Effect of Alkaline Fills on AMD Control

Overview

- Positive Impact of Valley Fills
  - » Improved Water Quality
  - » Improved Aquatic Environment
  - » Improved Compliance
  - » Decreased Cost

Project Area

- Black Castle Surface Mine
- MTR / Contour-HWM operation
- Operations from the late 1980’s
- Production growth from .25mm tpy to 4mm tpy
- Approximately 400 jobs
- xx million per year in taxes

Existing Conditions

- Valley Fills from Number 5 Block mining
- ABA's prior to H_2O_2 treatment
- Heavy water treatment
- Frequent pond maintenance

What was going on…

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Then comes…

A little bit more…

And Finally…

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One simple question

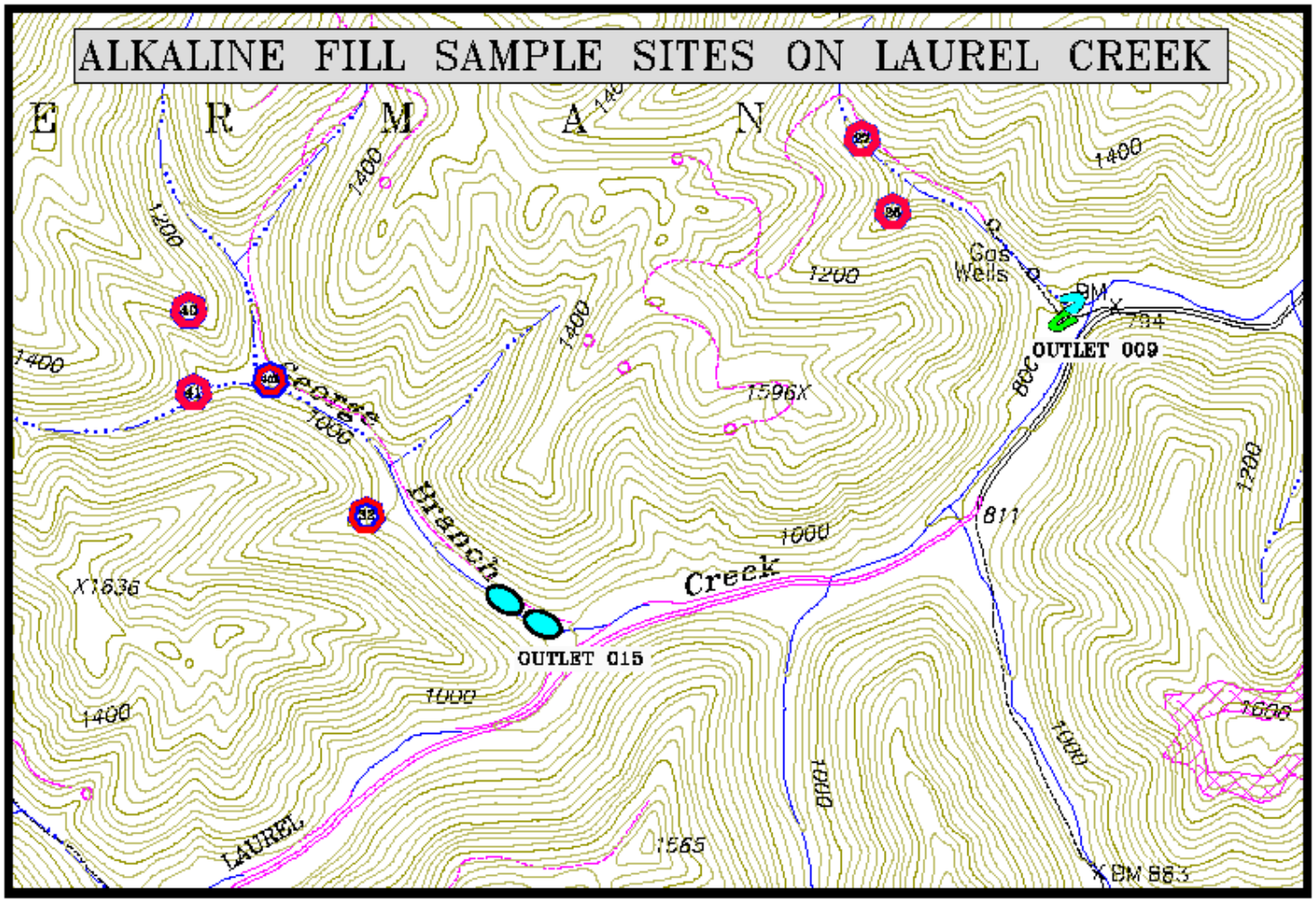
- Millions of tons of reserves, and big annual treatment costs
- It’s what every coal miner would ask?
- How do I mine my way out of this?

Simple Mass Balance on a Big Scale

- An abundance of alkalinity will counteract a limited amount of acidity.
- The neutralized acidity will allow of the precipitation of metals
- Additional metals will not be mobilized because acidity is limited.

Basic Chemistry

	Volume in fills (cy)	Average ABA	Net ABA
Existing Number 5 Block Fills	1,750,000	4.5	7,857,500
Buffalo Creek Fill Core	2,000,000	11.77	23,540,000
	3,750,000		31,397,500
Weighted Average ABA (Net ABA /Volume)			8.37
* Volumes are estimates for the purpose of illustrating relative volumes and stoichiometric			


ALKALINE FILL SAMPLE SITES ON LAUREL CREEK
E R M A N
OUTLET 009
OUTLET 015
Gas Wells
Branch
Creek
LAUREL
1400
1200
1000
1596X
X1636
1565
811
794
X BM 883

Implementation

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Partial Completion – Georges Branch

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Completed Fill in Unnamed Tributary

Completed Fill in Unnamed Tributary

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Pre-fill / Post-fill Data

Sample Period	pH	Alk.	Acidity	Cond.	Sulfate	T. Fe	D. Fe	T. Mn	D. Mn	T. Al	D. Al
Point 32	SU	----mg/l---		us/cm	----------mg/l----------						
Pre-Alkaline Fill (ave)	4.13	<2	221	3010	1227	0.05	N/A	63.47	61.52	20.49	20.26
Post-Alkaline Fill (2001-2004)	6.88	49	<0.36	1465	645	0.12	0.05	15.54	15	0.34	0.07
January 2008	7.02	70	<0.36	2830	1001	0.01	0.01	2.6	2.51	0.1	0.1
Point 40											
Pre-Alkaline Fill (ave)	4.57	<2	28	567	242	0.03	N/A	5.74	5.65	1.47	1.41
Post-Alkaline Fill (2001-2004)	6.67	46	<0.36	682	217	0.72	0.04	3.16	2.92	0.64	0.14
January 2008*	7.28	168	<0.36	1855	884	0.05	0.01	0.14	0.11	0.13	0.09
Point 41											
Pre-Alkaline Fill (ave)	4.26	<2	173	2065	812	0.05	N/A	36.38	35.24	16.31	16.1
Post-Alkaline Fill (2001-2004)	6.25	50	9	1155	480	0.5	0.08	10.76	10.31	1.27	0.6
January 2008 *	7.28	168	<0.36	1855	884	0.05	0.01	0.14	0.11	0.13	0.09

*The January 2008 sample for SP 40 and 41 was collected at a common point (SP 40A) below the now filled stream segments at SP 40 and SP 41.

Pre-fill / Post-fill Data (continued)

Sample Period	pH	Alk.	Acidity	Cond.	Sulfate	T. Fe	D. Fe	T. Mn	D. Mn	T. Al	D. Al
Point 26	SU	----mg/l---		us/cm	----------mg/l----------						
Pre-Alkaline Fill (ave)	3.52	<2	203	3167	1267	2.08	N/A	59.15	58.96	16.63	16.4
Post-Alkaline Fill (2001-2004)	7.3	107	<0.36	1534	654	0.17	0.06	1.87	1.82	1.31	1.24
January 2008	7.66	159	<0.36	1480	665	0.28	0.16	0.18	0.17	0.13	0.11
Point 27											
Pre-Alkaline Fill (ave)	4.59	<2	115	1977	842	0.08	N/A	28.16	27.52	7.17	7.05
Post-Alkaline Fill (2001-2004)	7.02	95	<0.36	1660	706	0.16	0.06	2.17	2.04	0.38	0.06
January 2008	7.63	132	<0.36	1510	812	0.33	0.01	2.35	0.25	1.17	0.14

Positive Results

- **Removed 68.68 tons per year of acidity**
- **Generated excess alkalinity of 29.81 tons per year**
- **Removed 106.34 tons per year of sulfate**
- **Removed 11.03 tons per year of manganese**
- **Removed 5.01 tons per year of aluminum**

*From 2004 evaluation

Pre-fill / Post-fill Benthics

	Fill 6 Toe (Fall 2001)	BC Site 7 (Fall 2007)
Total Individuals	172	95
Total Taxa	6	9
WV-SCI	18.5	58.2
HBI	6.0	4.4
% Scrapers	4.7	0.0
% Shredders	4.7	27.4
% EPT Individuals	0.0	58.9
Acicity (mg/l)	412	5
Alkalinity (mg/l)	<1.0	143
pH	3.83	7.65
Conductivity (us)	4000	1644
Aluminum, total (mg/l)	30.1	0.197
Iron, total (mg/l)	<0.02	0.123
Manganese, total (mg/l)	59.7	0.197
Hardness, total (mg/l)	1080	783
Sulfates, total (mg/l)	2500	702
TDS (mg/l)	3890	1240

More Post-fill Benthics

	Outfall 6011-009 Upstream (Spring 2000)	BC Site 10 (Fall 2007)
Total Individuals	1899	312
Total Taxa	18	13
WV-SCI	39.6	59.2
HBI	5.7	4.1
% Scrapers	5.1	44.2
% Shredders	1.0	8.3
% EPT Individuals	1.9	46.8
Acicity (mg/l)	<2.0	4.5
Alkalinity (mg/l)	34	114
pH	7.45	7.56
Conductivity (us)	1066	1789
Aluminum, total (mg/l)	0.15	0.28
Iron, total (mg/l)	0.06	0.076
Manganese, total (mg/l)	1.94	0.935
Hardness, total (mg/l)	548	848
Sulfates, total (mg/l)	328	891
TDS (mg/l)	875	1270

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No Longer Need These

Ponds Now!

Ponds Now!

The Great One Speaks…

- "Projected effluent discharging from the new alkaline fills will probably exhibit a **slight decrease in acidity**, along with a **possible decrease in aluminum**.

If anyone is interested…

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