OPEN-FILE REPORT 01-14

History, Geology, and Environmental Setting of the Griffin and Wilkesbarre Mines, Pike/San Isabel National Forest, Lake County, Colorado

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FOREWORD

Open-File Report 01-14 describes the history, geology, and environmental setting of the Griffin and Wilkesbarre Mines near Leadville. These mines lie mostly on private land, but effluent and some of the waste rock from the mines extend onto U.S. Forest Service-administered land and into St. Kevin Gulch, a headwater stream in the upper Arkansas River drainage basin. The U.S. Forest Service selected this site for detailed investigation because of the results of an abandoned mine inventory recently completed by the Colorado Geological Survey. State and Federal agencies and private owners can use this study for developing realistic and cost-effective reclamation plans for the Griffin and Wilkesbarre Mines.

Funding for this project was provided mostly by the U.S. Forest Service (Agreement No. 1102-0007-98-035). Partial funding came through the Water Quality Data program of the Colorado Geological Survey from the Colorado Department of Natural Resources Severance Tax Operational Fund. Severance taxes are derived from the production of gas, oil, coal, and minerals.

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ABBREVIATIONS AND SYMBOLS

AMLIP	Abandoned Mined Land Inventory Program
ATV	all-terrain vehicle
bk.	book
cm	centimeter
CGS	Colorado Geological Survey
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
cps	counts per second
CR	County Road
°	degree
EE/CA	Engineering Evaluation/Cost Analysis
EDR	Environmental Degradation Rating
EPA	United States Environmental Protection Agency
=	equals
FR	Forest Road
4WD	four-wheel drive
gpm	gallons per minute
<	less than
µg/L	micrograms per liter
µ	microns
µS	microSiemens
mg/L	milligrams per liter
>	more than
NPL	National Priorities List
n/a	not applicable
#	number
No.	number
oz(s)	ounce(s)
p.	page(s)
ppm	parts per million
%	percent
PHR	Physical Hazard Rating
pCi	picoCuries
lb(s)	pound(s)
PBS	Primary Base Series
SH	State Highway
x	times (when factoring ion concentrations or radioactivity)
trec	total recoverable
U.S.	United States
USFS	United States Department of Agriculture - Forest Service
BLM	United States Department of Interior - Bureau of Land Management
v.	volume

INTRODUCTION

During the summer of 1996 the Colorado Geological Survey (CGS) inventoried mines in the St. Kevin Gulch drainage basin as part of a statewide inventory of abandoned mines on, or affecting, U.S. Forest Service-administered lands in Colorado. CGS assigned Environmental Degradation Ratings (EDRs) of 1 (extreme environmental degradation) and 3 (potentially significant environmental degradation) to some of the mines and waste-rock piles in the "South of Wilkes Barre Tunnels" inventory area (USFS-AMLIP form 12-01-391/4350-1, Appendix). In 1999 the U.S. Forest Service requested more detailed information regarding selected mine features in this inventory area.

Mine workings discussed in this report are north of Leadville and Turquoise Lake, near the confluence of Shingle Mill Gulch and St. Kevin Gulch (Figure 1). Features described in this report are adits and associated waste-rock piles #100/200, #101/201, and #102/202. Adit #103 and associated waste-rock pile #203 were not considered significant environmental problems and were not included in this study (Appendix).

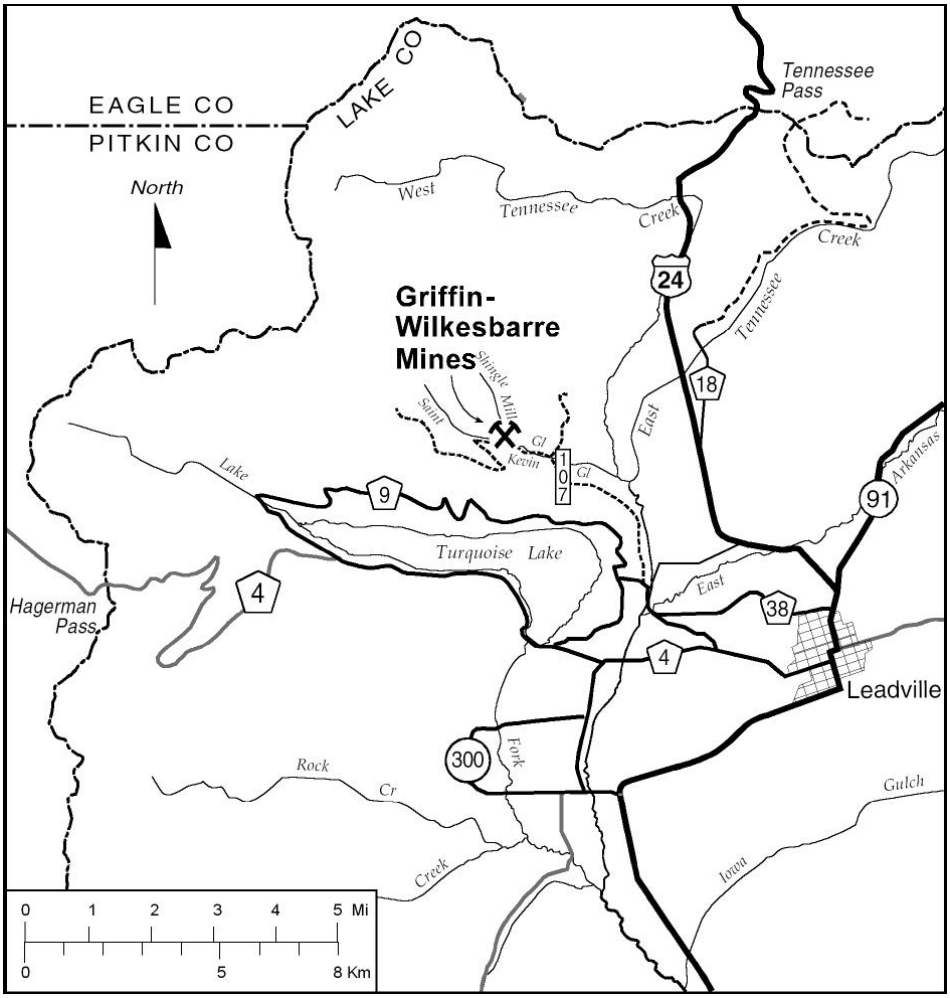

Figure 1. Index map of the Griffin-Wilkesbarre Mine area.

Various mineral surveys conducted in this area indicated that the mines included in this study are probably on or partly on privately owned patented mining claims. The Homestake Reservoir Primary Base Series (PBS) map and some of the mineral surveys show conflicting locations for the patented mining claims in relation to St. Kevin (Sow Belly) Gulch (Figures 2, 3, 4). An accurate survey might confirm ownership and location of the mines. Although the mine openings included in this study probably lie on private land, effluent and waste rock from them may affect National Forest System (NFS) land.

Two independently worked mines, the Griffin and the Wilkesbarre, were included in this inventory area. Adit #100 is probably the lowest access point (Tunnel No. 3) for the Griffin Mine (also known as the Gerald Griffin Mine and Carleton-Griffin Mine). Most of the mine features associated with the Griffin Mine were dug on the Gerald Griffin Lode and Carleton Lode patented mining claims and were not inventoried. Adit #100 was probably driven on the Annie G. or Griffin No. 2 patented claims, but was inventoried because the adit was on NFS land according to the PBS map. CGS assigned an EDR of 1 (extreme) to adit #100 and associated waste-rock pile #200. Mine effluent and waste rock from Tunnel No. 3 apparently extend onto NFS land.

Adits #101 and #102 were probably dug on the Wilkesbarre No. 3 Lode patented mining claim. The Wilkesbarre Group included five patented mining claims (Arty, Snow, and Wilkesbarre No. 1-3 Lodes). This investigation revealed no specific historical information regarding adit #101on the western side of Shingle Mill Gulch. It is likely that any minor production originating from this small working was included with the Wilkesbarre Group figures.

Adit #102 has been referred to as the Wilkesbarre Mine, Wilkesbarre Adit, and Wilkesbarre Tunnel, and has been spelled Wilkesbarrie and Wilkes Barre. Adit #102 is the lowest of the adits on the eastern side of Shingle Mill Gulch shown on maps of this area. The upper workings were not inventoried because they are on private land (Arty, Wilkesbarre No. 3, and Snow Lodes). The larger of the upper workings has been called the Arty and Snow Adit (Singewald, 1955, plate 27), Snow Adit, Snow Lode, and Snow Lode tunnel. Because the Wilkesbarre Mine was driven to develop the Arty and Snow vein, historical and production information from all of the workings associated with this vein were combined in most reports. Adits #101 and #102 and associated underground workings are seemingly confined to patented mining claims. However, waste rock and possibly mine effluent from both workings probably extend onto NFS land. EDR ratings of 3 (potentially significant) were assigned to adits #101 and #102 and associated dumps #201 and #202 on the Wilkesbarre No. 3 Lode.

The unpatented Consolidated Captain Kirby Placer claim was located over the area that contained parts of dumps #200, #201, and #202 (Mineral Survey No. 4562, available at the BLM, Colorado State Office). No surface or underground mine workings were observed, and almost no information was found regarding this claim. It is unlikely that any of the waste-rock piles described in this report were related to the placer operation.

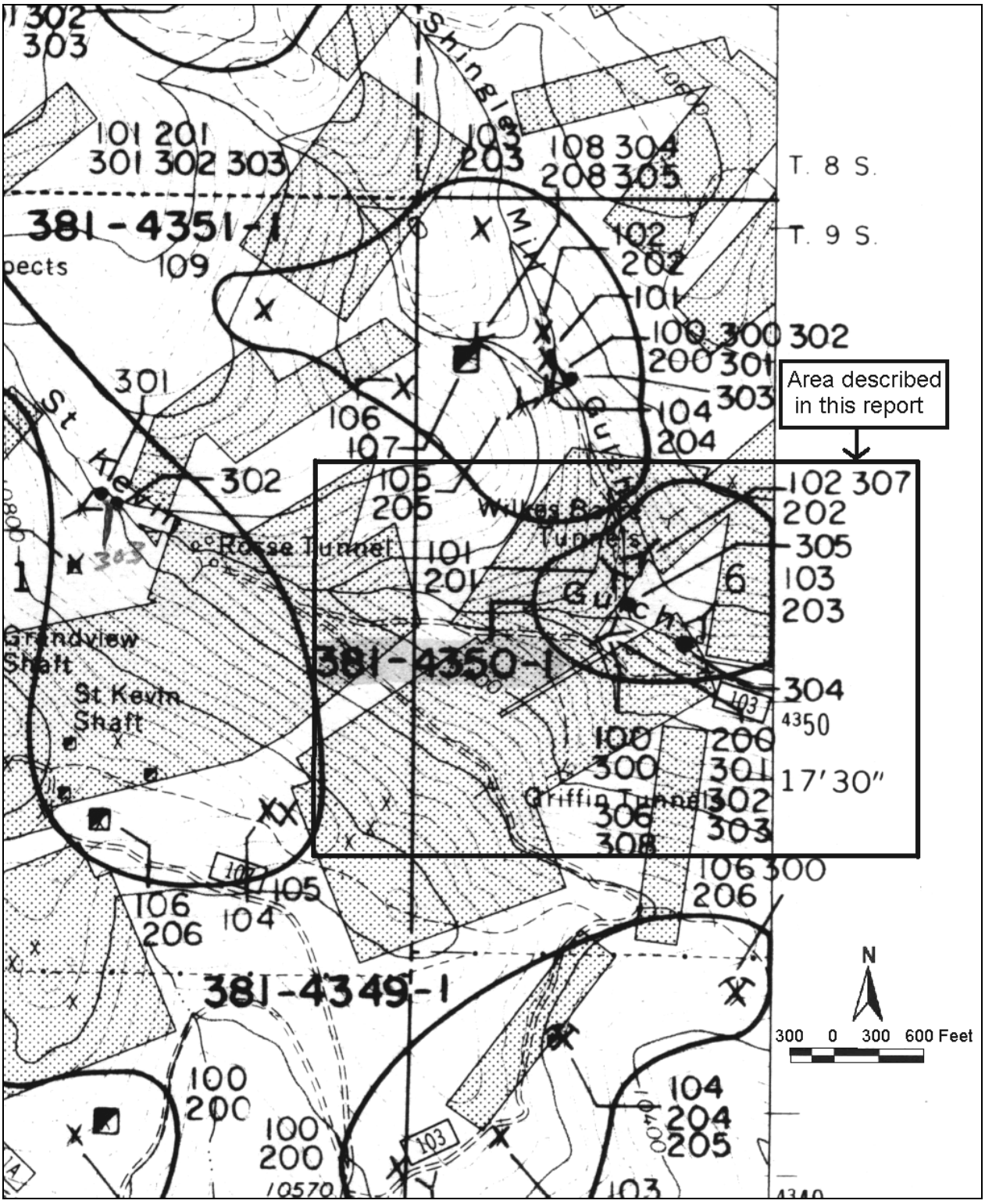

Figure 2. PBS map of the "South of Wilkes Barre Tunnels" inventory area.
[Scale is approximate; shaded areas are patented mining claims.]

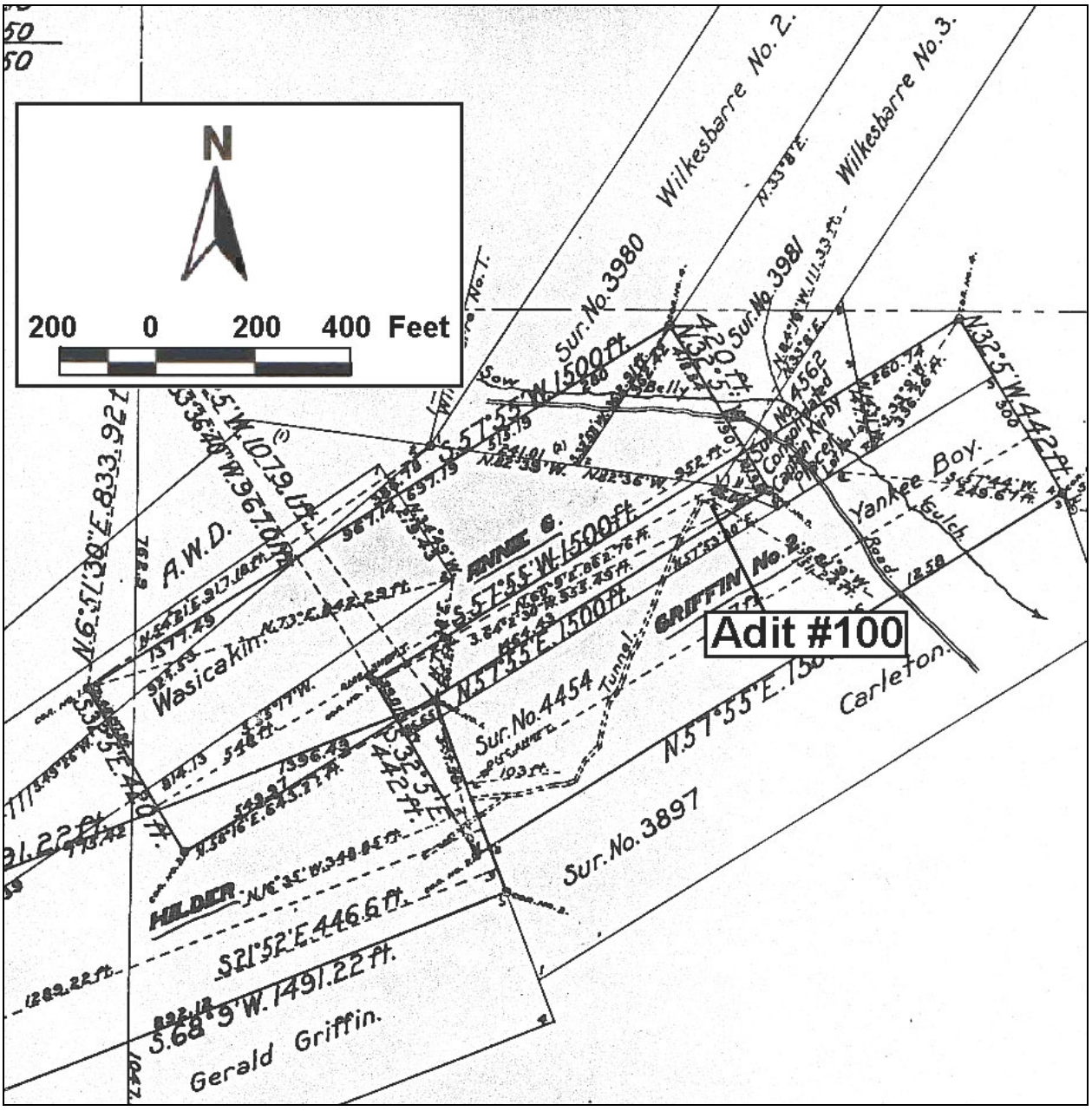

Figure 3. Mineral Survey No. 19848 of the Annie G. and Griffin No. 2 Lodes (modified; scale is approximate).

LOCATION

The "South of Wilkes Barre Tunnels" inventory area (12-01-381/4350-1) is in Lake County, Colorado, about 5 miles northwest of Leadville at the confluence of St. Kevin (Sow Belly) Gulch and Shingle Mill Gulch (Figure 1). Elevation of this area is about 10,400 feet. Forest Road 107 provides access to the mines. Adit #100 is on the southern side of St. Kevin Gulch; adits #101 and #102 are on the western and eastern side of Shingle Mill Gulch, respectively.

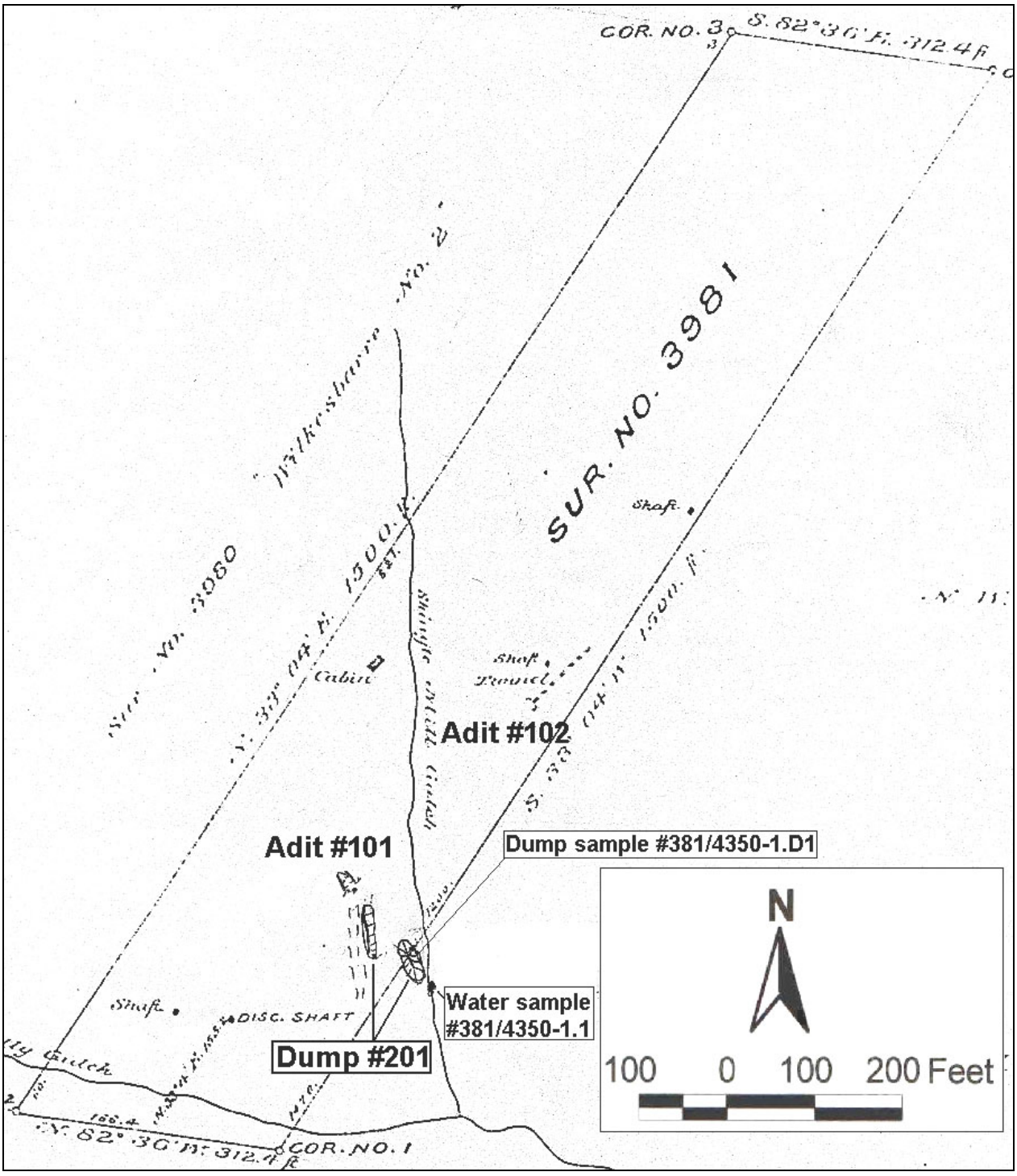

Figure 4. Mineral Survey No. 3981 of the Wilkesbarre No. 3 Lode
(modified; scale is approximate).

MINING HISTORY

Most of the productive veins in the St. Kevin and Sugar Loaf districts were discovered in the 1880's, and the maximum output for nearly all of them was before 1893 (Singewald, 1955, p. 251). Kimball (1996, p. 753) asserts that much of the mining was done about 1920. Little or no production has occurred since the end of World War II.

St. Kevin Gulch has been a "laboratory" for research involving abandoned mines and acid drainage beginning in about 1986 (Kimball, 1996). Many of the studies focused on the area around the Griffin Mine, including features #100/200 of the "South of Wilkes Barre Tunnels" inventory area, because of its obvious impact on St. Kevin Gulch.

Griffin Mine

The Griffin Mine produced intermittently from 1883 to 1939 (Table 1). Mine inspector and company reports suggest that Tunnel No. 3, which is probably adit #100, connected to the upper, more productive levels sometime after 1916 and prior to 1924 when the adjacent mill was completed. Historical evidence and the small volume of tailings below dump #200 suggest that the Griffin Mill processed a minimal tonnage of ore.

1883. No activity at the site is recorded prior to September, when Thomas F. Walsh and A.W. Duggan located the Gerald Griffin and Carleton Lodes. Walsh located the Yankee Boy Lode on the northwest side of the Carleton in December. (See bk. 61, p. 214, 287, 364.) A total of 37 tons of ore were produced during the excavation of a 65-foot-deep shaft at the Gerald Griffin Mine (Burchard, 1884, p. 265).

1885. In January, mineral surveys were conducted on the Gerald Griffin and Carleton Lodes. The surveys show an adit near the southwest side of the Carleton Lode, close to the Gerald Griffin Lode (Mineral Survey Nos. 3896 and 3897, available at the BLM, Colorado State Office). This adit is probably one of the levels of the Griffin Mine and may have a subsurface connection to adit #100 of this inventory area. In April, Thomas and Patrick Walsh, S. Vinson Farnum, and A.W. Duggan received patents on the claims. (See patents 11787, 11852, bk. D, p. 20-21.)

1886. A mineral survey was conducted on the Yankee Boy Lode owned by T.F. Walsh and others. Several shafts, but no adits, were surveyed on this claim that adjoined the northwestern boundary of the Carleton Lode. (See Mineral Survey No. 4454, available at the BLM, Colorado State Office.) This information suggests that adit #100 did not exist yet.

Table 1. Griffin Mine production.
(Compiled from information in text; X=unspecified quantity; ?=probable production.)

Year	Production	Au	Ag	Cu	Pb	Zn	Owner/operator(s)
1883	37 tons						Walsh and others
1888	X	$1,000	$13,000				Walsh and others
1889	X	$1,500	$25,000				
1890	X	$179	$2,176				
1899	X tons worth $20/ton						Rogers/Cody
1910	X	X	X	X	X		Cody
1911	2 carloads				X	X	Cody
1912	X		X		X		Cody
1915	Large quantities		X		X	X	Smith (manager)
1916	600 tons/month	X	X		X	X	Griffin Leasing Co.
1917	1,250 tons/month	?	X		X	X	Griffin Leasing Co. /Smith, Cody
1916-1917	100 shipments worth $30,000	X	X		X	X	
1918	X	?	X		X	X	
1919	150-200 tons/month; 25 cars by lessees	?	X		?	?	Wentworth (Smith-trustee)/Schrader
1920	677 tons	47 oz	10,000 oz		7 tons	122 tons	Griffin Mining Co. (Smith-president) /Schrader
1921	675 tons	34 oz	17,000 oz		13 tons	75 tons	Griffin Mining Co.
1924	X	?	?	?	?	?	Griffin Mining Co. (Smith-president)
1934	38 tons	35 oz	836 oz				Ewing
1935	16 tons	X	X		X		Zaitz
1939	X						
1915-1939	13,000 tons (0.09 oz/ton Au; 19 oz/ton Ag; 0.02% Cu; 2.9% Pb; 6.6% Zn	1,170 oz	247,000 oz	2.6 tons	377 tons	858 tons	

1887. No shipments were reported from the Griffin Mine (Munson, 1888, p. 175). In March, a mineral survey was conducted on the Consolidated Captain Kirby Placer claim owned by Pacific Mill and Mining Company. Lot No. 1 of this claim covered the area at the confluence of St. Kevin and Shingle Mill Gulches (Figure 3), probably including at least part of waste-rock piles #200, #201, and #202. No mine workings were surveyed in Lot No. 1 of this claim, and the claim was never patented. (See Mineral Survey No. 4562, available at the BLM, Colorado State Office.)

1888. About $1,000 in gold and $13,000 in silver were recovered from ore shipped from the Griffin Mine (Munson, 1889, p. 113).

1889. Production was valued at about $1,500 in gold and $25,000 in silver (Smith, 1890, p. 149).

1890. Production dropped to $179 in gold and $2,176 in silver (Smith, 1891, p. 136).

1891-1892. Amos Henderson (agent) paid taxes on the Gerald Griffin and Carleton Lodes in 1891 and 1892 (courthouse records).

1898-1902. C.W. Rogers owned the Gerald Griffin claim during these years (courthouse records). Rogers managed the Griffin Mine, which was leased to R.J. Cody and operated by four workers. Developments included a 60-foot-deep shaft and two adits, 500 and 700 feet long. Large bodies of pyritic ore were exposed in the adits. Silver sulfides occurred as streaks in the vein. Assays averaged $20/ton. (See D.L. Griffin, Mine Inspector report and Mine report-Griffin Mine v.4, p. 45, 125, September 21, 1899, Colorado Bureau of Mines.)

1907. C.W. Rogers and others owned the Gerald Griffin Lode. R.J. Cody paid the taxes for the claim (courthouse records).

1908. Cody located the Griffin No. 2 and Hilder Lodes in February and the Annie G. Lode in May (bk. 205, p. 521, 534). The Griffin No. 2 Lode apparently completely covered the Yankee Boy Lode and was partly overlapped by the Annie G Lode (Figure 3).

1910. Siliceous oxide and sulfide ore containing lead, copper, silver, and gold was shipped from an adit at the Carleton-Griffin Mine (Henderson, 1911, p. 422).

1911. One carload of zinc ore and one carload of lead ore were shipped (Henderson, 1912, p. 549).

1912. An unspecified quantity of lead-silver ore was produced (Henderson, 1913, p. 686).

1915. A large, but unspecified quantity of silver-lead-zinc sulfide ore was shipped from the Carleton-Griffin Mine (Henderson, 1917, p. 457). Lucien Smith managed the property, which was the only operating mine in the St. Kevin mining district. Reportedly, the St. Kevin district had been largely "inactive since the 1890's." (See A.E. Moynahan, Mine Inspector report-Gerald Griffin Mine, November 8, 1915, Colorado Bureau of Mines.)

1916. Charles Malloy (superintendent) and Smith managed the Griffin Leasing Company's property. The mine was worked through adits on three levels. A 216-foot raise connected the upper adits (Nos. 1 and 2). Tunnel No. 3 (adit #100) was 300 feet lower and did not connect with the other workings yet. A fissure vein in granite was mined above the No. 2 level. The zinc-iron-lead sulfide ore with values in gold and silver was sorted prior to shipping. About 300 tons of first-grade ore (20% zinc, 5% lead, 0.1 oz/ton gold, 35 oz/ton silver) was shipped monthly to the River Smelting Company at Florence. Monthly shipments averaging 300 tons of second-grade ore (8% zinc, 1.5% lead, 15 to 20 oz/ton silver) was used by the smelter as matte cleanser. (See A.E. Moynahan, Mine Inspector report-Griffin Leasing Company, September 25, 1916, Colorado Bureau of Mines.) Henderson (1919, p. 365) reports three varieties of ore were produced: oxidized ore containing silver; sulfide ore containing gold and silver; and a considerable quantity of silver-lead-zinc sulfide ore.

In December, a mineral survey was conducted on the Annie G., Griffin No. 2, and Hilder Lodes (Figure 3). An adit over 1,000 feet long extended under these claims, which were owned by Cody. This adit was under construction during the survey and was intended to develop the surveyed claims and the Gerald Griffin and Carleton Lodes to the south. (See Mineral Survey No. 19848, available at the BLM, Colorado State Office.) This adit was probably adit #100 of the inventory.

1907-1916. Cody owned the Carleton Lode (courthouse records).

1917. As of October, 30 employees were shipping 750 tons/month of low-grade ore to the River Smelting Company, 300 tons/month of high-grade ore (145 oz/ton silver and 45% zinc) to the A.V. Plant, and 200 tons/month to the Ohio and Colorado. Four ore streaks varying from 3 inches to 2½ feet wide occurred in a 40-foot-wide vein. Three adits (1,300, 1,600, and 1,700 feet long) provided access to the mine. The mine was controlled by Griffin Leasing Company and managed by Lucien Smith and Cody. (See R.J. Murray, Mine Inspector report-Griffin Leasing Company, October 11, 1917, Colorado Bureau of Mines.) Henderson (1920, p. 831) reports two types of ore produced: oxidized, siliceous, iron sulfide ore with abundant silver and some gold; and lead-zinc sulfide ore.

1916-1917. Nearly 100 shipments totaled $30,000, with the metal content ranging up to 0.13 oz/ton gold, 6.6 to 107.7 oz/ton silver, 6.6% lead, and 5 to 20% zinc (Singewald, 1955, p. 283).

1918. The mine shipped lead-silver sulfide and lead-zinc sulfide ores (Henderson, 1921, p. 852).

1919. In February, eight employees at the Griffin Mine were shipping 150 tons/month of sulfide ore to the A.V. Plant. Production increased to 200 tons/month by October. The mine was reportedly owned by H.A. Wentworth (Lucien Smith, trustee) and was leased to Harry Schrader. (See R.J. Murray, Mine Inspector reports-Griffin Mine, February 21, October 10, 1919, Colorado Bureau of Mines.) In December, Smith was awarded a patent for the Annie G., Griffin No. 2, and Hilder Lodes (patent 725081, bk. L, p. 45; bk. 483, p. 186). Henderson (1922a, p 777) reports that lessees working in a small part of the mine shipped 25 cars of silver ore in 1919. His report does not seem to match the mine inspector's information.

1920. In February, 20 employees were shipping about 20 tons/day of silver-lead sulfide ore to the Empire Zinc plant and 70 tons/day of oxide ore with gold and silver values to the A.V. plant. Most of the work was through the 1,600-foot-long No. 2 tunnel. (See Mine Inspector report-Griffin Mine, February 13, 1920, Colorado Bureau of Mines.) Total production for the year was 677 tons averaging 0.07 oz/ton gold, 15 oz/ton silver, 1% lead, and 18% zinc. Annual development included 18 feet of winzes, 445 feet of raises, 1,100 feet of drifts, and 680 feet of crosscuts. The mine was owned by Griffin Mining Company (L.W. Smith-President) and was leased part of the year to Schrader. Griffin Mining Company owned the Gerald Griffin, Carleton, Griffin No. 2, Hilder, Annie G., and Colonel Doggone patented claims, and the Wash No.1, Wash No. 2, and Medallion No. 2 unpatented claims. (See Operators Annual Report for 1920-Griffin Mine, to Colorado Bureau of Mines, January 14, 1921.) Henderson (1922b, p. 585) reported an unquantified amount of silver ore was shipped. Comparison of the production reported by the inspector and the operator suggests that the mine only produced for about a week at 90 tons/day. This is not likely, and total production for 1920 is probably higher than the operator reported.

1921. Griffin Mining Company owned and operated the mine. Twelve employees working underground and one employed on the surface shipped 675 tons of ore averaging 0.05 oz/ton gold, 25 oz/ton silver, 2% lead, 11% zinc, 8% iron, and 10% sulfur. Annual development included 50 feet of raises and 200 feet of drifts. (See Operators Annual Report for 1921-Griffin Mine, to Colorado Bureau of Mines, February 11, 1922.)

1922-1923. The mine had no recorded production, but in 1923 an oil-flotation mill was under construction (Henderson, 1927a, p. 633).

1924. Griffin Mining Company (Smith-President/Manager, J.C. Ingersol-Superintendent) operated the mine. The company was retimbering the mine, which comprised several adits connected by raises. A waste-filled stope and shrinkage mining method was planned for future operatisons. Veinlets of lead, iron, zinc, and copper sulfide (carrying gold and silver values) occurred in a large fissure zone in silicified granite. A 100-ton oil flotation and wet concentration mill was built near the portal of No. 3 Tunnel. When construction was completed, ore would be crushed at the No. 3 Tunnel and sent to the mill over a conveyor belt. (See R.J. Murray, Mine Inspector report-Griffin Mine, February 24, 1924, Colorado Bureau of Mines.) The Griffin Mine was the only reported producer in the St. Kevin district (Henderson, 1927b, p. 563). The placement of ore processing facilities near the portal of the No. 3 Tunnel suggests that it was used as a haulageway and was probably connected to the upper levels of the mine by 1924.

1933. The mine was apparently inactive for several years in the late 1920's, because Lake County sold the Gerald Griffin, Carleton, Annie G., Griffin No. 2, and Hilder Lodes to A.E. Ewing for back taxes (treasurers records).

1934. Perhaps Ewing mined some high-grade pockets, because 38 tons of ore averaging 0.932 oz/ton gold and 22 oz/ton silver were shipped from the Griffin Mine (Henderson, 1935, p. 223).

1935. Lake County reacquired the claims and sold them to Frank Zaitz for taxes, but then Zaitz did not pay taxes in 1936 (treasurers records). Henderson (1936, p. 262) reported that 16 tons of gold-silver-lead ore were shipped from the Griffin Mine.

1936. Singewald gained access to part of the Griffin Mine. No mine map was made because most of the accessible workings were either timbered or in severely broken ground. Singewald had access to a mine map made about 1917 and added his observations to information gained from the map, but did not publish the 1917 mine map. (See Singewald, 1955, p. 282.)

1939. An unspecified, but probably small tonnage of ore was shipped (Henderson, 1940, p. 272). Between 1915 and 1939, almost 13,000 tons of ore averaging 0.09 oz/ton of gold, 19 oz/ton of silver, 0.02% copper, 2.9% lead, and 6.6% zinc were shipped from the Griffin Mine (Singewald, 1955 p. 283). **No production is recorded after 1939.**

1945. Lake County sold the Gerald Griffin, Carleton, Annie G., Griffin No. 2, and Hilder Lodes to Joseph Kerzon for taxes. Kerzon owned the claims until 1959 (treasurers records).

1951. All of the workings at the Griffin Mine were inaccessible (Singewald, 1955, p. 282).

1959-1968. Angelina Kerzon and others (Joseph Kerzon's heirs?) owned the claims (treasurers records).

1968-1970. Angelina and Donald Kerzon, and Fred Kern were the owners (treasurers records).

1970-1999. Angelina and Donald Kerzon were owners until 1987; when Donald Kerzon became the sole owner. He sold the claims to Buckeye Associates in 1999. (See treasurers records.)

1994. Surface water associated with the lower Griffin Mine was used for mine drainage research by the U.S. Geological Survey and University of Colorado (Niyogi and others, 1999).

Wilkesbarre Mine (Group)

Production records for the Wilkesbarre Mine are incomplete at best. It yielded far less than the Griffin, and output was probably limited to gold and silver ore. The earliest recorded production was in 1888, but unrecorded production likely occurred earlier. The mine operated and probably shipped minor amounts of ore as late as 1945.

1883. Peter Cassilly, Wallace Hambleton, C.H.S. Whipple, and Philip Baker located the Snow Lode (bk. 83, p. 16).

1884. F.W. Becker, Lawrance Tipping, George R. Smith, George Duggan, Appleton J. Idle, Mrs. L.H. Prather, and August Fuhs located the Wilkesbarre No. 3 Lode in January. In April, H.Q. Hawley Jr. and Hugh D. Kennedy located the Arty Lode. (See bk. 61, p. 416; bk. 83, p. 39). The Wilkesbarre No. 3, Arty, and Snow claims overlap each other on the hillside above adit #102 (Figure 5).

1885. Mineral Survey No. 3981 was conducted on the Wilkesbarre No. 3 Lode, owned by G.R. Smith and others (Figure 4). The survey showed three shafts and a 100-foot-long tunnel (probably adit #102). The adjoining Wilkesbarre No. 1 and 2 Lodes were surveyed at the same time. (See Mineral Survey Nos. 3979, 3980, 3981, available at the BLM, Colorado State Office.)

1886. The Arty Lode, owned by J.T. White and others, was surveyed in December. Four shafts and a 100-foot-long adit were surveyed on the claim. (See Mineral Survey No. 4500, available at the BLM, Colorado State Office.) Later in December, patent 16840 was issued to Smith, Duggan, Charles A. Kerfoot, John W. Warren, and Idle for the Wilkesbarre No. 3 Lode (bk. D, p. 80).

1888. Ore shipped from the Wilkes Barre No. 2 was valued at about $4,000 in silver (Munson, 1889, p. 115).

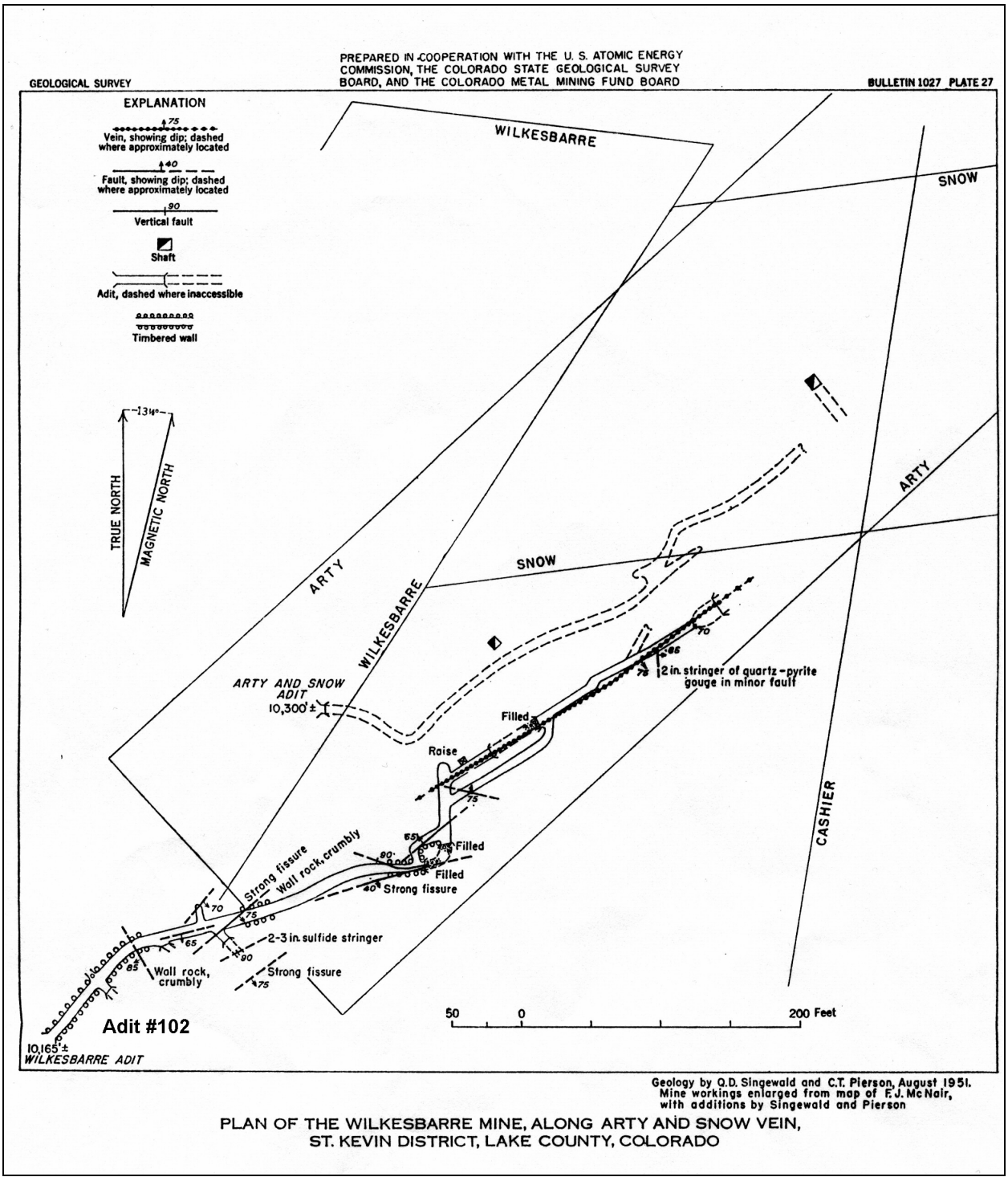

Figure 5. Map of the Wilkesbarre Mine. [Modified from Singewald (1955, plate 27).]

1890. The Snow Lode was surveyed. Two shafts were shown on Mineral Survey No. 6650 (available at the BLM, Colorado State Office).

1892. The Arty Lode mineral survey was amended to show the position of the Snow Lode (Mineral Survey No. 4500, available at the BLM, Colorado State Office). Both the Arty and the Snow Lodes were patented in 1892 (USFS records).

1901. Courthouse records listed Bell J. Walker, Margaret K. Kerfoot, J.W. Warren, and R.W. English as owners of the Wilkesbarre No. 3 Lode.

1904. Robert Morseman and associates drove over 300 feet of adit on the Wilkesbarre Group. High silver and some gold values were discovered in a 5-foot- to 8-foot-wide oxide ore zone. Shipments contained 70 to 110 oz/ton silver. (See Mining Reporter, August 4, 1904, v. 50, p. 121.)

1905. Courthouse records listed Walker, Kerfoot, Warren, E.C. English, and A.J. Idle as owners of the Wilkesbarre No. 3.

1910. Siliceous gold-silver ore was shipped from the Wilkesbarre Mine (Henderson, 1911, p. 422).

1916. Courthouse records listed Bell J. Ross, E.C. English, Elizabeth Armstrong, and Globe Investment Company as owners of the Wilkesbarre No. 3.

1921. The Snow and Arty claims were leased to Wilkesbarre Leasing Company, managed by William W. McCoy. Two miners shipped a small tonnage of siliceous sulfide ore from the Snow Lode tunnel to the A.V. plant. (See R.J. Murray, Mine Inspector report-Snow Lode tunnel, October 24, 1921; Operators Annual Report for 1921-Wilkesbarre Leasing Company, January 20, 1922, Colorado Bureau of Mines.) Courthouse records listed Ross, English, Armstrong, and Globe Investment Company as the owners of the Wilkesbarre No. 3.

1922. Three miners operated the Snow Lode tunnel (Snow-Arty Mine), which was 300 feet long. Silver ore was mined from a siliceous vein and shipped to Leadville. (See R.J. Murray, Mine Inspector report-Snowlode Tunnel, November 21, 1922, Colorado Bureau of Mines; Henderson, 1925, p. 541.)

1923. Miners working for Wilkesbarre Leasing Company at the Snowlode Tunnel performed 548 shifts underground and 185 shifts on the surface. An unspecified amount of silver ore was shipped. (See Operators Annual Report for 1923-Wilkesbarre Leasing Company on the Snowlode Tunnel, May 1, 1924, Colorado Bureau of Mines; Henderson, 1927a, p. 633.)

1920-1923. Shipments from the Arty and Snow Mines were worth about $15,000 and contained 8 to 30 oz/ton of silver and almost no gold, lead, or zinc (Singewald, 1955, p. 286-287).

1924. William McCoy and Company operated the Wilkesbarre and "Archie" (probably Arty) tunnels and Snow Lode under a lease from Griffin Mining Company. Two employees were driving a drift (probably adit #102) intended to intersect the Snow Lode vein about 50 feet below an area where rich silver ore had been mined. The rich silver ore was probably mined from the Arty and Snow adit (Snow Lode tunnel). The upper adit labeled as Wilkes Barre Tunnel on the Homestake Reservoir U.S. Geological Survey 7.5-minute topographic map is probably the Arty and Snow adit,

located on the Snow Lode. Considerable low-grade silver ore was shipped from the Snow Lode tunnel to the A.V. Plant during the year. (See R.J. Murray, Mine Inspector report-Wilkesbarrie and Archie Tunnels-Snow Lode tunnel February 24; June 21, 1924; Operators Annual Report for 1924-Snow Lode, March 14, 1925, Colorado Bureau of Mines.)

1925. Ore was shipped from the Snow and Arty Mines (Henderson, 1928, p. 718).

1930. Globe Incorporated failed to pay taxes on its interest in the Wilkesbarre No. 3 Lode in 1928, and J.W. Clark bought the interest from Lake County for back taxes (treasurers records).

1933-1950. In 1933 William Harvy acquired interest in the Wilkesbarre No. 3 Lode. From 1933 to at least 1950, H&C Corporation (Harvy and Casey) held interest in the claim. J.W. Clark held interest until at least 1941. Globe Incorporated owned interest from 1941 until 1947, when Casey consolidated ownership. (See treasurers records.) Perhaps Clark was the principal officer of Globe Incorporated.

1945. George Casey, Jr. and Associates operated the Snow Lode for part of the year, and the mine was operated by lessees for part of the year. Two workers cleaned out and retimbered about 250 feet of old workings with the intent of intersecting a known silver vein that was mined previously. (See R.J. Murray, Mine Inspector report, September 29, 1945; Operators Annual Report for 1945-Snow Lode, January 15, 1946, Colorado Bureau of Mines.)

No mining activity is recorded after 1945. Small exploration projects may have been completed since then.

1951. Much of the Wilkesbarre Mine (adit #102) was accessible for geologic mapping (Singewald, 1955, p. 286-287, plate 27). The mine map shows a raise that may connect to the Arty and Snow adit higher on the hill (Figure 5).

1975. George Casey made a right-of-way agreement involving the Wilkesbarre No. 3 and Snow lodes (bk. 427, p. 135).

1979. Charles and Joan Casey sold interest in the Wilkesbarre No. 3 and Snow Lodes to Robert W. Casey (bk. 435, p. 431).

1983. Globe Investment Company (George Casey-managing partner, Robert Casey, and the estate of Seeley S. Mudd) granted Windsor Resources a 2-year lease on several of their claims, including the Wilkesbarre No. 3 and Snow Lodes (bk. 468, p. 294-303).

1985. George Casey sold interest in the Wilkesbarre No. 3 and Snow Lodes to Globe Investment Company, one of the owners as of July 1999 (bk. 473, p. 21).

1990. Dunkin Group (a joint venture) gave the Arty Lode to the National Mining Hall of Fame and Museum in Leadville, the owner as of July 1999 (bk. 495, p. 183).

1994. Robert Casey and Tom Casey inherited interest in the Wilkesbarre No. 3 and Snow Lodes from Joan Casey (bk. 512, p. 665-668, 671, 926).

1999. Robert Casey and Tom Casey sold their interest in the claims to Hurricane Point Resources (bk. 541, p. 132, 348).

Unpatented Claims

In 1983 Windsor Resources (U.S.) Ltd. staked 40 claims (WDSR #1-40) in the St. Kevin mining district. Windsor acquired 97% interest in the St. Kevin-Independent property, which covered an area that included the "South of Wilkes Barre Tunnels" inventory area. The St. Kevin-Independent property covered 274 acres, and silver values were estimated at between 30 and 50 oz/ton (Starch and Hornbaker, 1985, p. 116-117). Windsor Resources filed no assessment work on the WDSR # 1-40 claims after 1986. The claims were declared abandoned in 1992, and BLM closed the case file in May 1993. (See mining record lead file 198288, available at the BLM, Colorado State Office.)

GEOLOGY

Precambrian granite hosts the mineralized fault zone/fissure that the Griffin Mine followed (Figure 6). The mineralized fissure terminates or pinches out at or near the contact of the granite with Precambrian schist and gneiss. The vein within the fault zone is up to 6 feet wide and strikes about N. 75° E., with an average dip of 73° to the southeast. Rock within the fault zone is intensely sericitized and locally silicified. The vein contains abundant fine-grained pyrite as streaks, layers, lenses, and veinlets, with localized areas containing sphalerite and galena. Minor amounts of slightly radioactive oxidized material (<4 times background levels) were found on the dump. (See Singewald, 1955, plate 26, figure 41, p. 282-283.)

Singewald (1955, p. 282-283) described an adit 150 feet lower than the lower main adit at the Griffin Mine, probably adit #100. He suggested that this lower adit exposed a vein 300 feet north of the Griffin vein, and the adit could have a crosscut extending to the Griffin vein. Dump #200 was stained yellow, probably because of oxidation of sulfide minerals, and pyrite was abundant (Appendix).

The Wilkesbarre Tunnels were driven mostly along the Arty and Snow vein. This vein was hosted by intensely sericitized granite throughout most of the underground workings that were accessible in 1951 (Figure 5). The vein strikes N. 57° E. and dips 70° southeast. Most production came from a 600-foot-long section of vein in the inaccessible (in 1951) Arty and Snow adit, higher in elevation than the Wilkesbarre adit (#102). This relatively rich ore shoot consisted of gouge and pyrite-bearing cherty quartz with moderately high silver concentrations. (See Singewald, 1955, plate 26, figure 41, p. 286-287.)

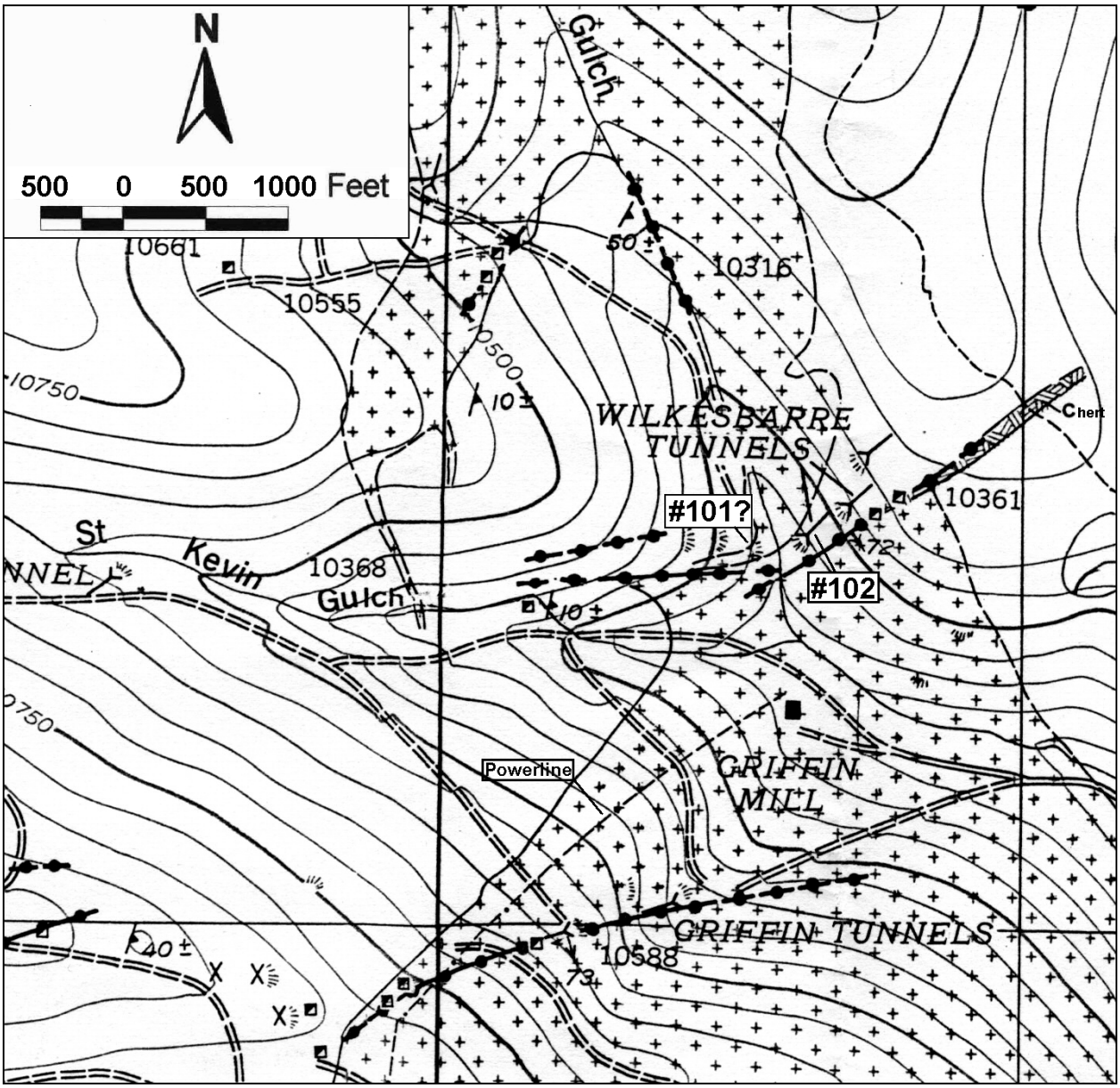

Figure 6. Geologic map of the "South of Wilkes Barre Tunnels" inventory area. [Modified from Singewald (1955, plate 26); scale is approximate; plus symbols=Precambrian granite; non-patterned areas=Precambrian schist and gneiss; dotted lines=veins.]

A waste-rock pile shown by Singewald (1955, plate 26) on the western side of Shingle Mill Gulch is probably the upper lobe of dump #201, associated with adit #101 (Figure 6). Adit #101 may have been driven to test one of the east-west-trending veins nearby. The lower lobe of this dump was stained yellow and consisted of altered granite with moderate pyrite (Appendix).

SITE DESCRIPTION

This inventory area includes a complex mix of NFS land and private land. Further complicating the surface ownership situation are discrepancies between mineral surveys conducted in this area and the U.S. Forest Service PBS map. Additional information regarding the positioning of these mines and surface ownership is presented in the *Introduction* of this report.

Adit #100 (probably Tunnel No. 3 of the Griffin Mine) is on the south side of St. Kevin Gulch, just upstream of its confluence with Shingle Mill Gulch (Figure 7). Adit #100 probably connected to and drained the upper workings of the Griffin Mine by 1924, when the Griffin Mining Company was building a mill, crusher, and conveyor belt near the portal of Tunnel No. 3 (R.J. Murray, Mine Inspector report-Griffin Mine, February 24, 1924, Colorado Bureau of Mines).

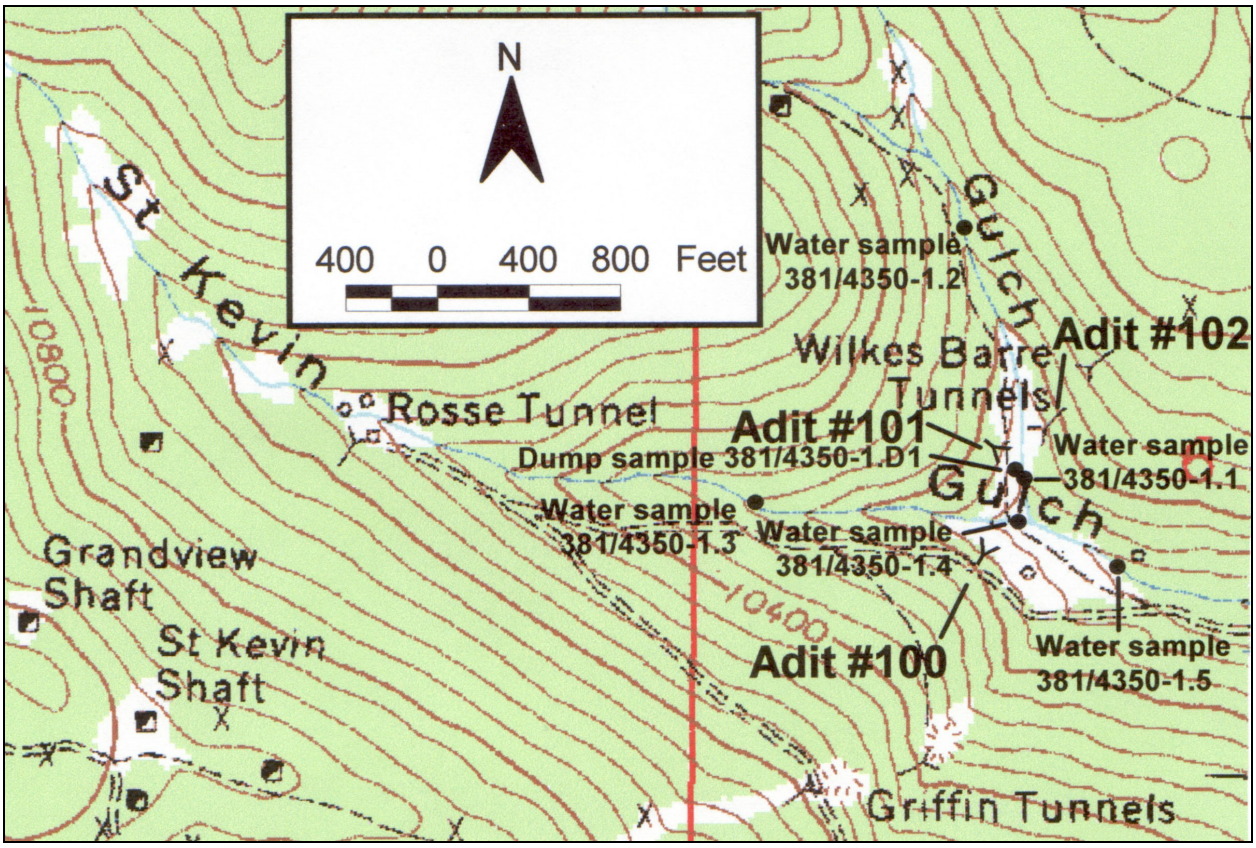

Figure 7. Map of 1999 sample sites in the "South of Wilkes Barre Tunnels" inventory area.

When inventoried in August 1996, water emerged from adit #100 where it was forming a mound of precipitate (Figure 8). The effluent infiltrated and flowed alongside bleached and yellow-stained dump #200 (Figure 9). A series of plastic pipes collected surface runoff and seepage from dump #200 and directed the flow into St. Kevin Gulch below its confluence with Shingle Mill Gulch. Abundant red precipitate lined the St. Kevin Gulch stream channel beginning where the effluent and dump seepage entered the gulch. (See Brown and others, 1996, p. 18-19.)

Figure 8. Photograph of caved adit #100 and precipitate mound in 1996.

The pipe system described by Brown and others (1996, p. 18-19) was placed by the University of Colorado and the U.S. Geological Survey in 1994 as part of a mine drainage experiment in St. Kevin Gulch. The collection system was designed to capture effluent and dump seepage from features #100/200 and divert this water into St. Kevin Gulch below its confluence with Shingle Mill Gulch. The diversion was quite effective and collected about 85% of the effluent and seepage. After the degraded water was diverted, the researchers measured the recovery of St. Kevin Gulch in the short reach between its confluence with Shingle Mill Gulch and the discharge point of the pipe. (See Niyogi and others, 1999.)

By July 1999 the system of plastic pipes had been dismantled. Most of the base of the dump was saturated with water, and numerous seeps emerged (Figure 10). Some of the effluent and seepage from dump #200 flowed onto and through tailings below dump #200. The tailings presumably were deposited by the short-lived Griffin Mill.

Adit #101 is on the west side of Shingle Mill Gulch (Figures 6, 7) and is probably associated with the unlabeled waste-rock pile shown by Singewald (1955, plate 26). This caved adit is most likely on private land, as is the upper lobe of associated dump #201 (Figure 4). In 1996 the adit was caved and discharged a small volume of water (Brown and others, 1996, p. 20). In 1999, recent survey stakes indicated that part of the lower lobe of dump #201 is probably on NFS land. This lower lobe lies in a wetland and is in contact with Shingle Mill Gulch for a short distance (Figure 11).

Adit #102 is probably the Wilkesbarre Adit shown by Singewald (1955, plate 27), and lies on the east side of Shingle Mill Gulch (Figures 6, 7). In 1999, recently placed survey stakes indicated that adit #102 is on private land (Figure 4), but a small portion of dump #202 probably extends onto NFS land. In August 1996, water was draining from caved adit #102 (Figure 12) and soaking into the ground alongside dump #202 (Figure 13) prior to reaching Shingle Mill Gulch at the surface. Abundant red precipitate coated the effluent channel. A dry, iron-stained gully extended beyond the infiltration point of the effluent in August 1996, indicating that surface flow of the effluent reaches the creek intermittently. Dump #202 is stained yellow, and part of the toe is in contact with Shingle Mill Gulch. (See Brown and others, 1996, p. 20.) Ruins of a building are on the bench.

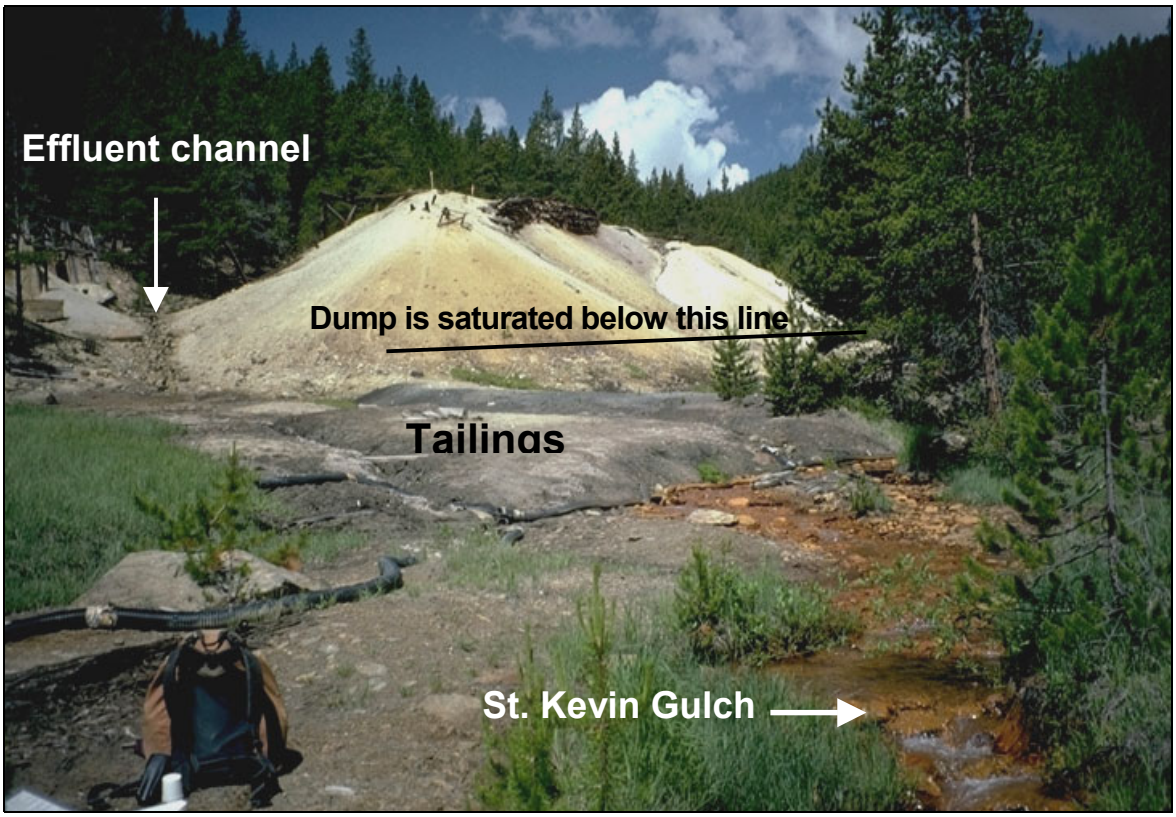

Figure 9. Photograph of the Griffin Mine waste-rock pile (dump #200) and tailings below.

Figure 10. Photograph of seeps with vegetation and water saturation level in dump #200.

Figure 11. Photograph of lower lobe of dump #201 in wetland.

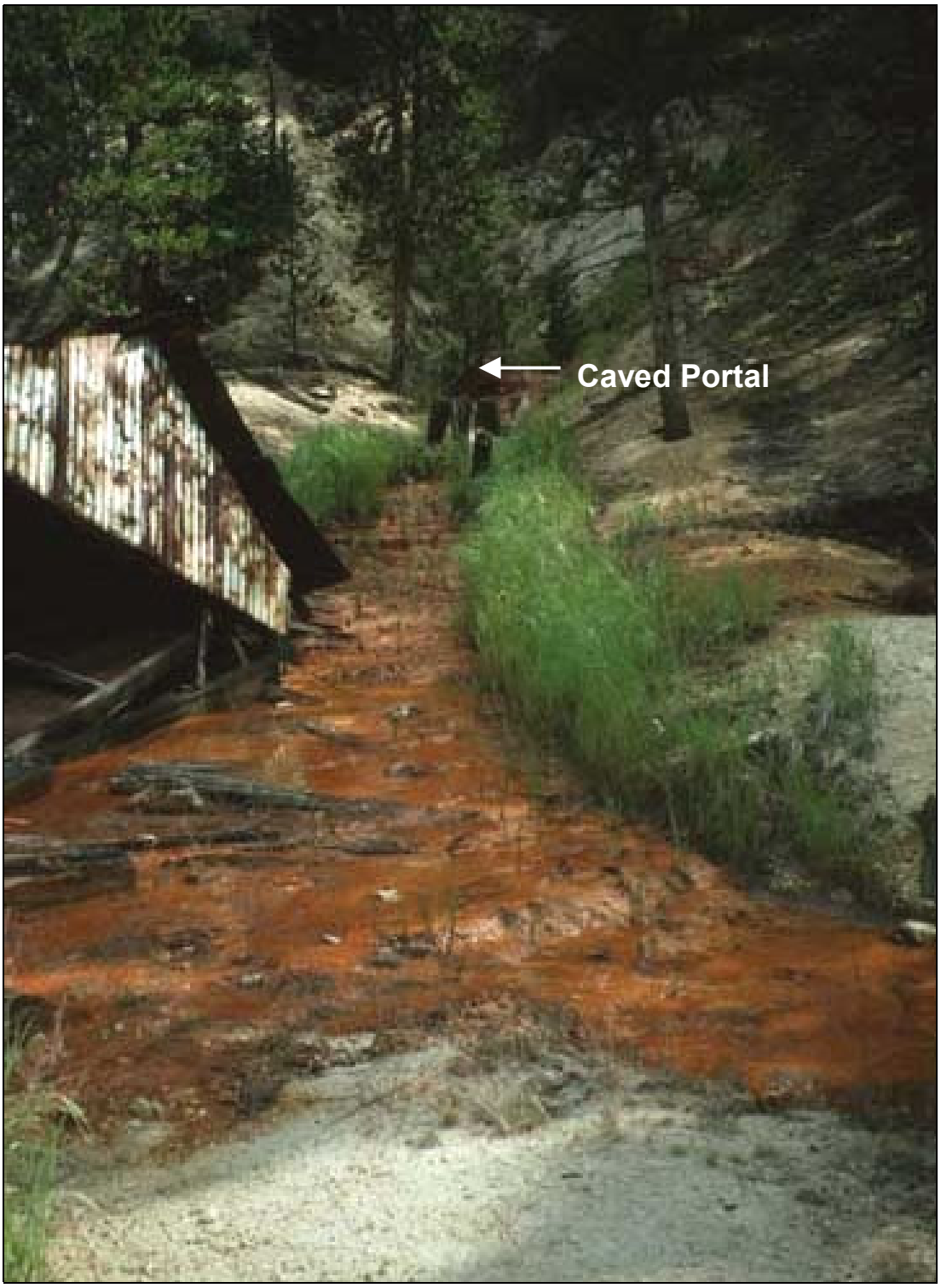

Figure 12. Photograph of caved adit #102 and effluent in 1996.

Figure 13. Photograph of dump #202 and iron-stained effluent channel in 1996.

WASTE AND HAZARD CHARACTERISTICS

In August 1996 water was draining from adit #100 at a rate of about 2 gpm. A series of plastic pipes that collected surface runoff and dump seepage directed this degraded water into St. Kevin Gulch downstream of Shingle Mill Gulch, where it deposited abundant red precipitate along the stream channel. Effluent tested at the portal had 3.3 pH and 2,130 µS/cm conductivity. Water emerging at the bottom of dump #200 had pH of 3.2 and conductivity of 2,380 µS/cm. Where the pipe discharged dump seepage and surface runoff into St. Kevin Gulch, the flow rate was 8.5 gpm, pH was 3.2, and conductivity was 2,140 µS/cm. The following day in August 1996 when water sample 381/4350-1.308 was collected from the pipe discharge, pH was 2.8 and conductivity was 2,090 µS/cm. The pipe discharge, which included effluent from adit #100, and seepage and surface runoff from dump #200, was extremely degraded with iron (100,000 µg/L), aluminum (17,000 µg/L), cadmium (480 µg/L), copper (450 µg/L), manganese (51,000 µg/L), sulfate (1,100 mg/L), and zinc (93,000 µg/L). (See Brown and others, 1996, p. 18-19.)

Dump #200 contained about 1,100 cubic yards and had prominent sulfur staining and a strong smell of sulfur. Pyrite was abundant. Although not positively identified, the mineralogy of the vein suggests that sphalerite and galena probably occur. The plastic pipe collection system had been dismantled when the site was visited in July 1999, and degraded water emerged from several places close to the toe (Figure 10). One of the seeps was draining water with 2.39 pH and 1,950 µS/cm conductivity. Some of the seepage from dump #200 entered directly into St. Kevin Gulch, and some flowed across tailings and merged with effluent from adit #100 before joining the St. Kevin Gulch stream (Figure 9). The mixture of effluent and dump seepage, after crossing the tails and just above the confluence with St. Kevin Gulch, had 2.27 pH and 1,913 µS/cm conductivity, indicative of severely degraded water.

In 1996 St. Kevin Gulch immediately upstream of its confluence with mine/dump seepage from features #100/200 had 5.3 pH and 145 µS/cm conductivity. A test from St. Kevin Gulch about 1,500 feet downstream from the Griffin-Wilkesbarre Mines area showed pH of 4.09 and conductivity of 167 µS/cm.

A small volume of water emerged from adit #101 during the inventory in 1996, but this water did not reach Shingle Mill or St. Kevin Gulch at the surface (Appendix). The effluent was not depositing precipitate and showed no obvious indications of degradation. This water was not tested or sampled in 1996 or 1999 because it infiltrated the ground within the patented Wilkesbarre No. 3 Lode claim (Figure 4).

Dump #201 had two separate lobes. The upper lobe was almost certainly on private land, but part of the lower lobe apparently straddled the property line (Figure 4). The lower lobe was an "island" in a wetland associated with Shingle Mill Gulch, and may not have originated from adit #101. Part of the eastern side of the "island" was in contact with the stream. The "island" part of dump #201 contained about 120 cubic yards of moderately cemented, yellow, red, tan, and gray gravel- and sand-size material, with a few cobbles. Iron oxides and quartz were abundant; fine pyrite was sparse. A composite sample of this part of dump #201 was collected in 1999 (Table 2). Sample results showed that the pile was moderately to highly mineralized, with concentrations of greater than 0.1% for lead, zinc, manganese, and phosphorus. Gold (0.13 oz/ton) and silver (48 oz/ton) were also elevated and approached ore grade. Potential acidity was moderately high, but neutralization potential was more than three times higher, and net acid-base potential was +60.4 tons $CaCO_3$/1,000 tons. Paste pH was slightly alkaline at 7.22.

Adit #102 is apparently on private land, but the southernmost part of dump #202 may extend onto NFS land (Figure 4, Appendix). During the inventory in August 1996, about 4 gpm of water drained from adit #102 and infiltrated into the ground alongside dump #202. Effluent tested at the portal had 5.8 pH and 463 µS/cm conductivity, suggesting moderate degradation. (See Brown and others, 1996, p. 20.) This effluent was not sampled in 1996 or 1999 because surface flow did not reach Shingle Mill Gulch or NFS land during the field visits. An iron-stained channel indicated that during high flow, the effluent probably reaches Shingle Mill Gulch at the surface (Appendix).

Dump #202 had about 800 cubic yards of oxidized, altered granitic rock with abundant pyrite. The surface was stained yellow, and the base was in contact with the Shingle Mill Gulch stream. Gullies and rills indicated that dump material has been eroded into Shingle Mill Gulch (Appendix).

Table 2. Analytical data for a composite sample from the "island" of dump #201 in the "South of Wilkes Barre Tunnels" inventory area.

Parameter	South of Wilkes Barre, dump #201, (381/4350-1.D1)
Paste pH	7.22
Neutralization potential (tons $CaCO_3$/1,000 tons)	85.3
Potential acidity (tons $CaCO_3$/1,000 tons)	24.9
Net acid-base potential (tons $CaCO_3$/1,000 tons)	+60.4
Al2O3 (%)	7.80
CaO (%)	2.74
Fe2O3 (%)	5.48
K2O (%)	2.15
MgO (%)	1.45
Na2O (%)	0.04
Sulfur (%)	1.38
Antimony (ppm)	2
Arsenic (ppm)	66
Beryllium (ppm)	1
Boron (ppm)	<1
Cadmium (ppm)	35.0
Cobalt (ppm)	6
Copper (ppm)	229
Gold (ppm)	0.460
Lead (ppm)	2884
Lithium (ppm)	30
Manganese (ppm)	5070
Mercury (ppm)	0.65
Molybdenum (ppm)	7
Nickel (ppm)	6
Phosphorus (ppm)	1023
Silver (ppm)	164.2
Strontium (ppm)	56
Vanadium (ppm)	17
Zinc (ppm)	4301

In an effort to determine the effects of mine effluent and waste-rock piles in this inventory area on water quality, five water samples were collected in July 1999 (Table 3). Two samples were collected from St. Kevin Gulch above its confluence with Shingle Mill Gulch. Two samples were collected from Shingle Mill Gulch. The furthest downstream sample site was in St. Kevin Gulch downstream of Shingle Mill Gulch, and below the influence of all of the mine features described in this report (Figure 14). In Table 3, water-quality standards listed for St. Kevin Gulch are general statewide standards because individual stream-segment standards for St. Kevin Gulch were not established by January 2001.

Figure 14. Photograph of St. Kevin Gulch below the Griffin and Wilkesbarre Mines.

Effluent from adit #100 (Griffin Tunnel No. 3) and seepage from associated dump #200 significantly impact St. Kevin Gulch above its confluence with Shingle Mill Gulch. Upstream of features #100/200, St. Kevin Gulch was lined with moderate quantities of red-brown precipitate. At sample site 12-01-381/4350-1.3 (Figure 7), flow was estimated at 180 gpm, pH was 4.75, and conductivity was 89 µS/cm. This water was degraded and exceeded standards in aluminum, cadmium, copper, lead, manganese, and zinc. Abandoned mines higher in this drainage basin may be the source of high metal concentrations at this sample site.

After some of the acidic, metal-laden seepage from dump #200 had entered St. Kevin Gulch, but upstream of the large inflow from the tailings (Figure 9), the channel was lined with abundant red-orange precipitate, pH dropped to 3.73, and conductivity increased to 173 µS/cm.

Sample 12-01-381/4350-1.4 was collected from St. Kevin Gulch slightly upstream of its confluence with Shingle Mill Gulch, and immediately downstream of its confluence with surface flow of highly degraded effluent from adit #100 and seepage from dump #200 (Figure 7). Abundant red-yellow-orange precipitate coated the stream channel, conductivity was 218 µS/cm, and pH dropped to 3.49. Aluminum, cadmium, copper, iron, lead, manganese, and zinc concentrations increased significantly compared to the upstream sample. Sulfate concentration doubled, but remained within standards. Perhaps more importantly, metal loading attributable to features #100/200 and the adjacent tailings was large; loads of many metals doubled or tripled. Compared to the upstream sample, loads increased by the following approximate amounts: dissolved aluminum (1.5 lb/day), dissolved iron (5 lb/day), manganese (3.5 lb/day), sulfate (78 lb/day), and zinc (9 lb/day).

Table 3. Analytical data for water samples from the "South of Wilkes Barre Tunnels" inventory area. (Water-quality standards listed for St. Kevin Gulch are statewide standards. Individual stream-segment standards had not been established for St. Kevin Gulch.)

Sample	12-01-381/4350-1.1, SOUTH OF WILKES BARRE, SHINGLE MILL-LOW (7/11/99)			
Parameter	Concentration/ measurement	Standard	Factor above standard	Load (grams/day)
Flow (gpm)	150.0			
pH (standard units)	6.37			
Conductivity (µS/cm)	27.0			
Alkalinity (mg/L CaCO3)	15.00			
Hardness (mg/L CaCO3)	12	None	N/A	
Aluminum (trec) (µg/L)	< 50	None	N/A	N/A
Antimony (trec) (µg/L)	< 1.0	6.0	Below standard	N/A
Arsenic (trec) (µg/L)	< 1.0	10.0	Below standard	N/A
Iron (trec) (µg/L)	78	1,000.0	Below standard	63.8
Thallium (µg/L)	< 1.0	0.5	Not detected	N/A
Zinc (trec) (µg/L)	37	2,000.0	Below standard	30.3
Aluminum (µg/L)	< 50	87.0	Below standard	N/A
Cadmium (µg/L)	< 0.3	0.2	Not detected	N/A
Calcium (mg/L CaCO3)	8	None	N/A	6,541.2
Chloride (mg/L)	< 50.0	250.0	Below standard	N/A
Chromium (µg/L)	< 10	11.0	Below standard	N/A
Copper (µg/L)	< 4.0	1.9	Not detected	N/A
Fluoride (mg/L)	< 0.10	2.0	Below standard	N/A
Iron (µg/L)	35	300.0	Below standard	28.6
Lead (µg/L)	< 1.0	0.2	Not detected	N/A
Magnesium (mg/L)	1.00	None	N/A	817.7
Manganese (µg/L)	24	50.0	Below standard	19.6
Nickel (µg/L)	< 20	19.2	Not detected	N/A
Potassium (mg/L)	< 1.0	None	N/A	N/A
Silicon (mg/L)	3.9	None	N/A	3,188.8
Silver (µg/L)	< 0.2	0.0	Not detected	N/A
Sodium (mg/L)	1.60	None	N/A	1,308.2
Sulfate (mg/L)	< 5	250.0	Below standard	N/A
Zinc (µg/L)	36	17.7	2.0	29.4

Table 3. Analytical data for water samples from the "South of Wilkes Barre Tunnels" inventory area--continued.

Sample	12-01-381/4350-1.2, SOUTH OF WILKES BARRE, SHINGLE MILL ABOVE (7/12/99)				12-01-381/4350-1.3, SOUTH OF WILKES BARRE, ST KEVIN ABOVE (7/12/99)			
Parameter	Concentration/ measurement	Standard	Factor above standard	Load (grams/day)	Concentration/ measurement	Standard	Factor above standard	Load (grams/day)
Flow (gpm)	150.0				180.0			
pH (standard units)	6.56				4.75			
Conductivity (µS/cm)	23.0				89.0			
Alkalinity (mg/L CaCO3)	14.00				< 10.00			
Hardness (mg/L CaCO3)	11	None	N/A		27	None	N/A	
Aluminum (trec) (µg/L)	< 50	None	N/A	N/A	1,100	None	N/A	1,079.3
Antimony (trec) (µg/L)	< 1.0	6.0	Below standard	N/A	< 1.0	6.0	Below standard	N/A
Arsenic (trec) (µg/L)	< 1.0	10.0	Below standard	N/A	< 1.0	10.0	Below standard	N/A
Iron (trec) (µg/L)	63	1,000.0	Below standard	51.5	470	1,000.0	Below standard	461.2
Thallium (µg/L)	< 1.0	0.5	Not detected	N/A	< 1.0	0.5	Not detected	N/A
Zinc (trec) (µg/L)	20	2,000.0	Below standard	16.4	1,700	2,000.0	Below standard	1,668.0
Aluminum (µg/L)	< 50	87.0	Below standard	N/A	680	87.0	7.8	667.2
Cadmium (µg/L)	< 0.3	0.2	Not detected	N/A	8.9	0.4	21.9	8.7
Calcium (mg/L CaCO3)	7	None	N/A	5,723.6	16	None	N/A	15,698.9
Chloride (mg/L)	< 50.0	250.0	Below standard	N/A	10.0	250.0	Below standard	9,811.8
Chromium (µg/L)	< 10	11.0	Below standard	N/A	< 10	11.0	Below standard	N/A
Copper (µg/L)	< 4.0	1.8	Not detected	N/A	86.0	3.9	22.2	84.4
Fluoride (mg/L)	< 0.10	2.0	Below standard	N/A	< 0.10	2.0	Below standard	N/A
Iron (µg/L)	19	300.0	Below standard	15.5	150	300.0	Below standard	147.2
Lead (µg/L)	< 1.0	0.2	Not detected	N/A	2.0	0.6	3.3	2.0
Magnesium (mg/L)	0.97	None	N/A	793.1	2.70	None	N/A	2,649.2
Manganese (µg/L)	12	50.0	Below standard	9.8	1,100	50.0	22.0	1,079.3
Nickel (µg/L)	< 20	17.8	Not detected	N/A	< 20	35.4	Below standard	N/A
Potassium (mg/L)	< 1.0	None	N/A	N/A	< 1.0	None	N/A	N/A
Silicon (mg/L)	3.9	None	N/A	3,188.8	4.7	None	N/A	4,611.5
Silver (µg/L)	< 0.2	0.0	Not detected	N/A	< 0.2	0.0	Not detected	N/A
Sodium (mg/L)	1.60	None	N/A	1,308.2	1.50	None	N/A	1,471.8
Sulfate (mg/L)	< 5	250.0	Below standard	N/A	37	250.0	Below standard	36,303.7
Zinc (µg/L)	18	16.3	1.1	14.7	1,700	35.0	48.5	1,668.0

Table 3. Analytical data for water samples from the "South of Wilkes Barre Tunnels" inventory area--continued.

Sample	12-01-381/4350-1.4, SOUTH OF WILKES BARRE, ST. KEVIN ABOVE SHINGLE MILL (7/12/99)				12-01-381/4350-1.5, SOUTH OF WILKES BARRE ST. KEVIN BELOW (7/12/99)			
Parameter	Concentration/ measurement	Standard	Factor above standard	Load (grams/day)	Concentration/ measurement	Standard	Factor above standard	Load (grams/day)
Flow (gpm)	180.0				500.0			
pH (standard units)	3.49				4.25			
Conductivity (µS/cm)	218.0				112.0			
Alkalinity (mg/L CaCO3)								
Hardness (mg/L CaCO3)	36	None	N/A		27	None	N/A	
Aluminum (trec) (µg/L)	1,600	None	N/A	1,569.9	1,100	None	N/A	2,998.1
Antimony (trec) (µg/L)	< 1.0	6.0	Below standard	N/A	< 1.0	6.0	Below standard	N/A
Arsenic (trec) (µg/L)	< 1.0	10.0	Below standard	N/A	< 1.0	10.0	Below standard	N/A
Iron (trec) (µg/L)	2,900	1,000.0	2.9	2,845.4	1,500	1,000.0	1.5	4,088.3
Thallium (µg/L)	< 1.0	0.5	Not detected	N/A	< 1.0	0.5	Not detected	N/A
Zinc (trec) (µg/L)	5,800	2,000.0	2.9	5,690.8	3,600	2,000.0	1.8	9,811.8
Aluminum (µg/L)	1,400	87.0	16.1	1,373.7	980	87.0	11.3	2,671.0
Cadmium (µg/L)	32.0	0.5	62.4	31.4	21.0	0.4	51.4	57.2
Calcium (mg/L CaCO3)	22	None	N/A	21,586.0	17	None	N/A	46,333.5
Chloride (mg/L)	< 50.0	250.0	Below standard	N/A	< 50.0	250.0	Below standard	N/A
Chromium (µg/L)	< 10	11.0	Below standard	N/A	< 10	11.0	Below standard	N/A
Copper (µg/L)	100.0	5.0	20.1	98.1	55.0	3.9	14.1	149.9
Fluoride (mg/L)	0.11	2.0	Below standard	107.9	< 0.10	2.0	Below standard	N/A
Iron (µg/L)	2,600	300.0	8.7	2,551.1	460	300.0	1.5	1,253.7
Lead (µg/L)	3.0	0.9	3.2	2.9	2.0	0.6	3.2	5.5
Magnesium (mg/L)	3.50	None	N/A	3,434.1	2.50	None	N/A	6,813.8
Manganese (µg/L)	2,800	50.0	56.0	2,747.3	1,600	50.0	32.0	4,360.8
Nickel (µg/L)	< 20	44.3	Below standard	N/A	< 20	35.6	Below standard	N/A
Potassium (mg/L)	< 1.0	None	N/A	N/A	< 1.0	None	N/A	N/A
Silicon (mg/L)	5.4	None	N/A	5,298.4	4.9	None	N/A	13,355.0
Silver (µg/L)	< 0.2	0.0	Not detected	N/A	< 0.2	0.0	Not detected	N/A
Sodium (mg/L)	1.60	None	N/A	1,569.9	1.70	None	N/A	4,633.4
Sulfate (mg/L)	73	250.0	Below standard	71,626.1	48	250.0	Below standard	130,824.0
Zinc (µg/L)	5,700	45.0	126.8	5,592.7	3,600	35.2	102.2	9,811.8

Water samples collected in 1999 from Shingle Mill Gulch suggest minor impact to the stream from features #101/201 and #102/202. Sample 12-01-381/4350-1.2 was collected above the influence of those mine features. The stream was clear, conductivity was 23 µS/cm, and pH was 6.56. This water slightly exceeded the hardness-based standard for zinc, but the hardness was very low and zinc load was almost negligible. Other parameters were within standards.

Sample 12-01-381/4350-1.1 was collected from Shingle Mill Gulch below features #102/202 and about 20 feet downstream of the "island" of dump #201. The stream was still clear, conductivity was 27 µS/cm, and pH was 6.37. Compared to the upstream sample, iron, manganese, and zinc concentrations roughly doubled, but only zinc exceeded standards. Although some metal concentrations increased below features #101/201 and #102/202, metal loading at the downstream site was minimal. The highest load of any trace or heavy metal was less than 1/6 lb/day (total recoverable iron).

Sample 12-01-381/4350-1.5 was collected in St. Kevin Gulch below its confluence with Shingle Mill Gulch and downstream of all the mine features described in this report. The stream channel was lined with abundant red-yellow-orange precipitate. Flow was estimated at 500gpm, conductivity was 112 µS/cm, pH was 4.25, and aluminum, cadmium, copper, iron, lead, manganese, and zinc concentrations exceeded standards. Probably because of dilution by the comparatively clean water of Shingle Mill Gulch, metal concentrations were generally lower than at the sample site immediately downstream of features #100/200. Although concentrations were generally less, loads of many parameters increased 50% to 300%. Some of the increased load may enter the stream via contaminated alluvial ground water from the saturated dump and adjacent tailings.

MIGRATION PATHWAYS

Ground Water Pathway

No wells permitted for household or domestic use have been completed within 2 miles of this inventory area (Colorado Division of Water Resources records). Three wells, which have not been drilled yet, are permitted about 1 mile west and southwest of this site. The permitted locations are upgradient and much higher in elevation than these mines. If the wells are completed some time in the future, they will not be affected by degraded water from the Griffin or Wilkesbarre Mines. Another well that is permitted but not drilled is about 1.3 miles northeast of the inventory area on the northeast side of Temple Gulch. If this well is completed, it will not be hydrologically connected to the waters of St. Kevin Gulch. The closest permitted and completed wells lie more than 2 miles east-southeast of the inventory area near Tennessee Creek, about ½ mile downstream of its confluence with St. Kevin Gulch and near the southern end of Tennessee Park. These two wells are owned by the U.S. Forest Service and are permitted for "other" or "monitoring" uses. They presumably draw from the alluvial aquifer of Tennessee Creek, because they are about 70 feet deep, and the water level is 6 feet below the surface. Yield for each well is 100 gpm.

Degraded water associated with dump and tailings seepage at features #100/200 has a measurable and significant effect on the surface water of St. Kevin Gulch. At least some of the degradation results from inflow of contaminated ground water from dump #200. This seepage is severely contaminated with aluminum, iron, cadmium, manganese, zinc, copper, and lead. Alluvial ground water in this reach of St. Kevin Gulch is probably similarly contaminated with metals. This poor-quality ground water associated with features #100/200 is a concern in the St. Kevin Gulch area, and it could possibly affect ground water in the Tennessee Creek alluvial aquifer, including the identified U.S. Forest Service wells. Those wells should be sampled to determine if metals possibly attributable to the Griffin Mine occur. Additional information is presented in the *Summary and Conclusions* section that follows.

The small volume of moderately degraded water associated with adits #101 and #102, and the apparent lack of significant impact to Shingle Mill Gulch suggests that ground water contamination is not a major concern at these sites, especially when compared to the severe impact of features #100/200.

Surface Water Pathway

No public water-supply or surface-water intakes are known on St. Kevin Gulch. Riparian habitat occurs along the length of the St. Kevin Gulch, and a large wetland exists about a mile downstream of the "South of Wilkes Barre Tunnels" inventory area, near its confluence with Tennessee Creek.

Degraded effluent from adit #100 and surface runoff from dump #200 and nearby tailings has a measurable and significant effect on the surface water of St. Kevin Gulch. Although water in St. Kevin Gulch exceeded standards for some metals upstream of the Griffin Mine, metal loads and concentrations increased dramatically below the inflow of surface and ground water from features #100/200.

Effluent from adits #101 and #102 was not sampled because surface flow did not reach NFS land during the site visits. An iron-stained, dry channel at features #102/202 suggests that effluent reaches Shingle Mill Gulch at the surface intermittently. Water samples collected for this investigation indicate minor metal loading into Shingle Mill Gulch from features #101/201 and #102/202. For most metals, this load is less than 1% of the loads carried in St. Kevin Gulch below its confluence with Shingle Mill Gulch.

Because of the severe effect of water associated with features #100/200 on the surface water of St. Kevin Gulch, this pathway is a major concern at the "South of Wilkes Barre Tunnels" inventory area.

Soil Exposure Pathway

No full-time residents live within 200 feet of any of the mine features described in this report. One of the local landowners lives or works a portion of the year in a trailer within 200 feet of dump #200 and the associated Griffin Mill tailings. According to estimated population data from the Colorado Department of Local Affairs, about 3,500 people live in and near Leadville, which is about 5 miles southwest of the inventory area. Although easily accessible, the Griffin-Wilkesbarre Mines area does not appear to be visited frequently or repetitively. Visitation by the public is probably sporadic and mostly during the summer and fall.

Visual examination and a waste-rock sample indicate that the dumps are not extremely mineralized, and exposures to the public are brief. The soil pathway poses little risk to the public.

Air Exposure Pathway

A trailer near dump #200 was being used as an intermittent residence or laboratory by one of the local landowners when this field investigation was conducted in July 1999. No full-time residents are known to live within a mile of the site. No one works full time at the site, although remediation work and research may be done intermittently. Visitation to the site by tourists is sporadic.

In 1951 much of the lowest level of the Wilkesbarre Mine (adit #102) was accessible and was mapped. Readings of radon gas in the mine were up to 10 times background levels recorded outside the mine (Singewald, 1955, p. 286-287, plate 27). By 1999 the adit was caved, eliminating the danger of the radon gas to the public.

The waste-rock piles examined for this study are composed of sand-size and larger material and show no evidence of significant wind erosion. Because waste rock is not easily airborne or extremely mineralized, no full-time residents live close to the site, and exposures to non-residents are brief, the air pathway poses little risk to the public.

SUMMARY AND CONCLUSIONS

Various mineral surveys and the PBS map have major differences regarding property boundaries in the "South of Wilkes Barre Tunnels" inventory area, and a survey is needed to clarify the position of the mine workings. Flagging in the area suggests that some surveys have been recently completed, but property boundaries were not clear during the field investigation in July 1999. It appears that the portal of adit #100 is probably in the overlapping part of the Griffin No. 2 and Annie G. patented claims. Dump #200 may extend onto NFS land. Adits #101 and #102 and most of dumps #201 and #202 are probably on the Wilkesbarre No. 3 patented mining claim. About half of the lower "island" lobe of dump #201 and a small portion of the southern part of dump #202 are probably on NFS land.

Adit #100, associated dump #200, and the adjacent tailings are the most environmentally damaging features within the "South of Wilkes Barre Tunnels" inventory area. This adit is probably Tunnel No. 3 of the Griffin Mine and was apparently used as a haulageway and for mine drainage in the latter stages of operations at the Griffin Mine. Effluent from adit #100 and some of the seepage from dump #200 flow through tailings that probably came from the Griffin Mill, then into St. Kevin Gulch. Additional seepage from dump #200 flows directly into St. Kevin Gulch. The addition of these acidic, metal-rich waters has a severe and visually obvious impact on St. Kevin Gulch. Although St. Kevin Gulch is degraded above the Griffin Mine, metal loads increase substantially along the stream reach that includes features #100/200 and Griffin Mill tailings. In addition, the volume of precipitate in the stream channel increases, and its color changes from light red-brown to red-yellow-orange as the dump seepage and mine effluent mix with St. Kevin Gulch.

Adit #102 is probably the Wilkesbarre Adit and probably connects to and drains the Arty and Snow Mine higher on the hillside. This adit discharges water that visual observation and test parameters suggest is moderately degraded, but the effluent only intermittently flows into Shingle Mill Gulch at the surface. Dump #202 shows evidence of moderate erosion and is in contact with Shingle Mill Gulch.

Adit #101 was a minor part of the Wilkesbarre Mine group, and probably has limited underground workings. A small amount of effluent seeped from the caved portal, but infiltrated a short distance from the adit on private land. This effluent did not appear degraded. The lower lobe of dump #201 is an "island" placed in a wetland associated with Shingle Mill Gulch. This mineralized dump is in contact with the stream for a short distance.

Shingle Mill Gulch slightly exceeds water-quality standards for zinc upstream of the Wilkesbarre Mine workings. Downstream of features #101/201 and #102/202, zinc concentration doubles, but zinc load is less than 0.1 lb/day.

Because of the large metal loading to St. Kevin Gulch from features #100/200, remediation efforts should be attempted. The source of the water that saturates dump #200 should be determined to engineer the most effective method to redirect that water away from the dump. Cutting off the source of the water should reduce or possibly eliminate the highly degraded seepage from the waste rock. Effluent from adit #100 should be diverted away from dump #200 and the Griffin Mill tailings. Surface runoff onto and through the tailings could be reduced by construction of diversion ditches. Removal of the waste rock and tailings and/or water treatment are also possible, but probably considerably more expensive solutions.

If permission is obtained from the landowner, water and waste-rock samples should be collected at features #102/202 to better determine the severity of any degradation caused by this site. Diverting mine effluent away from dump #202 may slightly improve water quality in Shingle Mill Gulch. Regrading and pulling back the toe of dump #202 would reduce erosion of the waste rock into the gulch.

The small volume of apparently clean effluent from caved adit #101 is probably not a serious concern in this inventory area, especially when compared to the much larger flows of highly degraded water from features #100/200 and the moderate discharge from adit #102. The mineralized "island" lobe of dump #201 rests in a wetland and may contribute to minor degradation in Shingle Mill Gulch. This lobe could be removed relatively easily if a suitable repository is available. The detrimental effects of disturbing an undamaged portion of the wetland may outweigh the benefits of dump removal, at least in the short term. The alkaline nature of dump #201 might allow the material to be used in future remedial actions at features #100/200.

Downstream of features #101/201 and #102/202, Shingle Mill Gulch carries less than 1% of the load of most trace and heavy metals compared to St. Kevin Gulch below their confluence. Therefore, any cleanup efforts at features #101/201 and #102/202 will probably not measurably improve water quality in St. Kevin Gulch.

Because of the mixed ownership of some of the mine features, any remediation efforts in the "South of Wilkes Barre Tunnels" inventory area will almost certainly require the cooperation of private landowners and government agencies.

REFERENCES

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Appendix. Abandoned Mined Lands Inventory Project form for the "South of Wilkes Barre Tunnels" area.

USFS-AMLI FIELD DATA FORM

LOCATION AND IDENTIFICATION

(1) **ID#:** 02- 08- 12 - 01 - 381 / 4350 - 1
rgn st fst rd xutm yutm area#

(2) **Sitename:** South of Wilkes Barre Tunnels

(3) **Other name/reference:** ST Kevin Gulch

1 (4) **Highest priority Environmental Degradation occurring in this area:** 1=extreme; 2=significant; 3=potentially significant; 4=slight; 5=none

5 (5) **Highest priority Mine Hazard noted in this area:** E=emergency; 1=extreme danger; 2=dangerous; 3=potentially dangerous; 5=no significant hazard

M (6) **Commodity:** C=coal; U=uranium; M=metals; I=industrial material. (Metal or Indust. material type: Gold/Silver)

(7) **Quad name and date:** Homestake Reservoir 1984

(8) **County:** Lake

(9) **2° map:** Leadville

(10) **Water Cataloguing Unit #:** 11020001

(11) **Mining district/coal field:** ST Kevin

(12) **Land survey location:** ___ - ___ - E½ sec 6 ,T 9S ,R 80W

(13) **Receiving stream:** ST Kevin Gulch flowing into ___
nearest named stream next named

(14) **Elevation (ft):** 10200

2 (15) **General Slope:** 1=0-10°; 2=11-35°; 3=greater than 35°

M (16) **Regional terrain:** R=rolling or flat; F=foothills; T=mesa; H=hogback; M=mountains; S=steep/narrow canyon

G,J (17) **Type of access:** N=no trail; T=trail; J=jeep road; G=gravel road; M=paved road; P=private/restricted road

G (18) **Quality of access for construction vehicles:** G=good; M=moderate; P=poor; X=very poor

(19) **Nearest town on map:** Leadville

10.5 (20) **Road distance from nearest town (#.# miles)**

(21) **Nearest road (name and/or #):** FR 103
FR=forest rd; CR=county rd; SH=state highway; I=interstate

Distance to following types of public uses (#.# miles):

0 (22) Road
— (23) Dwelling (year-round)
— (24) Campground/picnic area
— (25) Marked trail
0.1 (26) Other public use (explain) Jeeping, Biking, hiking

ENVIRONMENTAL INFORMATION

M (27) **Vegetation density adjacent to site:** D=dense; M=moderate; S=sparse; B=barren

PGWR (28) **Vegetation type adjacent to site:** B=barren; W=weeds; G=grass; R=riparian S=sagebrush/oakbrush/brush; J=juniper/piñon; A=aspen; P=pine/spruce/fir; T=tundra

N (29) **Evidence of intentional reclamation:** Y=yes; N=no (if yes, use comments)

1 (30) **Size of disturbed area in acres**

Y (31) **Potential historical structures in area:** Y=yes; N=no (if yes, use comments)

Y/N (32) **Evidence of bats:** G=guano; I=insect remains; B=bat sighting; O=other(use comments); N=no (use comments to expand on any positive evidence)

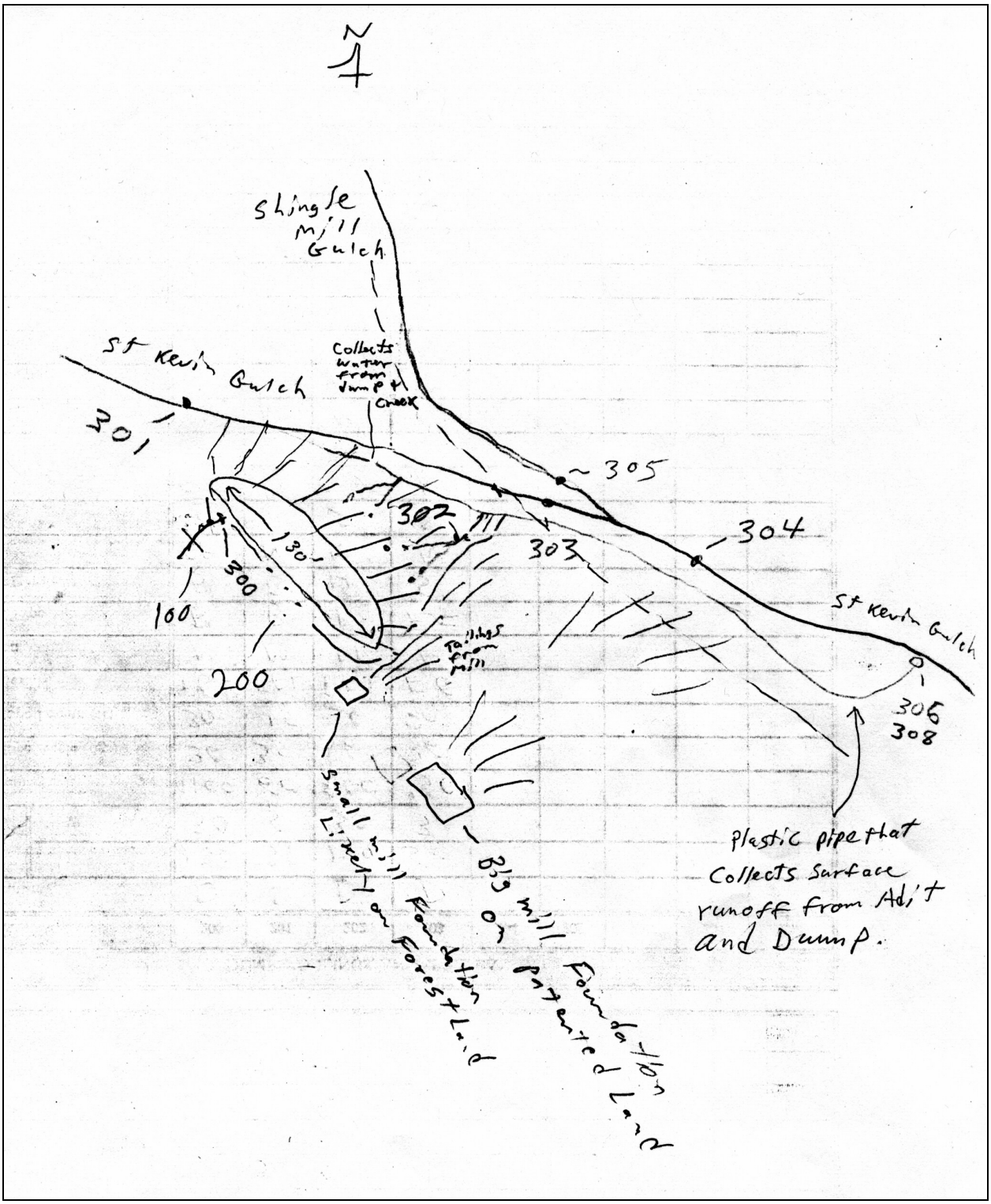
___ (33) **Recorded by/date:** Don Brown Boise 8-20-96

ADITS, SHAFTS, AND OPENINGS

Feature Nos.		100	101	102	103	104	105	106	107	108	109	110	111
Type of Feature		A	A	A	A								
Opening Size (ft)	H	60	30	50	30								
	W	20	20	15	10								
Depth (ft)		5	5	4	3								
Condition		F	F	F	F								
Drainage		W	W	W	N								
Access Deterents		N	N	N	N								
Deterent Condition		—	—	—	—								
Ratings	Env. Deg.	1	3	3.	5								
	Hazard	5	5	5	5								
Photo	Roll No.	RW5	—	RW5	—								
	Frame No.	2, 3	—	7	—								
Comments?		Y	Y	Y	Y								

DUMPS, TAILINGS, AND SPOIL BANKS

Feature No.		200	201	202	203	204	205	206	207	208
Type of Feature		D	D	D	D					
Plan view Dimension (ft.)	L	130	35	100	50					
	W	30	5	30	30					
Volume (yds)		1100	60	800	150					
Steepest Slope Angle (dgr)		36	35	36	36					
Steepest Slope Length (ft)		30	15	20	20					
Size of Materials		FGL	FGL	FGL	FG					
Cementation		M	M	M	M					
Vegetation Type		B	B	B	P, G					
Vegetation Density		B	B	B	S					
Drainage		SP	N	N	N					
Stability		S	S	S	S					
Water Erosion	of Feature	GR	N	G, R	R					
	Storm Runoff	C	C	C	C					
Wind Erosion		N	N	N	N					
Radiation Count		—	—	—	—					
Access Deterents		N	N	N	N					
Deterent Condition		—	—	—	—					
Ratings	Env. Deg.	1	3	3	4					
	Hazard	5	5	5	5					
Photo	Roll No.	RW5	—	RW5	RW5					
	Frame No.	4, 5	—	6, 8	9					
Comments?		Y	Y	Y	Y					
Soil Sample No.										


N
Shingle Mill Gulch
St Kevin Gulch
Collects water from Jumpoff Creek
301
~305
302
303
304
130
300
100
200
St Kevin Gulch
306
308
Plastic pipe that Collects surface runoff from Adit and Dump.
Small Mill Foundation on Forest Land
Big Mill Foundation on Patented Land

DRAINAGE/WATER SAMPLES

Item Nos.	300	301	302	303	304	305
Adit/Shaft/Dump No./Other=0 (If other location, describe in comments)	100	200	200	200	200	0
pH (standard units)	3.26	4.58	3.15	4.37	5.29	5.87
Conductivity (uS)	2130	187.2	2380	226	1445	120.3
Flow (gpm)	2	400	4	350	500	150
Method of Flow Measure	E	E	E	E	E	E
Date Flow/Sample (m/d/y)	8/20/96	8/20/96	8/20/96	8/20/96	8/20/96	8/20/96
Location of Sample/Flow	A	RU	B	RD	RD	RU
Evidence of Toxicity in Site Drainage	P	P	P	P	P	P
Evidence of Toxicity in Receiving Stream	P	P		P	P	N
Distance from Stream (ft)		0	6	0	0	0
Comments?	+	+	W	—	—	—
Lab Water Sample No.						

GPS READINGS

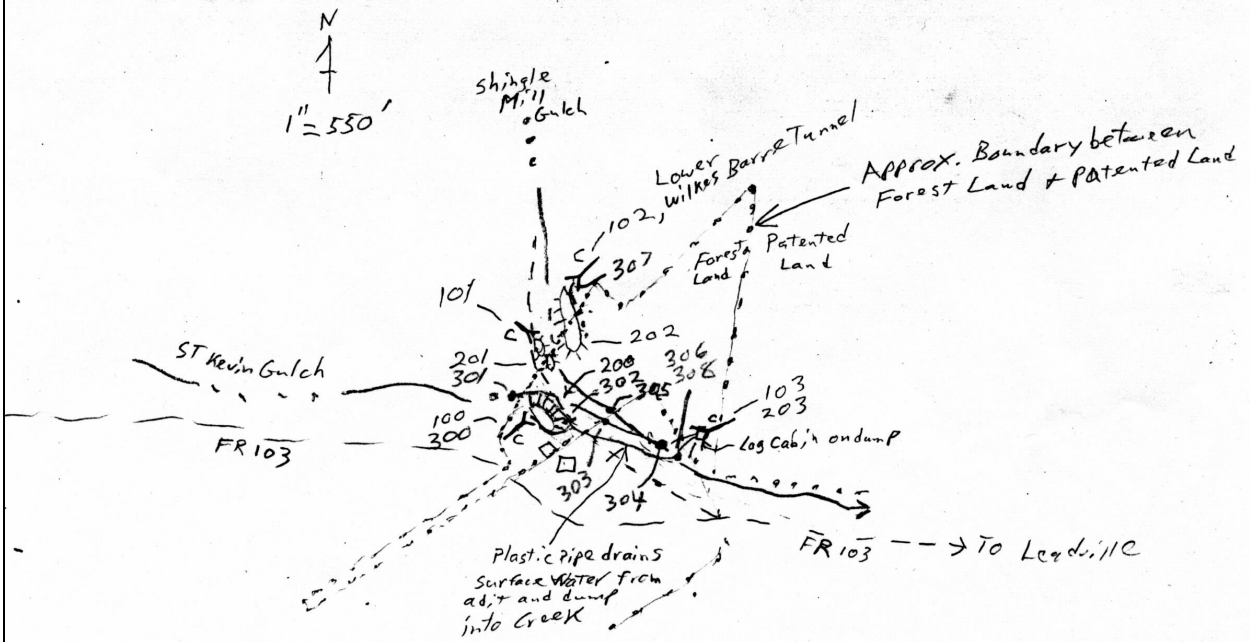
Ptr. No.	Location	
100 200	Lat. N 39 17 40.3 Long. W 106 22 45.7	5
101	Lat. N 39 17 42.8 Long. W 106 22 37.3	4
103	Lat. N 39 17 39.7 Long. W 106 22 37.1	4
	Lat. Long.	
	Lat. Long.	
	Lat. Long.	
	Lat. Long.	
	Lat. Long.	
	Lat. Long.	
	Lat. Long.	
	Lat. Long.	

more → over

DIAGRAM OF PROBLEM AREA (Locate all adits, shafts, dumps, prospects, etc. on topo map.)

Check off upon completion: ___ north arrow; ___ scale bar or general size noted; ___ direction to nearest trail/road/town noted; ___ significant mine features numbered

Adit shaft X prospect hole building dump or tailings collapsed adit and shaft fence



also see maps on back of page 2

DRAINAGE/WATER SAMPLES

Item Nos.	~~300~~ 306	~~301~~ 307	~~302~~ 308	303	304	305
Adit/Shaft/Dump No./Other=0 (If other location, describe in comments)	100 200	102	100 200			
pH (standard units)	3.21	5.83	2.84			
Conductivity (uS)	2140	463	2090			
Flow (gpm)	7.5	4	8.5			
Method of Flow Measure	D	E	D			
Date Flow/Sample (m/d/y)	8/20/96	8/20/96	8/21/96			
Location of Sample/Flow	B	A	B			
Evidence of Toxicity in Site Drainage	P	P	P			
Evidence of Toxicity in Receiving Stream	P	P	P			
Distance from Stream (ft)	0	50	0			
Comments?	Y	–	Y			
Lab Water Sample No.			381-4382-1308			

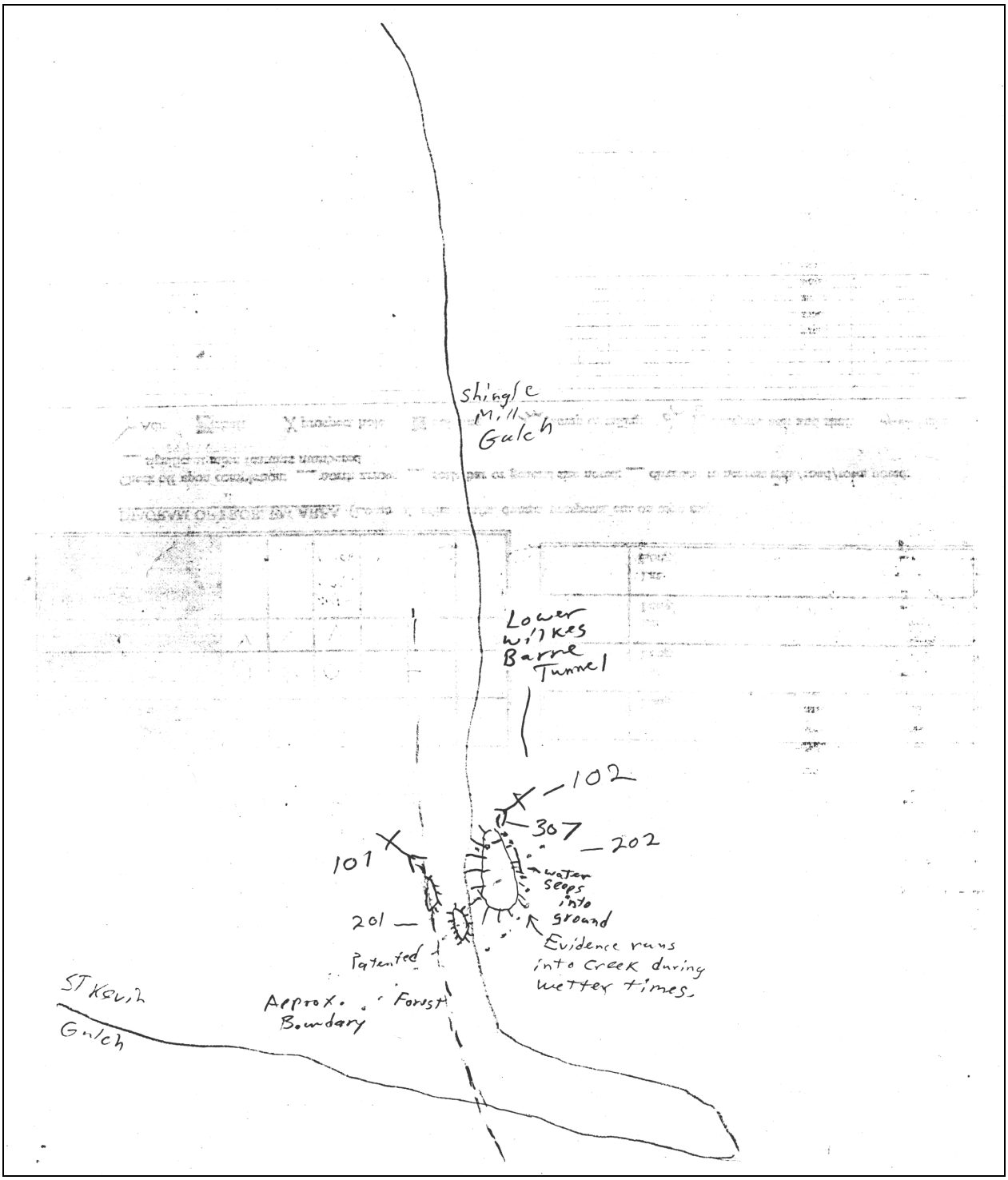
GPS READINGS

Ptr. No.	Location
	Lat. Long.
	Lat. Long.
	Lat. Long.
	Lat. Long.
	Lat. Long.
	Lat. Long.
	Lat. Long.
	Lat. Long.
	Lat. Long.
	Lat. Long.
	Lat. Long.

DIAGRAM OF PROBLEM AREA (Locate all adits, shafts, dumps, prospects, etc. on topo map.)

Check off upon completion: ___ north arrow; ___ scale bar or general size noted; ___ direction to nearest trail/road/town noted; ___ significant mine features numbered

Adit shaft X prospect hole building dump or tailings c collapsed adit and shaft fence


Shingle Mill Gulch
Lower Wilkes Barre Tunnel
102
307
202
101
201
water seeps into ground
Evidence runs into creek during wetter times.
Patented
Approx. Forest Boundary
ST Kevin Gulch

●81. Local person interviewed _____
Name Address

●82. Name and address of person desiring a copy of this form: _____

●83. Describe the minimum work needed to mitigate any public health, safety, welfare, or environmental problems observed at the site. Note specific reclamation activities along with an estimated cost and time period to implement each activity described. Code costs as: 1= less $10,000; 2= $10,000 to $100,000; 3= $100,000 to $500,000; 4= more than $500,000. Code estimated time to complete the activity as: 1= less than 1 month; 2= 1 to 12 months; 3= 1 to 3 years; 4= over 3 years

Cost	Time	Recommended reclamation activity

●84. Comments relating to health, safety, welfare, environmental, or restoration problems and any general comments. All comments must be keyed to mine feature # or drainage/water sample item #.

100 Caved adit not shown on Topo. Water drains out and goes both alongside dump and through plastic pipes collect the surface runoff from adit + dump.
302 sample taken just before collection pipe, drainage from dump.
306 taken from end of collection pipe just before goes into Creek.
200 dump of caved adit prominantly Sulfur stained and a strong Sulfur smell. Abundant pyrite.
101 + Caved adit on patented land, 2 dump lobes, the
201 lower lobe appears to be on or bordering Forest land. upper lobe about 40 yds. Altered granitic rock, prominent Sulfur + iron stains, abundant Pyrite
102 Lower Wilkes Barre Tunnel on patented land. Part of dump on Forest Land
202 Dump From lower Wilkes Barre Tunnel, altered granitic rock, intensely Sulfur stained, abundant Pyrite. Creek flows along base of dump.
103 Caved adit.
203 Log Cabin and dump fairly good Shape. Granitic rock on dump - minor iron stains. Base of dump in contact with Creek.
308 Water Sample, PW5 - From 10

-if more comments use back of page →

General Comment: Whole area is significantly degraded by mine drainage. Mine effluent empties into St. Kevin Gulch and gulch has abundant iron hydroxide precipitate along its length below these mines

-if more comments use back of page →

OFFICE/LITERATURE INFORMATION

●41. Owner of surface _____
●42. Last known operator _____
●43. Estimated production _____
●44. Dates of production _____
●45. Literature not cited in comments _____
●46. Citation of any historical register listing _____

CODES FOR TABULAR INFORMATION

ALL TABLES: If appropriate code is not listed, use: **N** = none or no; **N/A** = not applicable; **UNK** = unknown; **O** = other, explain in #84

ADITS, SHAFTS, & OPENINGS

- Type of feature: **A** = adit; **S** = vertical shaft; **I** = incline shaft; **P** = prospect hole; **ST** = stope; **G** = glory hole; **SU** = subsidence feature; **PT** = open pit; **O** = other, explain in #84.
- Condition: **I** = intact; **P** = partially collapsed or filled; **F** = filled or collapsed; **N** = feature searched for but not found (mine symbol on map)
- Drainage: **N** = no water draining; **W** = water draining; **S** = standing water only (note at what depth below grade)
- Access deterents: **N** = none; **S** = sign; **F** = fence; **C** = sealed or capped; **D** = open door or hatch; **L** = locked door or hatch; **G** = open grill; **O** = other, explain in #84.
- Deterent condition: **P** = prevents access; **D** = discourages access; **I** = ineffective
- Ratings: Hazard: **E** = emergency; **1** = extreme danger; **2** = dangerous; **3** = potential danger; **5** = no significant hazard
  Env. Deg.: **1** = extreme; **2** = significant; **3** = potentially significant; **4** = slight; **5** = none
- Comments?: **Y** = yes; **N** = no

DUMPS, TAILINGS, AND SPOIL AREAS

- Type of feature: **D** = mine dump; **T** = mill tailings; **W** = coal waste bank; **S** = overburden or development spoil pile; **DS** = dredge spoil; **HD** = placer or hydraulic deposit; **H** = highwall; **P** = processing site
- Size of materials: **F** = fine; **S** = sand; **G** = gravel; **L** = cobbles; **B** = boulders
- Cementation: **W** = well cemented; **M** = moderately cemented; **U** = uncemented
- Vegetation Type: **G** = mixed grass; **S** = sagebrush/oakbrush/brush; **J** = juniper/piñon; **A** = aspen; **P** = pine/spruce/fir; **T** = tundra; **R** = riparian; **F** = tilled crops; **B** = barren/no vegetation; **W** = weeds
- Vegetation Density: **D** = dense; **M** = moderate; **S** = sparse; **B** = barren
- Drainage: **N** = no water draining; **W** = water draining across surface; **S** = standing water only; **SP** = water seeping from side of feature
- Stability: **U** = unstable; **P** = potentially unstable; **S** = stable
- Water erosion: of Feature: **N** = none; **R** = rills; **G** = gullies; **S** = sheet wash
  Storm Runoff: **C** = in contact with normal stream; **S** = near stream or gully, but only eroded during storm or flood; **N** = no storm/flood runoff erosion
- Wind erosion: **N** = none; **D** = dunes; **B** = blowouts; **A** = airborne dust
- Radiation Count: **N** = none taken; record value of reading if taken
- Access deterents: **N** = none; **S** = sign; **F** = fence; **O** = other, explain in #84
- Ratings: Hazard: **E** = emergency; **1** = extreme danger; **2** = dangerous; **3** = potential danger; **5** = no significant hazard
  Env. Deg.: **1** = extreme; **2** = significant; **3** = potentially significant; **4** = slight; **5** = none
- Comments?: **Y** = yes; **N** = no

DRAINAGE/WATER SAMPLES

- Adit/Shaft/Dump No./Other: Indicate Feature No. associated with water information; **0** = other, explain in comments
- Flow (cfs): record seeps as 0.01 cfs (Rule of Thumb: a cfs ≈ one full-blast garden hose)
- Method of flow measure: **E** = estimate; **T** = bobber/stopwatch/x-section; **W** = weir; **D** = catchment; **F** = flow meter
- Location of sample and flow: **A** = immediately adjacent to adit/shaft; **B** = below dump/tailings; **C** = immediately above confluence with receiving stream; **SW** = standing water in/on feature; **RU** = receiving stream upstream of feature; **RD** = receiving stream dowmstream of feature;
- Evidence of toxicity: **N** = none; **A** = absence of benthic organisms; **W** = opaque water; **P** = yellow or red precipitate; **S** = suspended solids; **D** = salt deposits
- Comments?: **Y** = yes; **N** = no