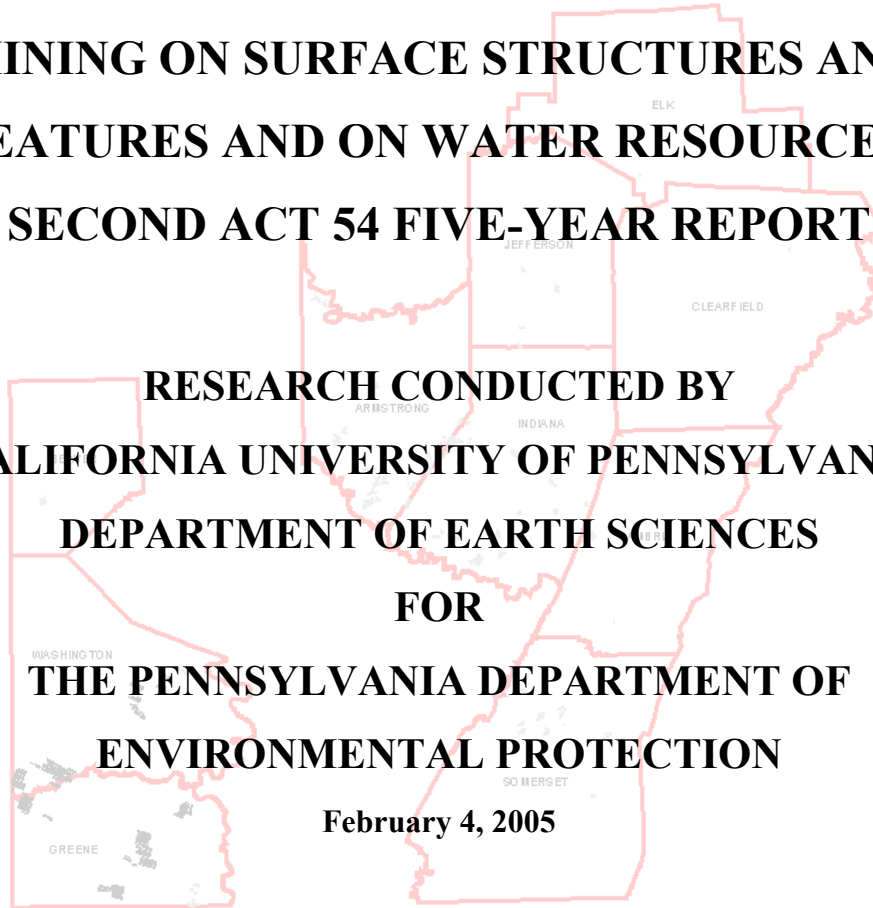


**THE EFFECTS OF SUBSIDENCE RESULTING
FROM UNDERGROUND BITUMINOUS COAL
MINING ON SURFACE STRUCTURES AND
FEATURES AND ON WATER RESOURCES:
SECOND ACT 54 FIVE-YEAR REPORT**

**RESEARCH CONDUCTED BY
CALIFORNIA UNIVERSITY OF PENNSYLVANIA
DEPARTMENT OF EARTH SCIENCES
FOR
THE PENNSYLVANIA DEPARTMENT OF
ENVIRONMENTAL PROTECTION**

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- Plate 1 is a display of all streams with segments examined for the study.
- Plate 2 is a display of all streams with segments examined relative to longwall mining.
- Plates 10-12 display streams with segments examined by county.
- Streams' segments are categorized as *Attaining Use*, *Attaining Use but Impaired*, *Not Attaining*, or *Unassessed*. The terminology "attaining use but impaired," is synonymous with "marginally attaining use."
- All labeling is accurate *for the time of collection*.

Section VII: EFFECTS OF MINING ON STREAMS

VII.A. Overview and Methodology

The purpose of this section of this current five-year report is to examine the extensiveness and severity of impact that subsurface mining activity, with an emphasis on, but not limited to, the longwall method, has on the streams. The primary causes of problems associated with deep mining are increased sedimentation, pooling, and other channel alterations, such as increased erosion, resulting from subsidence of the stream bed above the mined panels, and flow diminution resulting from the fissuring of the underlying bedrock.

The University reports on streams in three different parts in this section. The first part reports on stream segments that were undermined during the assessment period (see I.A.). The second covers those streams undermined between 1994 through 1998 of special interest, which needed further study listed in the 2001 Supplement to the first five-year report. The third deals with streams that were undermined in the 1980s and according to PA DEP records, had mining-related effects. The streams are listed under the mine that potentially impacted them.

Because of their size, longwall mines undermine more miles of streams than room-and-pillar mines. With more than 100 miles of undermined streams in the assessment period, most over longwall mines, the University's stream specialist had to choose a representative sample of streams for scientific observations and assessments (see VII.B below for streams identified as needing an assessment). One stream that was assessed during the study period of this report (Cherry Run, Armstrong County) was undermined by room-and-pillar mining, whereas 30 streams, primarily in Greene County and Washington County (along with South Branch of Two Lick Creek in Indiana County, Roaring Run in Cambria County, and Howells Run in Cambria County) that were evaluated were undermined by longwall panels. **The objective of these assessments was to determine whether the undermined streams meet the criteria, as of this study period, to attain their protected stream designated use in accordance with 25 PA code Chapter 93.**

The majority of streams in this study are designated as Warm Water Fisheries able to sustain breeding populations of fish species found in warm waters. Five streams (Cherry Run, Enlow Fork, Howells Run, South Branch of Two Lick Creek, and Templeton Fork) qualify as Trout Stocked Fisheries, streams that have the ability to maintain trout, but may not be capable of sustaining long term breeding populations of trout. Two streams (Roaring Run and Howells Run) are categorized as Cold Water Fisheries, streams capable of the maintenance or propagation, or both, of fish species including the Salmonidae (some trout and salmon) and additional flora and fauna that are indigenous to a cold water habitat.

In choosing stream segments for this limited study, the University sought, through GIS, to identify stream *segments* most likely to be affected by pooling because of their run-to-rise ratio and their position with respect to longwall panels, including stream segments that cut transversely across the surface above longwall panels (particularly at segments that might cross the lateral edge of a panel, where potential pooling is more likely). As mentioned in Limitations (section III), the limited time of the study period dictated the University's choices.

Habitat assessment procedures and forms were used to score habitat assessments post-mining. Post-mining fish and macrobenthic communities were sampled during daylight hours (see tables VII 2-11 for pre- and post-mining fish inventories). Fish communities were usually surveyed using a Smith-Root backpack-mounted pulse-DC electrofishing unit. A single electroshocking pass of approximately 200 yards, walking in a downstream to upstream direction was made at each of these sampled stations in accordance with USEPA procedures (USEPA 1990). Fish were enumerated, identified to species, and released alive after completion of the survey. At a couple of stations (as noted in the relevant station write-up), fish were dip netted, identified, and released in the field. Qualitative macroinvertebrate surveys were performed post-mining using dip-netting and handpicking of rocks. In most cases, benthic organisms were identified to the family level in the field and released alive. Because of time constraints, stream sites were randomly selected, and collected information was supplemented by pre-existing data

gathered by the PA DEP's Regional Water Management Office for the Statewide Water Assessment Program (Regional Water Management biologists), the PA DEP's California District Mining Office biologist, and scientists contracted by Consol Energy.

VII.B. Streams Undermined during the Assessment Period and Assessed after They Were Undermined

During the assessment period 31 different streams and 164 segments of streams tributary to them were undermined. Longwall mine panels undermined **96.95** miles of streams during the assessment period, whereas room-and-pillar and full-retreat mines undermined **18.53** miles of streams (see Scorecard for individual mines). During the period, problems were reported to the California District Mining Office for Dyers Fork and its tributaries, and to tributaries of Laurel Run, Enlow Fork, Robinson Fork, Mingo Creek, Spotted Tail Run, Dunkard Fork, and Roberts Run. Primarily, reported problems centered on low flow or on absence of flow. BUMIS records reveal that *twenty-two streams and/or ponds had an assigned "ST" claim number (ST0303 through ST0325) during the assessment period*. Such a number is normally assigned to a stream that reportedly suffered an impact during the assessment period, warranting an investigation by the California District Mining Office (see VII.K). Paper files housed in the California District Mining Office supplement BUMIS because they include reports of investigations by surface subsidence agents who made *in situ* observations after learning of reported stream impacts (VII.K).

Near the end of the assessment period, staff in the California District Mining Office gathered and tabulated information on all streams that had been undermined by longwall operations during the preceding five years. Undermined stream segments were identified and compared against records of stream assessment maintained by the PA DEP Bureau of Water Supply and Wastewater Management¹ to distinguish segments that had been assessed while mining was in progress or after mining was completed. After pairing assessment details with the list of undermined stream segments, the California District

¹ Stream assessment data are maintained by the PA DEP Bureau of Water Supply and Wastewater Management; however, field assessments are actually performed by the PA DEP Regional Water management biologists.

Mining Office identified a remaining group that had no observational details. This latter group was then targeted for field observations during the summer and fall of 2003 to determine if the streams were still flowing. The results of this data collection are provided in the table below (table VI.1). Table VI.1 also includes the results of assessments that were performed by Dr. Daniel Keogh as part of the University's reporting effort. To the usual categories of "attaining" (for "attaining use") and "not attaining," the University added another category: "attaining, but impaired." This category indicates a marginal attainment of use as a "warm water fishery," "cold water fishery," or "trout stocking fishery." As a further qualification of the term "attaining, but impaired," the University notes, in the stream assessment narratives below, that some streams show signs of ecological stress even though they are, at least minimally, "in attainment" of their use. "Attaining but impaired" could also be interpreted as "marginally attaining use." Crabapple Creek, for example, was recovering and attaining its use, but at the time of the observation was biologically impaired because of a prior period of dewatering. In the table below, the streams in need of assessment, as determined by the PA DEP because they were undermined after the Regional Water Quality Office (R.W.Q. O.) made a pre-mining assessment, are given two rankings, that of R.W.Q.O. and that of Dr. Daniel Keogh, the University's representative.

The University could not, because of the time constraints mentioned in the Limitations section (III), scientifically assess 115.48 miles of undermined streams, and the PA DEP acknowledged this limitation. The justification for examining the streams described in the narratives below was fourfold: The choice of streams to assess was based on 1) the spreadsheet listing of streams in need of assessment, 2) access to segments either in need of assessment or of reassessment with the help of the California District Mining Office biologist, 3) the list of streams mentioned in the 2001 Supplement, and 4) unmined stream segments that might serve as "controls" for comparison.

For some of the stream segments assessed by the University, such as the segment of Pumpkin Run (segment 40975_4.6334_4.9713) above the Dilworth 2-E longwall panel, the University chose to reinvestigate a stream that suffered an impact after being

Table VII.1. Streams determined by the PA DEP to be in need of assessment or investigation that the University observed because they were undermined during the assessment period and because they had a pre-mining R.W.Q.O. assessment but no post-mining assessment. This table does not include all streams that were undermined during the assessment period. That list can be found in a table in Appendix A. **UA** = not assessed by R.W.Q.O.; **A** = attaining; **I** = impaired; **AI** = attaining, impaired (for stream segments that were less inclusive than the University's assessed segment); **ABI** = attaining but impaired; **NA** = not attaining; **Agr** = agriculture is the cause of nonattainment; **Other** = causes other than mining and agriculture are the reason for nonattainment or impairment.

Stream Name	R.W.Q.O.-Assessment	Dr. Keogh's Assessment
Crabapple Creek	UA	ABI
Trib 32518 to Crabapple Creek	A	A
Enlow Fork	A,I	A
Kent Run	A	NA(Agr.)
Pumpkin Run	A	NA(Agr.)
Trib 40312 to S. Fork of Little Ten Mile	A	NA
Trib 40322 to S. Fork of Little Ten Mile	A	A
Trib 36989 to Little Chartiers Creek	A,I	ABI(Agr.),NA
Cherry Run	UA	A
Laurel Run 1.37-2.2 miles	A	NA
Laurel Run Down from Waynesburg	A	ABI(Other)
Robinson Fork B12, 13	I	ABI
Robinson Fork B14	I	A
Enlow Fork 7c	I	ABI
Enlow Fork 6c	I	A
Enlow Fork 8c, 9c, 10c	I	A
Hoovers Run 7s, 8s	A	A
Toms Run	UA	A
Patterson Run	UA	ABI(Agr.)
Muddy Creek	UA	ABI(Agr.)
Trib 36989 to Little Chartiers Creek	A,I	NA
Trib 36999 to Little Chartiers Creek	A	A
Smith Creek	I	ABI(Other)
Pursley Run	UA	A

undermined even though the California District Mining Office had already reported on the stream's condition (dry). The University assessed the stream during the study period to see whether or not any change in its condition had occurred since the investigation by the California District Mining Office. In choosing a stream like Hoover's Run, the University chose to look at the stream where it had been undermined during the prior Act 54 assessment period and where it had been undermined during the assessment period of this report.

VII.C. Bailey Mine

The following stream segments were undermined by Bailey Mine, a longwall mine.

VII.C.1. Crabapple Creek

Crabapple Creek is a perennial moderate gradient 2nd order tributary to Dunkard Fork of the Ohio River basin and is located in Rich Hill Township, Greene County. This stream is classified as a warm water fishery under 25 Pa. Code Chapter 93. Land use of this stream reach was primarily forest with some residential and agricultural components. This stream was dewatered as a result of undermining by panels. This location was visited in 2003 by the PADEP California District Mining Office biologist, and in 2004 by the California District Mining Office biologist and Daniel Keogh. In June 2003, the California District Mining Office biologist performed habitat evaluation and macroinvertebrate and fish surveys in his assessment of the reportedly dewatered reach. He observed normal flow at that time. A habitat assessment score of 200 was assigned. This is optimal under the surface water assessment protocol used. This reach of Crabapple Creek was forested with an undisturbed riparian zone upstream from the bridge. The stream channel had good riffle run pool development and sinuosity. Only two taxa from the EPT complex were collected in 2003. Only one family each of caddisflies (Trichoptera) and mayflies (Ephemeroptera) were collected. No fish were collected.

In July 2004, habitat assessment and a fish survey were performed. Macroinvertebrates were cursorily checked in a qualitative manner using a dip net. The volume of water within Crabapple Creek filled the channel with a moderate current, which was normal given the amount of precipitation and time of year. Epifaunal and instream cover, sedimentation and impaction, and bank conditions were optimal. This reach received a habitat assessment score of 200. The macroinvertebrate community had improved in 2004. Two stonefly families (Leuctridae and Pelridae) were present, and included individuals from the multi-year lifecycle *Acroneuria sp.* Three families of each mayflies (Ephemeroptera) and caddis flies (Trichoptera) were also present. Salamander larvae

were common in the stream. Only 21 fish were collected, representing 3 headwater/pioneering species creek chub (*Semotilus atromaculatus*), bluntnose minnow (*Pimephales notatus*), and black nose dace (*Rhinichthys atratulus*).

Given the high quality of Crabapple Creek in terms of habitat and the macrobenthic community, the fish species diversity and density are low. A definitive cause for the poor fish community structure cannot be determined with certainty without historical/pre-mining data. However, the presence of salamander larvae and pollution sensitive stream invertebrates plus the absence of apparent land use issues (such as pollution sources and riparian encroachment/destruction), lead to the conclusion that the dewatering, which is likely to be at least partially the result of undermining, is the most probable cause for the lack of fish, both number of species and the number of individuals. Though the dewatering coincided with undermining of Crabapple Creek, the possibility exists that the drought that occurred during 2001 and 202 in southwestern Pennsylvania could have contributed, at least in part, to the purported dewatering. The actual contributions of undermining and drought cannot be definitively determined without historical and mining-era hydrological data.

Crabapple Creek is currently in the process of recovering from the loss of flow that occurred. It is expected to fully attain its warm water fishery designation in the future because of the excellent habitat conditions, potential for unobstructed re-establishment of fish populations from Dunkard Fork, and the healthy macroinvertebrate community. However, because of the paucity of both number of species and individuals of the fish community in a stream that has excellent habitat conditions and macroinvertebrate community structure, *Crabapple Creek was biologically impaired* at the time of the University's observation.

VII.C.2. Tributary 32518 to Crabapple Creek

Tributary 32518 is a low gradient, 1st order tributary located in Rich Hill Township, Greene County. It has been described as an intermittent stream by Regional Water Management biologists, and classified as a warm water fishery under 25 Pa. Code

Chapter 93. It is one of several streams that were reportedly diminished by underground mining during the 1998-2003 assessment period. This stream was undermined during 2001, 2003, and 2004 for a distance of 4223 feet by 13C, 14C, 15C and 16C panels. In August 2004 Dr. Dan Keogh, the University's stream specialist, and the California District Mining Office biologist visited the stream to assess its current condition. Habitat assessment and substrate examination for macroinvertebrates were performed on a 200-yard segment.

The riparian zone and land use of this stream consisted of old field/pasture and low density residential. Observations indicated that cattle had recently been in the stream's riparian zone. This narrow stream had a sub-optimal (because of the lack of depth) regular series of riffle runs and small pools. The stream was flowing with a depth ranging from 1-4 inches in the riffle/run sections and about 4-7 inches in the pools. The substrate consisted primarily of cobble mixed with boulders, gravel, and sand. Impaction and sediment deposition were minimal, and Tributary 32518 scored optimally in this category.

The stream suffered from lack of variation in habitat and flow/depth environments and absence of canopy cover, which lowered its overall assessment score. The assessed segment was assigned a habitat score of 127. Creek chubs (*Semotilus atromaculatus*) were present in pools. Twelve families of macroinvertebrates were noted, and included Limnephilidae, Leuctridae, Hydropsychidae, and Heptageniidae. Shallow streams of this size generally do not support well-developed fish communities, so a diverse fish community was not expected. The macroinvertebrate community was typical of a 1st or 2nd order stream. A cursory examination of this tributary downstream from the assessed reach to the confluence with Crabapple Creek resulted in the conclusion that the assessed reach was representative of the stream as a whole. Therefore, ***this stream was determined to be attaining its warm water fishery designation.***

VII.C.3. Enlow Fork

Enlow Fork is a perennial 3rd through 5th order tributary to Wheeling Creek that flows through State Game Lands along the border between Greene and Washington Counties. Enlow Fork has been classified as a trout stocking fishery under 25 Pa. Code Chapter 93. Land use in this segment was forested State Game Lands. Though mining activities were begun during the time frame of the previous Act 54 report, mining continued under this section that flows over the 8C, 9C, and 10C panels until 1999 and 2000. Subsidence related pooling was reported in 2000 over the 9C and 10C panels. Restoration of subsidence induced pooling has occurred, was visited during June 2004 by the PADEP California District Mining Office biologist and Dr. Keogh. Some shifting of the stream channel with accompanying alluvial deposition of sand, gravel, and cobble over the former channel was observed just downstream from panel 8C, and pooling still existed downstream from the bridge in the 9C panel. However, according to CONSOL mapping, this segment existed as a pool prior to mining. Downstream from that pool, a regular series of riffle, runs and pools was observed. Positive improvement of habitat from restoration efforts using log barriers that were installed within the past year in 10C panel along the left bank to create riffle habitat and divert flow to the right bank were noted. Water levels and flow rate appeared to be normal throughout this section. *Enlow Fork over the 8C, 9C, and 10C panels meets its designation as a trout stocking fishery, based on the restoration of riffle/run habitat in this reach.*

VII.C.4. Kent Run

Kent Run is an intermittent high gradient 1st and 2nd order tributary to Dunkard Fork of the Ohio River Basin, and is located in Rich Hill Township in Greene County. This stream has been classified as a warm water fishery under 25 Pa. Code Chapter 93. Land use in this area is pasture/old field with gas wells, and sparse residential land use. The headwater section of Kent Run near Wind Ridge was dewatered as a result of undermining by 19A and 20A panels in 2003 (see photo below). Regional Water Management biologists had assessed this stream during 2000 prior to subsurface mining

activity and determined that Kent Run was attaining its warm water fisheries status at that time.

The California District Mining Office biologist had surveyed the panel section in July 2003 and again in March 2004 (station identification BM022). A loss of instream fish cover occurred, and its rating changed from marginally sub-optimal to poor. An increase in embeddedness and sediment deposition was noted. Riffle quality had increased by 2004. The bank condition was marginal to poor as a result of agricultural removal of the riparian zone. The habitat assessment score for this section declined from 133 to 103 during the 7 months. The gate area was assessed in 2004, and achieved a higher habitat evaluation (146) than the panel segment. Kent Run was sampled in 2004 by the California District Mining Office biologist and Dr. Keogh for fish and macrobenthic organisms in an un-mined stretch near the mouth for about 300 feet. This stream segment runs through Ryerson State Park (see photo, below), and is primarily forested, with a mowed picnic area and road near the mouth. This served as a control site as well as a means of examining the potential source of stream fauna to re-colonize the dewatered reach. This segment achieved a habitat evaluation of 186. The macrobenthic community contained 2 families of caddisflies (Trichoptera), 3 families of mayflies (Ephemeroptera), 2 families of stoneflies (Plecoptera). Thirteen species of fish were found. At the time of



The University's assessment, *Kent Run in the undermined region did not meet its warm water fishery designation as a result of mining-related dewatering, and to agricultural practices resulting in riparian destruction, sedimentation, and impaction.*

VII.D. Dilworth Mine

The following stream segments are underlain by Dilworth Mine, a longwall mine.

VII.D.1. Pumpkin Run

Pumpkin Run is an intermittent, low-gradient 2nd order tributary to the Monongahela River located in Jefferson Township, Greene Co. within the Ohio River basin. It has been classified as a warm water fishery under 25 Pa. Code Chapter 93. This stream was undermined by 2-E West panel with a depth of cover of 345 feet during 2000. The land use of this watershed is primarily agriculture and old field/pasture with a residential component. A pre-mining assessment was performed in 1999 by Regional Water Management biologists. They determined that Pumpkin Run was attaining its status as a warm water fishery.

Pumpkin Run was visited in June 2003 by the California District biologist and evaluated using a habitat assessment and macroinvertebrate survey. Stonefly (Plecoptera) and mayfly (Ephemeroptera) taxa were absent. Only 1 caddis fly family, Hydropsychidae, was recorded. Pumpkin Run scored poorly in habitat assessment with a score of 95. On October 2, 2003, a segment of Pumpkin Run and a tributary to Pumpkin Run, were found by the California District Mining Office biologist to be dry. These stream reaches are intermittent and the condition of the upstream segment of Pumpkin Run and its tributary were considered likely to be dry as a result of natural hydrological processes.

Dr. Keogh visited Pumpkin Run in July 2004. Water was present in the streambed at that time. Habitat assessment and a qualitative assessment of macroinvertebrates was performed. The riparian zone was poor with unstable and eroding banks as a result of removal of the riparian vegetation and agricultural activity. Conditions of the streambed showed a lack of quality substrate, and impaction and sedimentation, contributing to a lack of epifaunal cover, were evident. This reach of Pumpkin Run received a habitat assessment of 94, essentially not different from that assigned in 2003. Predominant macroinvertebrate taxa were midges (Chironomidae), caddis flies (Hydropsychidae), riffle beetles (Elmidae), and sludge worms (Oligochaeta). ***This stream did not meet***

requirements as a warm water fishery, primarily because of agricultural practices rather than mining effects.

VII.D.2. Tributary 40312 to South Fork of Little Ten Mile Creek

Tributary 40312 is a 2nd order tributary to South Fork of Little Ten Mile Creek and is located in Jefferson Township, Greene County. The lower reach of the stream is classified as perennial, while the upper two-thirds of the stream are intermittent.

Tributary 40312 is classified as a warm water fishery under 25 Pa. Code Chapter 93. Regional Water Management biologists assessed this stream in 2001, and found it in attainment as a warm water fishery. Land use surrounding this stream was forest in the lower half, and agriculture/pasture with sparse residential components in the upper half. This 1.27 mile long moderately high gradient stream was undermined by the 5F, 6F and 7F panels during 2002 for a distance of approximately 5560 feet. It was reported that loss of flow in this stream occurred because of the undermining. An attempt at restoration was performed during 2003 by grouting cracks in the stream channel, and flow was observed by the California District Mining Office biologist to have temporarily returned by spring, 2004. This stream was examined over a three-day period during July 2004 by Dr. Keogh, the first day in accompaniment of the California District Mining Office biologist. Neither habitat assessment, nor fish and macroinvertebrate surveys were performed because of *the absence of water in the streambed.*

The stream channel was dry in the perennial segment, with only a couple of small pools, primarily below a ledge approximately 15 feet high located approximately one-quarter mile south of the local road. Some small fish were still present in the largest of these pools. The riparian zone surrounding this stream segment was forested and well developed. Banks were stable with little indication of erosion. Fish and epifaunal cover included an abundance of woody debris and undercut banks. Substrates consisted primarily of boulder/slab and cobble with moderate amounts of gravel and sand. This stream segment should have a habitat assessment score of approximately 200, and it should support a healthy fish population under normal flow conditions. It was observed that *intermittent tributaries 40313 and 40314 and 40315), which had been undermined*

by panels 6F, 5F, and 4F and 3F panels, respectively, and empty into Tributary 40312, also lacked flow.

The headwater source of Tributary 40312 and the intermittent section of Tributary 40312 where it crosses under Rte 188 were also devoid of flow. Because of the time of year, the lack of water in these intermittent tributaries and the upper segment of Tributary 40312 might be the result of normal hydrological processes in this drainage basin, despite the above normal precipitation over each of the previous 13 months in southwestern Pennsylvania. The owner of the farm stated that the headwater segment of Tributary 40312 had always gone dry. *The perennial segment of this stream does not attain its status as a warm water fishery because of the lack of flow.* Other than the subsurface mining, there was no noticeable cause for the dewatering of this stream. This stream was being re-grouted in August.

VII.D.3 Tributary 40322 to South Fork of Little Ten Mile Creek

Tributary 40322 is an intermittent 1st order tributary to South Fork of Little Ten Mile located in Jefferson Township, Greene County. It is classified as a warm water fishery under 25 Pa. Code Chapter 93. This 2.04 mile long moderate gradient stream was undermined during 2001-03 by the 2F, 3F, 4F, and 2-E West panels for a length of 7195 feet. Pennsylvania Regional Water Management biologists assessed this stream in June 2001, and determined that it was attaining its designation as a warm water fishery. This stream was dewatered at stream mile 1.24 when it was visited post-mining by the California District Mining Office biologist in 2003. Dr. Keogh assessed the condition of this stream during July 2004, and Tributary 40322 was observed to have flowing water through all segments at this time. The riparian zone was fairly well developed with forest. In the upstream segment above the bridge where a small riffle should be present under high flow conditions, the stream was narrow (less than 5 feet), and shallow (less than 3 inches deep). A 100 feet long pool, approximately 8 feet wide and 15 inches deep, was present downstream from the bridge. The substrate of this segment was primarily cobble and gravel. This reach of Tributary 40322 achieved a habitat assessment score of 174, and *was determined to be in attainment of its stream designation.*

VII.E. Eighty Four Mine

The following stream was undermined by Eighty Four Mine.

VII.E.1. Tributary 36989 to Little Chartiers Creek

Tributary 36989 is a low gradient perennial 2nd order tributary to Little Chartiers Creek in South Strabane Township, Washington Co. in the Ohio River basin. It is classified as a warm water fishery under 25 Pa. Code Chapter 93. This stream was assessed from approximately 0.2 to 0.4 upstream from the confluence with Tributary 36996. This stream segment is undermined by 4 South panel. The land use in this area is primarily agriculture, and low density residential. A narrow (less than 50 feet on the right bank, less than 100 feet on the left bank) band of woods is present along most of the segment, but the entire area upstream was mowed field and pasture. Cows and horses on the farm above the location had access to the stream. A fetid odor indicating some nutrient enrichment present and clumps of algae were prevalent. The instream cover was good, but epifaunal cover was suboptimal, as was the bank condition. The substrate impaction and sediment deposition were moderately extensive. Pooling was evident and approximately 4 feet deep for 50 feet below the Zedicker Station Road bridge. The banks at this location were collapsing into the stream. Only red Chironomids were collected in the pool. This pooling could have occurred because of subsidence from undermining. A second possible cause of the pooling is that it may have resulted from heavy rain and flooding that had occurred that spring and summer. Pool creation can occur downstream from bridges as a result of the cemented walls under the bridge increases the flow rate as the water moves through the bridge. When that water reaches the non-cemented stream below the bridge, increased resistance to flow occurs and pooling and bank erosion may occur. Shallow pooling was downstream and extended for about 180 feet at the lower segment. This may or may not have resulted from mining activity. Sections of the streams in South Strabane Township that have not been undermined have pools of similar appearance. Without a pre-mining description of this segment, the nature of this pool is unknown.

This reach achieved a habitat assessment score of 108. The macrobenthic fauna for the stream segment overall was dominated by scuds (Gammaridae) and caddis fly (Trichoptera) larvae. Baetid mayflies, crane flies (Tipulidae), damselflies (Coenagrionidae) were among the other families noted. Three species of fish were collected by net, and included Johnny darters (*Etheostoma nigrum*), creek chubs (*Semotilus atromaculatus*), and blunt nosed minnows (*Pimephales notatus*). ***This stretch of Tributary 36989 to Little Chartiers Creek is in attainment of its warm water fisheries designation, but is impaired, primarily from agriculture.***

VII.F. Emilie 4 Mine

The following stream was undermined by Emilie 4 Mine, a room-and-pillar mine.

VII.F.1. Cherry Run

Cherry Run is a perennial 2nd order tributary to Crooked River in the Ohio River Basin located in Burrell Township in Armstrong County. It has been classified as a trout stocking fishery under 25 Pa. Code Chapter 93. Cherry Run was undermined by Emilie 4 Mine at a depth of approximately 100 feet in the headwater reach. A reach of approximately 300 feet of Cherry Run was evaluated in 2003 by the California District Mining Office biologist when habitat, fish, and macroinvertebrate assessments were performed, and in 2004 by Dr. Keogh who performed habitat assessment and qualitatively surveyed macroinvertebrates.

The diverse fish community that was surveyed in 2003 contained 6 darter species, (including logperch, *Percina caprodes*), golden and black redhorses (*Moxostoma erythrurum* and *M. duquesnii*), rockbass (*Ambloplites rupestris*), smallmouth bass (*Micropterus dolomieu*), and largemouth bass (*Micropterus salmoides*). A healthy community of macrobenthic organisms was noted during sampling in 2003 and 2004, and 3 families of stoneflies, 4 families of mayflies, and 6 families of caddisflies were collected each year. The dominant macroinvertebrate taxa included disturbance sensitive families from these groups (Leuctridae, Heptageniidae, and Glossosomatidae). The macroinvertebrate community in Cherry Creek was considered to be healthy and stable

because of a combination of the predominance of sensitive taxa, the high diversity of taxa, and the presence of a large number of EPT (Ephemeroptera/Plecoptera/Trichoptera) taxa. The number of darter species, and the presence of disturbance intolerant black redhorse and moderately intolerant golden redhorse and rock bass are indicative of a healthy fish community unaffected by the mining that had occurred. ***This stream meets the criteria as a Trout Stocking Fishery.*** Because undermining occurred at the assessed site and upstream of it, this attainment of trout stocking fishery would be expected to apply to Cherry Run downstream from this reach barring non-mining related stream degradation.

VII.G. Emerald Mine

The following stream was undermined by Emerald Mine, a longwall mine.

VII.G.1. Laurel Run

Laurel Run is a 2nd to 3rd order intermittent and perennial low gradient tributary to Little Ten Mile Creek within the Ohio River Basin located in Greene County. It has been classified as a warm water fishery under 25 Pa. Code Chapter 93. The 2 North, 3 North, 4 North, 6 North 7 North, 8 North, 9 North, and 10 North panels undermined Laurel Run from 1999-2003 for approximately 11,000 feet. Regional Water Management biologists assessed Laurel Run after much of the mining had occurred in 2001 and concluded that Laurel Run was in attainment of its stream designation as a warm water fishery at that time.

Laurel Run was randomly selected for this study by Dr. Keogh for evaluation of its current condition. Four reaches of this stream and its tributaries were visited on two occasions in 2004. The first 3 segments that were assessed (stream miles 1.37, 1.79, and 2.2 downstream from the headwaters) were located in Franklin Township, and included unnamed first and second order undermined tributaries. Laurel Run is an intermittent 2nd order stream at mile 1.37 from its headwaters, and a perennial 3rd order stream at the other sites. The 4th reach was east of the Greene County fairgrounds maintenance shed, downstream from Waynesburg.

Land use in the 3 upstream reaches consisted of old field and pasture. Gas wells were present approximately 2.2 miles from the headwaters. Approximately 15 percent of the region was secondary forest, mainly on the left bank. Residential neighborhoods exist at the lower of these three segments. On both visits, it was noted that the entire upstream section was completely dewatered at each of the three undermined sections that were visited. The upstream reaches were walked for approximately 200 yards, as were the unnamed tributaries for approximately 200 yards upstream from their confluence with Laurel Run. Evidence of a previous grouting attempt was noted by the presence of dried polyurethane foam in holes within the streambed about 2 miles from the headwaters. At the time of the visits to Laurel Run in June and July 2004, precipitation had been above normal for the Pittsburgh region for each of 13 consecutive months, so it is unlikely that the dewatering was the result of drought. There was no apparent evidence of water being deviated from Laurel Run for agricultural, industrial or other water uses. *It is possible that the intermittent reach towards the headwaters of Laurel Run was not flowing because of its normal hydrological cycle, despite the volume of precipitation that has fallen in the region during the previous year. It is also possible that segments of the stream classified as perennial within the upper reach south of Waynesburg are actually intermittent, and were also dry during late June and early July 2004 because of normal hydrological cycle. However, there is also a strong possibility that either the primary cause, or at least a contributing factor, of dewatering was the result of the subsurface mining activity.* The **current status of Laurel Run from 1.37 miles through 2.2 miles downstream from the headwaters is that it does not meet its stream designation as a warm water fishery.**

The reach of Laurel Run by the fairgrounds was within a forested area, and received runoff from the city of Waynesburg, some business operations, the municipal maintenance yard, the fairgrounds, and residential neighborhoods. This section of Laurel Run had been assessed by Regional Water Management biologists in 2001, and they determined that this reach was in attainment of its warm water fishery classification. Habitat assessment and qualitative macroinvertebrate sampling was performed in July, 2004 by Dr. Keogh over a 0.25 mile section upstream from the fairgrounds.



This reach was selected to determine if the absence of flow in the upstream reaches of Laurel Run south of Waynesburg was impacting the stream downstream from the city. This reach *had normal stream flow at the time of assessment, but no measurement was taken of the total discharge rate.* The riparian zone was fairly well protected, and extended for approximately 30-40 yards on the right bank, and for at least 100 yards on the left bank. The stream channel consisted primarily of pool/glide/run habitat, and the depth of the stream ranged from an inch in the shallows to about 4 feet in the deeper pools. Two riffles, each approximately 50-75 yards long were present at the upper region of this site, and the depth ranged up to 9 inches deep. The substrate was characterized by cobble, sandstone bedrock, gravel, and slab/boulders. Laurel run was assigned a habitat assessment score of 194. A fairly diverse, but not exceptional, macrobenthic fauna was observed, and included caddis fly (Trichoptera) families Hydropsychidae and Philoptomidae, and mayfly (Ephemeroptera) families Caenidae, Heptageniidae, Baetidae, and Leptophlebiidae. Fish were observed in pools. ***Laurel Run downstream from Waynesburg may be slightly biologically impaired as a result of runoff and some contaminants from Waynesburg, but not as a result of the upstream mine-related diminution of flow.***

VII.H. Enlow Fork

The following stream was undermined by Enlow Fork, a longwall mine.

VII.H.1. Robinson Fork

Robinson Fork is a low-gradient perennial 3rd order tributary to Enlow Fork in the Ohio River basin, and is located in West Finley Township, Washington County. Robinson Fork is classified as a Warm Water Fishery under 25 Pa. Code Chapter 93. Though part of this stream was undermined by the Bailey Mine, most of the mining activity beneath the stream was performed by Enlow Fork Mine. This stream was undermined by 3 D and 4 D panels of Bailey Mine, and the B 12, B 13, and B 14 panels of Enlow Fork Mine for a length of 3758 feet, with a depth of cover of 530 feet from 1998 through 2003. It was reported in the 2001 Supplement report to have developed subsidence related pooling. The land use along the segment of Robinson Fork undermined by Enlow Fork Mine is a combination of old field, pasture, and forest. About 10 percent of the watershed has agricultural and residential use.

The 4D and 5D Panels.

Regional Water Management biologists had previously screened this segment in 2000. They collected 12 macrobenthic taxa. Turbellarians had dominated this stream reach at that time as well.

The California District Mining Office biologist assessed the undermined stream segment that extended from the covered bridge at Good Intent Road and Dogwood Hill Road to the confluence with Enlow Fork in 1993. Habitat assessment, and macroinvertebrate and fish surveys were used to assess this reach (see accompanying tables below). The combination of extensive pooling and organic enrichment from an upstream dairy farm resulted in low dissolved oxygen levels (5.64 ppm). The habitat assessment scores for three sites within this reach of 106, 155, and 122 (marginal to suboptimal) indicate that a more extensive macroinvertebrate community should have been present than was observed during the University's assessment. The macroinvertebrate fauna in this reach was dominated by the tolerant (Hilsenhoff index of 9) taxa flat worms (Turbellaria). Other tolerant taxa, such as segmented worms (Oligochaeta), midges (Chironomidae), black flies (Simuliidae), and fingernail clams (Sphaeriidae), composed a large percent of the fauna. *Robinson Fork meets criteria for a warm water fishery but is impaired, both*

in terms of habitat and biology as a result of a combination of mining related subsidence causing pooling and organic pollution and siltation from upstream agricultural practices.

The California District Mining Office biologist in 2003 assessed the reach of Robinson Fork that was undermined by panel B14 in 1999 for a length of 695 feet. Techniques used to evaluate the current stream condition were habitat assessment, and fish and macroinvertebrate surveys. *This reach of Robinson Fork had normal flow post-mining and had a habitat assessment score of 151. Eighteen species of fish and seventeen macroinvertebrate families were collected. The fish community included 7 disturbance intolerant or moderately intolerant species rainbow darters, greenside darters, black redhorses, emerald shiners, rock bass, silver chub, and Northern hogsuckers. They comprised 32.1% (52 out of 162 individuals). The fish community does not appear to have been severely impacted by the undermining. The macroinvertebrate taxa that were identified included fish flies (Corydalidae), 4 families of mayflies (Ephemeroidea, Baetidae, Heptageniidae, and Isonychidae), 3 families of stoneflies (Perlidae, Perlodidae, and Leuctridae), 2 families of caddis flies (Hydropsychidae and Philopotamidae), and the riffle requiring beetle water penny (Psephenidae). Though moderately tolerant Baetid mayflies and Hydropsychid caddis flies were the dominant taxa, the presence of 6 quality taxa (130 of the total of 626 individuals collected, or 20.8%) from the EPT complex and the water pennies and fish flies comprising another 11.7% of that total. The macroinvertebrate community was appropriate for a relatively unimpaired stream.*

Robinson Fork in this reach attained its warm water fishery designation.

Table VII.2. Summary of 2001 and 2002 pre-mining (Panels 4D and 5D) and 2003 post-mining (Panel 4D and B12) fish collected from Robinson Fork overlying Bailey and Enlow Fork Mine. Adaptations: a From CEC Project Report 210703.0004 prepared for Consol, 2002; b From CEC Project Report 210703.0007 prepared for Consol, 2002

Fish Species	Ohio EPA Pollution Tolerance Group	US EPA Pollution Tolerance Group	5D Panel 2001^a	5D Panel 2002^b	4D Panel 2001^a	4D Panel 2002^b	4D Panel 2003	B12 Panel 2003
silverjaw minnow (<i>Ericymba buccata</i>)	NA	Intermediate	8	4	4	1		3
blacknose dace (<i>Rhynchithyes atratulus</i>)	Highly Tolerant	Tolerant	37	7	17	6		5
bluntnose minnow (<i>Pimephales notatus</i>)	Highly Tolerant	Tolerant	161	126	40	70	25	22
central stoneroller (<i>Campostoma anomalum</i>)	NA	Intermediate	181	48	108	229	6	10
striped shiner (<i>Luxilus chrysocephalus</i>)	NA	Intermediate	1		1			7
emerald shiner (<i>Notropis atherinoides</i>)	NA	Intermediate			1		6	17
creek chub (<i>Semotilus atromaculatus</i>)	Highly Tolerant	Tolerant	137	50	105	53	58	38
								13
white sucker (<i>Catostomus commersoni</i>)	Highly Tolerant	Tolerant	128	42	68	26	44	23
black redhorse (<i>Moxostoma duquesnei</i>)	Common Intolerant	Intolerant					10	12
golden redhorse (<i>Moxostoma erythrurum</i>)	Moderately Intolerant	Intermediate	5		3		2	
northern hogsucker (<i>Hypentelium nigricans</i>)	Moderately Intolerant	Intolerant	16	15	20	20	32	3
stonecat madtom (<i>Noturus flavus</i>)	Common Intolerant	Intolerant	5	2	1			
yellow bullhead (<i>Ameiurus natalis</i>)	Highly Tolerant	Tolerant	2		2	2		
black bullhead (<i>Ameiurus melas</i>)	Moderately Intolerant	Intermediate						1
green sunfish (<i>Lepomis cyanellus</i>)	Highly Tolerant	Tolerant	5	5		2		
pumpkinseed sunfish (<i>Lepomis gibosus</i>)	NA	Intermediate					2	5
rock bass (<i>Ambloplites rupestris</i>)	NA	Intermediate	2		2	6	4	1
smallmouth bass (<i>Micropterus dolomieu</i>)	Moderately Intolerant	Intermediate	2		17	16		
fantail darter (<i>Etheostoma flabellare</i>)	NA	Intermediate	12	21	28	19	9	5
greenside darter (<i>Etheostoma blennioides</i>)	Moderately Intolerant	Intermediate	4	8	2	4	1	4
rainbow darter (<i>Etheostoma caeruleum</i>)	Moderately Intolerant	Intermediate	13	11	41	11		2
johnny darter (<i>Etheostoma nigrum</i>)	NA	Intermediate	9	8	2		6	3
		Total # Species	18	14	18	14	13	18

Table VII.3. Summary of post-mining (2001) fish collected from Robinson Fork overlying Enlow Fork Mine Panels B5, B6, B12, and B13. Adapted from CEC Project Report 210664.0006 prepared for Consol, 2002

Fish Species	Ohio EPA Pollution Tolerance	US EPA Pollution Tolerance	B5 Panel 2001	B6 Panel 2001	B12 Panel 2001	B13 Panel 2001	Upstream Reference 2001
common carp (<i>Cyprinus carpio</i>)	Highly Tolerant	Tolerant		4			
silverjaw minnow (<i>Ericymba buccata</i>)	NA	Intermediate	45	28		75	
blacknose dace (<i>Rhynchichthyes atratulus</i>)	Highly Tolerant	Tolerant	157	45	44	73	541
bluntnose minnow (<i>Pimephales notatus</i>)	Highly Tolerant	Tolerant	591	617	73	415	635
central stoneroller (<i>Campostoma anomalum</i>)	NA	Intermediate	249	60	80	161	56
striped shiner (<i>Luxilus chrysocephalus</i>)	NA	Intermediate	9	2	14	69	
emerald shiner (<i>Notropis atherinoides</i>)	NA	Intermediate	1	6	1	1	
creek chub (<i>Semotilus atromaculatus</i>)	Highly Tolerant	Tolerant	449	306	116	418	635
white sucker (<i>Catostomus commersoni</i>)	Highly Tolerant	Tolerant	463	348	172	380	140
golden redhorse (<i>Moxostoma erythrurum</i>)	Moderately intolerant	Intermediate	1	1	2	1	46
northern hogsucker (<i>Hypentelium nigricans</i>)	Moderately Intolerant	Intolerant	2	5	1		
stonecat madtom (<i>Noturus flavus</i>)	Common Intolerant	Intolerant					
yellow bullhead (<i>Ameiurus natalis</i>)	Highly Tolerant	Tolerant					
green sunfish (<i>Lepomis cyanellus</i>)	Highly Tolerant	Tolerant		9	11	7	
rock bass (<i>Ambloplites rupestris</i>)	NA	Intermediate			2		
smallmouth bass (<i>Micropterus dolomieu</i>)	Moderately Intolerant	Intermediate					
fantail darter (<i>Etheostoma flabellare</i>)	NA	Intermediate	113	9	21	16	40
greenside darter (<i>Etheostoma blennioides</i>)	Moderately Intolerant	Intermediate	5		2	3	2
rainbow darter (<i>Etheostoma caeruleum</i>)	Moderately Intolerant	Intermediate	34	3	5	7	11
johnny darter (<i>Etheostoma nigrum</i>)	NA	Intermediate	24	40	5	19	23
		Total Number of Species	14	15	15	14	10

VII.H.2. Templeton Fork

Templeton Fork is a low gradient perennial 3rd order tributary to Enlow Fork in the Ohio River basin. It is located in East Finley Township, Washington County and has been classified as a trout stocking fishery under 25 Pa. Code Chapter 93. This stream has been undermined by the A1-A11, E1-E4, and the F1-F8 panels of Enlow Fork Mine. The Templeton Fork basin is a mix of agriculture/pasture, old field, and forest, with some sparse residential land use.

An upstream segment of Templeton Fork had a recent emergency gate cutting performed in 2004, at the request by a homeowner living along the flood plain, to alleviate pooling and flooding that occurred during mining operations. This stream restoration project resulted in the undercutting of the trees lining the banks at the gate cutting location. *A serious erosion problem is occurring as a result, and the trees will fall into the stream.* Dr. Keogh and the California District Mining Office biologist observed large alluvial deposits including gravel and large cobble have been transported for more than ½ mile downstream. These had not been present earlier in the year (personal communication, California District Mining Office biologist), and has most likely been caused by the restoration process. *Templeton Fork meets its stream designation as a trout stocking fishery. However, monitoring should continue because of the ongoing erosion and alluvial deposition that is taking place.*

VII.I. Streams Undermined between 1993 and 1998 and Listed for Further Study in the 2001 Supplement

VII.I.1. Bailey Mine

The following stream was undermined by Bailey Mine, a longwall mine.

VII.I.1.a. Enlow Fork

Enlow Fork is a perennial 3rd to 5th order Trout Stocked Fishery that is located along the border of Washington and Greene Counties, and empties into Wheeling Creek in the Ohio River Basin. It has been classified as a trout stocking fishery under 25 Pa. Code

Chapter 93. Segments assessed for this report have a land use that is primarily forest. Enlow Fork was reported in the Act 54 2001 Supplement to have suffered from both pooling and diminution of flow as a result of undermining. The total length of the stream that was undermined, beginning in 1998 and continued through 2000, by panels 7C, 8C, 9C, and 10C was 11,670 feet (7C undermined Enlow Fork prior to the assessment period). Regional Water Management biologists and the California District Mining Office biologist assessed several sections of Enlow Fork.

This stream was undermined by C2-C10 beneath the 5th order region and panels B1-B6 and E1-E3 through the upper section. Mining of these panels began in 1986 (B1), and continued through 2001 (E3). Consol PCC commissioned a study of panels C2-C9 and B1-B4 conducted in 1999 to examine the long-term impact and natural recovery from subsidence related pooling (CEC 2000). Despite the presence of rosyface shiners (*Notropis rubellus*) and a banded darter (*Etheostoma zonale*), the paucity of the fish and macroinvertebrate fauna, and the dominance of disturbance tolerant taxa (Oligochaeta and Hemiptera) lead to the conclusion that these stations were impaired.

The affected stream segment undermined by panel 7C during the previous assessment period was assessed for its post-mining condition in 2003 and 2004 by the California District Mining Office biologist. This panel undermined a segment of the stream prior to the assessment period. This segment was determined to have improved in quality since its reported impairment in 2002 by Water Management biologists (see Appendix A). The number of taxa has increased from 2 taxa post-mining to 15, and the number of mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddis flies (Trichoptera) had increased from 0 to 5 families. Taxa percent dominance is an indicator of low diversity and an unstable or impaired environment. The lower the score, the higher quality and stable the community structure. Enlow Fork overlying panel 7C improved in this indicator with the percent dominance declining from 66.67% to a normal 28.79%. ***It is apparent that this section of Enlow Fork has significantly recovered, and meets, as of the time of the University's assessment, the stream designation of trout stocking fishery, but remains***

impaired as a result of subsidence related pooling and accumulation of alluvial substrates resulting in the loss of riffle and run habitat.

Above Panel 6C Enlow Fork is a fifth order stream in this section located in Rich Hill Township in Greene County. This stream segment was undermined in 1998 for a length of approximately 2000 feet. Regional Water Management biologists assessed this reach of Enlow Fork in 2000. They noted that long pools were being formed below the gate entries as a result of mining activities, and concluded that the stream was impaired in this segment because of the loss of run and riffle habitat as a result of the subsidence related pooling and siltation. They did not observe a change in the biology because they sampled only the existing riffles and not the pooled segments. Therefore, they concluded that the mining was not impacting the quality of Enlow Fork outside of the pools based on the quality of macroinvertebrates and fish within the riffled area.

The California District Mining Office biologist assessed this segment of Enlow Fork in late July 2003 for habitat, fish, and macroinvertebrate quality. The stream had low flow at this time. The habitat assessment score for this reach was 181. Most categories scored marginally optimal or optimal with the exception of sediment deposition and impaction, which were sub-optimal. Fifteen species of fish were collected and included 5 stonecat madtoms (*Noturus flavus*) and 1 blackside darter (*Percina maculata*), species considered by the US EPA as being intolerant to disturbance (1988), and 24 rock bass, 32 rainbow darters, 23 greenside darters, 1 golden redhorse, and 1 smallmouth bass, moderately intolerant species out of the 357 individual fish that were collected. Only two tolerant species were represented. Twenty four taxa of macroinvertebrates were also collected. These included 2 families of stoneflies (Perlidae and Perlodidae), 5 families of mayflies (Baetidae, Ephemeridae, Isonychiidae, Heptageniidae, and Caenidae), and 3 families of caddis flies (Hydropsychidae, Limnephilidae, and Philopotamidae). The EPT complex comprised 21.2% of the total number of macroinvertebrates collected. Hydropsychidae was the dominant taxa, and represented 14.4% of the total macrobenthic community. The biology of this stream is typical of a healthy 5th order stream that is relatively undisturbed. ***This section of Enlow Fork was meeting the criteria for a trout stocking***

fishery based on the habitat assessment score, and healthy fish and macroinvertebrate and fish community structures.

Overall, Enlow Fork is attaining the criteria for a trout stocking fishery based on the assessed stations. However, riffle and run habitat has been lost as a result of the ongoing undermining. Restoration methods that were performed over panels 9C and 10C of this stream appear to have been successful. Careful monitoring and further restoration of pooled reaches should be continued because the designation as a trout stocking fishery is in jeopardy if more riffle and run habitat is lost.

VII.I.2 Blacksville 2 Mine

The following streams were undermined by Blacksville Mine, a longwall mine.

VII.I.2.a. Hoovers Run

Hoovers Run is a perennial 3rd order tributary to the Monongahela River of the Ohio River Basin in Wayne Township in Greene County. It has been classified as a warm water fishery under 25 Pa. Code Chapter 93. The land use of the watershed is old field/pasture and agriculture, with sparse residential and some forested land. This stream was reported in the 2001 Supplement to have suffered from pooling (see photo below) that was the result of longwall mining. This pooled segment (between stream miles 3.0-4.0) of Hoovers Run had been undermined in 1998 for a length of 1404 feet by panels 7S and 8S, with a depth of cover of 665 feet. The California District Mining Office biologist performed habitat assessment and surveyed the fish and macroinvertebrate communities at the affected segment in 2004. A high flow and pooling was observed at this site. All aspects of the habitat assessment scored marginal or poor, with the exception of instream cover and bank conditions, which were both sub-optimal. This reach of Hoover's Run received a habitat assessment score of 83. Despite the poor habitat assessment, this reach of stream had a healthy and diverse macrobenthic fauna including 15 taxa which included 11 families of mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddis flies (Trichoptera). Additionally, 11 species of fish including rock bass (*Ambloplites rupestris*), rainbow darters (*Etheostoma caeruleum*) greenside darters (*Etheostoma*

blennioides), Northern hogsuckers (*Hypentilium nigricans*), and small mouth bass (*Micropterus dolomieu*) were present. These are species that are moderately intolerant to disturbance (according to the Ohio EPA,

1988) and all except the rock bass and small mouth bass prefer riffle/run habitat. The central stoneroller minnow (*Campostoma anomalum*), a riffle run species, was also collected. Because of the diversity of riffle/run fish and macroinvertebrates and the high number of Ephemeroptera/Plecoptera/Trichoptera (EPT)



taxa, *Hoovers Run does not appear to have been biologically impacted by the pooling, and is in attainment of its stream designation as a warm water fishery.*

VII.I.2.b. Toms Run

Toms Run is a perennial 3rd order tributary to the Monongahela River of the Ohio River Basin in Wayne Township in Greene County. It has been classified as a warm water fishery under 25 Pa. Code Chapter 93, and was reported in the 2001 Supplement to have suffered from pooling. The undermined segment of Tom's Run was assessed by the California District Mining Office biologist in 2003. This stream segment was found to be sub-optimal in terms of fish and epifaunal cover with the substrate moderately embedded and deposition of sediments. Riffle development was moderately poor. The riparian zone was narrow, and highly impacted by human activity with reduced vegetative growth. The banks were unstable and erosion was fairly extensive. This segment of Tom's Run received a habitat assessment score of 128. Thirteen families of macroinvertebrates were collected, including 3 families of mayflies (Ephemeroptera), 1 families of stoneflies (Plecoptera), and 2 families of caddis flies (Trichoptera). *Toms Run was determined to be in attainment of it water designation.*

VII.I.3. Cumberland Mine

The following stream was undermined by Cumberland Mine, a longwall mine.

VII.I.3.a. Patterson Run

Patterson Run is an intermittent 1st and 2nd order moderate gradient tributary to Whitely Creek situated in Kirby Township in Greene County. It has been classified as a warm water fishery under 25 Pa. Code Chapter 93. This stream was undermined by the I and J panels for a distance of 3562 feet in 1998, and was reported in the 2001 Supplement to have suffered from diminution of flow. Two stations of the undermined section of this stream were investigated by the California District Mining Office biologist in March, 2004 using habitat assessment, and macroinvertebrate and fish surveys to evaluate its current condition. The two sites were similar in their habitat structure. Water was flowing on the date of assessment, filling approximately 50% of the channel. Both segments of the stream scored marginally in most categories, with riparian zone width scoring poorly, and riffle frequency and channel flow scoring suboptimally. The assessed reaches received habitat assessment scores of 93 and 98.

Thirteen species of fish and 305 individuals were collected from these sites, including four darter species (3 fantail darters (*Etheostoma flabellare*), 15 Johnny darters (*Etheostoma nigricans*), 1 rainbow darter (*Etheostoma caeruleum*), and 6 greenside darters (*Etheostoma blenniodes*). Greenside and Rainbow darters are classified as species that are moderately intolerant to disturbance (Ohio EPA, 1988). Additionally, 48 sand shiners (*Notropis stramineus*), also moderately intolerant to disturbance, were collected. Ten families of macroinvertebrates were collected. Three families of stoneflies (Perlidae, Perlodidae, and Capniidae) and 3 families of caddis flies (Hydropsychidae, Hydroptilidae, and Rhyacophilidae), 1 family of mayfly (Caenidae) were present. Caenid mayflies are considered disturbance tolerant species, and the absence of other mayflies is an indicator of stream degradation. The dominant taxa in Patterson Run were highly tolerant midges (Chironomidae), segmented worms (Oligochaeta), biting midges (Ceratopogonidae), and aquatic segmented worms (Oligochaeta). ***Patterson Run was determined to meet its stream designation as a warm water fishery based on the number of individual fish and presence of species of fish that included several moderately intolerant species. Despite meeting this classification, the stream appears***

to be impaired from agriculture because of the dominance of tolerant taxa and the absence of intolerant mayflies.

VII.I.4. Dilworth Mine

The following stream was undermined by Dilworth Mine, a longwall mine.

VII.I.4.a. Muddy Creek

Muddy Creek is a low gradient perennial 2nd order tributary to Ten Mile Creek in Cumberland Township, Greene County. It is classified as a warm water fishery under 25 Pa. Code Chapter 93. This stream was reported in the 2001 Supplement to have undergone subsidence related pooling because of undermining. The undermined stream segment (panel 13E west) was revisited in 2003 by the PADEP California district biologist, and in 2004 by the California District Mining Office biologist and Dr. Keogh. The land use of this stream basin is old field pasture/agriculture, with a rural residential component. Habitat assessment, fish and macroinvertebrate surveys were performed in 2003, and habitat assessment was performed along with a screening of macroinvertebrates in 2004. The stream was flowing at the time of both assessments. In 2004, this segment is a low gradient stream that has a narrow riparian zone disrupted by mowed fields. The channel is narrow and lacks sinuosity. Epifaunal and fish cover was poor. The substrate consisted primarily of silts, mud, and gravel. Riffle habitat was poor to non-existent. Subsidence related pooling was minor and did not appear to alter the pre-existing habitat of Muddy Run and its fauna. Muddy Run had a habitat assessment score of 61 in 2003, and 64 in 2004. The fish species that were collected in 2003 by the California District Mining Office biologist were consistent of species that are expected to be present in a 2nd order, low gradient stream. They included largemouth and small mouth bass (*Micropterus salmoides* and *M. dolomieu*), blue gill sunfish (*Lepomis macrochirus*), creek chubs (*Semotilus atromaculatus*), Johnny darters (*Etheostoma nigrum*), and fantail darters (*Etheostoma flabellare*). Macroinvertebrates collected by the California District Mining Office biologist in 2003 consisted of midges (Chironomidae), segmented worms (Oligochaeta), caddisflies (Hydropsychidae), and water striders (Gerridae and Microvellidae). These taxa are all tolerant of disturbance, and the overall

macroinvertebrate community structure indicate impairment. The same fauna was collected in 2004 by Dr. Keogh along with damsel flies (Coenagrionidae) and dragon flies (Gomphidae), and again are indicative of a disturbed system. Among the macroinvertebrates that were most noticeably absent that often inhabit low order, low gradient streams with muddy substrates were burrowing mayflies (Ephemeroidea) and the Caenidae mayflies. These taxa should not be affected by mining related pooling. Though *this stream is impaired, most likely as the result of agricultural practices*, including intrusion by cattle, and the elimination of a healthy riparian zone, the fish fauna that were present indicate that *the stream status attains its use as a warm water fishery*.

VII.I.5. Eighty Four Mine

The following streams were undermined by Eighty Four Mine, a longwall mine.

VII.I.5.a. Tributary 36989 to Little Chartiers Creek

Tributary 36989 is a low gradient perennial 2nd order tributary to Little Chartiers Creek in Zedicker Station, Washington County in the Ohio River basin. It is classified as a warm water fishery under 25 Pa. Code Chapter 93, and was reported in the 2001 Supplement to have suffered from subsidence related pooling and diminution of flow as a result of undermining. This stream was visited in 1999 and 2000 by Water Quality, and in 2004 by the California District Mining Office biologist (segment identification 36989_2.1607_31212). Segment 2.1607_2.6429 was undermined by 1 South panel with a depth of cover of 420 feet. Segment 2.6429_3.1212 was undermined by 2 and 3 South panels with a depth of cover of 490 feet.

Four habitat assessments were made along this reach. All categories of habitat assessment parameters ranked either marginal or poor, and there was little riparian vegetation present along this entire stretch of this stream. Pooling was evident, and riffles were essentially absent in the 2.1607_2.6429 segment (see accompanying plates for assessed stream locations). Habitat assessment scores were 55, 70, 97, and 84. Macroinvertebrates representing 6 families were collected from only one location of this stream. The Pennsylvania modified Hilsenhoff index score indicates a community

moderately tolerant of organic enrichment. Seven species of fish, all of which are considered tolerant, were collected. Regional Water Management biologists indicated that the stream is contaminated by acid mine drainage, metals, and suspended solids. This stream also receives runoff from agriculture, and a cattle auction house. Pooling similar to that which occurs as a result of subsidence caused by undermining has been noted within the drainage basin where undermining has not taken place. Some of this pooling that was observed might have occurred naturally or because of other sources. The roads and railroad bed that run along segments of this stream inhibit the stream from flowing through a naturally dynamic channel, and may have contributed to the formation of pools. ***Tributary 36989 to Little Chartiers Creek meets its warm water fishery designation, but is impaired from full attainment because of a combination of land use issues and possibly because of subsidence related pooling.***

VII.I.5.b. Tributary 36999 to Little Chartiers Creek

Tributary 36999 is a low gradient perennial 2nd order Warm Water Fishery in South Strabane Township, Washington County in the Ohio River basin that was by reported in the 2001 Supplement to have suffered from subsidence related pooling and diminution of flow as a result of undermining. This stream was visited in January (by Regional Water Management biologists) and in July 2004 by Dr. Keogh when the stream was evaluated from stream mile 1.5 to the confluence with Tributary 36989. The stream reach assessed in January received a habitat score of 106, and the segment visited in July was assigned a habitat assessment value of 111. Scores were suboptimal for instream and epifaunal cover, embededness and sediment deposition, and riffle development. All other parameters were scored as marginal to poor. Riffles and pools were shallow. Pooling was fairly extensive, but shallow, and extended for approximately 800 feet of the 1000 feet surveyed. It is likely that this pooling is the result of, at least in part, the railroad bed that runs along the south side of this stream, inhibiting the stream from following a natural course. It might also be partially caused by subsidence. Nineteen families of macroinvertebrates were noted in July, with 1 family of mayflies (Ephemeroptera), 2 families of stoneflies (Plecoptera), and 3 families of caddis flies (Trichoptera). Six species of fish were collected including 2 darter species Johnny darters (*Etheostoma*

nigricans) and barred fantailed darters (*Etheostoma flabellere*). ***Tributary 36999 is attaining its warm water fishery designation.***

VII.I.6. Emerald Mine

The following streams were undermined by Emerald Mine, a longwall mine.

VII.I.6.a. Smith Creek

Smith Creek is a perennial low gradient 2nd order tributary to Laurel Run in Franklin Township, Greene County, and is classified warm water fishery under 25 Pa. Code Chapter 93. Smith Creek was reported in the 2001 Supplement to have suffered from diminution of flow as a result of undermining. Approximately 1000 feet of Smith Run was undermined by the J and K panels. Land use in this watershed is primarily agriculture/pasture with some business and residential components, and receives runoff from Route 218. After mining, Regional Water Management biologists determined in 2002 that Smith Creek was impaired as a result of mining related diminution of flow and from grease, oil, and metal contamination. This stream was also assessed for its post-mining condition at the undermined section by the California District Mining Office biologist. (One of the sample locations was not directly over a longwall panel) The assessment was performed through habitat assessment and fish and macroinvertebrate surveys in June, 2003. Assessments were performed on an upstream, primarily riffle-dominated segment that was undermined, and a downstream section that was mainly pool/run and that had not been undermined.

At the time of the University's assessment, Smith Creek had normal flow conditions. The riparian zone and vegetative protection ranged from marginal to poor over both segments, and the banks were eroding as a result of the removal of the natural vegetation over extended lengths of this stream, especially in the riffle segment. Smith Creek received habitat assessment scores of 146 (at the mined reach) and 130 (at the un-mined segment). The fish and macrobenthic were less than optimal in their diversity at both sections of this stream. Six species of fish (43 individuals) were collected from the mined reach, and included longnose dace (*Rhinichthys cataractae*), blacknose dace

(*Rhinichthys atratulus*), blunt nose minnows (*Pimephales notatus*), Johnny darters (*Etheostoma nigrum*), creek chubs (*Semotilus atromaculatus*), and striped shiners (*Luxilus chrysocephalus*), species that are all characteristic of small 2nd order warm water streams. Whereas most of these species are pioneer/headwater species tolerant to disturbances, the Longnose Dace is a species described by the Ohio EPA (1988) as a disturbance intolerant species. Only 6 families of macroinvertebrates were collected in this reach, but included the stonefly families Perlodidae and Leuctridae, and mayfly families Heptageniidae and Siphonuridae. In the downstream reach, nine species of fish, and 44 total individuals, were collected. Longnose dace, a riffle species that had been collected at the undermined station was not present at this site. Fish species collected at this station, but not at the upstream site, included pumpkin seed sunfish (*Lepomis gibbosus*), smallmouth bass (*Micropterus salmoides*), black bullhead (*Ameiurus melas*), Stoneroller minnow (*Campostoma anomalum*), and Northern hogsucker (*Hypentelium nigricans*). All are characteristic of pools/runs in small to medium sized streams, and the Northern hogsucker and smallmouth bass are considered moderately intolerant to disturbance (Ohio EPA, 1988). Ten taxa of invertebrates were collected. With the exception of the stonefly Perlodidae, the mayfly Heptageniidae, and the caddis fly Hydropsychidae, the macroinvertebrates were species characteristic of pools, and considered tolerant to disturbance. It is possible that the lack of diversity and individuals may be related to dewatering, but the poor condition of the sediments, the amount of sediments within the stream are most likely a primary factor in the lack of diversity and numbers of individuals. ***Smith Creek meets the criteria as a warm water fishery, but, because of the marginally adequate fish and macroinvertebrate community structure, is impaired as a result of poor land management practices that resulted in riparian degradation, sediment deposition, and contaminated runoff.***

VII.I.6.b. Pursley Run

Pursley Run is a low gradient perennial 2nd order tributary to South Fork in Franklin Township, Greene County, and is classified as a warm water fishery under 25 Pa. Code Chapter 93. This stream was reported in the Act 54 1999 report supplement to have undergone subsidence related pooling as a result of being undermined by panels 7, 8, 9,

10 and 11 Right. A post-mining assessment was performed by the California District Mining Office biologist in October, 2003. Habitat assessment and macroinvertebrate and fish surveys were used to evaluate this stream. Pursley Run received a habitat assessment score of 85 at both of the two undermined segments. All habitat parameters were deemed marginal to poor, with the exception of instream cover and bank vegetation protection, which were considered sub-optimal. Bank erosion because of agriculturally induced riparian zone loss and impaction related to agricultural runoff were considered to be the primary causes of the stream degradation.

Eighteen species of fish were collected in 2003, including 3 darter species (Johnny darter, fantail darter, and greenside darter), golden redhorse, and Northern hogsuckers. The greenside darter, golden redhorse and northern hogsuckers are considered moderately intolerant to pollution. A total of 738 individuals were collected from the two 200 meter fish surveys. A total of fifteen macroinvertebrate taxa were collected. Most of the taxa are characteristic of riffles and runs. The caddis fly, Hydropsychidae, a family that requires flowing waters, but is somewhat tolerant of pollution was the dominant group. Midges (Chironomidae), riffle beetles (Elmidae), and mayflies (Baetidae), all of which are somewhat pollution tolerant riffle/run groups, were the other predominate taxa. The stoneflies (Perlodidae and Leuctridae), caddis flies (Polycentropidae and Philopotamidae), and mayfly (Isonychiidae) were taxa that were present that are considered moderately intolerant to disturbance and require flowing water. Based upon the impact of agricultural practices along this stream, which was the primary source of habitat impairment, it is highly doubtful that any mining related pooling is impacting the biology of this stream. ***Pursley Run was deemed to be attaining its stream designation as a warm water fishery*** because of the good diversity of fish species, and the numbers of individual fish that were present.

VII.I.7. Enlow Fork Mine

The following stream was undermined by Enlow Fork Mine, a longwall mine.

VII.I.7.a. Rocky Run

Rocky Run is a low gradient perennial 3rd order tributary to Enlow Fork in the Ohio River basin, and is located in East Finley Township, Washington County. It is classified as a warm water fishery under 25 Pa. Code Chapter 93. It was reported to have developed subsidence related pooling in the 2001 Supplement. Three segments of this stream were assessed by the University's representative, Dr. Keogh, in 2004. They were the stream segments that were undermined by the A 10, A 11, F 1 and F 2 panels with a depth of cover of 570 feet, and for a length of 5178 feet. The segment of Rocky Run just downstream from the East Finley Horseshoe Club on Rocky Run Road has recently undergone emergency gate cutting and stream restoration to alleviate pooling and flooding that had occurred after the undermining (see photo below). Approximately 300 feet of the banks and stream channel were cemented in this effort. Aside from eliminating instream and epifaunal cover, this "restorative" process has caused an increase in the velocity of the stream through the cemented segment. The modification ends just downstream from the covered bridge at the end of this section (see photo below). A plunge pool has formed, and massive erosion of the stream banks, has caused a doubling of the stream channel width at this point. The few trees situated on the banks at the location where the cement channel is returned to a natural channel are being undercut, have exposed roots, and will soon fall into the stream. This will have a negative effect on Rocky Run for some distance downstream through increased sediment deposition and embededness. *This segment of Rocky Run does not meet its stream designation as a warm water fishery because of the loss of spawning habitat plus the erosion, instability and sediment deposition that has occurred as a result of this restoration effort. Currently, this failure to meet the warm water fishery designation pertains only to the reach where the remediation took place and immediately downstream below the bridge.*

Table VII.4. Summary of fish collected from Rocky Run pre-mining (May 2001) stations overlying Enlow Fork F4, F5, and F6 gates and Mine panels.

Fish Species	Ohio EPA Pollution Tolerance	US EPA Pollution Tolerance	F4 Panel May 2001	F4 Gate May 2001	F5 Panel May 2001	F5 Gate May 2001	F6 Panel May 2001	F6 Gate May 2001
silverjaw minnow (<i>Ericymba buccata</i>)	NA	Intermediate			4		2	
blacknose dace (<i>Rhynchichthyes atratulus</i>)	Highly Tolerant	Tolerant	16	2	6	3	4	18
bluntnose minnow (<i>Pimephales notatus</i>)	Highly Tolerant	Tolerant	59	2	23	1	12	22
fathead minnow (<i>Pimephales promelas</i>)	Highly Tolerant	Tolerant						
central stoneroller (<i>Campostoma anomalum</i>)	NA	Intermediate	13	4	6	4		18
striped shiner (<i>Luxilus chrysocephalus</i>)	NA	Intermediate	10	2	10	4	2	6
emerald shiner (<i>Notropis atherinoides</i>)	NA	Intermediate						
creek chub (<i>Semotilus atromaculatus</i>)	Highly Tolerant	Tolerant	39	6	19		11	13
white sucker (<i>Catostomus commersoni</i>)	Highly Tolerant	Tolerant	5		4	3	3	
northern hogsucker (<i>Hypentelium nigricans</i>)	Moderately Intolerant	Intolerant	1					
stonecat madtom (<i>Noturus flavus</i>)	Common Intolerant	Intolerant						
green sunfish (<i>Lepomis cyanellus</i>)	Highly Tolerant	Tolerant			1			
pumpkinseed sunfish (<i>Lepomis gibosus</i>)	Moderately Tolerant	Intermediate						
bluegill sunfish (<i>Lepomis macrochirus</i>)	Moderately Tolerant	Intermediate						
rock bass (<i>Ambloplites rupestris</i>)	NA	Intermediate						
smallmouth bass (<i>Micropterus dolomieu</i>)	Moderately Intolerant	Intermediate						
largemouth bass (<i>Micropterus salmoides</i>)	NA	Intermediate						
fantail darter (<i>Etheostoma flabellare</i>)	NA	Intermediate	41	17	22	16	26	31
greenside darter (<i>Etheostoma blennioides</i>)	Moderately Intolerant	Intermediate						
rainbow darter (<i>Etheostoma caeruleum</i>)	Moderately Intolerant	Intermediate	2					1
johnny darter (<i>Etheostoma nigrum</i>)	NA	Intermediate	7	1	3		5	2
	Total Number of Species		11	7	10	6	8	8

From Pike Environmental Consulting Prepared for Consol, 2002

Table VII.5. Summary of fish collected from Fish Collected from Rocky Run pre-mining (September 2001) stations overlying Enlow Fork F4, F5, and F6 Gates and mine panels.

Fish Species	Ohio EPA Pollution Tolerance	US EPA Pollution Tolerance	F4 Panel	F4 Gate	F5 Panel	F5 Gate	F6 Panel	F6 Gate
silverjaw minnow (<i>Ericymba buccata</i>)	NA	Intermediate	46	3	18	7	32	5
blacknose dace (<i>Rhynchichthyes atratulus</i>)	Highly Tolerant	Tolerant	73	26	16	9	45	10
bluntnose minnow (<i>Pimephales notatus</i>)	Highly Tolerant	Tolerant	396	13	135	25	45	10
fathead minnow (<i>Pimephales promelas</i>)	Highly Tolerant	Tolerant						
central stoneroller (<i>Campostoma anomalum</i>)	NA	Intermediate	24	6	19	7	10	8
striped shiner (<i>Luxilus chrysocephalus</i>)	NA	Intermediate	6	3	15	11	4	12
emerald shiner (<i>Notropis atherinoides</i>)	NA	Intermediate						
creek chub (<i>Semotilus atromaculatus</i>)	Highly Tolerant	Tolerant	377	49	19	45	74	38
white sucker (<i>Catostomus commersoni</i>)	Highly Tolerant	Tolerant	8	7	28	2	8	16
northern hogsucker (<i>Hypentelium nigricans</i>)	Moderately Intolerant	Intolerant		1	1	2		2
stonecat madtom (<i>Noturus flavus</i>)	Common Intolerant	Intolerant						
green sunfish (<i>Lepomis cyanellus</i>)	Highly Tolerant	Tolerant			1	1		2
pumpkinseed sunfish (<i>Lepomis gibosus</i>)	Moderately Tolerant	Intermediate						
bluegill sunfish (<i>Lepomis macrochirus</i>)	Moderately Tolerant	Intermediate						
rock bass (<i>Ambloplites rupestris</i>)	NA	Intermediate						
smallmouth bass (<i>Micropterus dolomieu</i>)	Moderately Intolerant	Intermediate						
largemouth bass (<i>Micropterus salmoides</i>)	NA	Intermediate						
fantail darter (<i>Etheostoma flabellare</i>)	NA	Intermediate	114	16	41	25	22	9
greenside darter (<i>Etheostoma blennioides</i>)	Moderately Intolerant	Intermediate				1		
rainbow darter (<i>Etheostoma caeruleum</i>)	Moderately Intolerant	Intermediate	5			2	2	
johnny darter (<i>Etheostoma nigrum</i>)	NA	Intermediate	91	4	6	3	8	6
	Total Number of Species		10	10	11	13	10	11

From Pike Environmental Consulting Prepared for Consol, 2002

Table VII.6. Summary of fish collected from Fish Collected from Rocky Run post-mining (December, 2003 and July, 2004) stations overlying Enlow Fork F4, F5, and F6 gates and mine panels.

Fish Species	Ohio EPA Pollution Tolerance	US EPA Pollution Tolerance	A10 Panel 2003	A10 Panel 2004	F1 + F2 Panels 2003	F1 + F2 Panels 2004
silverjaw minnow (<i>Ericymba buccata</i>)	NA	Intermediate		9		3
blacknose dace (<i>Rhynchichthyes atratulus</i>)	Highly Tolerant	Tolerant		1		
bluntnose minnow (<i>Pimephales notatus</i>)	Highly Tolerant	Tolerant	29	22	18	59
fathead minnow (<i>Pimephales promelas</i>)	Highly Tolerant	Tolerant		1		16
central stoneroller (<i>Campostoma anomalum</i>)	NA	Intermediate	38	2	17	7
striped shiner (<i>Luxilus chrysocephalus</i>)	NA	Intermediate	2		2	9
emerald shiner (<i>Notropis atherinoides</i>)	NA	Intermediate	13	5	8	25
creek chub (<i>Semotilus atromaculatus</i>)	Highly Tolerant	Tolerant	5	11	8	8
white sucker (<i>Catostomus commersoni</i>)	Highly Tolerant	Tolerant	9		3	38
northern hogsucker (<i>Hypentelium nigricans</i>)	Moderately Intolerant	Intolerant	1			
stonecat madtom (<i>Noturus flavus</i>)	Common Intolerant	Intolerant		1		
green sunfish (<i>Lepomis cyanellus</i>)	Highly Tolerant	Tolerant				6
pumpkinseed sunfish (<i>Lepomis gibosus</i>)	Moderately Tolerant	Intermediate	6	1	5	14
bluegill sunfish (<i>Lepomis macrochirus</i>)	Moderately Tolerant	Intermediate		2	1	5
rock bass (<i>Ambloplites rupestris</i>)	NA	Intermediate	1	4		
smallmouth bass (<i>Micropterus dolomieu</i>)	Moderately Intolerant	Intermediate	6	1		
largemouth bass (<i>Micropterus salmoides</i>)	NA	Intermediate				1
fantail darter (<i>Etheostoma flabellare</i>)	NA	Intermediate	26	16	5	30
greenside darter (<i>Etheostoma blennioides</i>)	Moderately Intolerant	Intermediate	15	4		2
rainbow darter (<i>Etheostoma caeruleum</i>)	Moderately Intolerant	Intermediate	3	3	1	4
johnny darter (<i>Etheostoma nigrum</i>)	NA	Intermediate	14			6
		Total Number of Species	14	15	10	16

VII.J.7.b. Templeton Fork

Templeton Fork is a low gradient perennial 3rd order tributary to Enlow Fork in the Ohio River basin. It is located in East Finley Township, Washington County and has been classified as a trout stocking fishery under 25 Pa. Code Chapter 93. This stream has been undermined by the A1-A11, E1-E4, and the F1-F8 panels of Enlow Fork Mine. The Templeton Fork basin is a mix of agriculture/pasture, old field, and forest, with some sparse residential land use. It was reported to have developed subsidence related pooling in the Act 54, 1999 Supplement.

A9 Panel

This segment of Templeton Fork was undermined in 1998. The California District Mining Office biologist evaluated the current condition of this reach in August 2003 using habitat assessment and macroinvertebrate and fish surveys. This segment scored a 146, considered sub-optimal, in fish habitat assessment using PA DEP's surface water assessment protocol.

Twenty four taxa of macroinvertebrates were collected including 9 families from the EPT complex. Six mayfly (Ephemeroidea, Caenidae, Isonychiidae, Heptageniidae, Siphonuridae, and Baetidae), 2 stonefly (Perlidae and Perlodidae), and 3 caddis fly (Philopotamidae, Polycentropidae, and Hydropsychidae) families represented this group. The diversity of this generally disturbance-intolerant group and the overall diversity of the macrobenthic community is indicative of a healthy and relatively undisturbed stream. Eighteen species of fish were collected during the survey (see accompanying tables below). Four tolerant species (creek chub, blacknose dace, bluntnose minnow, and white sucker) and 14 moderately intolerant species, including 1 rainbow trout and five darter species, were present in the survey. Darters comprised approximately 23% of the fish population. The fish community is typical of a relatively undisturbed and healthy 3rd order stream in southwestern Pennsylvania. The section of Templeton Fork undermined by the A9 panel attains its protective status designation as a trout stocked fishery based on the diverse fauna present.

A10-A11 Panels

This reach of Templeton Fork was undermined by Enlow Fork Mine in 1998 for a length of approximately 2000 feet. Consol performed an emergency gate cutting over a 600-foot area between the A10 and A11 panels in 1998 within this section of Templeton Fork to alleviate occasional upstream flooding. Eight hundred cubic yards of overly loose material (cobble, gravel, sand) were removed during this process. CEC assessed the stream reach in December 1999, one year after the gate cutting. It was concluded that the A11 panel had improved biology and habitat in comparison to an uncut panel (see accompanying tables below). Ten species of fish were collected from the undermined panel and 13 species were collected from the cut gate versus 7 species from the uncut panel (A8) and 9 species from the uncut gate (A7). However, they believed that the removal of substrate resulted in a reduced macroinvertebrate community and habitat score, at least temporarily, as a result of the removal of substrates (CEC 2000). Regional Water Management biologists assessed this section, plus the segment undermined by the F1 panel, of Templeton Fork in 2000. They determined that the reach was impaired as a result of subsidence related pooling and siltation. This determination was based on the observation of pooling (in part from a beaver dam, partially from mining) upstream and downstream from where they sampled. The California District Mining Office biologist evaluated this reach undermined by A10-A11 panels in 2003 using habitat assessment, and fish and macroinvertebrate surveys as tools in his determination. Seventeen species of fish were collected (see accompanying tables below). Three intolerant (black redhorse, stonect madtom, and longnose dace) and 3 tolerant (bluntnose minnow, white sucker, and creek chub) species were noted. The remaining 11 species were of intermediate tolerance, indicating an improvement of instream conditions. This segment scored 147, sub-optimal, in the habitat assessment, using DEP's surface water assessment protocol. Riparian width scored the worst, largely the result of Templeton Road along the right-hand bank and the lack of canopy. Bank condition, channel flow status, Bank conditions, and the infrequency of riffles also contributed to the score of less than optimal. The macrobenthic community was represented in the survey by 18 families. This included 8 families from the EPT complex. This included 4 mayfly (Ephemeroidea, Baetidae, Siphonuridae, and Isonychiidae), 1 stonefly (Perlodidae), and 3 caddisfly

(Hydropsychidae, Philoptomidae, and Limnephilidae). The percent dominant taxa (Hydropsychidae) was a respectable 19.96%. The results of this assessment of Templeton Run indicate that the A10 and A11 reach of Templeton Fork is unimpaired. Panels A1-A7. The reach of Templeton Fork undermined by panels A1-A7 is a low gradient 4th order river that extends from the confluence of Templeton Fork and Enlow Fork to just downstream from the mouth of Rocky Run. The California District Mining Office biologist visited this breach in September 2003. Two stations within this segment were evaluated for macroinvertebrates and fish and a habitat assessment was performed. Habitat scores of 93 and 99 were assigned. Based on DEP's surface water assessment protocol, these sites rated poor. Fifteen and 18 macroinvertebrate taxa were collected from these stations, and included 6 and 7 EPT taxa, respectively. This reach of Templeton Fork was determined to be unimpaired.

Templeton Fork meets its stream designation as a trout stocking fishery.

Table VII.7. Summary of Templeton Fork Fish Collected from reference and post-gate cutting undermined (1999) stations overlying Enlow Fork Mine panels A8, A11, and gates A7 and A10.

Fish Species	Ohio EPA Pollution Tolerance	US EPA Pollution Tolerance	A11 Cut Panel 1999	A10 Cut Gate 1999	A8 Uncut Panel 1999	A7 Uncut Gate 1999	A10-A11 Panel 2003	E02 Panel 2003
silverjaw minnow (<i>Ericymba buccata</i>)	NA	Intermediate		9				
blacknose dace (<i>Rhynchithyes atratulus</i>)	Highly Tolerant	Tolerant	37	1		8		
longnose dace (<i>Rhynchithyes cataractae</i>)	Rare Intolerant	Intolerant					1	
reidside dace (<i>Clinostoma elongates</i>)	Common Intolerant	Intolerant						
bluntnose minnow (<i>Pimephales notatus</i>)	Highly Tolerant	Tolerant	12	72	8	6	19	12
bullhead minnow (<i>Pimephales vigilax</i>)	NA	Intermediate						
central stoneroller (<i>Campostoma anomalum</i>)	NA	Intermediate	231	83		51	37	41
striped shiner (<i>Luxilus chrysocephalus</i>)	NA	Intermediate	3			1	10	17
sand shiner (<i>Notropis stramineus</i>)	Moderately Intolerant	Intermediate						
emerald shiner (<i>Notropis photogenis</i>)	NA	Intolerant		1			1	24
silver shiner (<i>Notropis photogenis</i>)	Common Intolerant	Intolerant						
creek chub (<i>Semotilus atromaculatus</i>)	Highly Tolerant	Tolerant	19	2		5	11	3
white sucker (<i>Catostomus commersoni</i>)	Highly Tolerant	Tolerant	3	2		2	2	8
golden redhorse (<i>Moxostoma erythrurum</i>)	Moderately Intolerant	Intermediate						
black redhorse (<i>Moxostoma duquesnei</i>)	Common Intolerant	Intolerant					3	3
northern hogsucker (<i>Hypentelium nigricans</i>)	Moderately Intolerant	Intolerant	12	14			16	12
stonecat madtom (<i>Noturus flavus</i>)	Common Intolerant	Intolerant	1					1
green sunfish (<i>Lepomis cyanellus</i>)	Highly Tolerant	Tolerant			2			
pumpkinseed sunfish (<i>Lepomis gibosus</i>)	Moderately Tolerant	Intermediate						
bluegill sunfish (<i>Lepomis macrochirus</i>)	Moderately Tolerant	Intermediate			1			
longear sunfish (<i>Lepomis megalotus</i>)	Common Intolerant	Intolerant						
rock bass (<i>Ambloplites rupestris</i>)	NA	Intermediate					3	2
smallmouth bass (<i>Micropterus dolomieu</i>)	Moderately Intolerant	Intermediate		1	1		5	3
largemouth bass (<i>Micropterus salmoides</i>)	NA	Intermediate			1			
spotted bass (<i>Micropterus punctulatus</i>)	NA	Intermediate						
rainbow trout (<i>Oncorhynchus mykiss</i>)	NA							
fantail darter (<i>Etheostoma flabellare</i>)	NA	Intermediate	10	7		2	23	15
greenside darter (<i>Etheostoma blennioides</i>)	Moderately Intolerant	Intermediate		3	1	3	11	29
rainbow darter (<i>Etheostoma caeruleum</i>)	Moderately Intolerant	Intermediate	12	11		9	1	21
johnny darter (<i>Etheostoma nigrum</i>)	NA	Intermediate		25	6		10	10
logperch darter (<i>Percina caprodes</i>)	Moderately Intolerant	Intermediate					4	
blackside darter (<i>Percina maculata</i>)	NA	Intermediate					3	
	Total Number of Species		10	13	7	9	17	15

From Civil and Environmental Consultants Project 98786.0025. Prepared for Consol Pennsylvania Coal Company, 1999.

Table VII.8. Summary of Templeton Fork Fish Collected from Pre-Mining (May 2001) stations overlying Enlow Fork F4, F5, and F6 Gates and Mine Panels.

Fish Species	Ohio EPA Pollution Tolerance	US EPA Pollution Tolerance	F4 Panel May 2001	F4 Gate May 2001	F5 Panel May 2001	F5 Gate May 2001	F6 Panel May 2001	F6 Gate May 2001
silverjaw minnow (<i>Ericymba buccata</i>)	NA	Intermediate			4	27		3
blacknose dace (<i>Rhynchithyes atratulus</i>)	Highly Tolerant	Tolerant	44	54	25	6	3	1
longnose dace (<i>Rhynchithyes cataractae</i>)	Rare Intolerant	Intolerant						
redside dace (<i>Clinostoma elongates</i>)	Common Intolerant	Intolerant		1				1
bluntnose minnow (<i>Pimephales notatus</i>)	Highly Tolerant	Tolerant	38	23	128	109	2	12
bullhead minnow (<i>Pimephales vigilax</i>)	NA	Intermediate						1
central stoneroller (<i>Campostoma anomalum</i>)	NA	Intermediate	33	76	42	11		12
striped shiner (<i>Luxilus chrysocephalus</i>)	NA	Intermediate	4	6	3			1
sand shiner (<i>Notropis stramineus</i>)	Moderately Intolerant	Intermediate			1			
emerald shiner (<i>Notropis atherinoides</i>)	NA	Intermediate						
silver shiner (<i>Notropis photogenis</i>)	Common Intolerant	Intolerant						
creek chub (<i>Semotilus atromaculatus</i>)	Highly Tolerant	Tolerant	23	25	57	12	1	1
white sucker (<i>Catostomus commersoni</i>)	Highly Tolerant	Tolerant		14	12		1	6
golden redhorse (<i>Moxostoma erythrurum</i>)	Moderately Intolerant	Intermediate						
black redhorse (<i>Moxostoma duquesnei</i>)	Common Intolerant	Intolerant						
northern hogsucker (<i>Hypentelium nigricans</i>)	Moderately Intolerant	Intolerant		10	3	3		4
stonecat madtom (<i>Noturus flavus</i>)	Common Intolerant	Intolerant		1	1			
green sunfish (<i>Lepomis cyanellus</i>)	Highly Tolerant	Tolerant						
pumpkinseed sunfish (<i>Lepomis gibosus</i>)	Moderately Tolerant	Intermediate						
bluegill sunfish (<i>Lepomis macrochirus</i>)	Moderately Tolerant	Intermediate		1				
longear sunfish (<i>Lepomis megalotus</i>)	Common Intolerant	Intolerant						1
rock bass (<i>Ambloplites rupestris</i>)	NA	Intermediate		4		1		3
smallmouth bass (<i>Micropterus dolomieu</i>)	Moderately Intolerant	Intermediate				1	1	6
largemouth bass (<i>Micropterus salmoides</i>)	NA	Intermediate						
spotted bass (<i>Micropterus punctulatus</i>)	NA	Intermediate						
rainbow trout (<i>Oncorhynchus mykiss</i>)	NA							
fantail darter (<i>Etheostoma flabellare</i>)	NA	Intermediate	72	103	49	46	17	64
Table VII.G. continued								
greenside darter (<i>Etheostoma blennioides</i>)	Moderately Intolerant	Intermediate	4	13		1	2	
rainbow darter (<i>Etheostoma caeruleum</i>)	Moderately Intolerant	Intermediate	17	48	28		9	1
johnny darter (<i>Etheostoma nigrum</i>)	NA	Intermediate	4	6	22	13		1
logperch darter (<i>Percina caprodes</i>)	Moderately Intolerant	Intermediate						
blackside darter (<i>Percina maculata</i>)	NA	Intermediate						
	Total Number of Species		9	15	13	11	8	16

From Pike Environmental Consulting Prepared for Consol, 2002

Table VII.9. Summary of Templeton Fork Fish Collected from Post-Mining (September, 2001) stations overlying Enlow Fork F4, F5, and F6 Gates and Mine Panels.

Fish Species	Ohio EPA Pollution Tolerance	US EPA Pollution Tolerance	F4 Panel Sept. 2001	F4 Gate Sept. 2001	F5 Panel Sept. 2001	F5 Gate Sept. 2001	F6 Panel Sept. 2001	F6 Gate Sept. 2001
silverjaw minnow (<i>Ericymba buccata</i>)	NA	Intermediate			26	2	1	5
blacknose dace (<i>Rhynchithyes atratulus</i>)	Highly Tolerant	Tolerant	33	72	32	30	29	3
longnose dace (<i>Rhynchithyes cataractae</i>)	Rare Intolerant	Intolerant						
reduceside dace (<i>Clinostoma elongates</i>)	Common Intolerant	Intolerant						
bluntnose minnow (<i>Pimephales notatus</i>)	Highly Tolerant	Tolerant	5	42	104	24	31	104
bullhead minnow (<i>Pimephales vigilax</i>)	NA	Intermediate						
central stoneroller (<i>Campostoma anomalum</i>)	NA	Intermediate	15	91	92	8	13	32
striped shiner (<i>Luxilus chrysocephalus</i>)	NA	Intermediate			10		1	5
sand shiner (<i>Notropis stramineus</i>)	Moderately Intolerant	Intermediate						
emerald shiner (<i>Notropis atherinoides</i>)	NA	Intermediate						
silver shiner (<i>Notropis photogenis</i>)	Common Intolerant	Intolerant						
creek chub (<i>Semotilus atromaculatus</i>)	Highly Tolerant	Tolerant	29	98	112	57	27	26
white sucker (<i>Catostomus commersoni</i>)	Highly Tolerant	Tolerant		22	28	10	7	9
golden redhorse (<i>Moxostoma erythrurum</i>)	Moderately Intolerant	Intermediate						
black redhorse (<i>Moxostoma duquesnei</i>)	Common Intolerant	Intolerant						
northern hogsucker (<i>Hypentelium nigricans</i>)	Moderately Intolerant	Intolerant	2		3	1	5	
stonecat madtom (<i>Noturus flavus</i>)	Common Intolerant	Intolerant			1	2	2	1
green sunfish (<i>Lepomis cyanellus</i>)	Highly Tolerant	Tolerant						
pumpkinseed sunfish (<i>Lepomis gibosus</i>)	Moderately Tolerant	Intermediate						
bluegill sunfish (<i>Lepomis macrochirus</i>)	Moderately Tolerant	Intermediate						
longear sunfish (<i>Lepomis megalotus</i>)	Common Intolerant	Intolerant						
rock bass (<i>Ambloplites rupestris</i>)	NA	Intermediate				1		4
smallmouth bass (<i>Micropterus dolomieu</i>)	Moderately Intolerant	Intermediate		2	2	1	2	4
largemouth bass (<i>Micropterus salmoides</i>)	NA	Intermediate						
spotted bass (<i>Micropterus punctulatus</i>)	NA	Intermediate						2
rainbow trout (<i>Oncorhynchus mykiss</i>)	NA							
fantail darter (<i>Etheostoma flabellare</i>)	NA	Intermediate	43	101	36	27	44	85
greenside darter (<i>Etheostoma blennioides</i>)	Moderately Intolerant	Intermediate	3	10	9	4	2	9
rainbow darter (<i>Etheostoma caeruleum</i>)	Moderately Intolerant	Intermediate	24	61	19	15	25	14
johnny darter (<i>Etheostoma nigrum</i>)	NA	Intermediate	5	10	13	8	4	13
logperch darter (<i>Percina caprodes</i>)	Moderately Intolerant	Intermediate						
blackside darter (<i>Percina maculata</i>)	NA	Intermediate						
Total Number of Species			9	10	14	14	14	15

From Pike Environmental Consulting Prepared for Consol, 2002

Table VII.10. Summary of Templeton Fork Fish Collected in 2003 from Undermined stations overlying Enlow Fork Mine panels.

Fish Species	Ohio EPA Pollution Tolerance	US EPA Pollution Tolerance	A8-A9 Panel	A10-F1 Panel	Station E001 A5 Panel	Station E002 A6-A7 Panel
silverjaw minnow (<i>Ericymba buccata</i>)	NA	Intermediate				
blacknose dace (<i>Rhynchithyes atratulus</i>)	Highly Tolerant	Tolerant	11			
longnose dace (<i>Rhynchithyes cataractae</i>)	Rare Intolerant	Intolerant		1		
reidside dace (<i>Clinostoma elongates</i>)	Common Intolerant	Intolerant				
bluntnose minnow (<i>Pimephales notatus</i>)	Highly Tolerant	Tolerant	83	19		12
bullhead minnow (<i>Pimephales vigilax</i>)	NA	Intermediate				
central stoneroller (<i>Campostoma anomalum</i>)	NA	Intermediate	53	37		41
striped shiner (<i>Luxilus chrysocephalus</i>)	NA	Intermediate	7	10	2	17
sand shiner (<i>Notropis stramineus</i>)	Moderately Intolerant	Intermediate				
emerald shiner (<i>Notropis photogenis</i>)	NA	Intolerant	8	1		24
silver shiner (<i>Notropis photogenis</i>)	Common Intolerant	Intolerant	5			
creek chub (<i>Semotilus atromaculatus</i>)	Highly Tolerant	Tolerant	10	11		3
white sucker (<i>Catostomus commersoni</i>)	Highly Tolerant	Tolerant	7	2	29	8
golden redhorse (<i>Moxostoma erythrurum</i>)	Moderately Intolerant	Intermediate	18		1	
black redhorse (<i>Moxostoma duquesnei</i>)	Common Intolerant	Intolerant		3	28	3
northern hogsucker (<i>Hypentelium nigricans</i>)	Moderately Intolerant	Intolerant	8	16	5	12
stonecat madtom (<i>Noturus flavus</i>)	Common Intolerant	Intolerant				1
green sunfish (<i>Lepomis cyanellus</i>)	Highly Tolerant	Tolerant				
pumpkinseed sunfish (<i>Lepomis gibosus</i>)	Moderately Tolerant	Intermediate			3	
bluegill sunfish (<i>Lepomis macrochirus</i>)	Moderately Tolerant	Intermediate			7	
longear sunfish (<i>Lepomis megalotus</i>)	Common Intolerant	Intolerant				
rock bass (<i>Ambloplites rupestris</i>)	NA	Intermediate	1	3	7	2
smallmouth bass (<i>Micropterus dolomieu</i>)	Moderately Intolerant	Intermediate	3	5	8	3
largemouth bass (<i>Micropterus salmoides</i>)	NA	Intermediate			1	
spotted bass (<i>Micropterus punctulatus</i>)	NA	Intermediate				
rainbow trout (<i>Oncorhynchus mykiss</i>)	NA		1			
fantail darter (<i>Etheostoma flabellare</i>)	NA	Intermediate	19	23		15
greenside darter (<i>Etheostoma blennioides</i>)	Moderately Intolerant	Intermediate	12	11	2	29
rainbow darter (<i>Etheostoma caeruleum</i>)	Moderately Intolerant	Intermediate	24	1		21
johnny darter (<i>Etheostoma nigrum</i>)	NA	Intermediate	9	10	5	10
logperch darter (<i>Percina caprodes</i>)	Moderately Intolerant	Intermediate		4		
blackside darter (<i>Percina maculata</i>)	NA	Intermediate	2	3		

		Total Number of Species	18	17	12	15
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VII.J. Streams That Were Undermined Prior to the First Five-Year Act 54 Report

VII.J.1. Cambria 33 Mine

The following stream was undermined by Cambria 33 Mine.

VII.J.1.a. Howells Run

Howells run is a perennial 2nd order Cold Water Fishery tributary to the Little Conemaugh River in Township, Cambria County. It was undermined by Cambria 33 mine longwall panels from 1983-1989. Howells Run was reportedly dewatered during the undermining process. The stream was assessed by the California District Mining Office biologist during 2003 just upstream from the US Steel reservoir, and by the PA DEP California District Mining Office biologist and Dr. Keogh in 2004. The segment of this stream that was assessed in 2004 was a 200-yard upstream reach above Rte. 2013 near Howells Run Road. The riparian zone downstream from the bridge and for approximately 150 feet upstream from the bridge was reduced to old field. Forest was present for a minimum of 400 feet further upstream, especially on the left bank. Evidence of channelization within the past 15 years upstream from the bridge in the form of riprap banks was present, and decreased the habitat score. The substrates were composed primarily of boulder/slab and cobble. Algae were present on the boulders. Siltation and impaction were light to moderate. Howells Run was assigned a habitat assessment score of 176. The upstream, reach, which had been completely dewatered, displayed a fish fauna that consisted primarily of young of the year Yellow Perch (*Perca flavescens*). A small ledge within the stream (see photo below) appeared to serve as a barrier to the perch, and this segment was dominated by the long-nosed dace (*Rhinichthys cataractae*), a species that inhabits cool (4-16° C), fast, small to mid-sized streams with cobble and gravel riffles. Brown trout (*Salmo trutta*) that were native to Howell's Run, rock bass (*Ambloplites rupestris*), and creek chub (*Semotilus atromaculatus*) were also found in this section. Both segments of the stream had a well-developed macrobenthic fauna, which included four families of caddis flies (Trichoptera), four families of mayflies (Ephemeroptera), two families of stoneflies (Plecoptera). Individuals from the stonefly genus *Acroneuria*, which has a multi-year nymph life-cycle, were present. The fish species present upstream from the ledge are most probably derived from populations

that existed upstream from the dewatered segment. Longnose dace (*Rhinichthys cataractae*) is a disturbance intolerant species, and rock bass is considered to be moderately intolerant to disturbance (Ohio EPA 1988). This reach upstream from the ledge, despite having relatively low fish species diversity and population densities, has a fairly healthy and stable community structure because of the presence of these species in appropriate proportions (dominant insectivores with lesser numbers of carnivores). On the other hand, the reach downstream from the ledge is dominated by young of the year (no adults were captured) yellow perch, which is a piscivorous species. This segment is *biologically unstable* because of this dominance.

Though the segment appears to be hydrologically recovered from the dewatering, progression to a healthy and stable fish community structure is most likely impeded by two factors. First, the reservoir probably serves as a barrier that inhibits the migration of



stream species into Howells Run from other sources. Secondly, the young of the year perch are probably feeding on the eggs and fry of fish species that migrate downstream and use this segment for breeding. For full recovery to occur, it may be necessary to introduce adult carnivore fish species to reduce spawning success of perch in the area, and follow

this up by introducing appropriate smaller stream fish species later. ***Howells Run attains its designation as a cold water fishery, though some fish community structure impairment exists.***

VII.J.1.b. Roaring Run

Roaring Run is a perennial 2nd order tributary to the Little Conemaugh River in Cambria Township in Cambria County. It is classified as a cold water fishery under 25 Pa. Code Chapter 93. Roaring Run was undermined 16 years prior to the current assessment

period and is included in this report for purposes of evaluating the long-term effects of longwall mining operations.

Roaring Run had been reported to suffer from diminution of flow during summer months beginning in July 1982 and continuing through 1989 (Department of Environmental Resources Bureau of Mining and Reclamation, 1989). Roaring Run was extensively undermined by six panels (2 north of Route PA 160, and 4 south of Route PA 160), for a total length of 10,100 feet between 1980-1988. The PA DEP determined that the undermining was the cause of the dewatering, and that the process was ongoing at the time of the 1989 report. In its report, the PA DEP found that the natural balance of macroinvertebrates and fish had been disrupted in approximately one and a half miles of the stream and that Hydropsychid caddisflies, a major invertebrate component of perennial flowing waters were essentially absent in the diminished section. Although the PA DEP ordered the mine operator to restore the stream, restoration work was never undertaken. The Environmental Hearing Board overturned the PA DEP's order, finding that PA DEP had failed to demonstrate that the stream had continuous flow prior to mining.

Recently, the stream was re-examined to determine its current condition. Post-mining assessments were performed in 2003 by the PA DEP California District Office biologist, and in July 2004 by the PA DEP California District Office biologist and Dr. Keogh. Habitat assessment and fish and macroinvertebrate sampling were performed over a 200-yard segment upstream from the bridge near the confluence of Roaring Run and Howells Run (see accompanying plate; SR 2013). Land use in this area is primarily forest with pipeline and electrical line right-of-ways and is lightly populated. Stream flow and depth appeared normal for a 2nd order stream, with well-developed riffles and pools, and a full channel. Numerous springs fed into Roaring Run in the section upstream from Route 160. A forested riparian zone was present. Slight to moderate impaction and siltation were present which appeared to be from, in part, the flow of sand from the springs into the stream. The substrate consisted primarily of boulder/cobble with some sand and gravel, and the epifaunal cover was good. Roaring Run was assigned a habitat

assessment score of 200 in 2003 and 2004. The fish community was dominated by pioneering species, but also contained pumpkinseed sunfish (*Lepomis gibbosus*) in the pools, and blacknose dace (*Rhinichthys atratulus*) throughout the stream. *Both of these species are characteristic of perennial streams.* When this stream had been sampled in 1989 by PA DEP, all of the fish were believed to be young of the year in this section, an indication of intermittency.

In 2004, multiple age classes (based on size difference) were observed. Brook trout (*Salvelinus fontinalis*), which had been collected in 1989, were not observed during the sampling in 2004. The macroinvertebrate community structure was typical of a small 2nd order headwater stream, and included mature multi-year life cycle stoneflies (Plecoptera *Acroneuria sp.*) and the slow growth seasonal caddis fly family Hydropsychidae. These insects require perennial stream conditions, and were not present in this stream reach in 1989. The flow conditions that were observed at Roaring Run in late July 2004 as well as the presence of fish and macroinvertebrates characteristic of a perennial *stream lead to the conclusion that the condition of Roaring Run has improved since 1989 and that the stream has returned to perennial flow status. Roaring Run meets the criteria for a cold water fishery.*

VII.K. A Report on an Impacted Stream that had been Undermined in the 1980's

VII.K.1. South Branch of Two Lick Creek

South Branch of Two Lick Creek is a perennial 2nd order Trout Stocking Fishery located east of Cooksport, Indiana County. This stream segment was undermined by Greenwich Mine, a room-and-pillar mine, in the 1980s and was reported to have suffered from loss of flow. Two segments of this tributary were visited and assessed during 2003 by the California District Mining Office biologist and 2004 by Dr. Keogh. In 2004, flow had returned to all segments of the stream. The upstream segment was characterized by a well-developed forested riparian zone, stable banks, good epifauna and fish cover, and boulder/gravel substrates devoid of silt. This reach achieved a habitat assessment score of 206. No fish were encountered by the PA DEP investigator in 1993, but the

investigator found a sufficient macrobenthic community to support a Stocked Trout Fishery. The macrobenthic fauna included 6 Stonefly (Plecoptera), 3 Mayfly (Ephemeroptera), and 4 Caddisfly (Trichoptera) families.

Fish were present in this reach in 2004 and included stream bred, young of the year Brown Trout (*Salmo trutta*). ***This stream segment is recovering from dewatering and is attaining its function as a Stocked Trout Fishery.*** The reach downstream from the mine drainage treatment facility had a riparian zone that had evidence of human activity as a result of construction of the treatment plant and its discharge stream into South Branch of Two Lick. Fewer trees were present and vegetation along the banks (which showed evidence of erosion) was reduced. The streambed contained some deposits of unstable alluvium and impaction was sub-optimal. The habitat evaluation score for this stream segment was 194. Fish collected included 8 adult brown trout (*Salmo trutta*) and Mottled Sculpin (*Cottus bairdii*). ***The fish and macroinvertebrate communities were appropriate for a Trout Stocking Fishery and impact from mine activity was not evident.***

VII.L. Investigations of Impacted Streams Conducted by the California District Mining Office during the Assessment Period: Summaries of Paper Files

During the assessment period, the California District Mining Office investigated a number of streams and ponds actually or supposedly impacted by underground mining. Surface subsidence agents and compliance officers variously visited streams to observe reported problems and reported in memoranda their stream observations in a manner that does not uniformly identify the streams by a specific segment number.

Because the memoranda do not always contain the precise locations of an investigated stream, matching segments that were visited by the University to those visited by the California District Mining Office is tenuous at best. Nevertheless, the memoranda are important indicators of the extent to which streams and ponds are affected or perceived to be affected by underground mining. **Twenty-two streams and/or ponds** had associated reports of impact during the assessment period. The following summarizes the

information that the University found in the written reports of agents of the California District Mining Office on some of the streams impacted during the assessment period. (The stream names in the following list are reported here as they are reported in the memoranda) The uneven coverage of information reflects the nature of the reports read by the University's researchers. Surface subsidence agents and compliance officers apparently visited a stream in question and then wrote their observations or recorded their observations orally for later dictation. Readers of this Act 54 report should not, however, conclude that the unevenness of the reports reflects the only response to a reported problem by the California District Mining Office.

These reports indicate that agents of the California District Mining Office investigated the stream in question within a reasonable period following the faxed report of a problem. A thorough reading of the reports indicates that the investigators from the California District Mining Office examined more than the length of streams purported to have subsidence impacts. It is the understanding of the University that following such observations as appear below, the California District Mining Office compliance officers and biologist further investigated the streams with purported impacts to monitor the condition of the sites in question and, when they judged necessary, to make recommendations or require restorative actions. (If necessary, the California District Mining Office compliance officers issue "orders" to mine operators who were in noncompliance) With the exception of the direct quotations, the following paragraphs are paraphrases of the original field observations.

VII.L.1. Shriver Run

This stream was observed in the spring of 2003 and found to be dry. Undermined by Emerald Mine, the stream was observed to have "good flows except for a period from late July thru [sic.] September prior to mining in both 2001 and 2002 when I (California District Mining Office surface agent) noted the stream was dry." A tributary, referred to as the "Humane Society segment" had undermining in the underlying 4 North panel that began in May 2000 and that ended in April 2001. The depth of cover ranges from 700

feet near the headgate of 3 North panel to 425 feet near the headgate of 5 North panel at the confluence with Laurel Run.

VII.L.2. Dyers Fork (Two Separate Observations)

This stream was observed in the late summer and in the fall of 2002. Underlain by Emerald Mine at a mine depth of 545 feet at the headwaters, the stream flows into the 45 panel area. This stream had been observed pre-mining to have “good flows.” Longstanding ponds within the stream’s drainage basin that overlie 45 panel and 46 panel were dry in August 2002. In September, the stream had flow in some sections, but one section was dry. Natural riffle zones were dry in October: “Generally, the stream would disappear 300 to 400 feet behind the face [of the advancing panel] but would maintain flow immediately in advance of the panel face. In one instance, the stream lost flow on both sides of the panel face [leading edge].

This stream was observed to have ponds in the spring of 2003.

VII.L.3. Tributary 32653 to Robinson Fork

This stream overlies Bailey Mine panels 4D and 3D and was investigated in the summer of 2002. Depth to mine ranges from 396 to 500 feet. It was undermined by 3D in December 2001, by 4D in May and June 2001, and by 5D in August 2002. The investigator noted the formation of “pressure ridges” in parts of the streams overlying the 3D panel and within the 2D tailgate.

VII.L.4. Unnamed and Unnumbered Tributary to Dunkard Fork

This stream overlies panels 14C and 15C of Bailey Mine. At the time of the observation in October 2002, the headwaters above the northern gates of 14C were dry. A pond had formed near the center of the panel, but the stream was dry over 14C panel and over most of 15C panel.

VII.L.5. Tributary 32511 to Dunkard Fork

This stream was visited in the spring of 2003. The depth of cover ranges from 546 feet at the 16C tailgates to approximately 523 feet at the 16C headgates. The observed section was undermined between February and March 2003. The 15C panel also undermined this stream between January 2002 and February 2002. Flow in the stream had stopped in the vicinity of a compression ridge and to the north of this ridge the streambed was observed to be “cracked and dry” One flowing section had water visibly flowing into the ground on the northern side of another compression ridge, and the water re-emerged on the southern side. The California District Mining Office investigator described the compression ridge as “quite impressive.”

VII.L.6. Stone Coal Run

This stream was visited in the fall of 2002, when sections were observed to be dry. Bailey Mine underlies the stream by 294 feet at the unmined 17C panel headgate to 573 feet at the mined 12C panel tailgate. Panels 11, 12, 13, and 14C panels were mined at the time of the observation and 15C was being mined in October. The initial mining occurred at the 1C panel tailgate in spring 2000. According to the observers from the California District Mining Office, the stream was dry over 12C, 13C, and 14C except for a 450-foot low-flow segment over the center of 14C. Also, the observers noted a transverse pressure ridge inside the 14C tailgate. (The memorandum does note that weather conditions were dry)

VII.L.7. Tributary 32652 to Robinson Fork

This stream was observed in the summer of 2002. The depth of cover ranges from 396 feet at the mouth (at Robinson Fork) to 673 feet at the headwaters. The tributary overlies Bailey Mine’s 2D (mined May –August 2001), 3D (mined November-December 2001), 4D (mined May-June 2002), and 5D (mined during the observation) panels. From the headwaters downstream the stream was observed to be dry over most of its reach. A few small sections had low flow. A follow-up observation revealed that the stream “was dry from the tailgate for the LW-46” panel.

VII.L.8. Tributary 32653 to Robinson Fork

This stream was observed in the summer of 2002. The stream overlies the 3D and 4D panels of Bailey Mine. The depth of cover ranges from 396 feet to 500 feet. At the time of the observation, mining had begun in the 5D panel. The observers noted “significant dry sectors” in the static tension zones and both gate entries for the 3D panel and the northern static tension zone of the 4D panel. The stream had dry areas, also, in the 2D panel and tailgate. Flow disappeared and reappeared over the 2D panel. Pressure ridges were noted in the 3D panel and “within the 2D tailgate area.” In a return visit in October, the investigators from the California District Mining Office noted that the stream conditions “resembled closely the conditions on the original July 19, 2002 survey.”

VII.L.9. Unnamed and Unnumbered Tributary to Robinson Fork

This stream was observed in the late summer of 2002 and found to be dry. It was undermined by Bailey Mine’s 3D, 4D, and 5D panels at depths ranging from 450 feet to 730 feet.

VII.L.10. Unnamed and unnumbered tributary to Mingo Creek

This stream was observed in the late summer of 2002 in a stretch paralleling Patterson Road “and located above the 0 West Panel of Maple Creek Mining.” The depth of cover at the site ranged from 289 feet at the 0 West tailgates to 255 feet at the 0 West headgates. The stream was undermined commencing on August 27, 2002. There was no flow where the stream runs beneath Gilkeson Road. The Maple Creek 9 Right Panel stream that runs into the tributary had no flow, and the unnamed tributary to Mingo Creek had no flow, but was “moist and muddy.” Anecdotal information from local residents attests to the stream’s having undergone a change since the commencement of mining activities.

VII.L.11. Robert’s Run

This stream was observed in the fall of 2002. It is undermined by Blacksville #2’s 1R through 8R panels. At the time of last observation and write-up, the mining was still in

progress. The California District Mining Office investigator notes, “Historically all the panels that were mined under Robert’s Run have pooled in the center of the panels and seasonal flooding has occurred.” The depth of cover for the 8R panel ranges from 606 feet to 595 feet running north to south, where the stream was undermined between September 22, 2002 and September 29, 2002. The stream runs transversely over the panel. Pooling of the stream began 274 feet from the tailgate, and the pool was 898 feet long. The California District Mining Office investigator notes, “The entire pool was stained white...The white precipitate EXTENDED [sic.] beyond the limits of the 8R panel.”

VII.M. Assessments That Were Not Performed

Several of the original specifications of the MOU were not completed for this report. After determining the length of streams that had been undermined during the assessment period (115.48 miles), the University’s researchers and the PA DEP agreed that it was impossible to perform field assessments of all the undermined streams within the study period of 160 days allotted for the preparation of this report (see Limitations, section IIIB). Also, by agreement with the PA DEP, the University did not conduct a geomorphologic assessment on the basis of the Rosgen Classification System because such an assessment would have required an evaluation of every 50- to 100-foot segment of streams. An unanticipated limitation occurred when the first stream specialist withdrew from the project because of a personal emergency. Dr. Daniel Keogh replaced the first stream specialist.

A further limitation was imposed by the lack of uniform, detailed pre-mining stream assessments that would have made an accurate comparison of pre- and post-mining stream conditions possible. It was often difficult to determine impact because of the lack of descriptive pre-mining data of the habitats and fauna. Many streams in southwestern Pennsylvania are degraded by other land use issues, which make it difficult, if not impossible to discern impact with any degree of certainty. Currently, there are no metrics that accurately discern impacts that result from mining-related subsidence. Regardless of

these limitations, the University's representative assessed 31 stream segments to sample the undermined streams for potential impacts caused by subsidence.

VII.N. Findings

Impairment resulting from the diminution of flow in streams is a potential problem primarily associated with headwater 1st and 2nd order streams. Only two 3rd order or higher streams (Laurel Creek and Enlow Fork) were reported to become impaired by loss of flow.

In many cases, stream flow eventually recovered on its own without intervention. These streams often had healthier riparian zones.

The use of photodegradable polyurethane grout has not resulted in the sustained return to flow in Laurel Run.

Despite efforts to "grout," streams over the Waynesburg sandstone formation that were undermined by the Dilworth and Emerald mines have not returned to their sustained low flow conditions.

Affected streams had other impairment issues. Among the most serious of these were land use impairments caused by agricultural (and general farming) practices, especially the permitting of cattle and horses into the streams, the elimination of the riparian zone right up to the stream edge, and the leakage of septic tanks into the watershed.

Subsidence related pooling with accompanying bank erosion and sediment deposition is a potential problem associated with longwall mining. An insufficient number of room-and-pillar mines were involved in this study to make any statement regarding this method concerning pooling, nor any comparisons with longwall mining.

Pooling was not observed in streams with a gradient of 3 feet of rise per 100 feet of run or greater.

When the pre-mining data on a stream was unavailable (or nonexistent), the Act 54 University researchers could not accurately determine the extent of impairment that occurred as a result of subsidence related pooling and sedimentation.

*Two species that are highly intolerant of disturbance and have requirements clean streams with high flow rate, the banded darter (*Etheostoma zonale*) and the variegated darter (*Etheostoma variatum*) were not found in any of the undermined stream segments, but were common in the un-mined section of Dunkard Fork in Ryerson State Park upstream from the confluence with Kent Run. Without pre-mining data, it cannot be determined whether these two species, which are not common in southwestern Pennsylvania, had occurred in the streams before undermining.*

Restoration techniques to rectify subsidence related pooling, such as gate cutting, can alleviate problems, such as loss of riffle/run habitat and formation of long stretches of deep pools (These can be oxygen-depleted). Restoration of Enlow Fork over the 9C and 10C panels is an example of this. The amount of riffle habitat was restored to pre-mining conditions through the use of a combination of gate cutting, which occurred during 2000, to reduce the water level and the installation of log barriers, which occurred during 200, at strategic positions on bends to redirect the flow.

VII.O. Recommendation

The habitat, fish, and macroinvertebrate data should be gathered prior to the undermining of a stream to make possible an evaluation of changes attributable to underground mining and a determination of whether or not such changes rise to the level of impairment.

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