ANALYSIS OF SAMPLES COLLECTED AT SPECIAL-STUDY SITES
SPECTRAL REFLECTANCE PROJECT

REMOTE ASSESSMENT OF THE LOCATION AND QUALITY OF MINE DRAINAGE USING SPECTRAL REFLECTANCE, SOUTHERN ANTHRACITE COALFIELD, PENNSYLVANIA

Contaminated mine drainage (CMD) from abandoned coal mines typically contains high concentrations of iron and other metals, which degrade water supplies and aquatic ecosystems and which ultimately can precipitate as rust-colored coatings on streambeds. Locating CMD and characterizing the chemistry of discharges and receiving streams can be difficult, time consuming, and costly because CMD originates from numerous nonpoint sources and access can be restricted in areas having few roads, steep terrain, and private ownership. A remote-sensing technique for locating and characterizing the chemical quality of discharges and affected streams could provide an efficient and cost-effective means of obtaining data on the sources and effects of CMD in a watershed.

The purpose of the Spectral Reflectance project is to demonstrate a remote-sensing method for identifying and characterizing surface waters affected by coal-mine drainage. Our goal is to use Digital Multispectral Video (DMSV) technology for aerial spectral-reflectance measurements to distinguish between acidic (pH <4) and near-neutral (pH 6 - 6.5) water that is affected by CMD. Spectral data from both ground and aerially-mounted imagers were collected during different seasons at 15-20 sites in the Southern Anthracite Coalfield. As part of this evaluation of the DMSV technology, water-quality and streambed precipitate samples at six sites in the Schuylkill River Basin (fig. 8) were collected during the water year. The water-quality data are being used to verify that spectral-reflectance imaging is capable of differentiating acidic and near-neutral water. Specific research objectives are (1) to verify that the aerial spectral-reflectance images and data are comparable to ground spectral-reflectance images and data; (2) to quantify the relation between key water-quality measures and both ground-collected and aerially collected spectral-reflectance data; and (3) to explain the sources of variability by analyzing microbial populations and the mineralogy and chemistry of streambed precipitates.

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TABLE 1.--SPECTRAL REFLECTANCE PROJECT STATION LIST.

REMARKS.--All samples collected by the U.S. Geological Survey.

LOCAL ID	STATION NUMBER	STATION NAME	LATITUDE	LONGITUDE	DRAINAGE AREA
		MISCELLANEOUS-RECORD STATIONS			
Bell-121	404512076025501	BELL WATER LEVEL TUNNEL NEAR MIDDLEPORT, PA	40°45′12"	76°02′55"	n.a.
Bell-1	0146742496	BELL WATER LEVEL TUNNEL 400 FT DOWNSTREAM, NEAR MIDDLEPORT, PA	40°45′12"	76°02′58"	.02
SCr-149	404403076072401	SILVER CREEK MINE TUNNEL NEAR NEW PHILADELPHIA	40°44′03"	76°07′24"	n.a.
SCr-2	01467456	SILVER CREEK MINE TUNNEL, 700 FT DOWNSTREAM, AT NEW PHILADELPHIA, PA	40°43′43"	76°07′28"	.02
Otto-190	403958076191401	OTTO AIR SHAFT NEAR LLEWELLYN, PA	40°39′58"	76°19′14"	n.a.
Otto-2	0146784350	OTTO AIR SHAFT, 1,100 FT DOWNSTREAM, NEAR LLEWELYN, PA	40°40′07"	76°19′07"	.09

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WATER-QUALITY DATA, WATER YEAR OCTOBER 1998 TO SEPTEMBER 1999
MISCELLANEOUS STATION ANALYSES

DATE	TIME	AGENCY COLLECTING SAMPLE (CODE NUMBER) (00027)	AGENCY ANALYZING SAMPLE (CODE NUMBER) (00028)	DISCHARGE, INST. CUBIC FEET PER SECOND (00061)	SPECIFIC CONDUCTANCE (µS/CM) (00095)	PH WATER WHOLE FIELD (STANDARD UNITS) (00400)	PH WATER WHOLE LAB (STANDARD UNITS) (00403)	COLOR (PLATINUM-COBALT UNITS) (00080)	OXIDATION REDUCTION POTENTIAL (MV) (00090)	TEMPERATURE WATER (DEG C) (00010)	OXYGEN, DISSOLVED (MG/L) (00300)	OXYGEN, DISSOLVED (PERCENT SATURATION) (00301)
				404512076025501 BELL WATER LEVEL TUNNEL NR MIDDLEPORT, PA (LAT 40 45 10N LONG 076 02 53W)								
MAY 1999												
27...	1100	1028	80020	1.0	276	3.9	3.7	<1	604	9.6	4.0	35
JUL												
29...	1145	1028	80020	.86	275	4.0	3.7	<1	606	9.7	.8	7
				0146742496 BELL WATER LEVEL TUNNEL, 400 FT DS, NEAR MIDDLEPORT, PA (LAT 40 45 12N LONG 076 02 58W)								
MAY 1999												
27...	1045	1028	80020	1.0	278	3.9	3.7	<1	608	10.0	10.0	89
JUL												
29...	1230	1028	80020	.86	278	3.8	3.6	10	601	10.5	9.7	89
				404403076072401 SILVER CREEK MINE TUNNEL NR NEW PHILADELPHIA, PA (LAT 40 43 48N LONG 076 07 26W)								
MAY 1999												
27...	1300	1028	80020	2.7	538	6.6	5.5	5	361	12.5	.8	87
JUL												
29...	1330	1028	80020	1.0	589	5.9	5.9	60	292	13.0	.5	4
				01467456 SILVER CR MINE TUNNEL, 700 FT DS, AT NEW PHILADELPHIA, PA (LAT 40 43 42N LONG 076 07 28W)								
MAY 1999												
27...	1230	1028	80020	2.7	287	6.0	6.0	5	364	12.5	7.5	70
JUL												
29...	1400	1028	80020	1.0	578	6.1	4.9	5	250	13.0	7.7	74
				403958076191401 OTTO AIR SHAFT NR LLEWELLYN, PA (LAT 40 39 58N LONG 076 19 14W)								
MAY 1999												
27...	1430	1028	80020	3.5	539	5.9	5.9	5	258	12.0	.4	4
JUL												
29...	1515	1028	80020	2.1	554	6.0	6.0	5	245	12.0	.3	3
				0146784350 OTTO AIR SHAFT, 1100 FT DS, NEAR LLEWELLYN, PA (LAT 40 40 07N LONG 076 19 07W)								
MAY 1999												
27...	1400	1028	80020	3.5	538	6.6	6.3	<1	44	12.5	9.3	87
JUL												
29...	1545	1028	80020	<2.1	553	6.5	6.2	5	188	13.0	9.2	88

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WATER-QUALITY DATA, WATER YEAR OCTOBER 1998 TO SEPTEMBER 1999
MISCELLANEOUS STATION ANALYSES

DATE	ACIDITY (MG/L AS CACO3) (00435)	CALCIUM DIS-SOLVED (MG/L AS CA) (00915)	MAGNE-SIUM, DIS-SOLVED (MG/L AS MG) (00925)	SODIUM, DIS-SOLVED (MG/L AS NA) (00930)	ANC WATER UNFLTRD FET FIELD MG/L AS CACO3 (00410)	SULFATE DIS-SOLVED (MG/L AS SO4) (00945)	CHLO-RIDE, DIS-SOLVED (MG/L AS CL) (00940)	ALUM-INUM, DIS-SOLVED (µG/L AS AL) (01106)	IRON, TOTAL RECOV-ERABLE (µG/L AS FE) (01045)	IRON, DIS-SOLVED (µG/L AS FE) (01046)	MANGA-NESE, DIS-SOLVED (µG/L AS MN) (01056)
404512076025501 BELL WATER LEVEL TUNNEL NR MIDDLEPORT, PA (LAT 40 45 10N LONG 076 02 53W)											
MAY 1999											
27...	54	13	11	2.2	0	100	3.4	890	--	2600	1300
JUL											
29...	36	14	12	2.2	0	110	2.7	890	9500	5100	1400
0146742496 BELL WATER LEVEL TUNNEL, 400 FT DS, NEAR MIDDLEPORT, PA (LAT 40 45 12N LONG 076 02 58W)											
MAY 1999											
27...	46	13	11	2.2	0	110	3.3	950	--	2600	1300
JUL											
29...	30	14	12	2.1	0	120	2.6	880	14000	4700	1400
404403076072401 SILVER CREEK MINE TUNNEL NR NEW PHILADELPHIA, PA (LAT 40 43 48N LONG 076 07 26W)											
MAY 1999											
27...	100	46	29	2.5	2	260	2.0	350	--	24000	3400
JUL											
29...	59	51	30	2.8	22	270	2.0	280	18000	27000	3600
01467456 SILVER CR MINE TUNNEL, 700 FT DS, AT NEW PHILADELPHIA, PA (LAT 40 43 42N LONG 076 07 28W)											
MAY 1999											
27...	67	46	29	2.5	9	250	2.0	340	--	23000	3400
JUL											
29...	46	51	30	2.7	4	260	2.1	120	15000	25000	3600
403958076191401 OTTO AIR SHAFT NR LLEWELLYN, PA (LAT 40 39 58N LONG 076 19 14W)											
MAY 1999											
27...	59	36	32	7.6	40	220	2.0	180	--	12000	2300
JUL											
29...	54	41	34	7.9	54	230	2.6	200	18000	16000	2600
0146784350 OTTO AIR SHAFT, 1100 FT DS, NEAR LLEWELLYN, PA (LAT 40 40 07N LONG 076 19 07W)											
MAY 1999											
27...	33	36	32	7.7	25	220	2.0	62	--	11000	2300
JUL											
29...	23	40	34	8.0	26	230	2.6	24	20000	14000	2500