Remediation of The Block-P Mine Barker Hughesville Mining District, Montana

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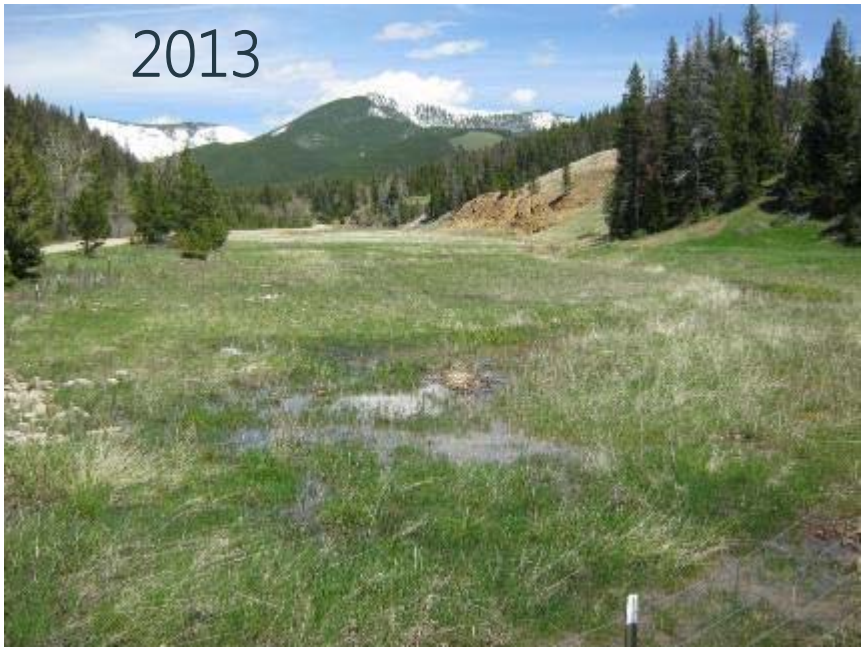
Project Team

Block P Mine Site Before Source Removal Action

Block P Mill Removal Action 1998 to 2006

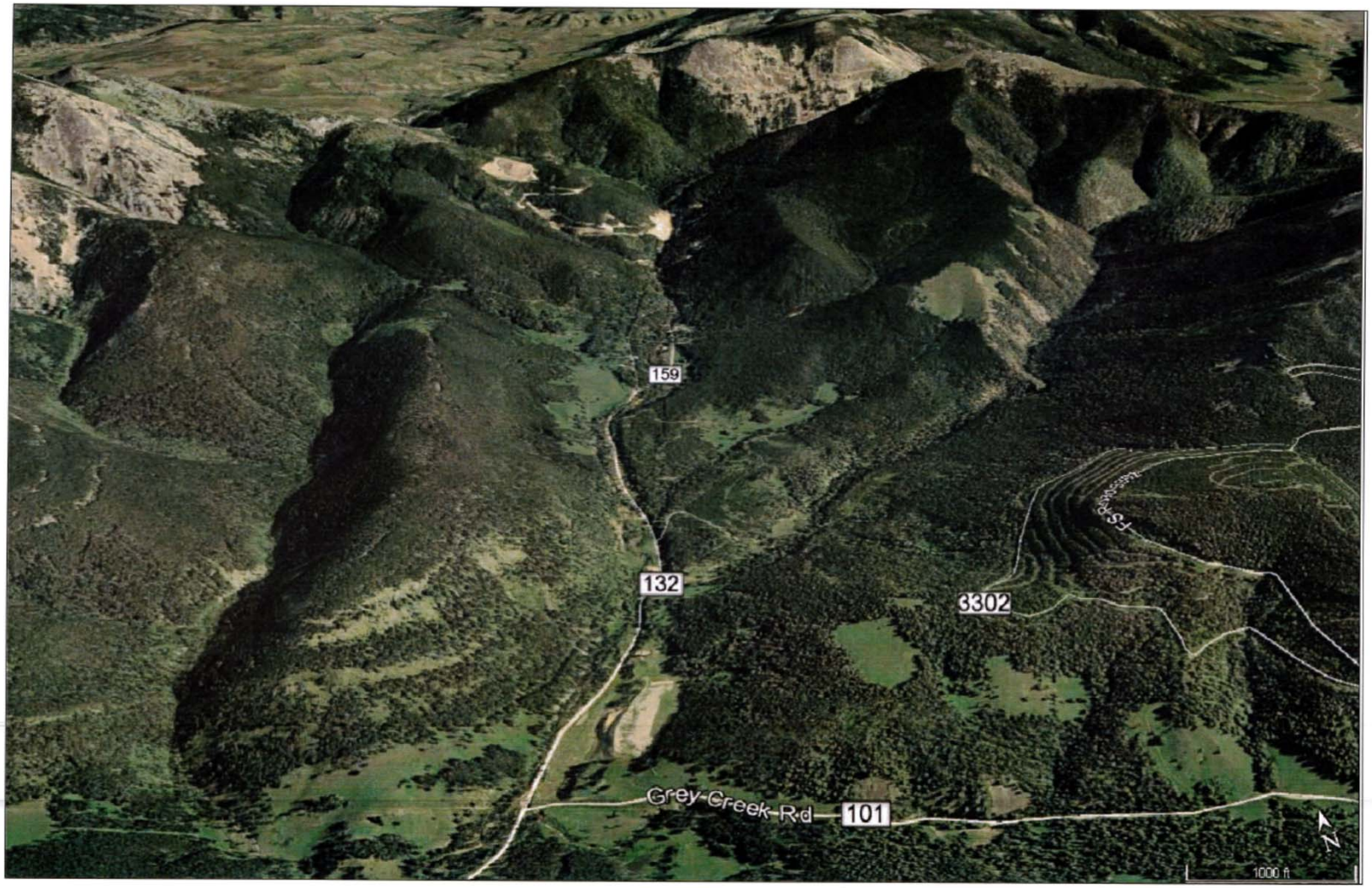


Block P Mill Removal Action 1998 to 2006

Approx 100,000 cys excavated from lower bench and Bender Creek and consolidated with 60,000 cys in the upper bench

Maps and Background Information

3-D Image of Barker Hughesville Mining District



Mines Up Stream (Galena Creek) from Block P Mine

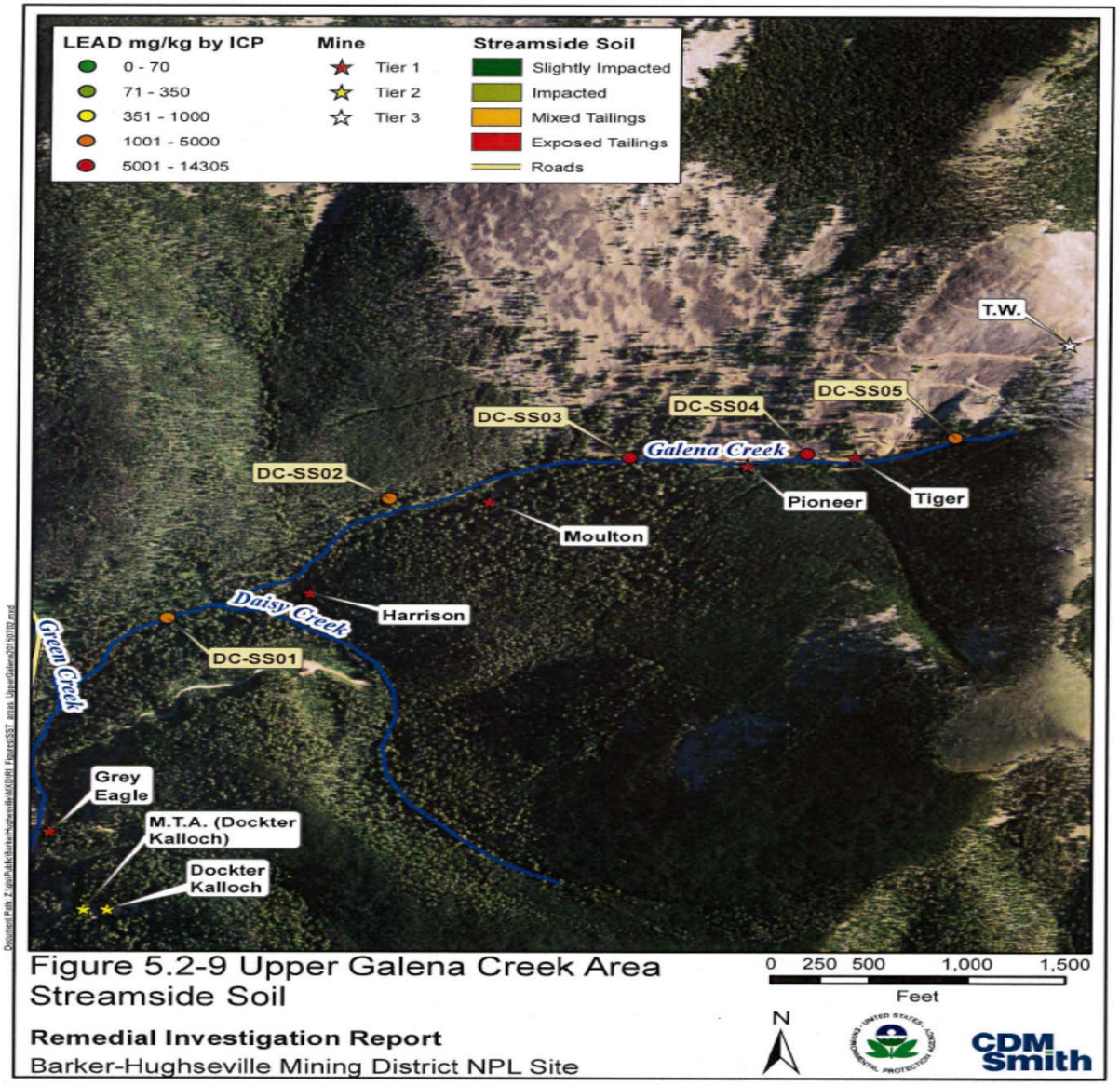


Figure 5.2-9 Upper Galena Creek Area Streamside Soil

Remedial Investigation Report

Barker-Hughseville Mining District NPL Site

Mines Adjacent To Block P

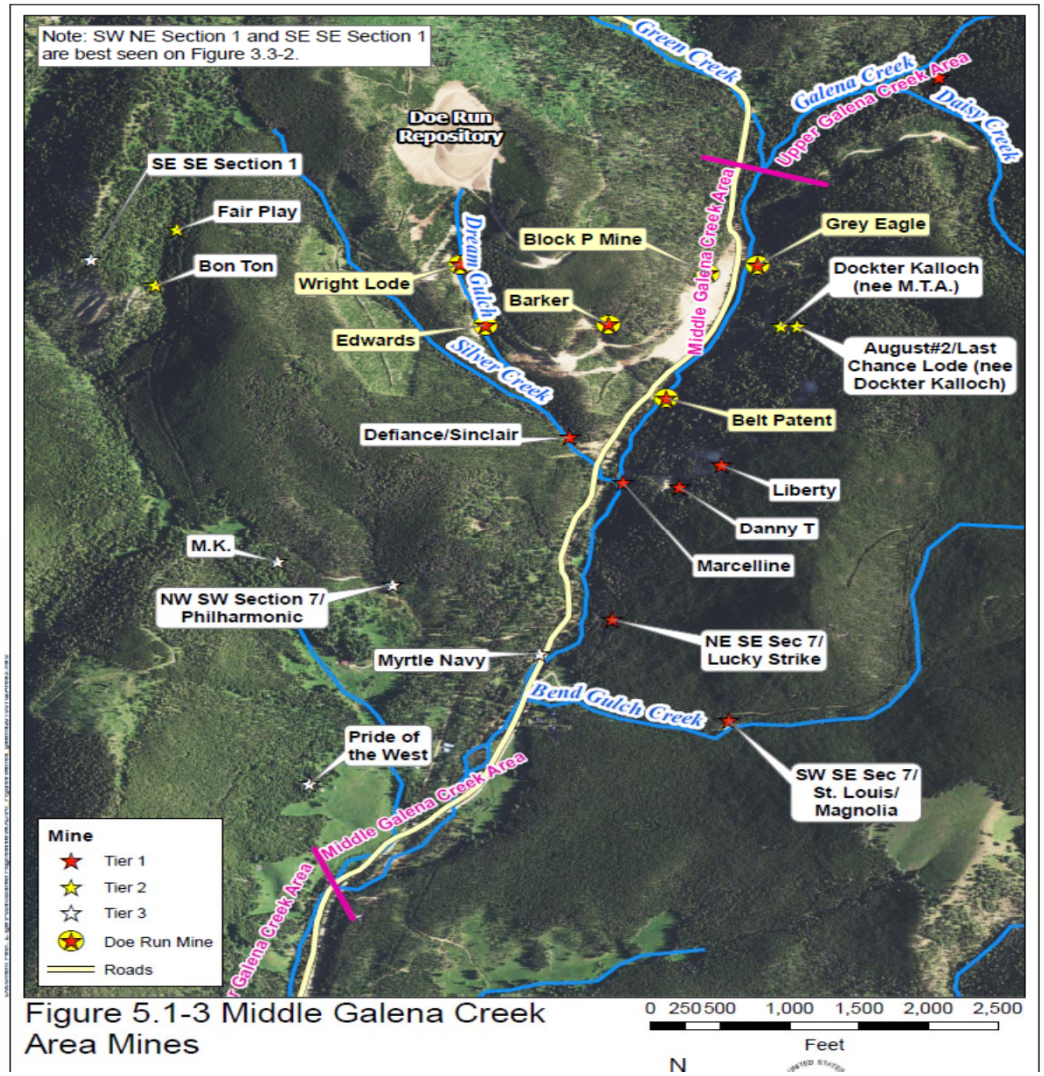
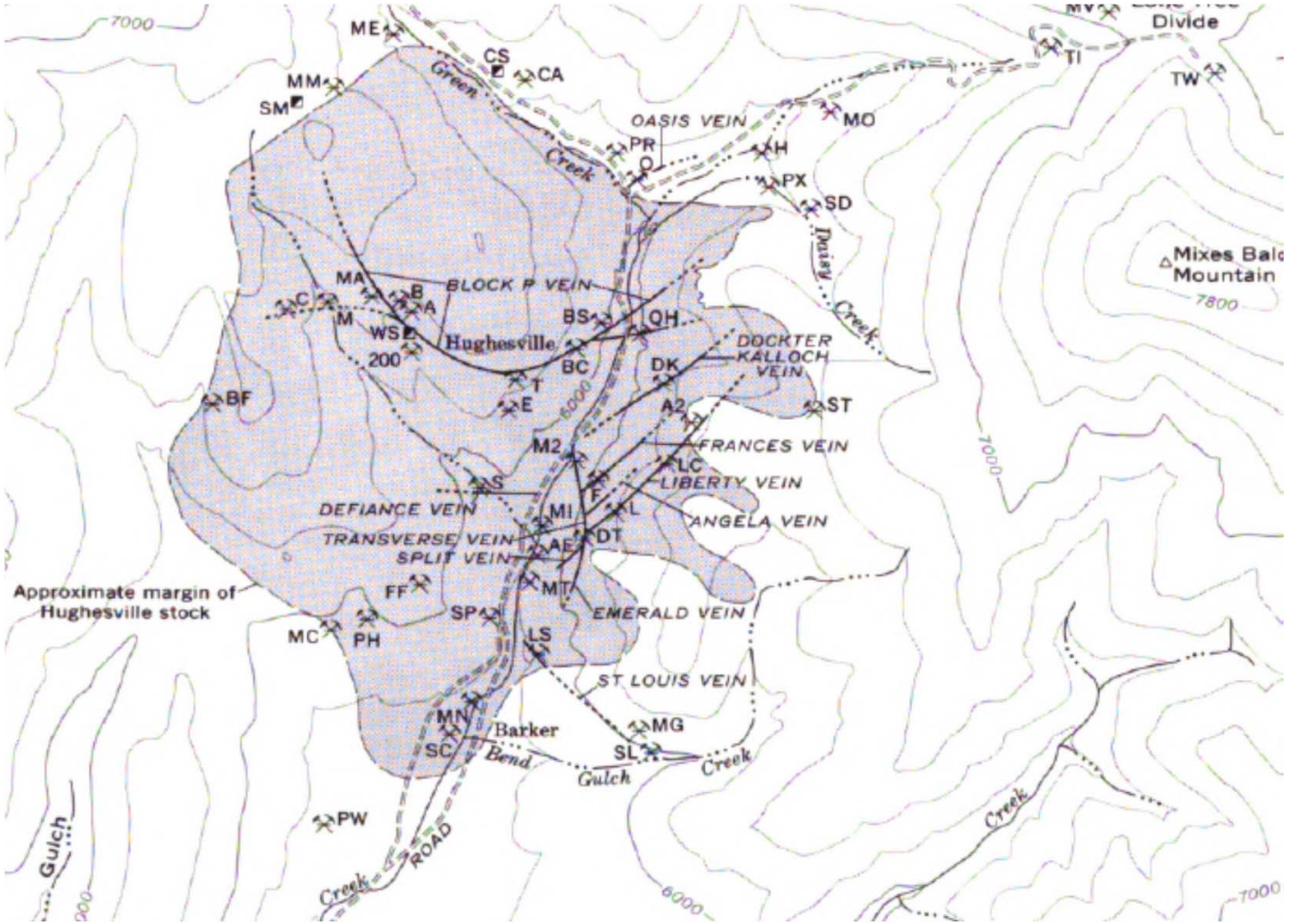
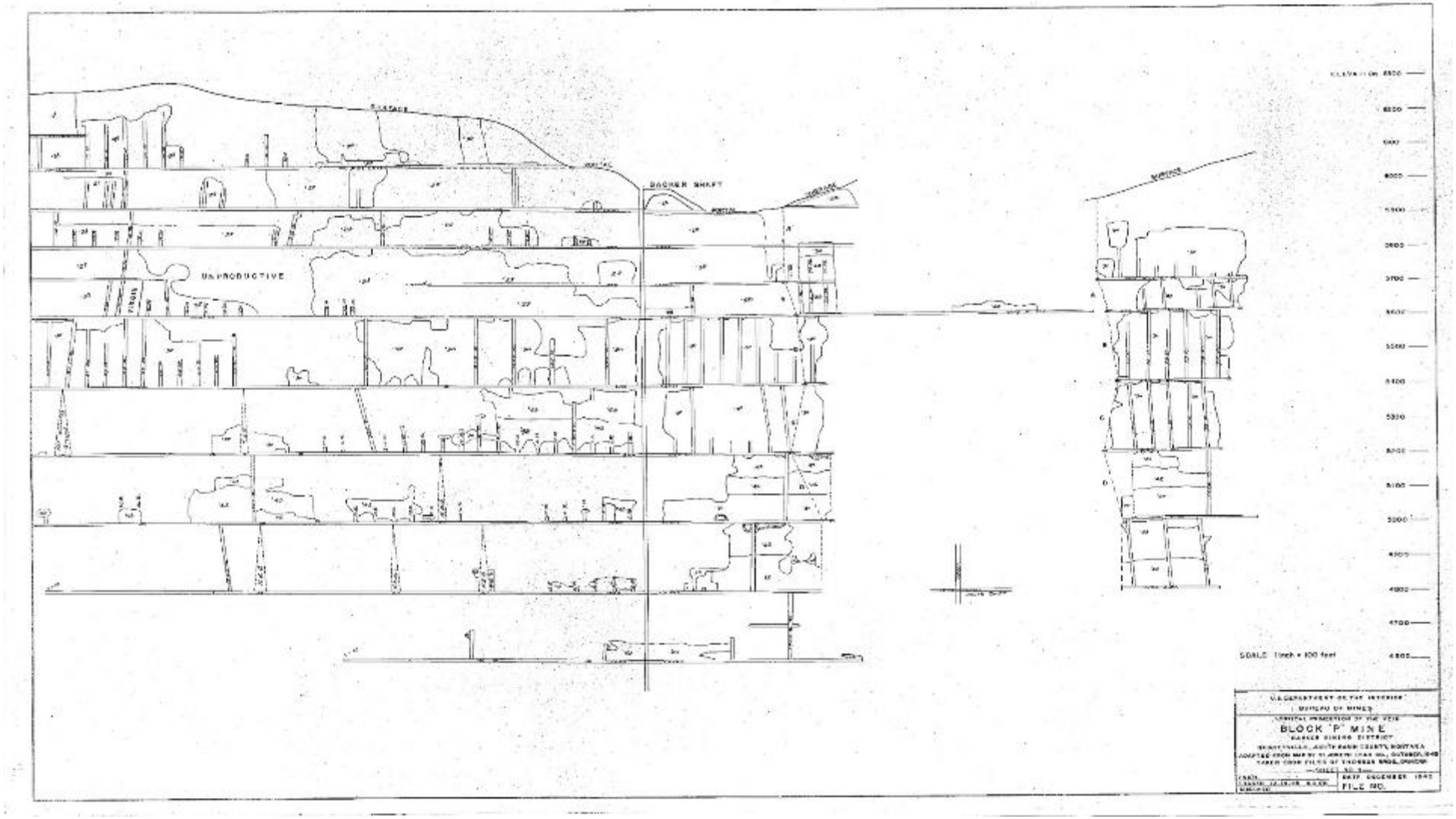


Figure 5.1-3 Middle Galena Creek Area Mines

Hughesville Granitic Stock



Block P Mine Map (Along Strike)



Plan View Mine Map

Vulcan Image Block P Workings

- Tilted Plan view

Vulcan Image Block P Workings

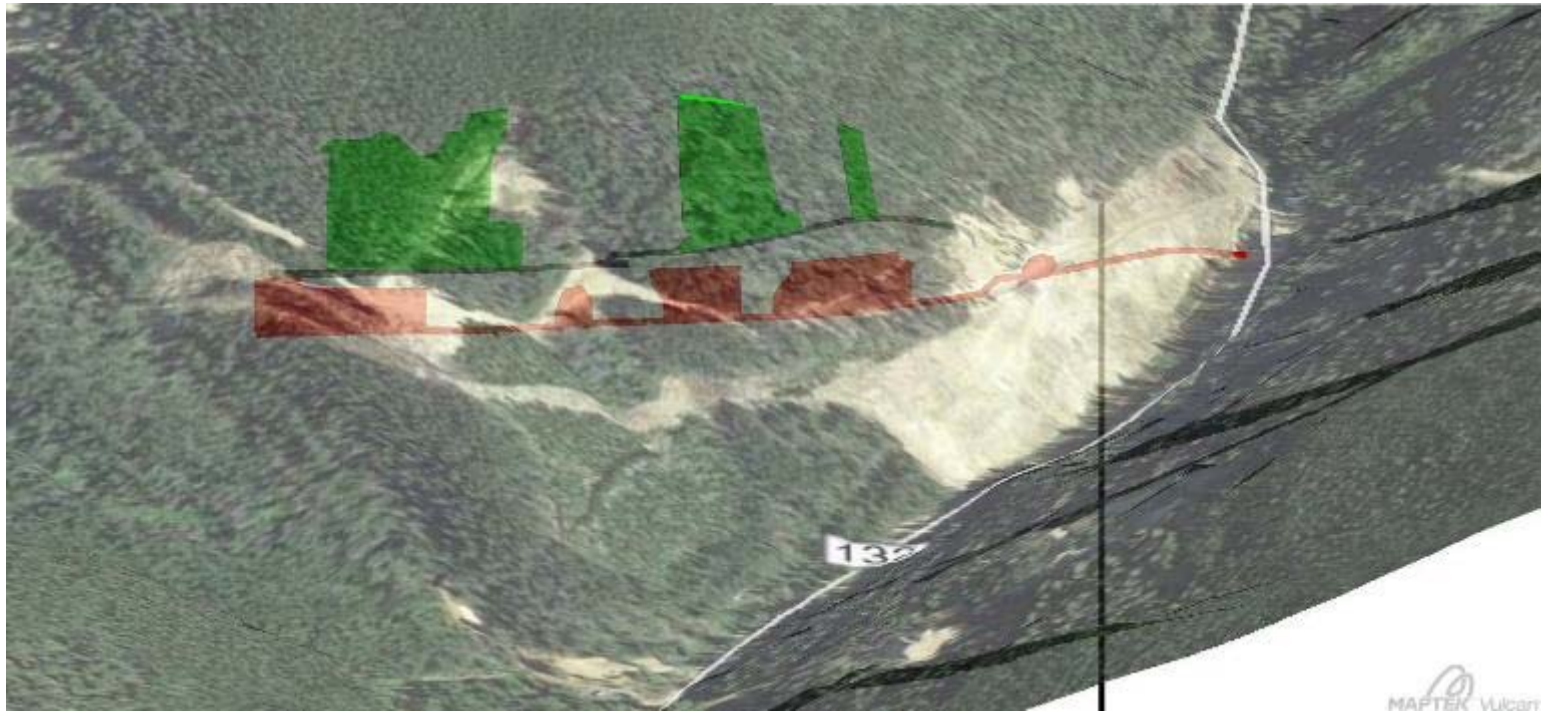
- Planview of Underground Workings

75 Level Adit – View in Early 2017

Grey Eagle Adit

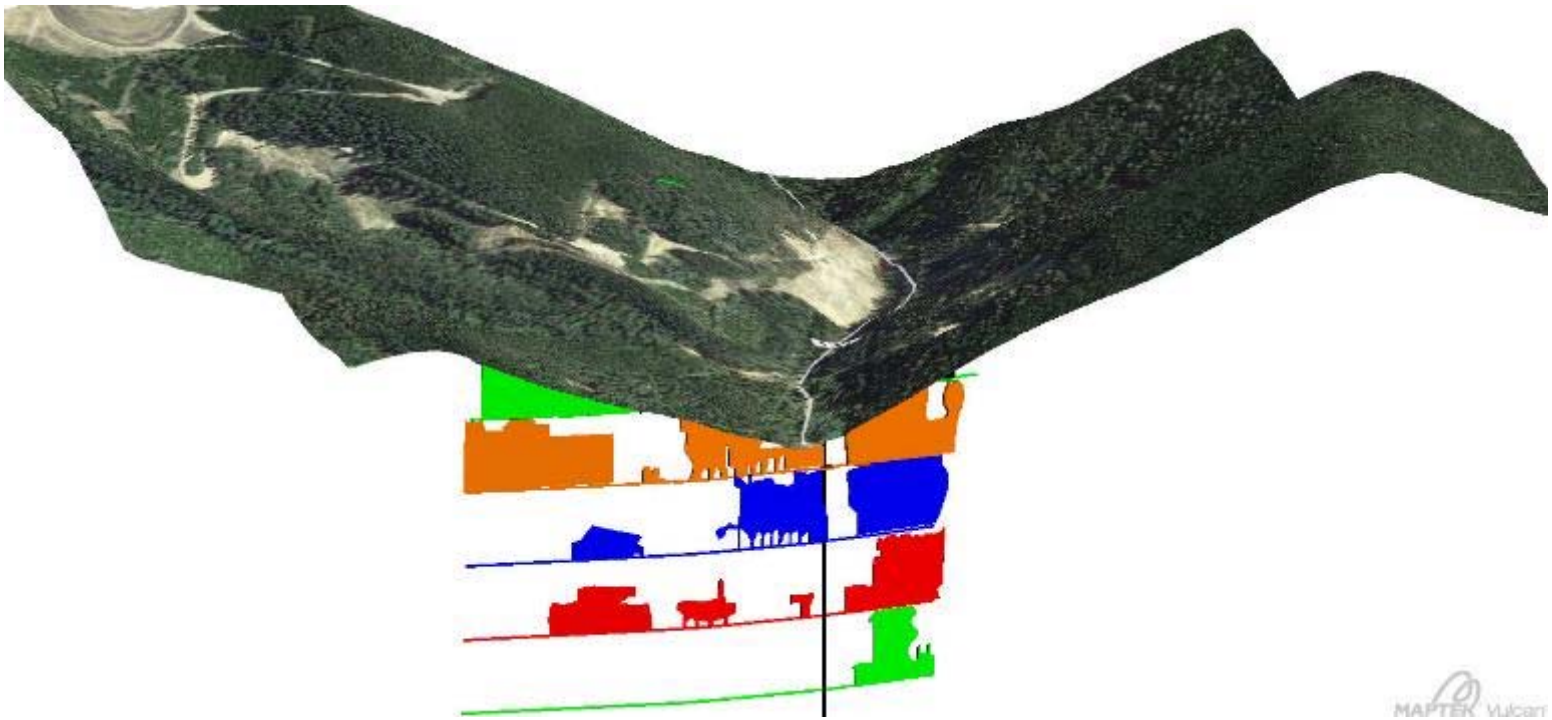
Vulcan Image Block P Workings

- 80’ and 75’ Levels with the Barker Shaft

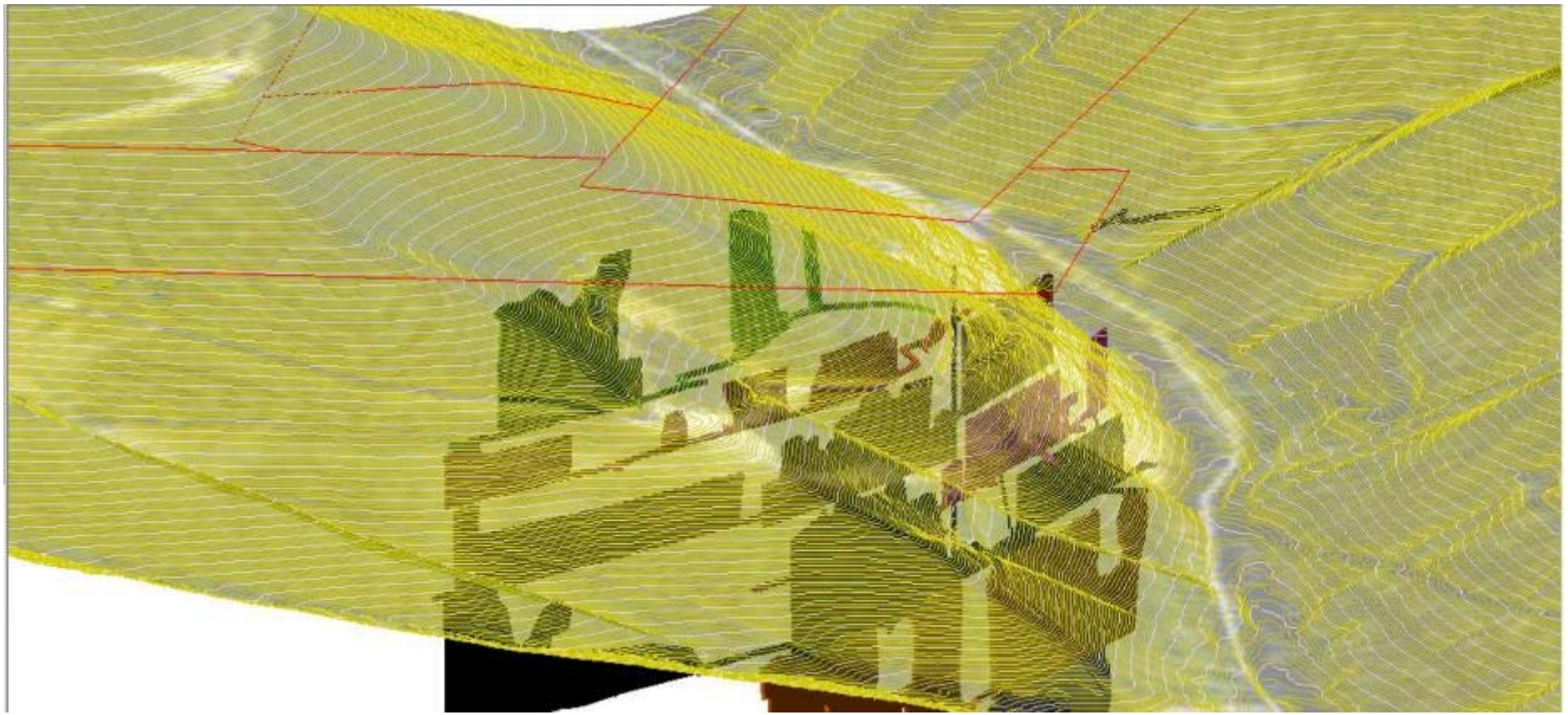


Vulcan Image Block P Workings

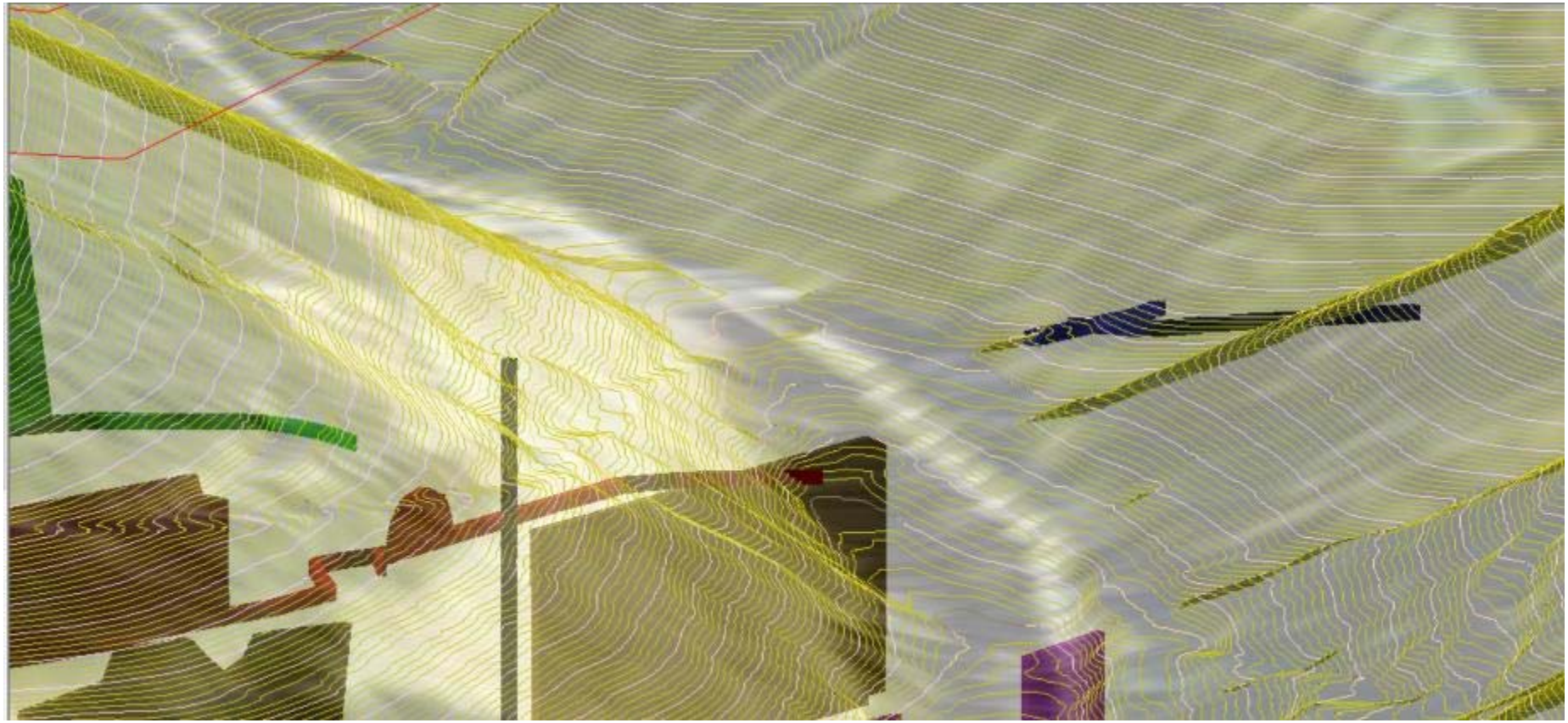
- Block P Stope Cross -Sections



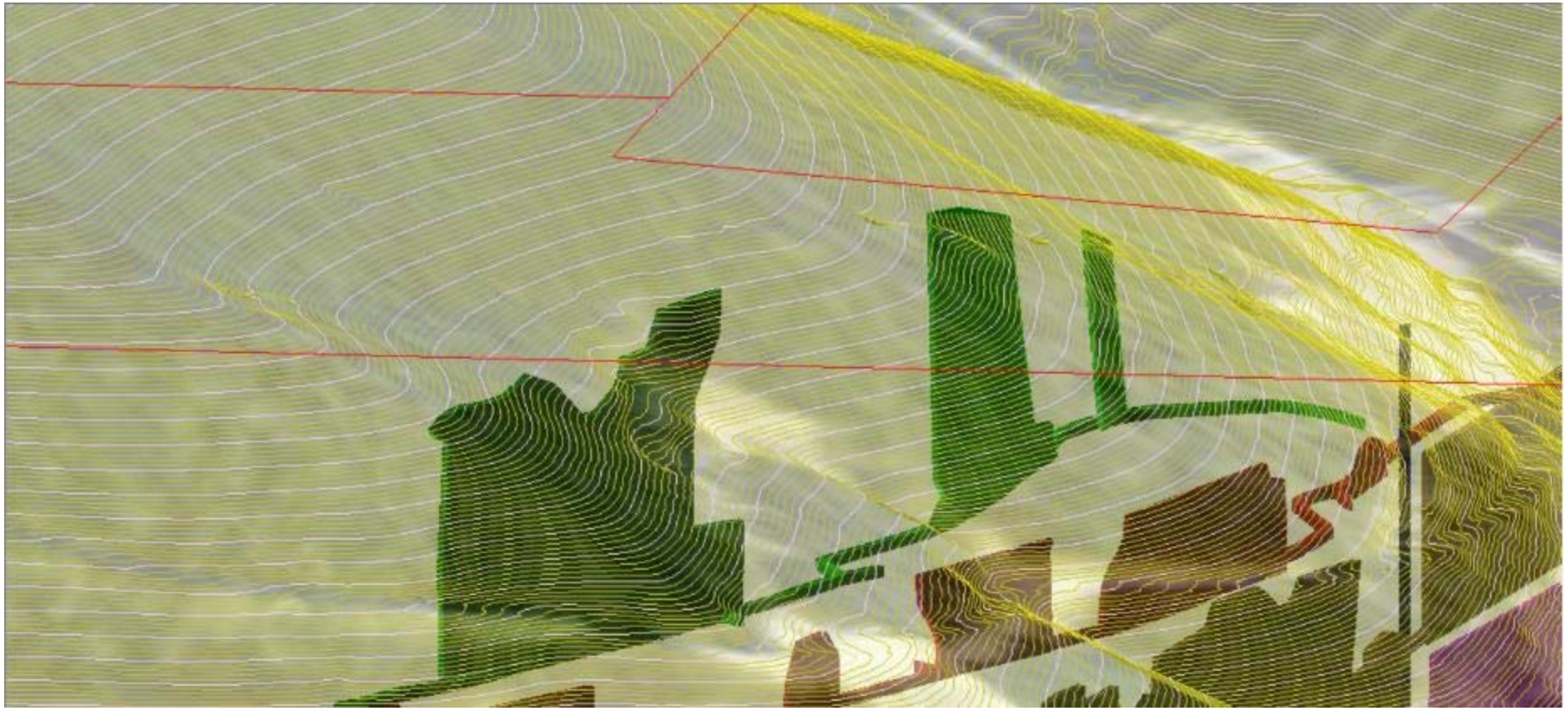
Lidar, Claim Boundary's and Workings



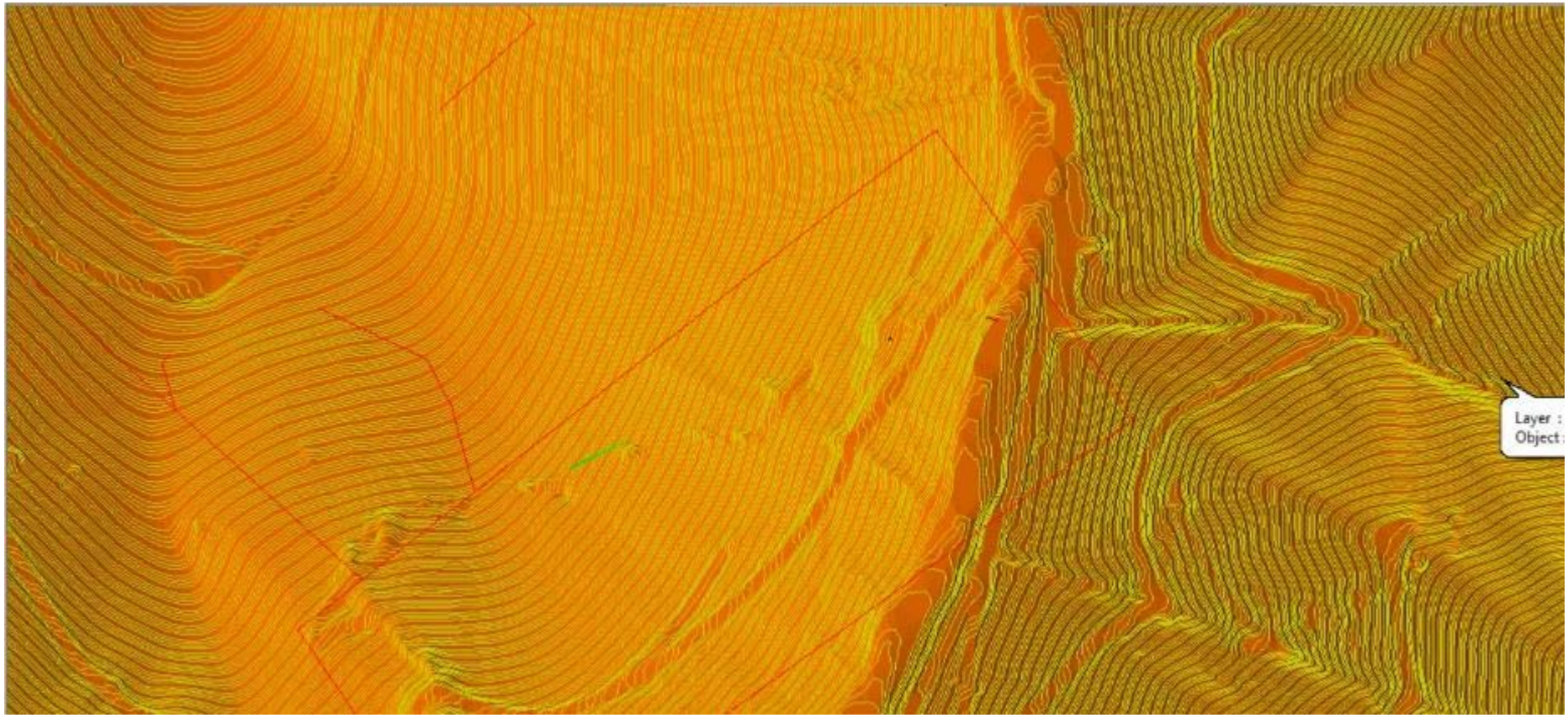
Close-up Showing the Surface Expression of Adits



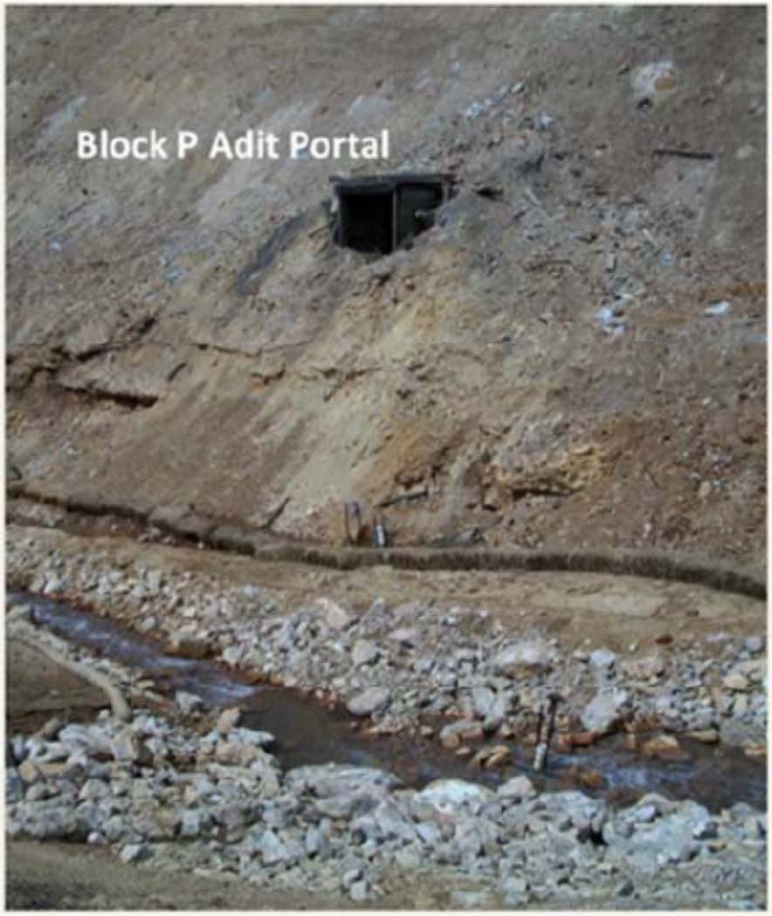
Stopes that are Close to the Ground Surface



Lidar Helps Reveal the Subsidence Area's



Pre-Remediation Block P Mine



Grey Eagle Adit - Discharge

Block P Seep #1 – 25 gpm Pre- Remediation

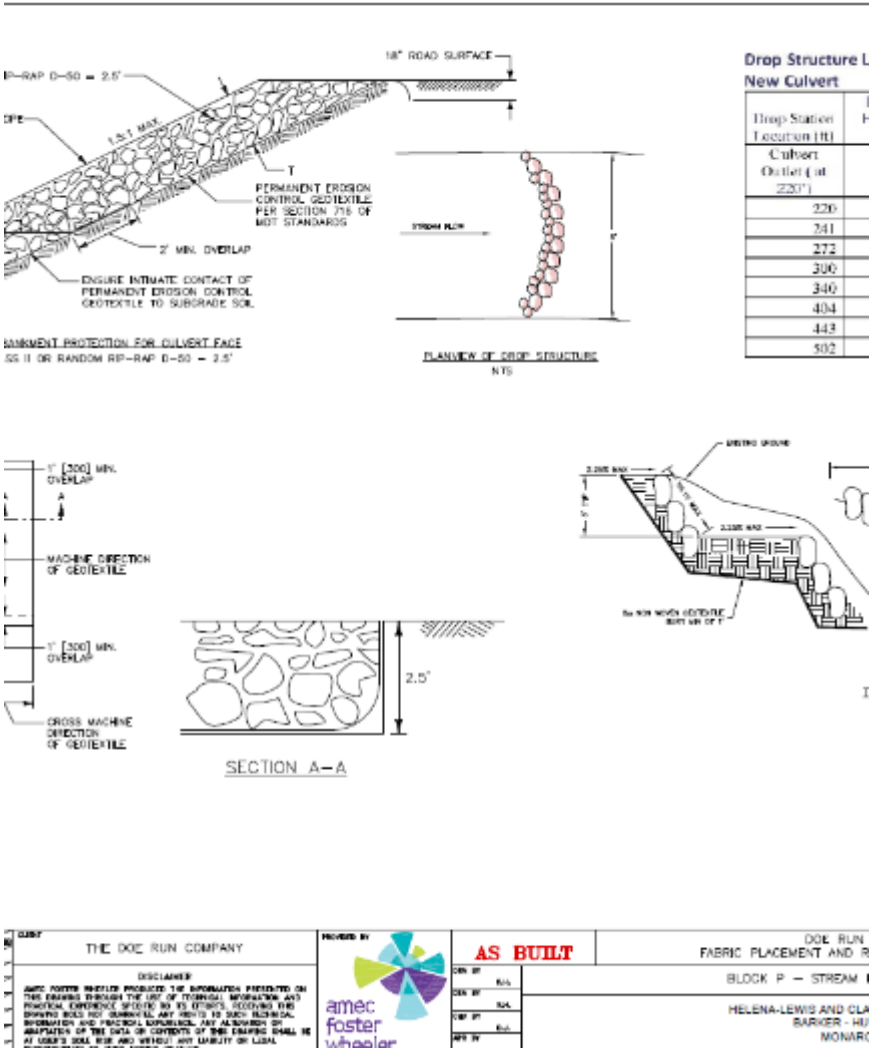
Block P Seep #2 was 25 to 50 GPM Pre -Remediation

Site in Early 2017 Prior to Fill

2017 Interim Action

Block P Remedial Objectives

- Be Safe
- Plug/Reduce the flow Rate of Acid Water into Galena Creek, fill mine voids with Water
- Reduce the amount of Heavy Metals into Galena Creek
- Build a Stable Stream Channel
- Reclaim Areas that Didn't Take during 2011 Removal Action

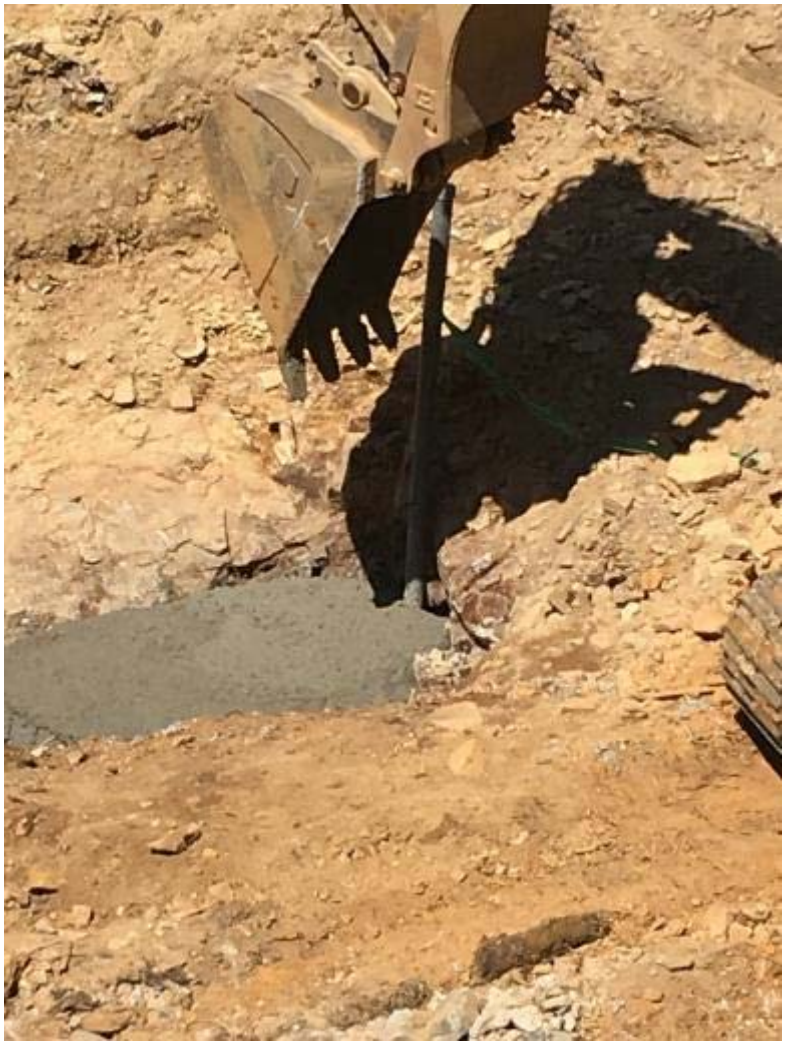


During Plugging, we found that Seep #2 – was a Drift

We Removed all Loose Material and Filled it with Acid Resistant Grout

Preparation for Filling Seep #2

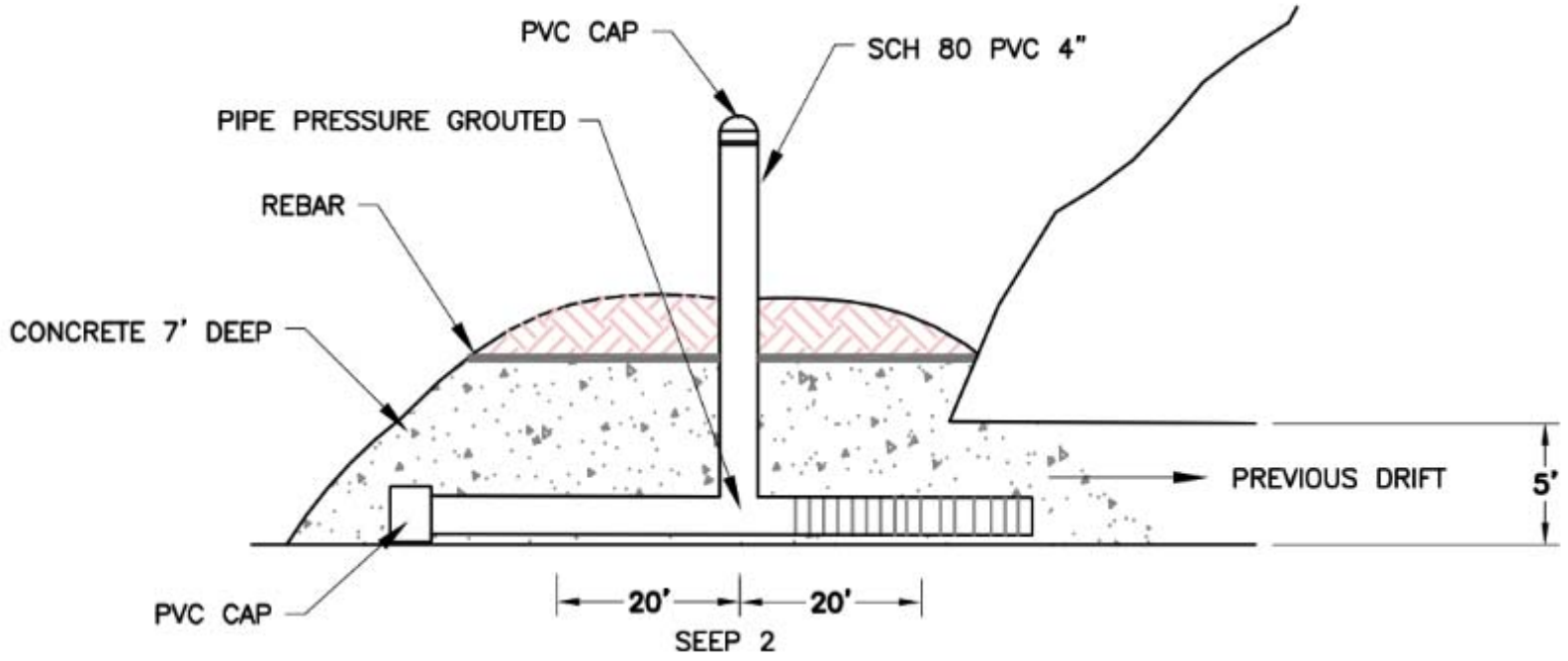
Filling the Drift with Grout and Rebar



Avanti Grout Placed in Bedrock Fractures at Seeps

SEEP 3 AVANTI GROUT

Schematic of Seep #2 Plug



We Backfilled the Seep Areas with Low Perm Material after Grouting

We had to Move the Stream to Protect the Low-Perm Fill from Scour and add a Culvert to Allow us to Deepen the Fill

Culvert Installation

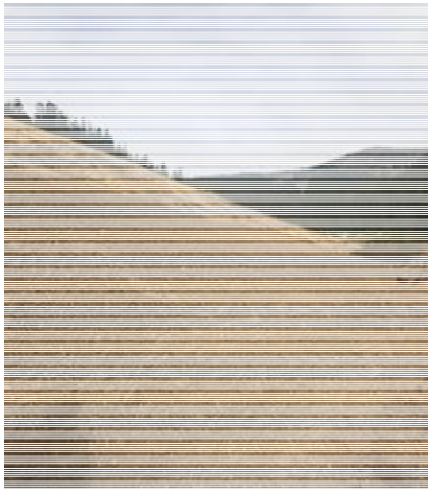
wood.

THE DOE RUN COMPANY 150 YEARS

Birds –Eye View of Fill Operations

Adit Gate Installation

South End Slope Stabilization



Snowed Out October 2017 – Nearly Done

Seeps Flow and Quality Before and After Remediation

TABLE 4
2017/Historic Adits and Seeps Monitoring Summary
Block P Mine Complex, Barker-Hughesville Mining District

Sampling Station	Location	Sampling Date	Comments	Key Field Parameters					Total Recoverable Metals (µg/L)								
				Discharge (gpm)	pH	SC (mmhos/cm)	DO (mg/L)	Temp (°C)	Al	As	Cd	Cu	Fe	Pb	Mn	Ni	Zn
GE-1	Grey Eagle Adit	6/14/2017	Sampled at notched weir	11.7	3.76	0.309	11.99	7.01	1800	53	57	62	5400	130	6300	4.2J	10000
BP-1	75' Level Adit	6/14/2017	Sampled following storm event	2	2.79	0.86	12.85	5.77	1000	83	54	900	28000	370	8000	17	9000
Adit-BB-1	"	5/1/2012	Spring Flow	ND	ND	ND	ND	ND	5260	309	24.1	104	113000	83.7	51400	44.8	23000
SEEPS-ALL	Combined Seeps	10/18/2017	Remaining consolidated seep flow	2.23	5.7	0.8	6.4	8.12	440J	2.8	52	20	9200	1.2	28000	24	15000
SBP-1	Upper Seep	6/14/2017	Seeps plugged and backfilled during summer 2017 stream reconstruction	12.53	3.18	1.547	2.01	7.54	8500	140	59	170	130000	100	58000	60	27000
SBP-2	Middle Seep	6/14/2017		≈10	3.23	1.32	2.96	6.93	6700	120	66	400	110000	110	51000	46	25000
SBP-3	Lower Seep	6/14/2017		0.5 – 1.0	3	1.272	7.78	19	22000	31	140	2000	12000	97	21000	37	24000
GC-32[4]	Single Seep	9/9/2014	Single seep evident following mine waste removal	ND					6680	53.6	68.2	437	106000	82.5	52300	32.9	27100
		6/17/2014		ND					5870	49.9	76.6	479	108000	86	51500	38.3	27100
SW-BB-2		5/8/2013		82	3.43	2.046	1.31	7.5	7350	60.6	163	3810	135000	224	58200	37.8	36100
SBPM-1	Block P Mill Repository	6/14/2017	Low flow, <1 gpm	<1	4.43				11000	6.3	44	370	17000	ND	92000	62	15000
Montana Department of Environmental Quality (DEQ) Circular DEQ-7 (April 2017)			Circular DEQ-7 (April 2017), Human Health Standard for Surface Water						NA	10	5	1300	NA	15	NA	100	2000
			Circular DEQ-7 (April 2017), Aquatic Life Standards, stated as Acute						750	340	0.49	3.79	NA	13.98	NA	145	37
			Circular DEQ-7 (April 2017), Aquatic Life Standards, stated as Chronic						87	150	0.252	2.852	1000	5.452	NA	16.12	37.2

NA – Not Applicable
NM – Not Measured
ND - No Data

Qualifiers: J indicates that the result is less than the Reporting Limit (RL) but greater than or equal to the Method Detection Limit (MDL) and the concentration is an approximate value.

Notes:

1 Analyzed for Total Recoverable Metals in accordance with EPA Method 6020A, and reported in micrograms per liter (µg/L).

2 Chronic Aquatic Life Standards hardness dependent (25 mg/L).

3 Flow estimated at 22 gpm on 06/29/17.

4 Monitored by EPA ESAT Team

Up and Down Stream Pre- and Post Remediation Water Quality

TABLE 3
2017/Historic Surface Water Monitoring Summary
Block P Mine Complex, Barker-Hughesville Mining District

Sampling Station	Location	Sampling Date	Comments	Key Field Parameters					Total Recoverable Metals (µg/L)[1]								
				Flow cfs	pH S.U.	SC µmhos/cm	DO mg/l	Temp °C	Al	As	Cd	Cu	Fe	Pb	Mn	Ni	
GC-35 (GC-SS-1)	Galena Creek Upper End Block P	10/18/17	Immed. above temp. diversion dam		5.9	254	12.98	5.22	ND	0.84J	0.37J	4.2	0.86	77	1.1J	1.1	
		06/14/17	Immed. above upper Culvert	0.85	7.34	198	13.66	5.5	1400	2.8J	1.1J	56	3000	130	290	2.2J	
		10/10/16			6.57	133	11.85	4.15	412	1.54	1.04	31.6	1820	82.3	246	1.55	
		06/06/16			6.75	264	14.61	3.05	176	0.79	1.1	55.6	960	32.2	325	1.64	
		09/30/15			7.67	300	12.85	3.6	58.3	1.3	0.39	7.9	343	21.9	138	1.7	
		06/02/15			7.08	187	12.77	5.35	165	0.8	0.94	38.9	1150	35.2	293	1.4	
		09/11/14			7.75	227	9.93	3.97	109	0.8	0.81	30.8	609	15	244	1.7	
		05/12/14			6.77	156	11.49	3.53	186	1.1	0.24	9.4	428	4.4	51.3	1.1	
		09/10/13			7.4	297	14.69	7.66	29.9	0.98	0.37	3.6	116	1.4	82.3	0.95	
		05/08/13			6.59	171	10.48	4.1	997	3.7	0.53	23.2	2210	65.7	180	2.1	
GC-30 (GC-SS-2)	Galena Creek Lower End Block P	10/18/17	Immed. below lower culvert		5.49	309	15	5.83	310	2.4J	7.1	12	1000	11	2500F1	3.7J	
		06/14/17		2.66	6.35	287	12.41	8.04	1500	8.1	4.4	53	ND	0.86	77	1.1J	
		10/10/16			6.73	225	11.79	4.82	974	16.2	6.44	59.2	7660	107	2960	4.17	
		06/06/16			6.8	339	9.78	5.3	500	6.93	4.87	64.6	5490	39	2790	3.61	
		09/30/15			6.99	388	13.42	2.56	387 *	4	4.77	11	6480	15	4130	5.1	
		06/02/15			6.83	270	12.46	6.5	532	9	5.62	50.8	5910	42.2	2750	3.4	
		09/11/14			NM	306	9.97	4.54	561	4.8	6.18	42.7	6250	24.5	3690	4.4	
		05/12/14			5.48	352	11.82	3.35	787	18	8.36	62.8	9980	23.1	5170	5	
		09/10/13			6.5	377	11.71	6.47	512	5.1	7.3	21.6	7940	19.4	4830	4.9	
		05/08/13			6.34	375	10.37	3.3	1180	22.8	12.5	124	10900	46.5	4860	5.4	
Montana Department of Environmental Quality Circular DEQ-7 (April 2017)[2]				Human Health Standard for Surface Water					NA	10	5	1300	NA	15	NA	100	
				Aquatic Life Standard - Acute					750	340	0.49	3.7	NA	13.98	NA	145	
				Aquatic Life Standard – Chronic					87	150	0.25	2.85	1000	0.545	NA	16.1	

Footnotes:

1 Analyzed for Total Recoverable Metals in accordance with EPA Methods 6020A and 6020C, and reported in micrograms per liter (µg/L)..

2 Circular DEQ-7 standards for metals in surface water are based on total recoverable metals concentrations in accordance with digestion procedure – EPA Method 200.2.

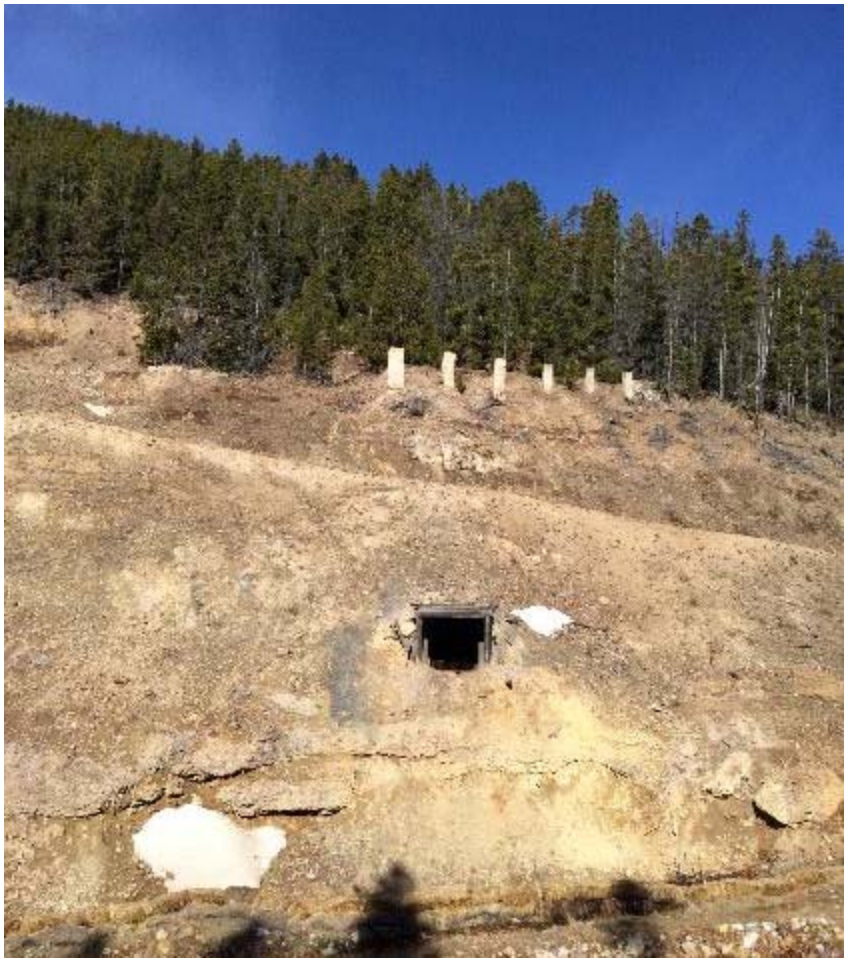
Chronic Aquatic Life Standards hardness dependent (25 mg/L).

Flow measured on 6/29/17 (due to equipment failure on 06/14/17).

Flow estimated at 22 gpm on 06/29/17.

Qualifiers:

Fill Before and After Remediation



Next Steps for 2018 and Beyond

Identify any "Grass Roots Mining" and Reclaim

- Combine Vulcan Models and Lidar to Identify Physical and Hydraulic Risk Areas
- Field Verify Risk Areas
- Generate a work Plan for Remediation
- Generate a Design for Risk Areas
- Complete Subsidence Risk Reduction and Hydraulic Risk reduction in 2018

Mineralized Naturally Occurring Material
Re-Evaluating Background in 2018

- Native (Undisturbed) soil

Client Sample Results

Client: AMEC Foster Wheeler E & I, Inc
Project/Site: Barker Hughesville Project

TestAmerica Job ID: 580-72438-1

Client Sample ID: BS-NSC-01
Date Collected: 10/12/17 14:00
Date Received: 10/27/17 09:40

Lab Sample ID: 580-72438-1
Matrix: Solid
Percent Solids: 79.3

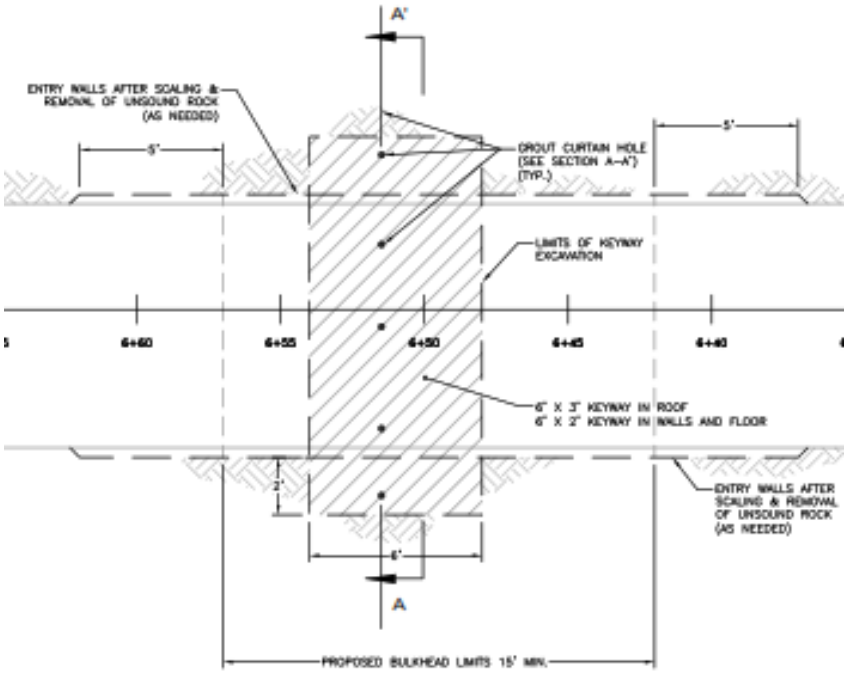
Method: 6020A - Metals (ICP/MS)

Analyte	Result	Qualifier	RL	MDL	Unit	D	Prepared	Analyzed	Dil Fac
Arsenic	28		0.38	0.071	mg/Kg	☼	10/30/17 11:34	10/31/17 15:41	10
Cadmium	2.4		0.29	0.055	mg/Kg	☼	10/30/17 11:34	10/31/17 15:41	10
Copper	96		0.71	0.16	mg/Kg	☼	10/30/17 11:34	10/31/17 15:41	10
Iron	25000		29	8.2	mg/Kg	☼	10/30/17 11:34	10/31/17 15:41	10
Lead	730		0.38	0.034	mg/Kg	☼	10/30/17 11:34	10/31/17 15:41	10
Manganese	22000		1.4	0.32	mg/Kg	☼	10/30/17 11:34	10/31/17 15:41	10
Nickel	9.9		0.38	0.14	mg/Kg	☼	10/30/17 11:34	10/31/17 15:41	10
Zinc	420		3.8	1.2	mg/Kg	☼	10/30/17 11:34	10/31/17 15:41	10
Aluminum	12000		21	4.7	mg/Kg	☼	10/30/17 11:34	10/31/17 15:41	10

General Chemistry

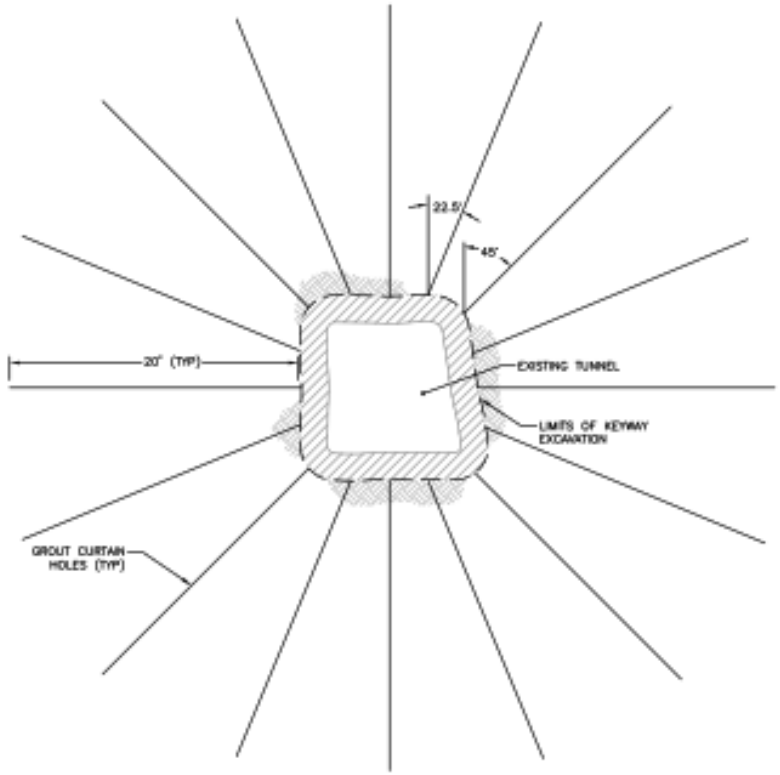
Analyte	Result	Qualifier	RL	RL	Unit	D	Prepared	Analyzed	Dil Fac
Percent Solids	79.3		0.1	0.1	%			10/29/17 14:35	1
Percent Moisture	20.7		0.1	0.1	%			10/29/17 14:35	1

Design a Bulkhead for 75 Adit, Complete Abbreviated Consultation with EPA/DEQ for Ponding Mine Water



PLAN VIEW
KEYWAY GROUTING

SCALE: 3/8"=1'

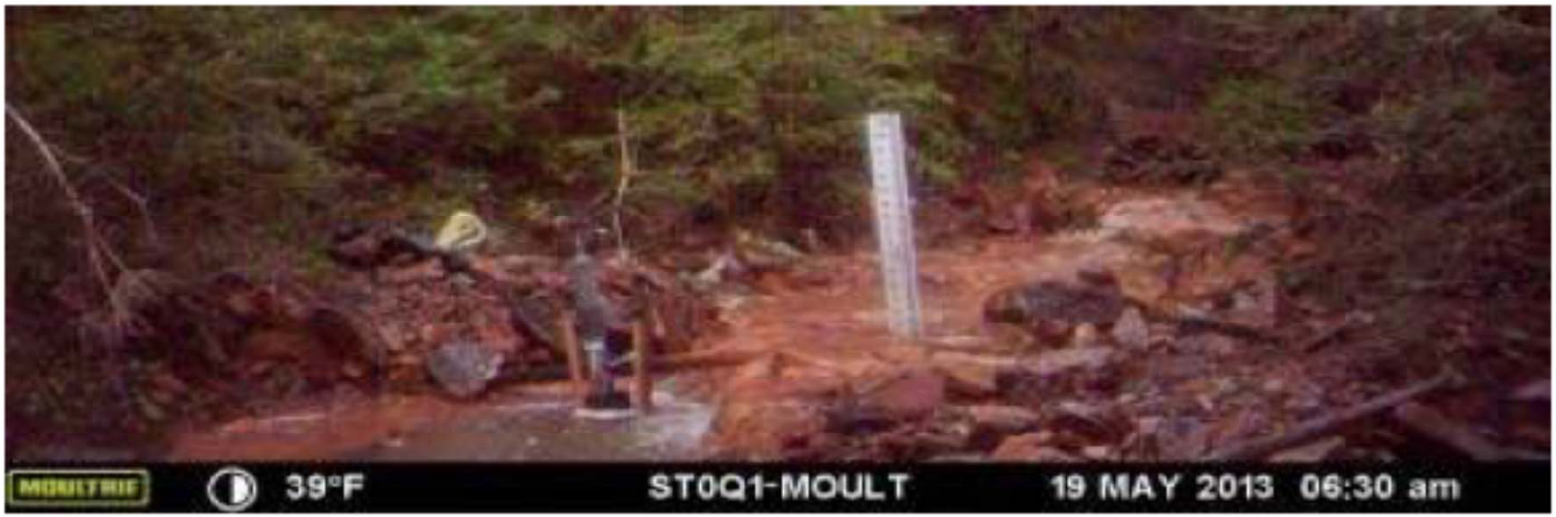


SECTION A – A'
KEYWAY GROUT CURTAIN

SCALE: 3/16"=1'

Support DEQ and EPA in an Upper Reach Galena Creek to Lower Reach Remediation Program for Other Mines

Figure 3-7. Select photographs of Upper Galena Creek below Moulton Mine from game camera, during and after large precipitation events



 Source CDM Smith RIFS Document

Questions?

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