SECTION 11: Discussions

11.A – Overview

The Amendments to Act 54 require "determining, to the extent possible, the effects of deep mining on subsidence of surface structures and features and on water resources." During review of the specific tasks in the scope of work, some apparent effects outside of the defined scope emerged. Given the potential importance of these trends to the protection of citizen's rights and protection of the environment, these issues are discussed in this section.

These discussions are organized as follows:

1) Changing property holding patterns above underground mining
2) Unexpected subsidence effects (far field subsidence effects and effects at closed mines)
3) Comprehensive evaluation of the hydrologic balance

11.B Changing property holding patterns above underground mining

Mine operator purchases of properties above underground mining, including purchases to resolve subsidence impacts, have the potential to adversely alter overlying communities. In many cases properties are purchased for operational needs. The University noticed a high rate of subsidence impact resolution through company purchase of the impacted property. BUMIS reveals a substantial proportion of impacts are resolved through company purchase of the impacted property (n.b., BUMIS does not differentiate between purchases pre- and post-mining). Of the 192 water supply impacts that were deemed company liable, 54 of those cases were listed as resolved by operator purchase of the impacted property (Table 5-4). For comparison, 54 cases represent an increase in purchases compared to previous assessment periods (34 company purchases of water supply impacted properties in the 3rd assessment period and 37 during the 4th assessment period).

These rates of operator purchase inferred from impact reports do not capture the complete scope of company real estate acquisitions as part of mining. Figure 11-1 shows the extent of operator owned parcels over mining during the 5th assessment period in Harvey Mine. A substantial portion (more than 40 %) of land area over these longwall panels is owned by the mine operator. 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 5th Act 54 assessment but have the potential to create economic strain on communities living over active mines. This would require an analysis of the long-term economic strain beyond the scope of work for this report.

Figure 11-1. Map of property ownership over longwall mining in Harvey Mine during the 5th assessment period. All properties in grey are listed as being owned by CONSOL or by entities with a contact address at "1000 Consol Energy Dr." in Canonsburg, PA (i.e., Nineveh Coal Company, Greene Hill Coal Co., Monongahela Railroad Company, Conrhein Coal Company) in the most recent 22.7 form submitted to the PADEP. Grey areas constitute more than 40 % of the longwall panel areas.

11.C Unexpected subsidence effects

11.C.1 – Far Field Effects

Subsidence impacts during this assessment sometimes occurred at locations beyond those predicted by accepted empirical and analytical subsidence models. In the subsidence modeling literature, impacts that occur outside of predicted subsidence are referred to as "far field" effects

(Waddington and Kay 2003). Protections defined for subsidence impacts ranging from identification of pooling prone areas in streams to the width of the rebuttable presumption zone rely, at least in part, on the spatial distribution of subsidence predicted by these models. Therefore, the occurrence of far field effects in areas outside of expected zones could lead to a situation where the current provisions in Act 54 may not fully protect areas above mining.

There are several cases of potential far field effects that have not been resolved. In the absence of a final resolution, these could not be assessed by the University. This discussion relies on two primary lines of evidence suggesting the need to: 1) determine the cause of these far field effects; and 2) assess if current policies are sufficiently protective; and 3) decide if policies need to be altered to ensure protection from far field effects.

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. In this case, the longwall face continued underneath this residence so impacts ultimately were unambiguously due to mining. However, if these far field effects had occurred beyond the edge of the panel, the property owner would have had a much greater burden of proof. In another case, 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.

11.C.2 – Subsidence Effects over Inactive Mines.

Another unexpected aspect of subsidence effects during the 5th assessment period was the substantial number of effects reported over mines that had been inactive for many years (sixty-four structures (Section 4.D.4), fourteen water supply (Section 5.D.4), and fourteen land effects (Section 6.D.3)). A large proportion of these reported effects (twenty) were found to be company liable impacts. The potential for subsidence impacts occurring well after the mining operations have ceased makes simple policy tools for protection of environmental systems and property owners (e.g., bonds) less certain and therefore potentially less protective.

Determination of processes responsible for subsidence impacts over inactive mines is expensive and likely site specific. However, 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. Clarification of processes in inactive mining areas with multiple impacts can improve protections for communities above these mines.

11.D Comprehensive Evaluation of the Hydrologic Balance

As the implementation of the Act 54 provisions have evolved over time, protections for surface water have grown substantially. While protections for structures, water supplies, etc. are specifically outlined in the actual Act 54 legislation, the language protecting streams and rivers is limited. But, because the Pennsylvania Constitution and the Clean Steams Law provides protection for these waters, the "Surface Water Protection – Underground Bituminous Coal Mining Operations" (TGD 563-2000-655) was formalized in 2005 (PADEP 2005). The policies in this TGD provide guidance for protection of surface water systems that is not included in the Act 54 language.

One of the challenges in the protection of surface waters is that these systems are strongly connected to other dynamic conditions (e.g., climate, groundwater). In addition, jurisdiction over hydrological system components is divided among multiple agencies (state and federal) and specific divisions in the PADEP. So, a system that integrates multiple environmental systems is managed by agencies with a relatively narrow focus (e.g., the PA Fish and Boat Commission governs fish kills; the U.S. Army Corps of Engineers governs dredge and fill of Waters of the United States). In the case of mining, policies to address hydrological impacts have been developed while the agency diligently completes all of the other functions they are obligated to fulfill. If decisions made on a case by case basis are not periodically reviewed, then policy gaps can emerge.

Given this evolution of policies in a fractured jurisdictional framework (e.g., dredge by USACE, Fish by PAFBC, etc.) and the integrated nature of hydrological systems, there are cases where a comprehensive evaluation of policy can improve protection of the hydrological balance. This section identifies several cases where a comprehensive approach may improve protections for the environment and ultimately the benefits citizens of the Commonwealth derive from hydrologic systems.

11.D.1 – Integration of Subsidence Stream Impacts with Impairment Reporting Systems

The Clean Water Act (Section 303(d)), requires Pennsylvania to:

> identify those waters within its boundaries for which the effluent limitations required by section 301(b)(1)(A) and section 301(b)(1)(B) are not stringent enough to implement any water quality standard applicable to such waters. The State shall establish a priority ranking for such waters, taking into account the severity of the pollution and the uses to be made of such waters.

These 303(d) lists are the most comprehensive documentation of stream impairment and water quality on a statewide basis.

Streams in undermined areas have been listed on the 303(d) list (Figure 11-2), under various causes related to “Subsurface Mining.” Some are related to water quality (“Subsurface Mining – Osmotic Pressure”), while others are much broader (“Subsurface Mining – Other Habitat Alterations”). 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.

Not all of the streams experiencing flow loss during the 5th assessment period are included in the 303(d) listings. For example, in the 5th assessment period there were 153 cases of flow loss impacts on 24.6 miles of stream but very few reaches of stream over panels mined during this period were listed (Figure 11-2).

Integration of subsidence impacts with broader hydrological management frameworks would make the subsidence impacts and repairs more apparent to all citizens of the Commonwealth. This integration of mining subsidence policy with broader PADEP and Commonwealth of Pennsylvania regulatory frameworks like the 303(d) list would enhance holistic protection of hydrological components of environmental systems.

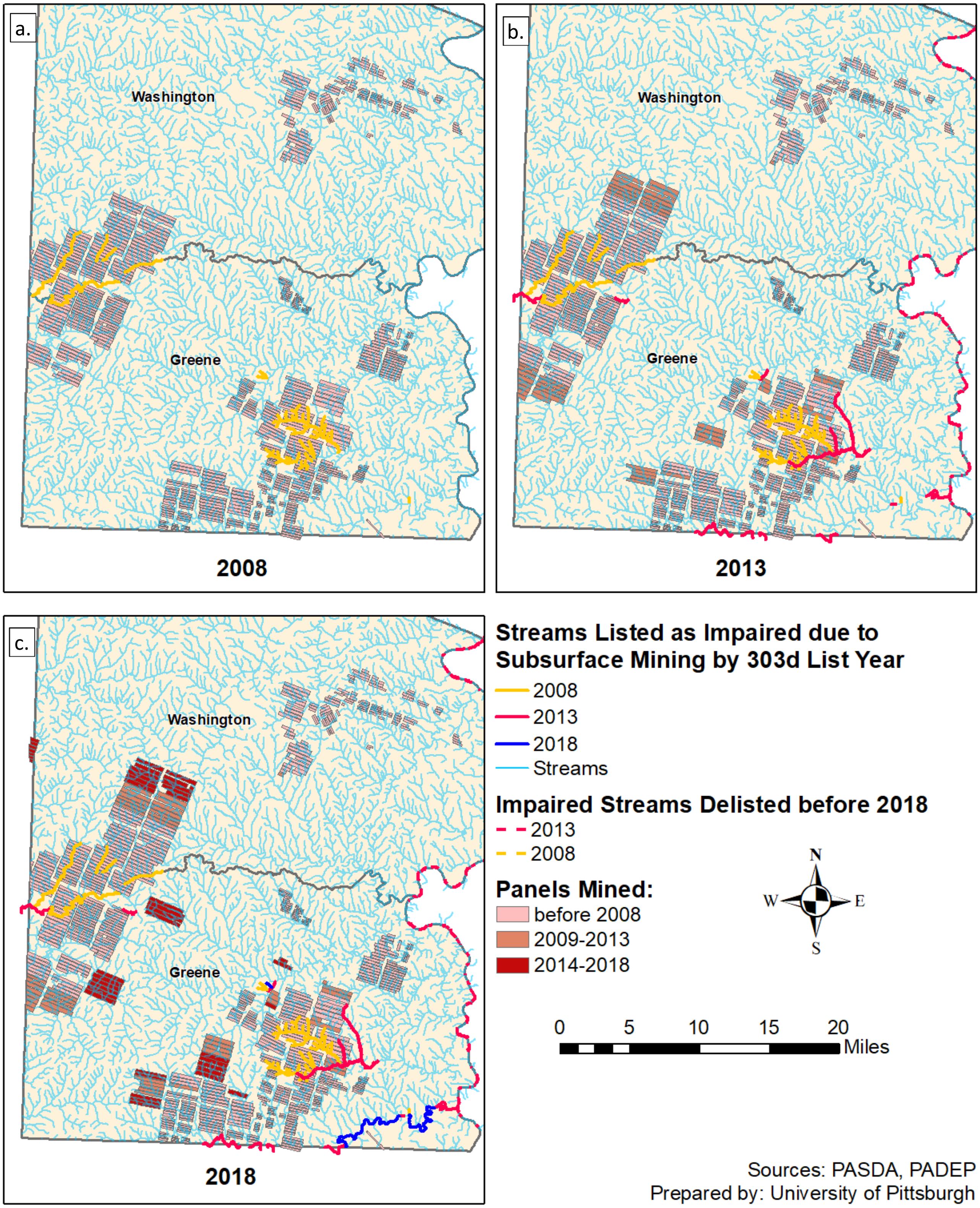

Figure 11-2. Streams listed as impaired due to subsurface mining by 303(d) list year for a) 2008, b) 2013, and c) 2018. Dashed lines in later maps are streams listed in earlier periods, that have since been delisted.

11.D.2 – Changes in Wetland Delineations

Review of wetland delineations reported in permit renewals revealed significant change in wetland density across mine operations (Figures 11-3 and 11-4). This change is not expected given the similarities in landscape across a single mine. Further, in both cases, this change in mapped wetland density occurs roughly in 2017. While this timing and spatial pattern is surprising, determination of reasons for the change are beyond the scope of work for this assessment. However, if wetland delineation methods are not consistent, then comparing wetland area before and after mining will not be an accurate representation of the impact of mine subsidence. If the identified wetland area is less than actual wetland acreage, the end result is less protection of wetland areas. Further, inconsistent approaches to wetland delineation could reduce the benefits that citizens of the Commonwealth derive from these wetlands.

The University has provided recommendations for how to standardize the wetland data gathering and submission process in Section 12. Please consider these inconsistencies when interpreting the data in Section 10.B.2, and when comparing to any future reports of mining impacts on wetlands. These inconsistencies together indicate that we likely could not capture all wetland acreage, and the University's estimates of the total areas of wetlands undermined and any associated mining effects are therefore underestimates.

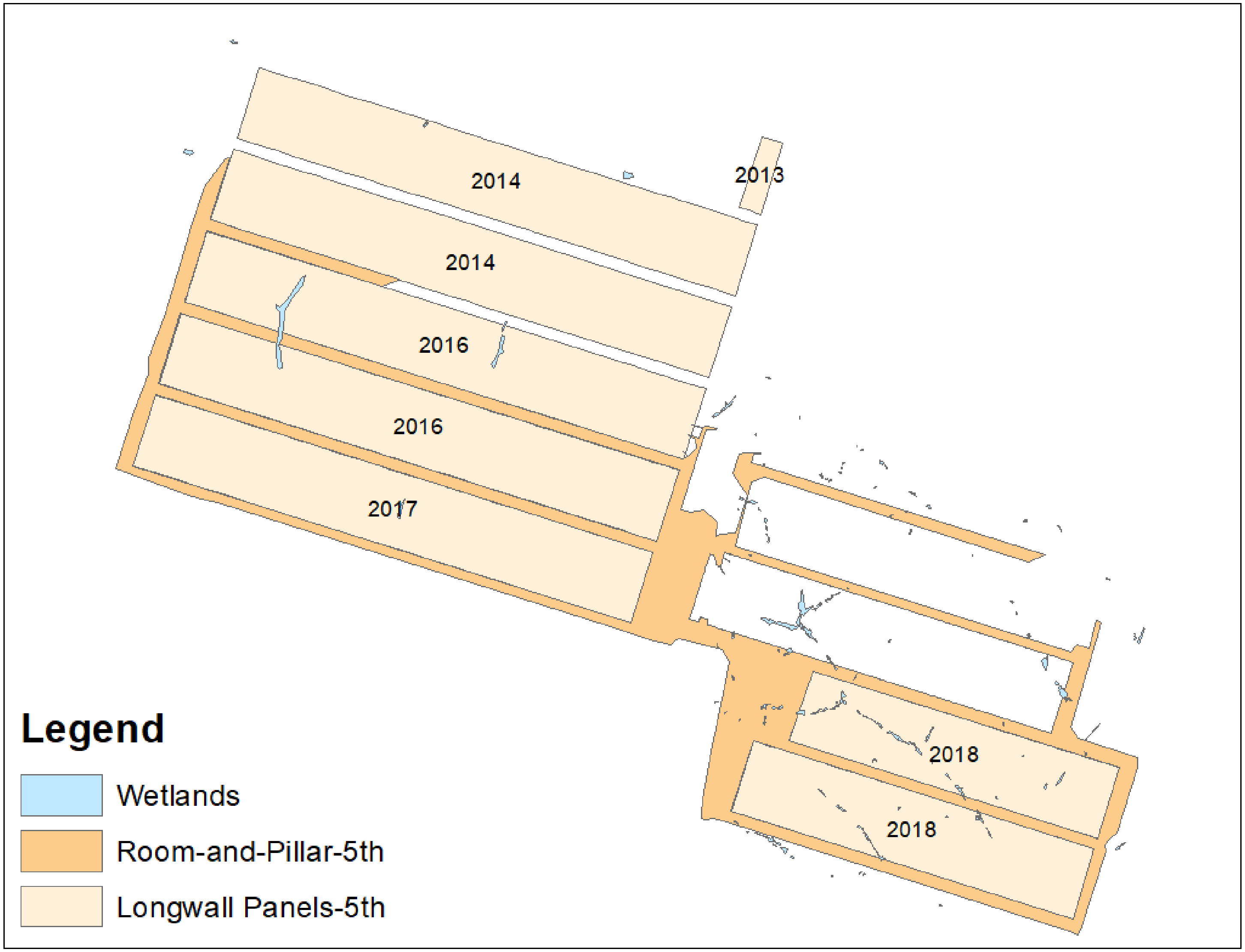

Figure 11-3. Map of Cumberland Mine indicating a change in the number of wetlands delineated over 5th assessment longwall panels.

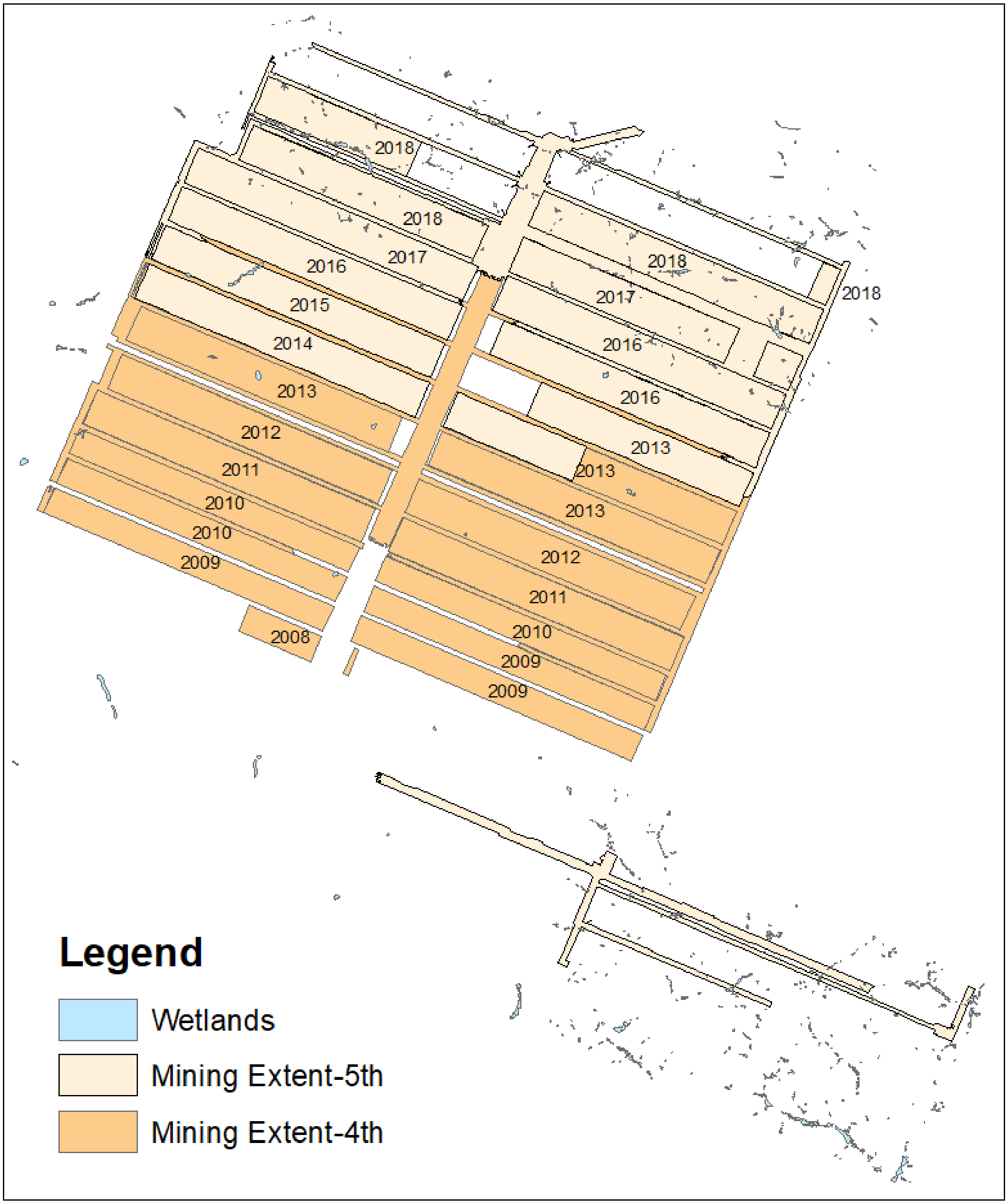

Figure 11-4. Map of Enlow Fork Mine indicating a change in the number of wetlands delineated over 5th assessment longwall panels (compare 4th assessment and early 5th assessment panels to late 5th assessment panels and future panels to the south)

11.D.3 – Hydrologic Balance and Augmentation.

Examination of BUMIS reveals several cases where stream augmentation waters were sourced from nearby surface waters. This practice is problematic. The hydrologic balance of nearby surface waters is disturbed to restore the hydrologic balance of the stream that has lost flow following subsidence impacts. Ideally, correction of the hydrologic balance should not require disruptions to the hydrologic balance elsewhere. When implemented from a downstream portion of the stream, this mitigation practice is effectively a water "treadmill" where water that already has flowed through a reach is removed and routed through the reach again.

Focus on single reaches or monitoring stations in water policy can result in breakdowns in water flow accounting. Examination of a stream segment in isolation can miss broader hydrologic inputs or outputs. Integration of groundwater and wetland data into assessment of stream impact and recovery at a watershed scale can identify impacts to these broader connections. Regular, comprehensive review of policy is essential to effectively ensure hydrologic balance.

References

PADEP. (2005) "Surface Water Protection – Underground Bituminous Coal Mining Operations," Technical Guidance Document 563-2000-655, October 8, 2005, 43 p.

Waddington, A., and D. Kay. (2003) "The Impacts of Mine Subsidence on Creeks, River Valleys and Gorges Due to Underground Coal Mining Operations," Proceedings in Aziz, N. (ed), Coal 2003: Coal Operators' Conference, University of Wollongong & the Australasian Institute of Mining and Metallurgy, 2003, pp. 101-116.