
# TDS Evolution from Valley Fills at Coal Mac

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Arch Coal, Inc.

# Coal Mac, Inc.

**Subsidiary of Arch Coal, Inc.**
**Employees - 299**
**Annual sales - 3 MM tons**
**Excavator/Loader mine**

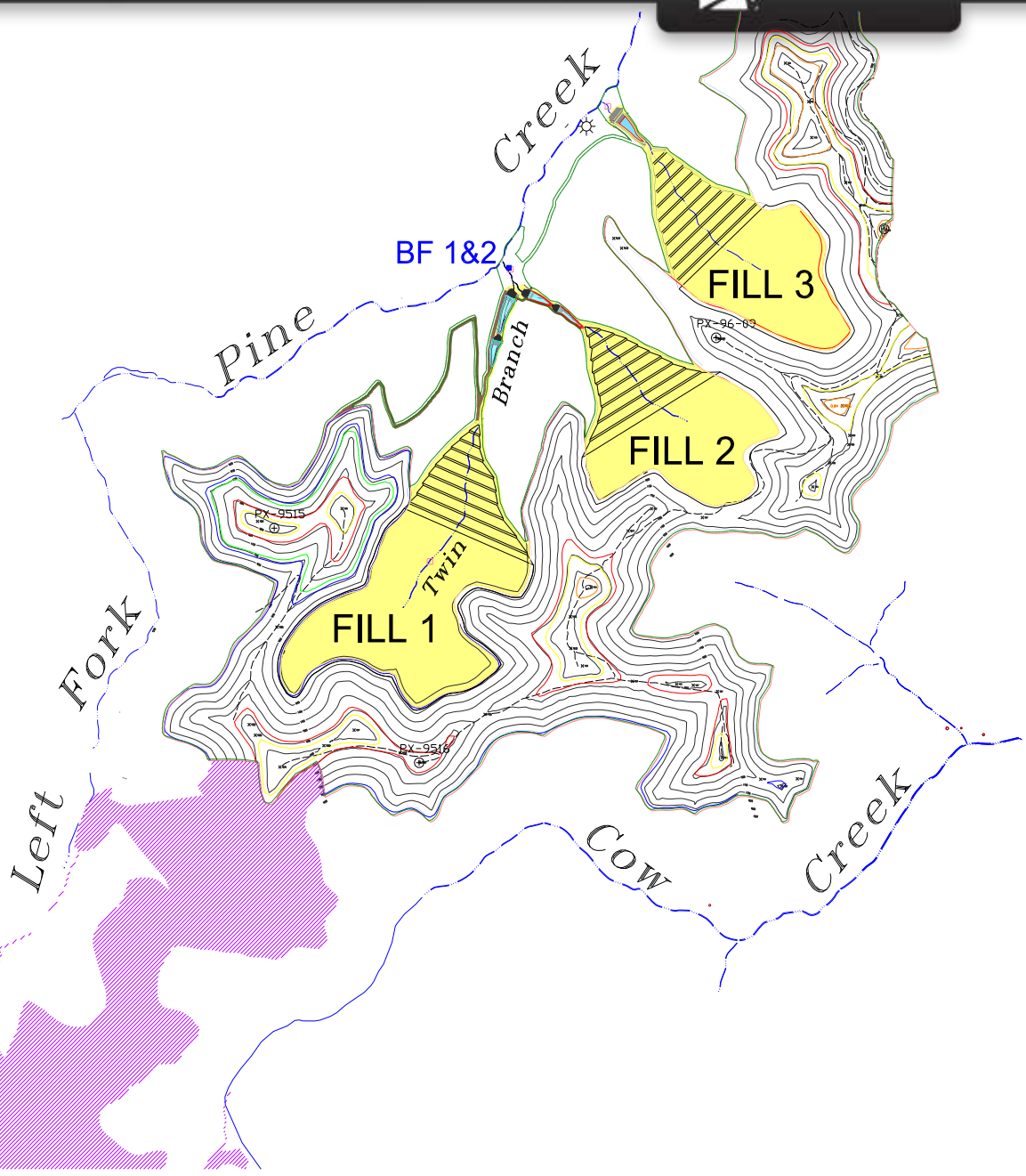
Arch Coal, Inc.

# Pine Creek 1

***Logan County, WV***
***Pine Creek of Island Creek***

***Mining area – 537.10 ac.***
***Valley fill area – 206.20 ac.***

***WV Article 3 & Article 11***
***Submitted – 04/06/2006***
***Approved – 09/05/2008***



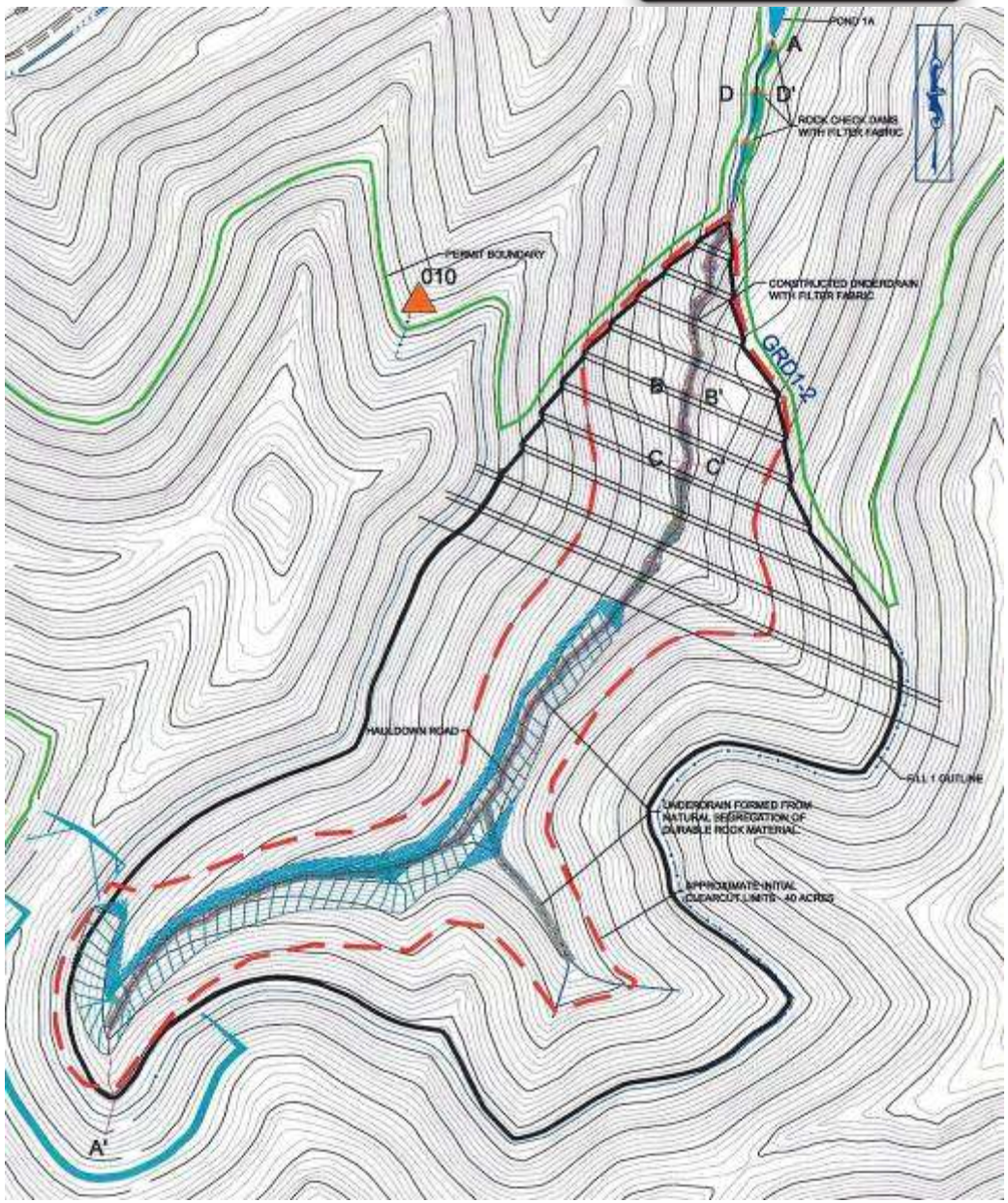
# EPA Review Timeline

- **January, 2009** – EPA commences extra regulatory review process of CWA Section 404 permits.
- **June 11, 2009** – Enhanced Coordination Procedure (ECP) - The EPA, the Corps, and the Department of the Interior releases a Memorandum of Understanding (MOU) specifying the use of the Multi-criteria Integrated Resource Assessment (MIRA) process to ***expedite*** permit process
- **September 11, 2009** – Initial list 79 pending permit applications released. All failed to pass MIRA.
- **January 13, 2010 –** Initial ECP Review
- **April 1, 2010** – EPA Issues Comprehensive Guidance which includes requirement of maximum benchmark conductivity of 500 microSiemens per centimeter.

# USACE approval – 07/27/2010

- Only valley fill 1 approved
- Future fills contingent on meeting benchmark conductivity of 500 micro-siemens/cm downstream of Fill 1.
- Additional mitigation (Creation/restoration)
- Several watersheds permanently set aside
- Special valley fill construction techniques

- **Special valley fill construction specs**
  - *Special handling plan using inert sandstone for underdrain*
  - *Internal checks*
  - *Underdrain wrapped with filter fabric*
  - *Limited brushing (5th bench level)*
  - *Compaction and Internal drain on 5th bench level*
  - *Compaction and Internal drain on Coalburg seam level*



# Inert sandstone for underdrain

- Most inert underdrain material located between the Lower Stockton seam and the Coalburg rider.

# Internal check

# Internal checks

# Filter fabric placement

- Placement of the fabric wrap for the under drain was labor intensive and time consuming.

# Underdrain placement

- Additional views of the underdrain placement over the filter fabric.

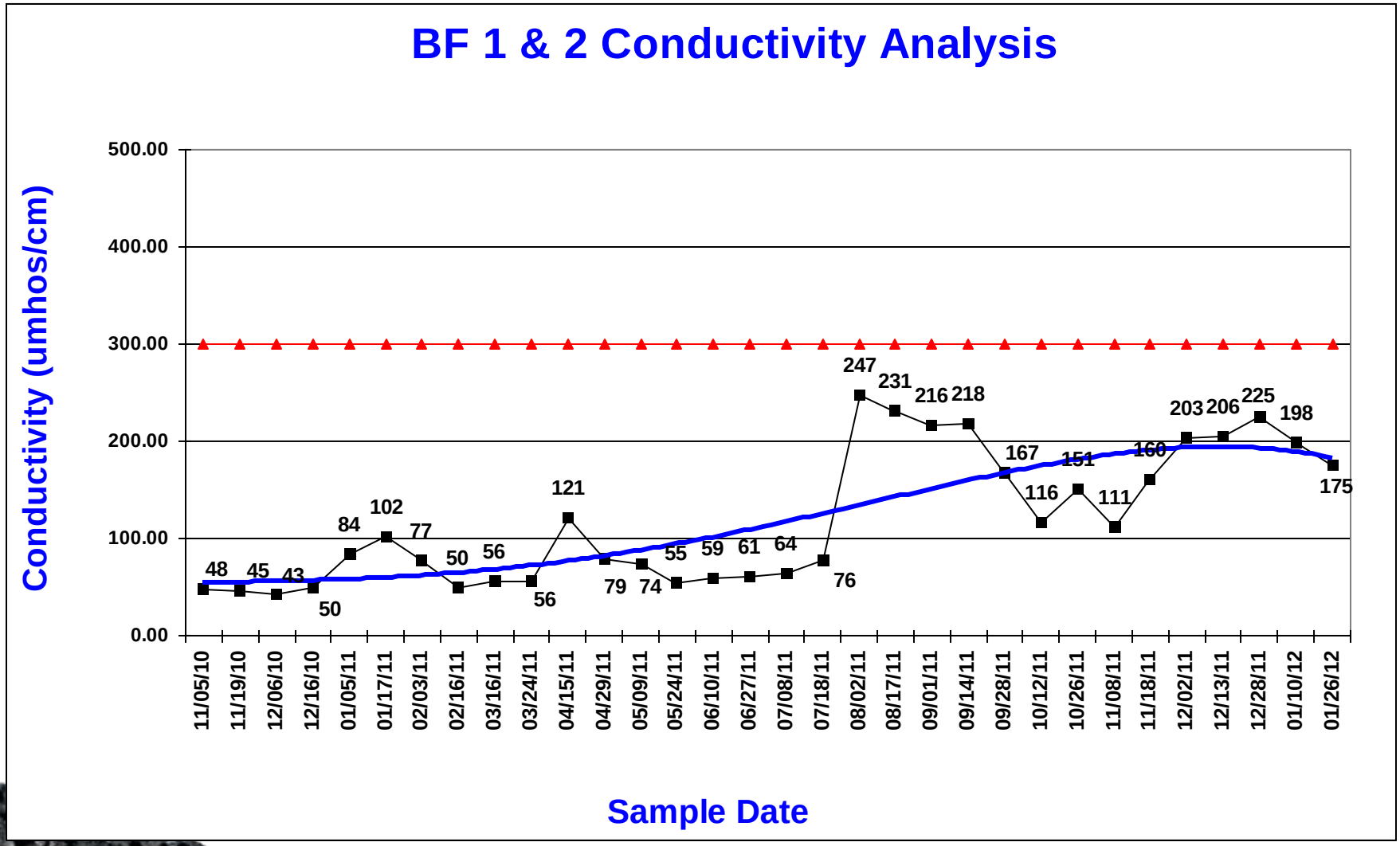
# Limited Brushing

# Toe of fill

# *Limited Brushing*

# *Valley Fill 1 progress  Feb - 2012*

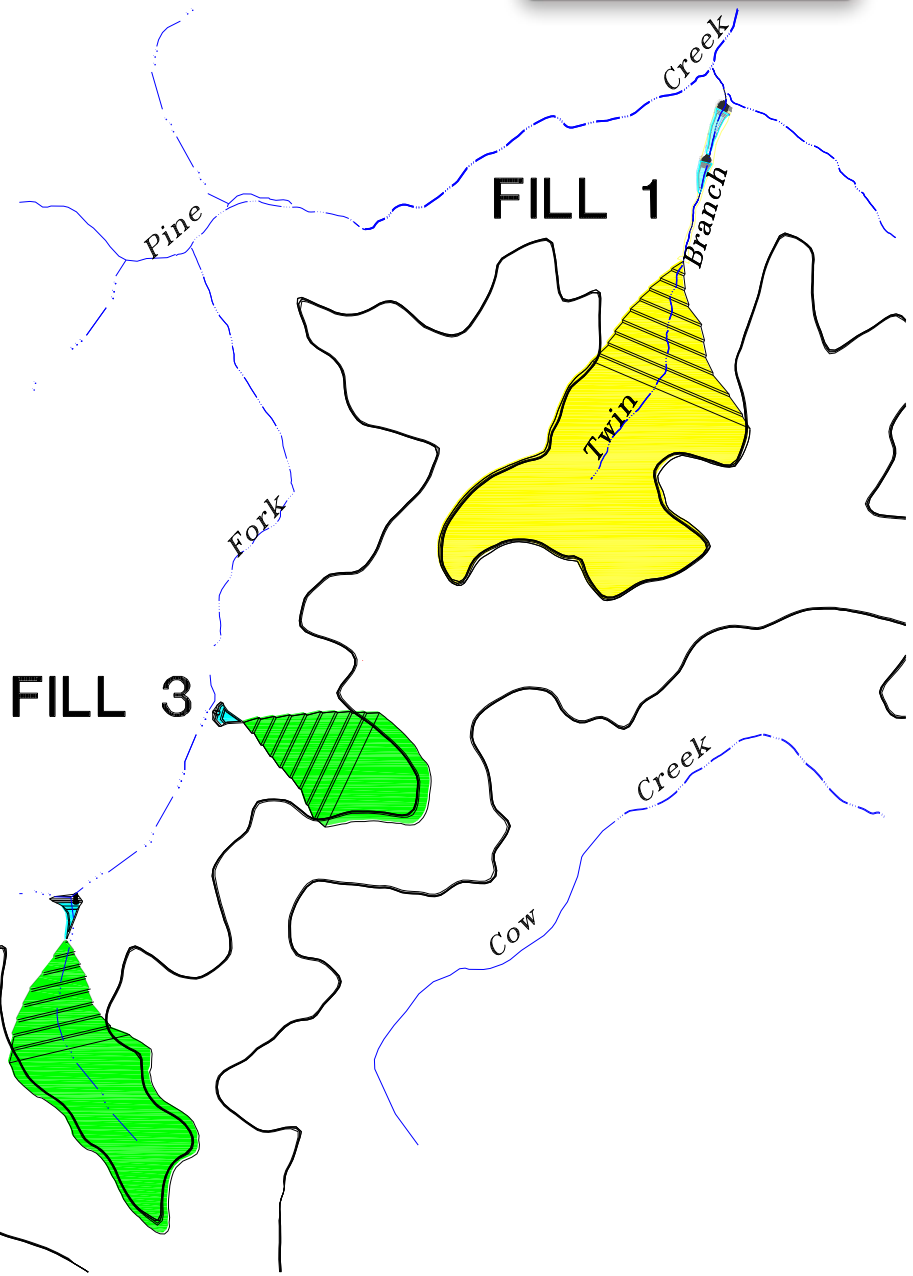
# VF1 - Conductivity Results



# Success?

**Conductivity Comparison**

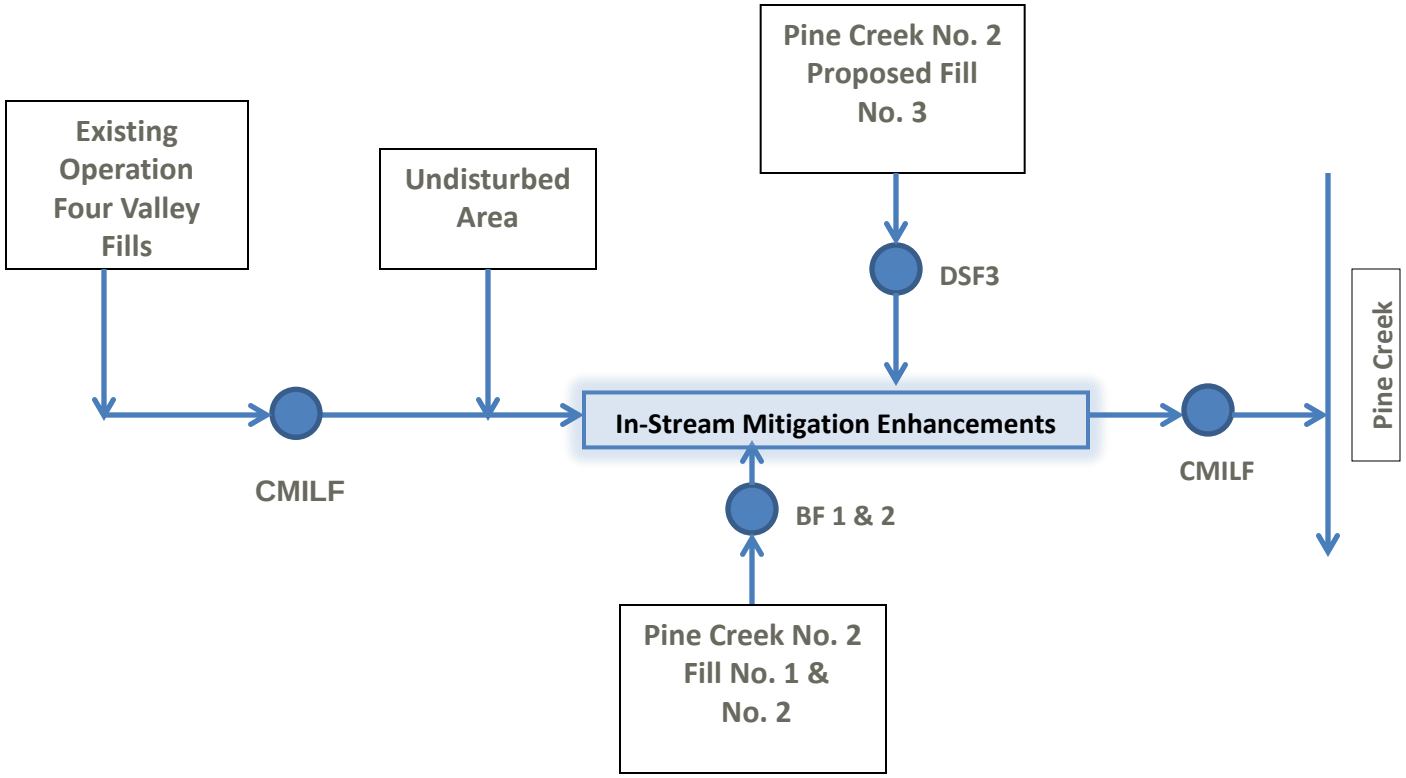
| Outlet No. | Avg Cond (umhos) | Min Cond (umhos) | Max Cond (umhos) |
|---|---|---|---|
| BF 1 & 2 | 120 | 43 | 247 |
| Fill 3 | 538 | 277 | 802 |
| Fill 4 | 939 | 299 | 1,215 |



# *Fill 3 – 538 umhos avg.*

# *Fill 4 – 939 umhos avg.*

# Flow Diagram – Left Fork of Pine Creek



# *Left Fork of Pine Creek*

- Contribution Watershed Area ……2,931acres
- Preserved Area …….. 74.1acres
- Number of Fills in the Watershed ……5

# *Flow x Conductivity*

Calculations based upon U.S.G.S. equation where:

$$\overline{C}_{CMDLFPC} - (\overline{C}_{CMILF} + \overline{C}_{BF1\&2} + \overline{C}_{DSF3}) = \overline{C}_{Remaining\ Watershed}$$

where $\overline{C}_n$ is the average of the product of Flow x Conductivity for the data set:

# Left Fork of Pine Creek

| Before Permit Issuance | | | |
|---|---|---|---|
| Station | Flow (cfs) x Conductivity (umhos) | Average Conductivity (umhos) | Flow (cfs) |
| CMDLFPC | 1537 | 440 | 3.61 |
| CMILF | 522 | 496 | 1.2 |
| BF 1 & 2 | 187 | 307 | 0.76 |
| DSF3 | 88 | 299 | 0.32 |
| ALL OTHERS | 740 | 556 | 1.33 |

# Left Fork of Pine Creek

| After Permit Issuance | | | |
|---|---|---|---|
| Station | Flow (cfs) x Conductivity (umhos) | Average Conductivity (umhos) | Flow (cfs) |
| CMILF | 999 | 642 | 1.83 |
| CMDLFPC | 3995 | 395 | 10.47 |
| BF 1 & 2 | 99 | 109 | 0.82 |
| DSF3 | 4.24 | 12 | 0.13 |
| ALL OTHERS | 2805 | 364 | 7.69 |

# Left Fork of Pine Creek

| Post Mining Compared to Pre Mining | | | |
|---|---|---|---|
| Station | Flow (cfs) x Conductivity (umhos) | Average Conductivity (umhos) | Flow (cfs) |
| CMDLFPC | 2458 | (45) | 6.86 |
| CMILF | 477 | 146 | 0.63 |
| BF 1 & 2 | (88) | (198) | 0.06 |
| DSF3 | (84) | (287) | (0.19) |
| ALL OTHERS | 2065 | (192) | 6.36 |

# Left Fork of Pine Creek

Comparison of WVSCI Scores to Conductivity Levels

| Station | Before Permit WVSCI | Average Conductivity (umhos) | After Permit WVSCI | Average Conductivity (umhos) | Difference Post Mining to Pre Mining | |
|---|---|---|---|---|---|---|
| | | | | | WVSCI | Conductivity (umhos) |
| CMDLFPC | 76.36 | 440 | 68.36 | 395 | (8.00) | (45) |
| CMILF | 86.53 | 496 | 63.96 | 642 | (22.57) | 146 |
| BF1&2 | NA | 307 | 85.19 | 109 | NA | (198) |
| DSF3 | NA | 299 | 68.12 | 12 | NA | (287) |
| | | | | | | |
| NA - Both locations were dry during sampling event | | | | | | |

# *THANK YOU*

## ***Questions***