years that restoration and monitoring activities typically last.

As with previous Act 54 Reports, this 5<sup>th</sup> one includes a chapter (Section 12) which summarizes recommendations to improve the efficiency and effectiveness of the Department's mining operations and the preparation of future Act 54 reports. We believe that most of its 32 separate recommendations are very good, although it is extremely concerning that several of the recommendations are that the Department enforce its existing policies. The 4<sup>th</sup> Act 54 Report likewise had included specific recommendations, 22 of them, many divided into multiple parts. The Citizens Advisory Council has reviewed and evaluated each of these Act 54 reports, has solicited and passed along public input and comments, and has made numerous thoughtful and practical comments and recommendations of its own.

Following careful review of each of the 5 five-year Act 54 Reports, Schmid & Company also made many recommendations on specific issues and procedures that we believe would be useful to improve the operations of the Bureau of Mining Programs in preventing

environmental damage. Practical comments and suggestions aimed at improving the scope of the Act 54 reports and the TGD on stream protection also have been provided.

**But what's the point?** What can be said that hasn't already been said? What can be recommended that hasn't already been recommended (often the very same suggestions and recommendations after each 5-year report)? Most recommendations that have been made, no matter how practical or insightful, simply have not been taken seriously by the Bureau of Mining Programs. Any changes that *are* made, *if* they are made, represent minor fiddling around the edges, mere fig leaves and smoke screens that largely serve to deceive the public into believing that something is being done or might be done, or worse, that nothing really needs to be done at all.

It is now more than 25 years since enactment of Act 54; five mandated five-year Reports have been prepared, at significant cost to the taxpayers of the Commonwealth and the nation (the cost of these reports is split 50-50 with the federal Office of Surface Mining Reclamation and Enforcement). Yet the actual monetary cost of preparing these Reports pales in comparison to the physical, economic, and psychological costs being inflicted on coalfield residents and their communities. The real costs of Act 54 are the lost opportunities spread out over a quarter-century --- opportunities to ensure that damages to structures and water supplies actually are being repaired as required by the Act; opportunities to ensure that streams, wetlands, and other water resources are being accurately inventoried, and that impacts to those resources are being avoided and minimized so that they are fully protected under existing federal and Commonwealth laws and regulations as required by Act 54; opportunities to ensure that subsidence damages are accurately predicted and that consequences are imposed on mine operators who either fail to make accurate predictions or fail to make timely and complete reparations.

Many of the recommendations in this 5<sup>th</sup> and previous Act 54 Reports relate to ways to better collect, compile, and track data regarding the number and types of impacts that are occurring due to mining-induced subsidence. Many of the recommendations involve better ways to identify and track how, and how quickly or slowly, damages to structures, water supplies, and water resources are being resolved by mine operators. The specific details reported in the five Act 54 assessments prepared to date have changed each time, but the same basic and undeniable conclusion is always there: **The operation of the Department's Bureau of Mining Programs with respect to longwall mining is not working in a way that aligns with Act 54, the Clean Streams Law, the Dam Safety and Encroachments Act, or the Pennsylvania Constitution.** The Department does not merely need better tools for counting and tracking the impacts. It needs to step back and determine how to prevent these damages going forward in the future.

Damages to structures and water supplies continue unabated, numbered in the hundreds each 5-year period, and just a small percentage of them --- well below 20% --- reportedly are repaired as Act 54 intended. Structures and water supplies (wells), the two man-made features directly addressed by Act 54, *could* be repaired by man, and the law anticipated that they *would* be repaired. But that is not happening, or at least, it cannot be determined to be happening based on the data collected and compiled for these Act 54 Reports.

Streams, wetlands, and the hydrologic balance are complex natural systems. Predictions of impacts to these water resources are imprecise at best, and non-existent most of the time in longwall mine applications. Environmental restoration is complicated, and it is utter hubris to believe that such complex, interconnected natural systems can be completely understood, much less easily repaired after the massive disruptions caused by longwall subsidence. In any case, whether or not predictions of hydrologic damage are accurate is irrelevant because the Bureau of Mining Programs has not been tracking them, nor does it impose any consequences on permittees for inaccurate predictions or deficient monitoring or reporting.

Environmental damages are being treated like structural damages – they are being *allowed* if a mine permittee submits even a vague plan to try to correct them. But Act 54 did not change the previous standard of protection to avoid and minimize environmental impacts on aquatic resources. The Bureau of Mining Programs has changed the standard of environmental protection in the context of underground mining for the past 25 years, treating damages to aquatic resources from longwall coal mines much more leniently than the Department treats similar damages from other types of development. Act 54 explicitly did not change any of the environmental protections established by laws and regulations, and it could not supersede the Constitutional Trust protections afforded to current and future Commonwealth residents. As discussed previously, Act 54 was directed at *structural* damages, not *environmental* ones. Yet under the Bureau of Mining Programs the environment has suffered, and continues to suffer, as water resources routinely become collateral damage to the structural damages allowed by Act 54.

The vast majority of mine-related damages in southwestern Pennsylvania, and almost all of the environmental damages, are the result of one method of underground coal mining --- longwall. Act 54 explicitly does not prohibit any specific method of underground coal mining. Indeed, there is no need to prohibit longwall mining, or to dictate one method of mining over another in any particular situation. That is not the purpose of the Bureau of Mining Programs or of the Department more broadly. What the Department can do --- what it *must* do --- is impose and consistently enforce a standard of environmental protection on underground mining activities, and then allow mine operators to extract their coal in any way feasible, so long as they meet that standard.

The Bureau of Mining Programs does not need to invent or apply a new standard, nor does its standard for mining need to be complicated. In fact, it merely needs to apply the same standard of environmental protection that existed prior to Act 54, a standard which was not altered by Act 54, a standard which is still in place today for non-mining projects throughout the Commonwealth. Our best and only recommendation would be that **the Bureau of Mining Programs should apply this standard: damage to surface water and groundwater features from underground coal mining must be prevented.** Not “prevented” as in: the water resource damages can be allowed if some vague mitigation measures are proposed and maybe later applied --- that has not worked for the last 25 years. Rather, “prevented” as in: water resources must be accurately inventoried and then damage to them “avoided”. For too long the Department has failed to ensure that longwall mine engineers maximize environmental protection in furtherance of its trusteeship obligations.

Water resource impacts should not be avoided only if or where it may be convenient to do so. As the US Supreme Court ruled in 1987, surface support serves a valid public purpose. The 1966 Mining Law had imposed a valid standard in prohibiting subsidence damage to certain structures. The BMSLCA specifically declared in Section 4 that:

In order to guard the health, safety and general welfare of the public, no owner, operator,.... shall mine bituminous coal so as to cause damage as a result of the caving-in, collapse or subsidence....[of certain structures].

The BMSLCA went on to say that if subsidence *did* damage a protected structure unexpectedly, the mine operator had 6 months to repair it (or provide money for its repair), and if that did not happen, its mine permit would be suspended or revoked. Clearly, accidents will happen, and even careful engineering does not guarantee that damage will never occur. So a strict penalty was imposed to ensure compliance with the law. A similarly strict standard of protection must be imposed and enforced for water resources, one that does not result in longwall subsidence damage to nearly half of all streams undermined.

Act 54 changed the 1966 Mining Law prohibition on damage to structures, but it made no changes to environmental protection laws, regulations, or standards in place at that time. Therefore, in accordance with Act 54, mine operators are allowed to damage homes, other manmade structures, and some water supplies, yet they are *not allowed* to damage streams, wetlands, or other water resources. If the Bureau of Mining Programs simply recognizes that reality and re-adopts the Department's historic standard of environmental protection, then it may begin to operate in accordance with its Constitutional obligations.

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This report was prepared on behalf of the Citizens Coal Council by Stephen P. Kunz with the assistance of Dr. James A. Schmid. Both are senior ecologists with Schmid & Company, Inc. Mr. Kunz has been a consulting ecologist since receiving a degree in human ecology from Rutgers University in 1977. Dr. Schmid is a biogeographer with more than 50 years of experience in ecological consulting. Both Mr. Kunz and Dr. Schmid are certified as *Senior Ecologists* by the Ecological Society of America and as *Professional Wetland Scientists* by the Society of Wetland Scientists.

Mr. Kunz and Dr. Schmid offer outstanding credentials as experts in ecology, wetlands, environmental regulation, and impact assessment. They have analyzed the environmental impacts of many kinds of proposed development activities in many states, including coal mining facilities, industrial facilities, transportation facilities, and commercial and residential developments. They have prepared environmental inventories and written Environmental Impact Statements under contract to various federal, State, and local government agencies, and a diverse array of private sector entities. Regarding the regulation of underground coal mining, they have reviewed and provided public comments on proposed new regulations, revisions to existing regulations, technical guidance documents, and permit application forms and procedures, both at the State and federal levels. They also have reviewed and assessed specific coal mine permit applications. Regarding Pennsylvania Act 54, they have reviewed and provided formal comments on all five of the five-year assessments and associated documents.

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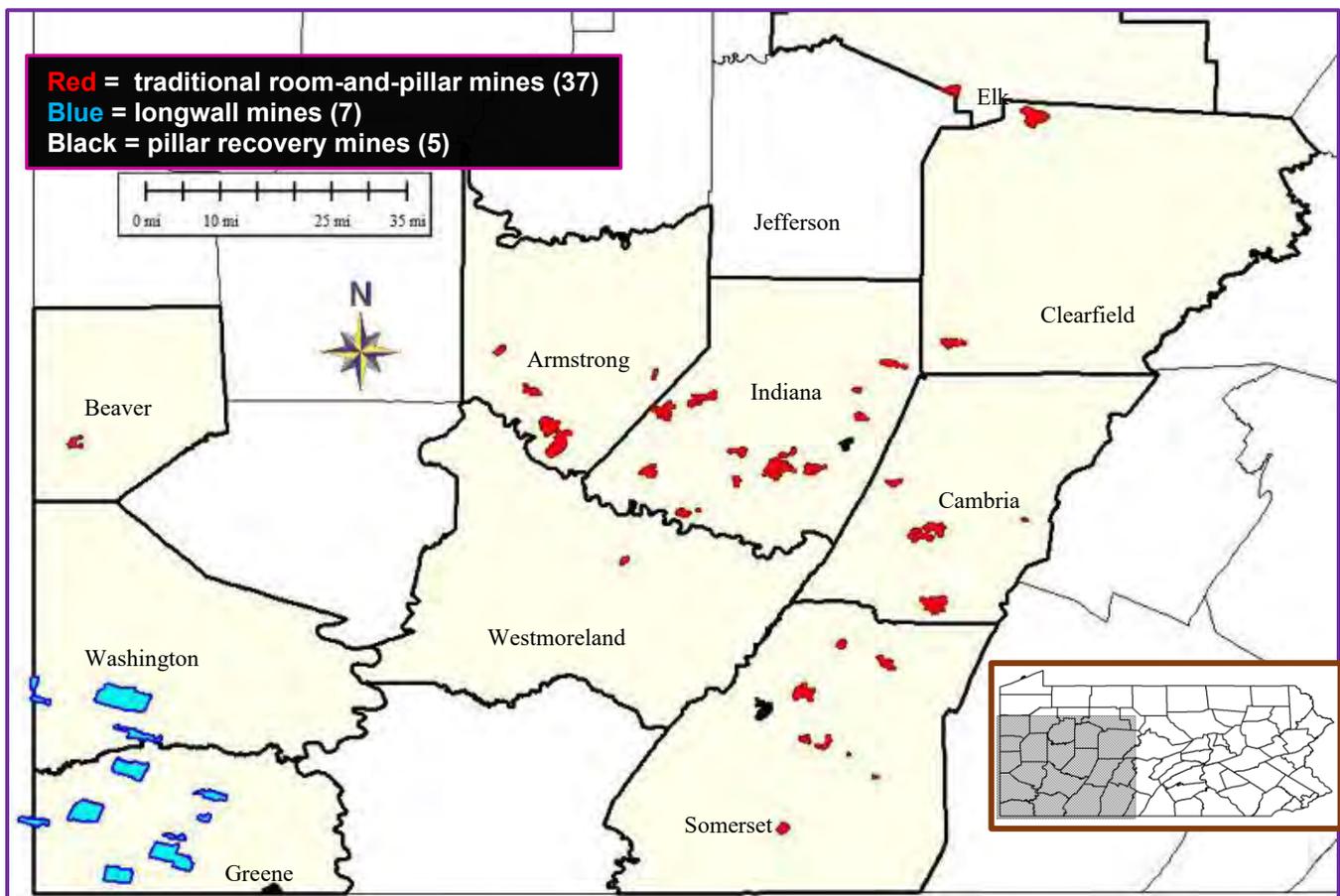
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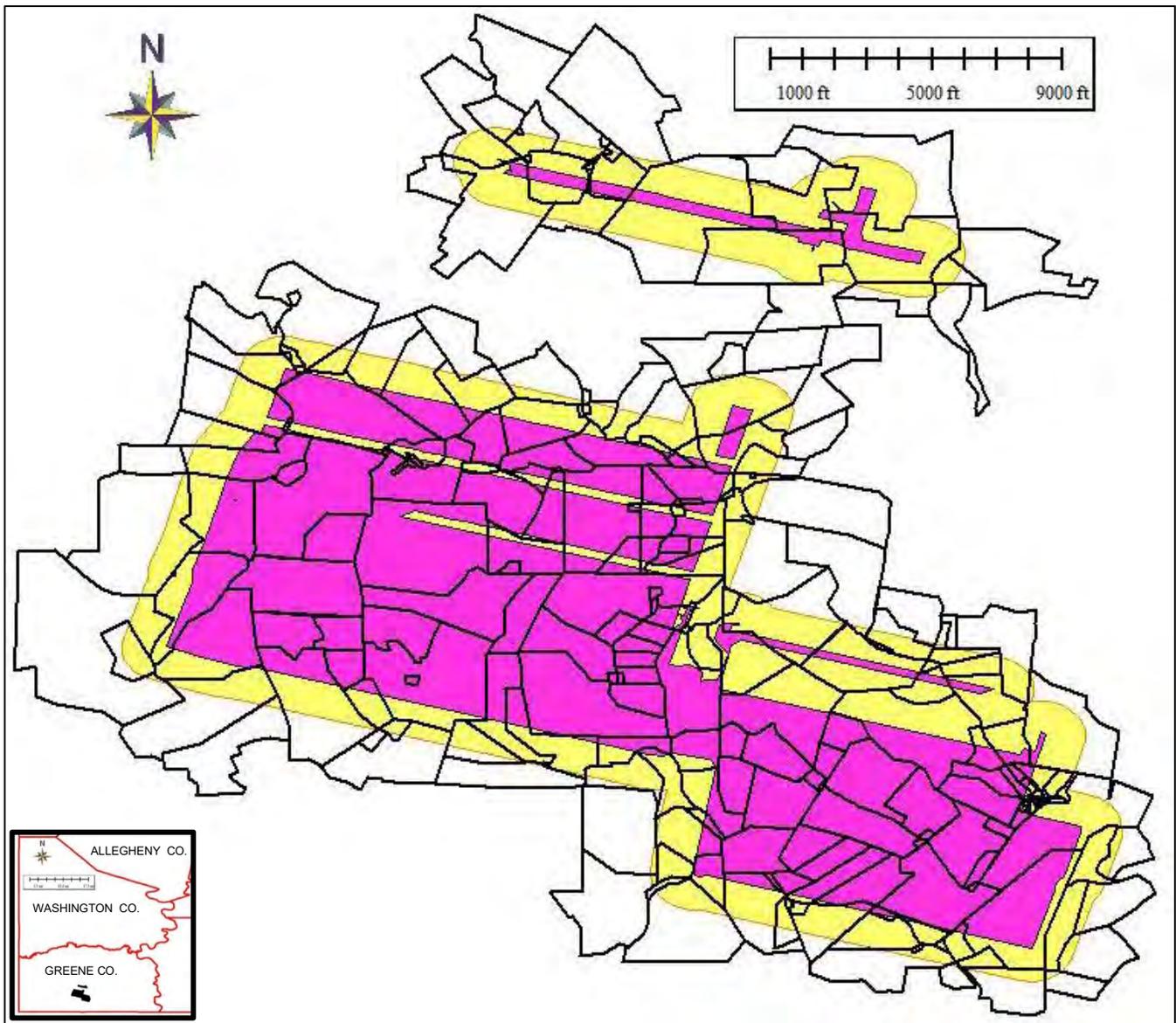
## APPENDIX A: UNDERGROUND COAL MINES IN PA

During the 5<sup>th</sup> Act 54 Period (August 2013 to August 2018) there were 49 underground bituminous coal mines active in 10 counties in western Pennsylvania. The locations of those mines, by type of mine, are identified in **Figure A1** below. Those 49 mines undermined 3,296 properties in the 5<sup>th</sup> Period, and nearly 15,000 properties in total have been undermined over the last 25 years. **Figure A2** illustrates the layout of properties over one operation (Cumberland Mine). The three methods used for underground mining (room-and-pillar, pillar recovery, and longwall) are summarized on the following pages.



**FIGURE A1.** Locations of the 49 underground bituminous mines active during the 5<sup>th</sup> Act 54 Period in 10 counties in western Pennsylvania, including 37 traditional room-and-pillar mines (red), 7 longwall mines (blue), and 5 pillar recovery mines (black).

(Note: Locations of 7 longwall mines and 5 pillar recovery mines are shown on slightly larger-scale maps on page 78.)

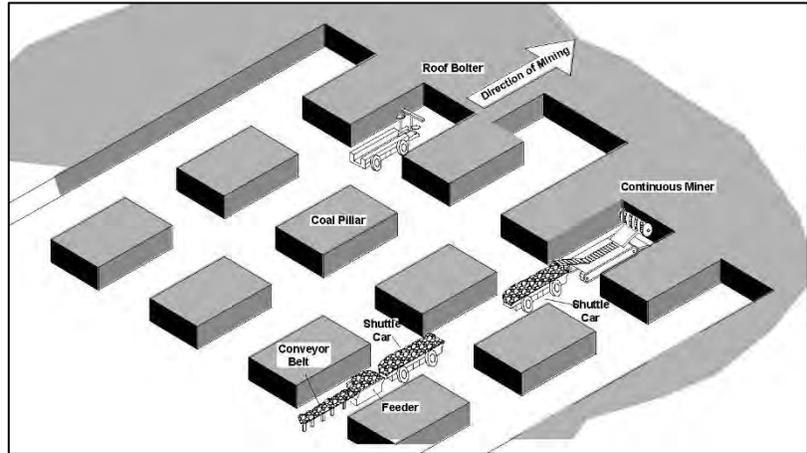


**FIGURE A2:** Surface properties associated with areas actively mined at Cumberland Mine during the 5<sup>th</sup> Act 54 5-year period. Cumberland Mine is a longwall mining operation in southcentral Greene County, Pennsylvania (black in inset). According to the 5<sup>th</sup> Act 54 Report, 179 land parcels were at least partially undermined by Cumberland Mine during the period.

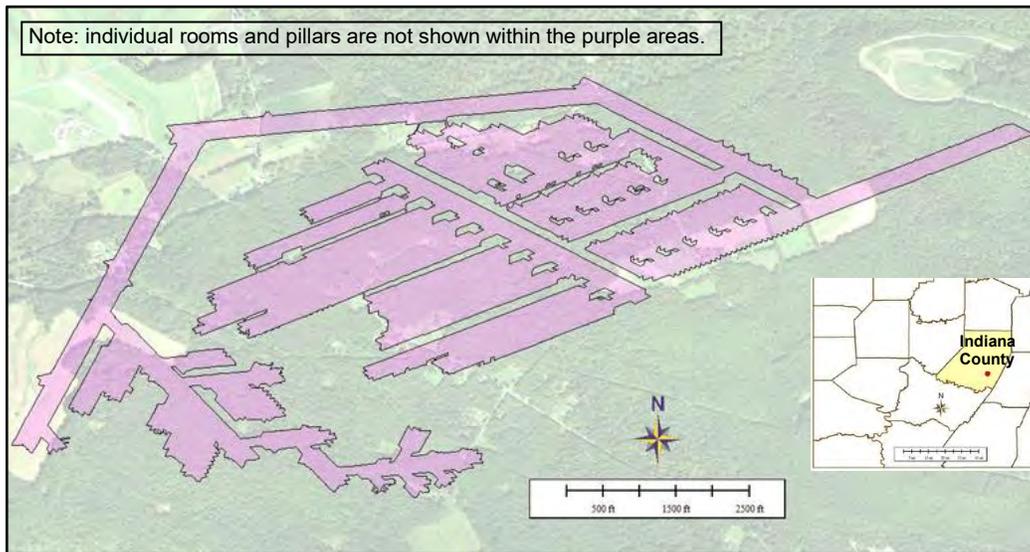
Purple shading indicates total extent of mining (longwall and room-and-pillar combined; individual panels and gates/entries are not disaggregated) during the 2013-2018 period. Yellow shading indicates the 1,000-foot buffer area around mined areas. Black lines outline individual property parcels.

A total of 3,296 properties in Pennsylvania were undermined by the 49 bituminous underground mines combined that were active during the 5<sup>th</sup> Act 54 5-year period. During the past 25 years, nearly 15,000 properties have been undermined.

**Room-and-pillar** is the traditional method of underground coal mining in Pennsylvania. Using a continuous miner, this method extracts up to about 60% of the coal in an area, but leaves enough coal in place (in the pillars) to support the mine roof (see **illustration** at right). It has been practiced in the Commonwealth since the late 1700s (PADEP 2014a), and it continues to be used profitably today. Prior to the 1966 BMSLCA and subsequent mining regulations, uncontrolled room-and-pillar mining caused significant subsidence



damage throughout the Commonwealth. Modern room-and-pillar mining, by contrast, generally does not cause surface subsidence, at least not intentionally and not if the mine is properly designed and operated to preserve roof support. Room-and-pillar mines have the design flexibility to extract coal of a wide range of thicknesses and depths. Room-and-pillar mining is employed to extract coal from several different Pennsylvania coal seams.



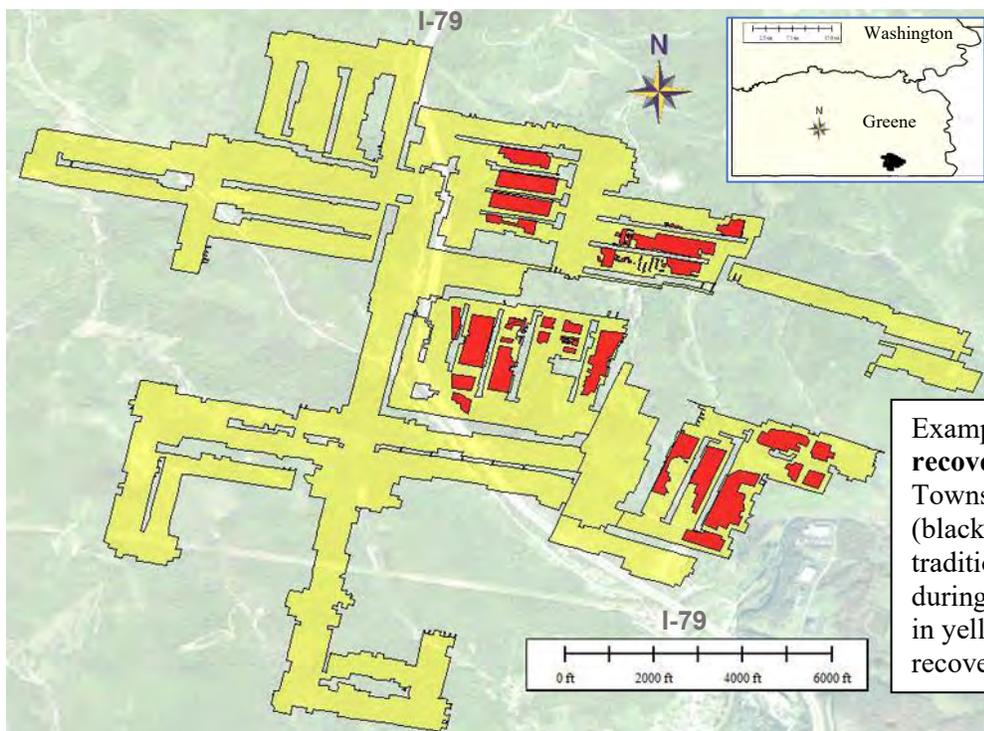
Example of the extent of a traditional **room-and-pillar mine** (above): Barrett Mine, in Brush Valley Township, Indiana County (red dot in inset). This mine extracts coal from about 500 feet below the surface in the Lower Kittanning seam. The extent of areas undermined by room-and-pillar methods during the 5<sup>th</sup> Act 54 Period is shaded purple.

Most (37, or 76%) of the 49 mines active during the 5<sup>th</sup> Act 54 period were traditional room-and-pillar mines. Although spread across 8 counties, most of those room-and-pillar mines were active in 4 counties (Indiana, Somerset, Cambria, and Armstrong), with one each in Beaver, Westmoreland, and Elk counties, and two mines in Clearfield County. The 5<sup>th</sup> Act 54 Report incorrectly identifies the location of Cherry Tree Mine as being in Clearfield County (it is in Indiana County) and Kocjancic (misspelled *Kojancic*) Mine as being in

Jefferson County (it is in Elk County), presumably using their mailing address locations rather than the areas of active mining.

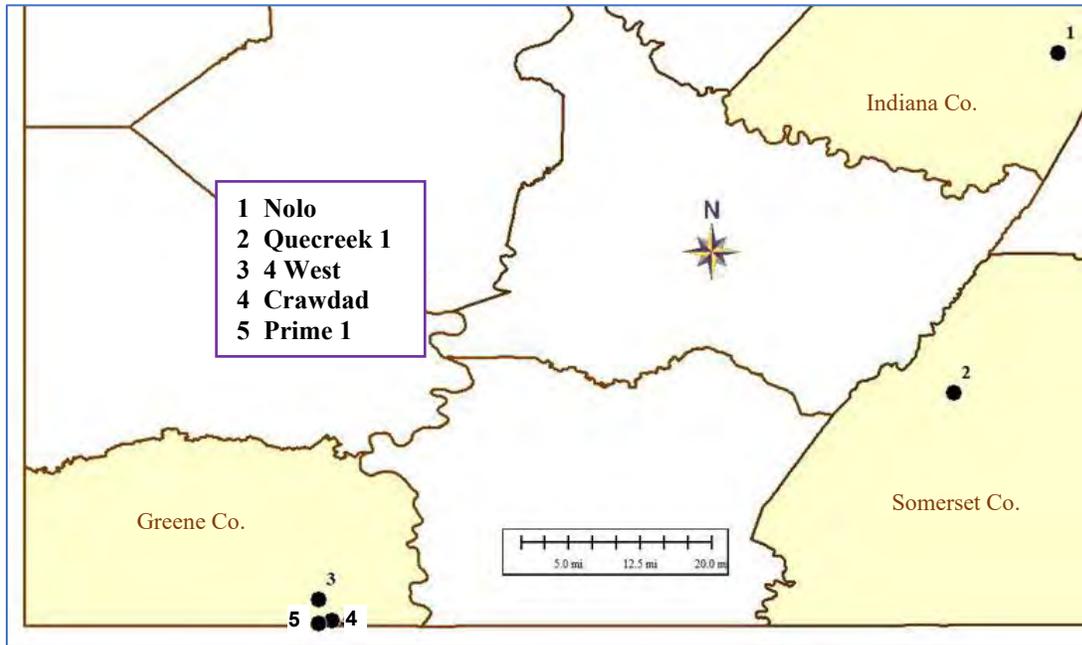
**Pillar recovery** (*a.k.a.*, pillar removal; *a.k.a.*, retreat mining) is a variation of traditional room-and-pillar mining. A pillar recovery mine starts out like a traditional room-and-pillar mine, but then some of the coal pillars are selectively removed ("pulled"). In the past, before modern standards and best practices were developed, support pillars were either robbed by unauthorized people or intentionally removed by mine operators to a greater extent than was safe. The removal of the support pillars often resulted in the collapse of the overburden (rock above the mine) and in the weakening of adjacent pillars, causing localized surface subsidence to occur, often at unpredictable times. Pillar removal mining therefore was a particularly dangerous and destructive form of mining. Between 1978 and 1998, this type of mining was responsible for 25% of US coal mining deaths caused by failures of the roof or walls, even though it represented only 10% of the coal produced (Chase et al. 2002). Modern pillar recovery mines are significantly safer and less damaging due to their compliance with stricter design standards.

Prior to the widespread use of longwall mining, pillar removal mining was generally used as a "high-extraction" method to recover a higher percentage of coal than could be obtained with traditional room-and-pillar mining. In Pennsylvania, pillar recovery mining has declined in popularity in favor of the more efficient high-extraction method --- longwall mining. During the 5<sup>th</sup> Act 54 period (2013-2018), only 5 of the 49 active mines were labeled pillar recovery mines, and pillar recovery methods were used in only 11% of the overall area of pillar recovery mines themselves. During the last 15 years pillar recovery mines accounted for less than 7% of the total underground bituminous coal produced in Pennsylvania.



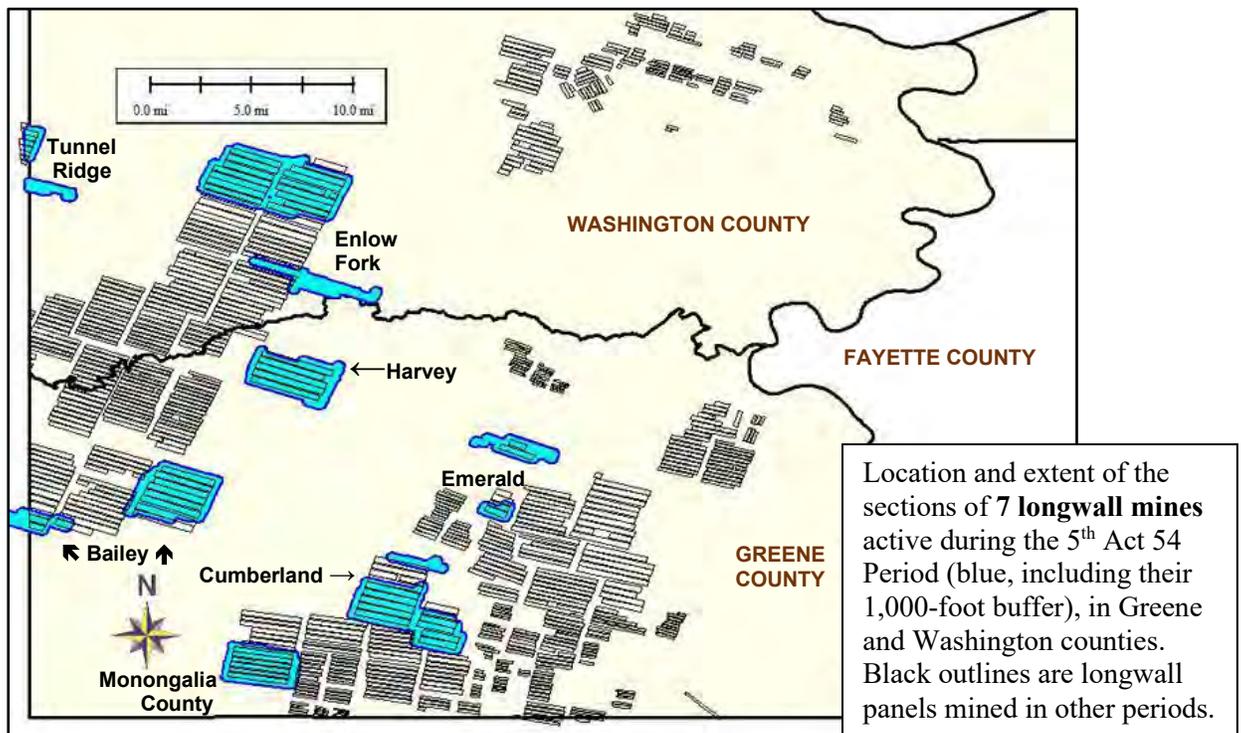
Example of the extent of a **pillar recovery mine**: *4 West Mine*, in Perry Township, southeastern Greene County (black in inset). The areas mined by traditional room-and-pillar methods during the 5<sup>th</sup> Act 54 Period are shown in yellow, the areas where pillar recovery was used are shown in red.

Note: individual rooms and pillars are not shown within the yellow and red areas.



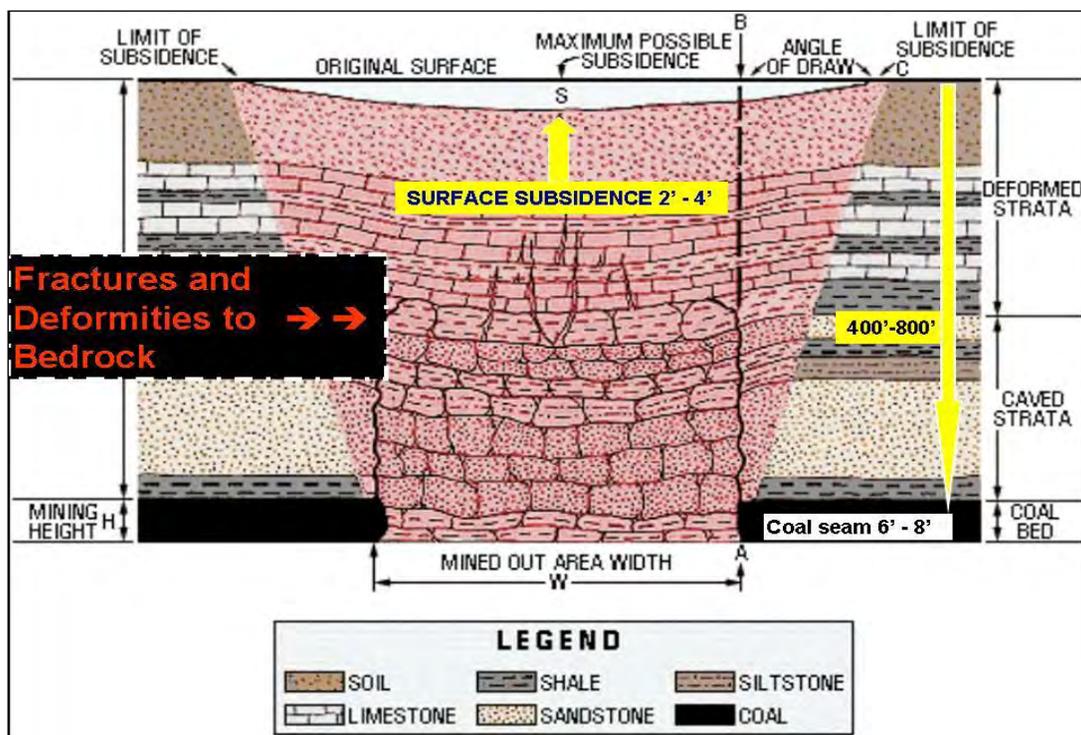
Locations of the 5 pillar recovery mines (black dots) active during the 5<sup>th</sup> Act 54 Period.

**Longwall** mining began to be used in Pennsylvania during the 1970s. The relatively thick (typically 6 to 8 feet) and level Pittsburgh coalbed in Pennsylvania is an ideal environment for longwall mining methods, which can remove up to about 75% of the coal in a mine permit area. During the 5<sup>th</sup> Act 54 Period there were 7 active longwall mines.

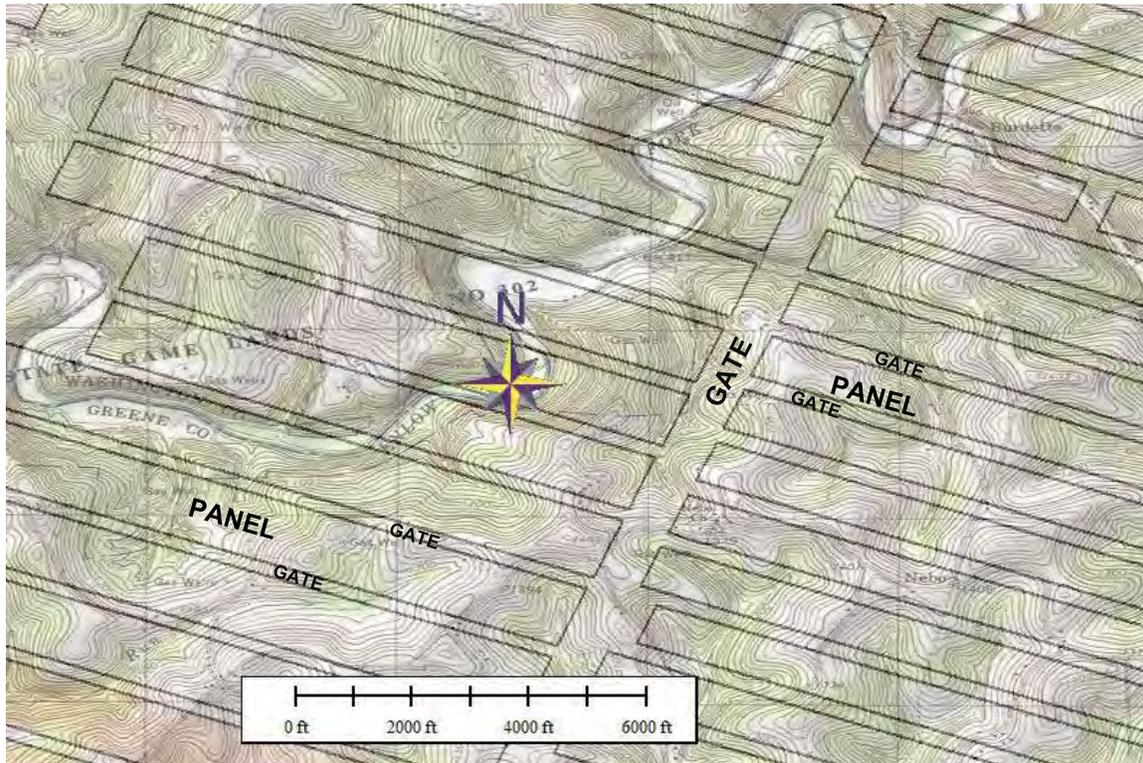


A longwall mine starts out using traditional room-and-pillar methods to develop access "gates" and entryways around the perimeter of large rectangular blocks ("panels") of coal (**Figure A3**). A cutting machine (shearer) then moves horizontally along the face of the coal seam, depositing broken pieces of coal onto a conveyor that carries them to the surface. The roof at the cutting face is temporarily supported and protected by large hydraulic jacks. As the operation progresses forward, the overburden immediately behind the relocated jacks collapses into the void, resulting in subsidence of the land surface above. Individual longwall panels currently are up to 1,600 feet wide and more than 2 miles long, often encompassing 400 to 500 acres each. Surface subsidence is an intrinsic part of longwall mining because no coal remains in a panel to provide surface support (the only support is in the narrow gates *between* the panels where coal pillars remain).

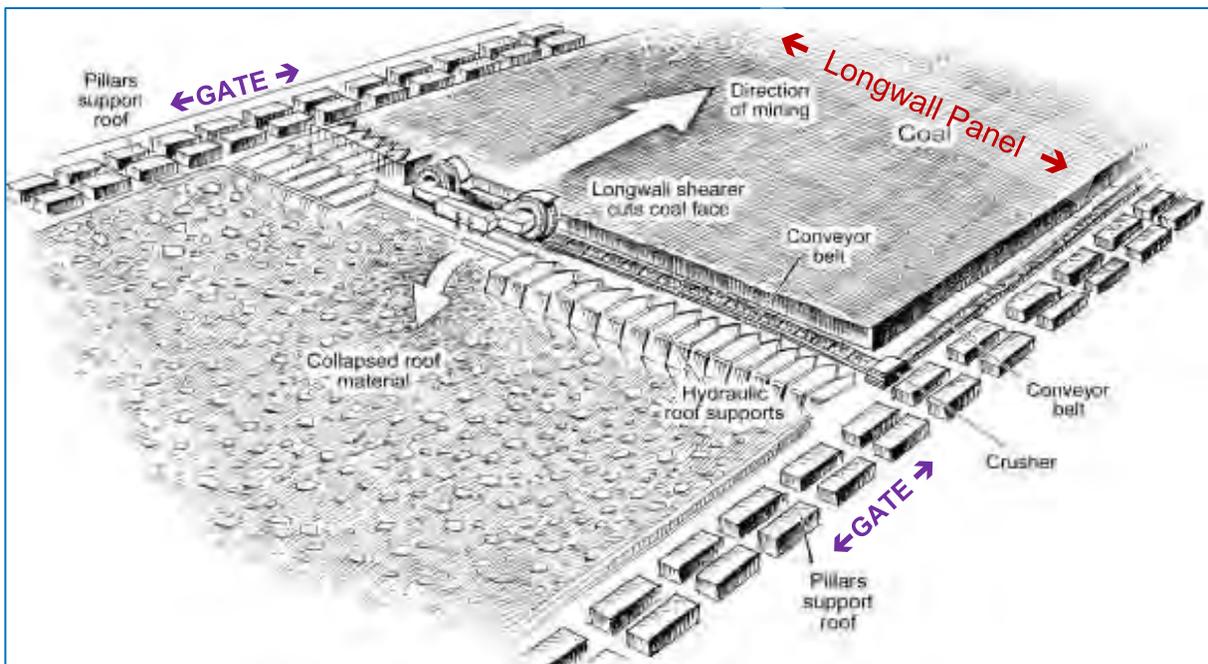
### CROSS-SECTION of a LONGWALL MINE



As shown above in cross-section, when a longwall mine 800 feet below the ground surface extracts an entire 7-foot thick seam of coal, it creates a large void into which the overburden falls, which causes the rock layers above to bend, twist, and crack creating stress fractures and deformities that can extend to the surface. This results in irregular subsidence at the surface, up to 4 feet or so vertically near the center of the panel, and less near the gates and entryways at the edges of the panel. For structures, streams, and other features on the surface, this movement and cracking can be devastating, and the progression of longwall mining has aptly been compared to a slow-moving earthquake. Any coal seams above the longwall-mined seam are rendered unminable.



**FIGURE A3.** Typical layout of longwall panel and gate footprints beneath the landscape near the border between Greene County and Washington County (**above**), and diagram of part of a typical longwall panel (**below**) showing room-and-pillar mining around the perimeter and the shearer cutting horizontally along the coal face.



## APPENDIX B: PUBLIC ACCESS TO DATA

The 5<sup>th</sup> Act 54 Report, like previous ones, presents much useful information in its 995 pages. For the most part it analyzes data originally provided either by the Department or by mine operators (although the University of Pittsburgh researchers apparently had no access to complete mine permit applications). Those data were compiled and synthesized (often digitized) by the report researchers/authors, and then presented in graphic or tabular form with accompanying explanatory text in the final report, which is more than twice the size of the 4<sup>th</sup> Act 54 Report. As scientists, we at Schmid & Company value reproducibility of findings and transparency of data. In reading through the 5<sup>th</sup> Report, there were numerous times when we wanted to see the raw data, because the summarized version was either not clear or presented statistics that were inconsistent. For example, in Appendix B of the 5<sup>th</sup> Report it is impossible to discern each of the wetlands shown because of the small scale of the maps. Furthermore, the mapped wetlands in Appendix B apparently do not correspond with the wetlands listed in Appendix J for each mine. In instances such as this we thought it would be useful to examine the geospatial data layers of pre-mining and post-mining wetlands, by mine, that were used by the University in conducting their wetland analyses. Similarly, 680 individual water supply impacts were reported for Enlow Fork Mine, but they cannot be distinguished on the small-scale map in Appendix B of the 5<sup>th</sup> Report. There are many other such examples.

Additionally, we observed numerous errors and omissions in the reported data which the Department apparently either did not request the University to correct prior to release of the final report or failed to notice. This led us to question the soundness of at least some of the conclusions that were presented in the 5<sup>th</sup> Report (see section below), and to wonder what other conclusions might also be based on faulty or erroneous data. The only way we could feel confident about the reported data and conclusions would be to review the original data used in the analyses and evaluate those data ourselves. As reported in the 5<sup>th</sup> Act 54 Report (and as also was the case for the 4<sup>th</sup> and 3<sup>rd</sup> Reports), much of the data was provided by the Department and by mine operators to the University researchers in digital formats and incorporated into the GIS databases created specifically for these analyses; the Act 54 Reports discuss having received or created GIS shapefiles or other spatial data files for most of the key elements evaluated.

Consequently, we attempted to obtain the underlying geodatabase/shapefile data by submitting a formal Right to Know Law (RTKL) request to the Department. Our RTKL request was submitted less than a week after the Department made its 5<sup>th</sup> Act 54 Report publicly available in December 2019. We requested copies of digital GIS files of various specific types of information which the University claimed to have created under its Act 54 contracts with the Department for analyzing the effects of subsidence on structures, water supplies, land, and water resources. We did not seek the entire database, just specific relevant geodatabase layers and shapefiles. We requested the files associated with the most recent (5<sup>th</sup>) Act 54 Report, as well as similar spatial data files from the 4<sup>th</sup> and 3<sup>rd</sup> reports which the University also

had prepared on behalf of, and under contract to, the Department, and which reportedly were used in compiling parts of the 5<sup>th</sup> Report.

We initially were told by the Department that it did not have the requested database files in its possession, and so it could not provide them per our RTKL request. (We do not know why the Department would not retain, or request, a complete copy of all data and materials used in the production of its Act 54 reports.) We were told by the Department that the University of Pittsburgh had the files, and that we should ask the University for them directly. When we *did* ask the University for the digital data files, several times, we never received any response from them. We suggested that the Department should direct the University (its subcontractor) to release the files to us. Ultimately we received *some* digital files from the Department in response to our RTKL request, but they were incomplete and were almost entirely associated with mining activities during the 4<sup>th</sup> five-year assessment period.

During February 2020 we appealed the Department’s incomplete response to our RTKL request to the Pennsylvania Office of Open Records (OOR), and on 29 April 2020, the OOR issued a Final Determination on the matter which directed the Department to provide the requested files to us within 30 days (including any relevant ones that may be in the possession of the University of Pittsburgh). We subsequently received some additional geodatabase files associated with the 5<sup>th</sup> period, but they appeared to relate largely to baseline, pre-mining conditions and not impacts or impact resolutions. As of this writing eight months past the OOR’s deadline, we still have not received all of the requested digital GIS files from the Department.

One of the specific comments/recommendations of the Citizens Advisory Council (CAC) in July 2015 on the 4<sup>th</sup> Report related to “Public Engagement and Transparency”. It noted:

Given the level of skepticism that pervaded comments received by the CAC on DEP’s responsibilities under Act 54, **the CAC recommends attention be focused by DEP on implementing or enhancing** public information dissemination measures that focus on **transparency**. Such measures could include **public accessibility to the information tracked in BUMIS and other DEP databases** through secure internet sites so that all parties affected – DEP, mine operators, land owners, and others – are held accountable to their responsibilities under Act 54. [emphasis added]

The issue of public access to the Act 54 data also had been raised by the CAC in its formal (June 2012) comments to the Department on the 3<sup>rd</sup> Act 54 Report. In its letter to then-Secretary Michael Krancer, the CAC noted:

Questions were raised regarding ownership and availability of data used to prepare the current [3<sup>rd</sup>] report; unless data is proprietary, **data collected under a state contract should be the property of DEP and made publically [sic] available**. While we understand that some information may contain personal information and thus should be confidential, **most of the resource and structure impact data should be made public and utilized by the Department for further analysis**. [emphasis added]

Clearly, the CAC understands the importance of public access to this information. Access to

the underlying data used in these Act 54 Reports, which are funded entirely with State and federal taxpayer dollars, would allow the public to confirm the validity of the claims and conclusions made in the assessments. This access is especially important when the reported data appear to be internally inconsistent or contradictory, as we found in the 5<sup>th</sup> Act 54 Report and discuss in this review. Public confidence in the data and analyses are crucial.

### Significant Errors in Data on Structures and Water Supplies

One of the more obvious errors we initially found in reading the 5<sup>th</sup> Act 54 Report was related to impacts to structures. Table 4-3 in Section 4 (Structure Impacts) compares subsidence-induced structure effects during the 3<sup>rd</sup>, 4<sup>th</sup>, and 5<sup>th</sup> Report periods. Some of the reported numbers are simply incorrect, however, making several of the conclusions incorrect as well.

Table 4-3 lists (a) total “reported” effects, then (b) those effects found by the Department to be mine company-liable and (c) those effects found to be not mine company-liable, by assessment period. The one missing number is (d) those reported effects not yet resolved or where liability has not yet been determined, labeled “interim resolutions” --- these are listed on the same page but in a separate table (Table 4-5).

Thus, the total reported effects (a) should be the sum of the other three categories (b+c+d). This might have been easier to understand had all of the numbers been presented in the same table.

For the 5<sup>th</sup> period, the reported numbers add up correctly:  $247+99+109 = 455$

For the 4<sup>th</sup> period, they don’t add up:  $338+92+59 = 489$  (not 389 as reported)  
So the numbers for the 4<sup>th</sup> period are off by 100, but which number(s) is wrong? One needs to go back and read the 4<sup>th</sup> Act 54 Report to determine that the total mine company-liable effects during that period was 238, not 338 as reported in Table 4-3 of the 5<sup>th</sup> Report. So if you use the correct number you can get the correct reported total:  $238+92+59 = 389$ .

The reported number for mine company-liable effects (338) was off by 100 (making it 42% too high;  $100/238=0.42$ ). As a result, the actual number of mine company-liable effects as a percentage of total reported 4<sup>th</sup> period effects is lower than reported (it should be 59% rather than 87% as reported, which incidentally makes it more in line with the other two five-year Act 54 periods addressed by the University of Pittsburgh). The reported percentages should have been a tip-off: only 2 of the 3 numbers (b+c) were reported in Table 4-3, but their total ( $86.9 + 23.6$ ) alone exceeds 100%.

For the 3<sup>rd</sup> period, the numbers also do not add up. The total (456) is not the sum of (b+c+d)  $301+59+72 = 432$ . So, what is wrong there? One needs to reread the 3<sup>rd</sup> Act 54 Report to determine that what now is labeled “interim resolutions” at that time was divided into “interim resolutions” (72) and “outstanding resolutions” (24); so if you add those together (96) and add that sum to the company-liable (301) and company not-liable (59) you get the correctly-reported total (456).

Simple, but obvious, errors such as these make one question the accuracy of other numbers and findings in the 995-page 5<sup>th</sup> Report. Such errors also led us to want to review the original underlying data for ourselves, thus prompting our RTKL request. Once we received some (but not yet all) of the spatial database files per our RTKL request, we encountered additional (and in some cases, much more serious) errors that we cannot resolve.

By chance we happened to have had the permit application drawings and first-hand knowledge of several properties above a section of the Enlow Fork Mine that was active during the 5<sup>th</sup> Act 54 period. Once we received the geodatabase files presumably used by the University in conducting its 5<sup>th</sup> period analyses, we examined the one for Enlow Fork Mine and focused our attention on the two properties known to us. We knew that both properties had experienced significant damage as a result of 5<sup>th</sup> period longwall mining, including to the main homes and other structures on the surface, and also to their water supplies and aquatic resources. We were surprised to discover, however, that neither of the two homes, nor any of their water supplies, were identified on the “structures” or “watersources” layers in the Enlow Fork 5<sup>th</sup> period files<sup>16</sup>. Many other structures in the vicinity of these two homes *were* identified, but these two (and a few others, as could be seen clearly on a recent aerial photograph) were not mapped. This finding raises several questions: are these two structures identified on some other spatial database file that we have not yet received per our RTKL request? Were the impacts to these two homes included in the structure impacts *reported* for the 5<sup>th</sup> period? How many other structures were missing from the maps used to conduct the 5<sup>th</sup> Act 54 analyses?

In the case of the missing water supplies, we determined that the “Ef\_watersources5” layer we received for the 5<sup>th</sup> Act 54 period for Enlow Fork Mine, which identifies 97 separate wells, springs, or other supplies, included only 7 water supplies within the RPZ of areas actually undermined during the 5<sup>th</sup> period --- the other 90 water supplies shown on that GIS layer were above areas mined during the 4<sup>th</sup> or 3<sup>rd</sup> periods. The 5<sup>th</sup> Act 54 Report states that there were 680 water supplies undermined by Enlow Fork Mine during the 5<sup>th</sup> period, yet only 7 of them are identified on the spatial data layer of “watersources” which we received per our RTKL request.

Errors such as these also raise questions about the care taken by University researchers to edit and internally review this Report, and by the Department which is ultimately and legally responsible for the Report and its conclusions in accordance with Act 54. Unfortunately, the errors noted above were not the only ones we found. Errors such as these, however, demand that all of the underlying GIS data layers for this 5<sup>th</sup> Act 54 analysis be publicly released and be independently reviewed (not by us necessarily, but by someone with competence and experience in both GIS and Act 54-related matters), and that satisfactory explanations for all these irregularities be provided. Only then might the 5<sup>th</sup> Report be capable of serving as a credible data source for use by policymakers, legislators, and the public.

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<sup>16</sup> In the geodatabase files we received for Enlow Fork Mine for the 4<sup>th</sup> period, about 300 water supplies were identified above areas actually mined during the 5<sup>th</sup> period (not the 4<sup>th</sup>), but none of *them* is on either of the two properties known to us.