In-stream AMD treatment for Large Watershed Restoration: Martin Ck Project

Results: 3 nov 15 to 12 Mar 16

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BACKGROUND

- WVDEP/OSR currently treats bond forfeiture sites at source under NPDES permits:
  - For small discharges this is extremely expensive
  - Almost no environmental benefit

- WVDEP/OSR Seeks to demonstrate the effectiveness of in stream dosing to:
  - Recover more stream miles
  - Improve efficiency of SRF expenditures

IN STREAM DOSING

- Advantages
  - Many more stream miles recovered per dollar invested
  - Lower capX, opX
  - Alternative NPDES permitting
  - Easier to attract investors
- Disadvantages
  - Sludge deposition in streams
  - Length of sacrifice zone
  - Unknown downstream benefits for steep stream channels with high metal loadings-Fickey Run

PROJECT WV 342 OBJECTIVES

- Document stream mile recovery in worst case scenario: Martin Ck basin, Preston Co. WV
- Optimize doser configuration and dosing rates
- Avoid $1MM solutions to $100k problems

Fickey Run in-stream doser with solar panels

RESTORATION GOAL

OSR has set a restoration goal of restoring the lower 3.4 miles of Muddy Creek to its designated stream usage by decreasing the water quality impairment from pre and post law coal mine discharges within the watershed.

This will effectively reestablish biologic connectivity throughout the entire 15.6 miles of Muddy Creek. Also, as part of the 10 year variance term, OSR will be constructing a treatment facility at its T&T EM-113 site that will be treating water from the T&T site, Viking Coal UO-519, as well as the Preston Energy UO-235 site.

WATER QUALITY VARIANCE

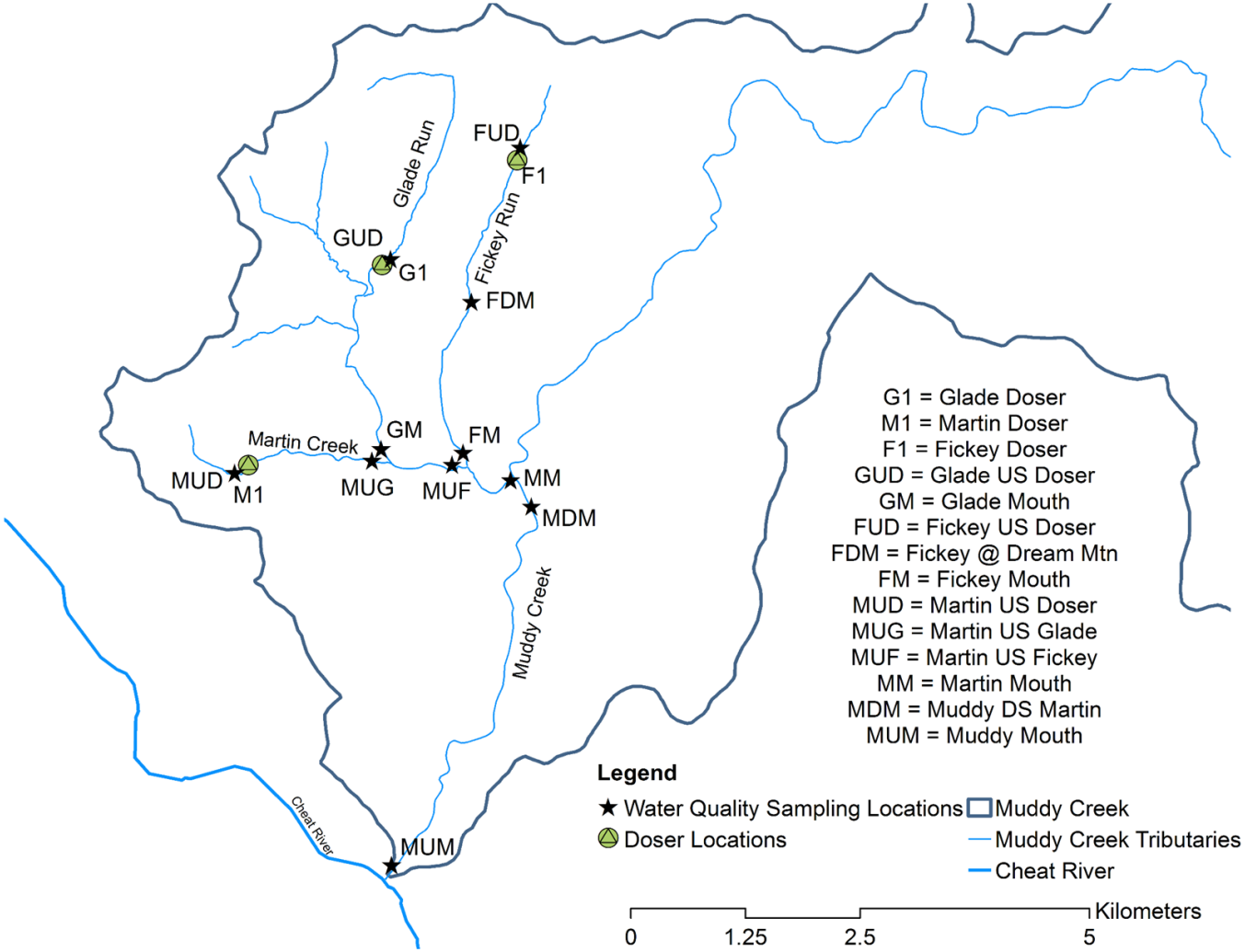
7.2.d.8.2. A variance pursuant to 46 CSR 6, Section 5.1, based on human-caused conditions which prohibit the full attainment of any designated use and cannot be immediately remedied, shall apply to WV DEP Division of Land Restoration's Office of Special Reclamation's discharges into Martin Creek of Preston County and its tributaries, including Glade Run, Fickey Run, and their unnamed tributaries. **The**

following existing conditions will serve as instream interim criteria while this variance is in place: pH range of 3.2-9.0, 10 mg/L total iron, and 15 mg/L dissolved aluminum. Alternative restoration measures, as described in the variance application submitted by WV DEP Division of Land Restoration's Office of

Special Reclamation, shall be used to achieve significant improvements to existing conditions in these waters during the variance period. Conditions will be evaluated during each triennial review throughout the variance period. This variance shall remain in effect until action by the Secretary to revise the variance or until July 1, 2025 whichever comes first.

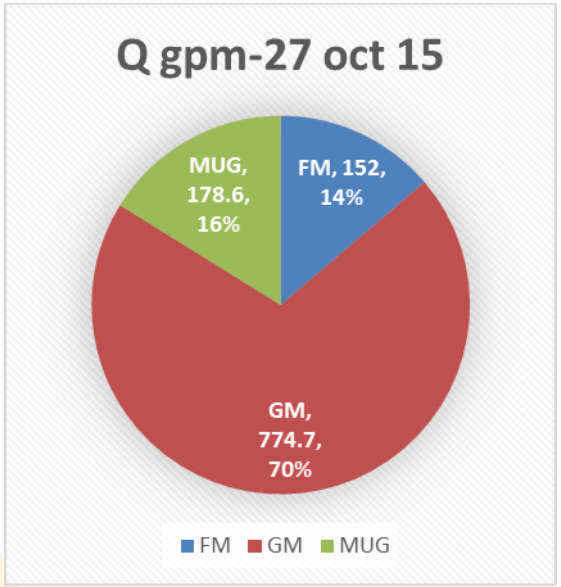
Dosers
M1, F1 went on line around
3 nov 15
F1 offline 1 dec 15

G1 went online
15 dec 15

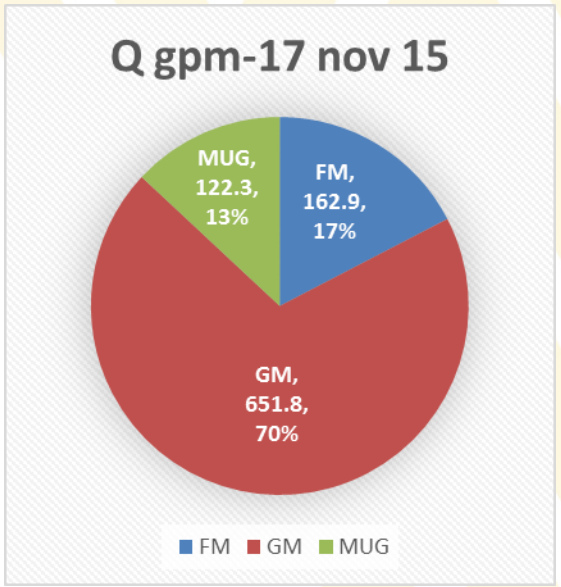


Flow distribution in Fickey, Glade and Martin Cks

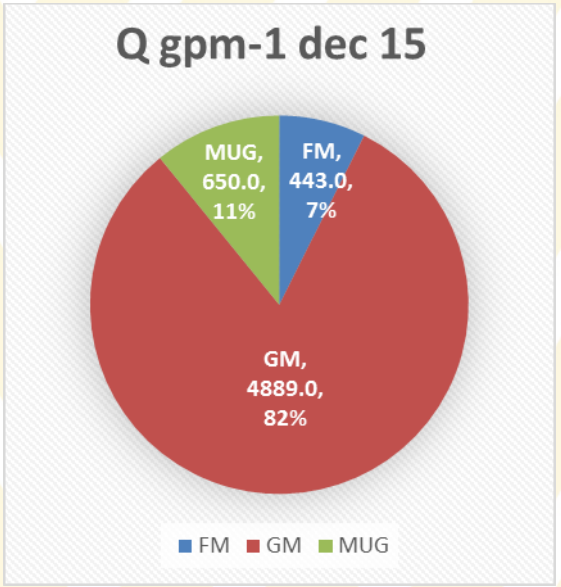
Low flow



Low flow



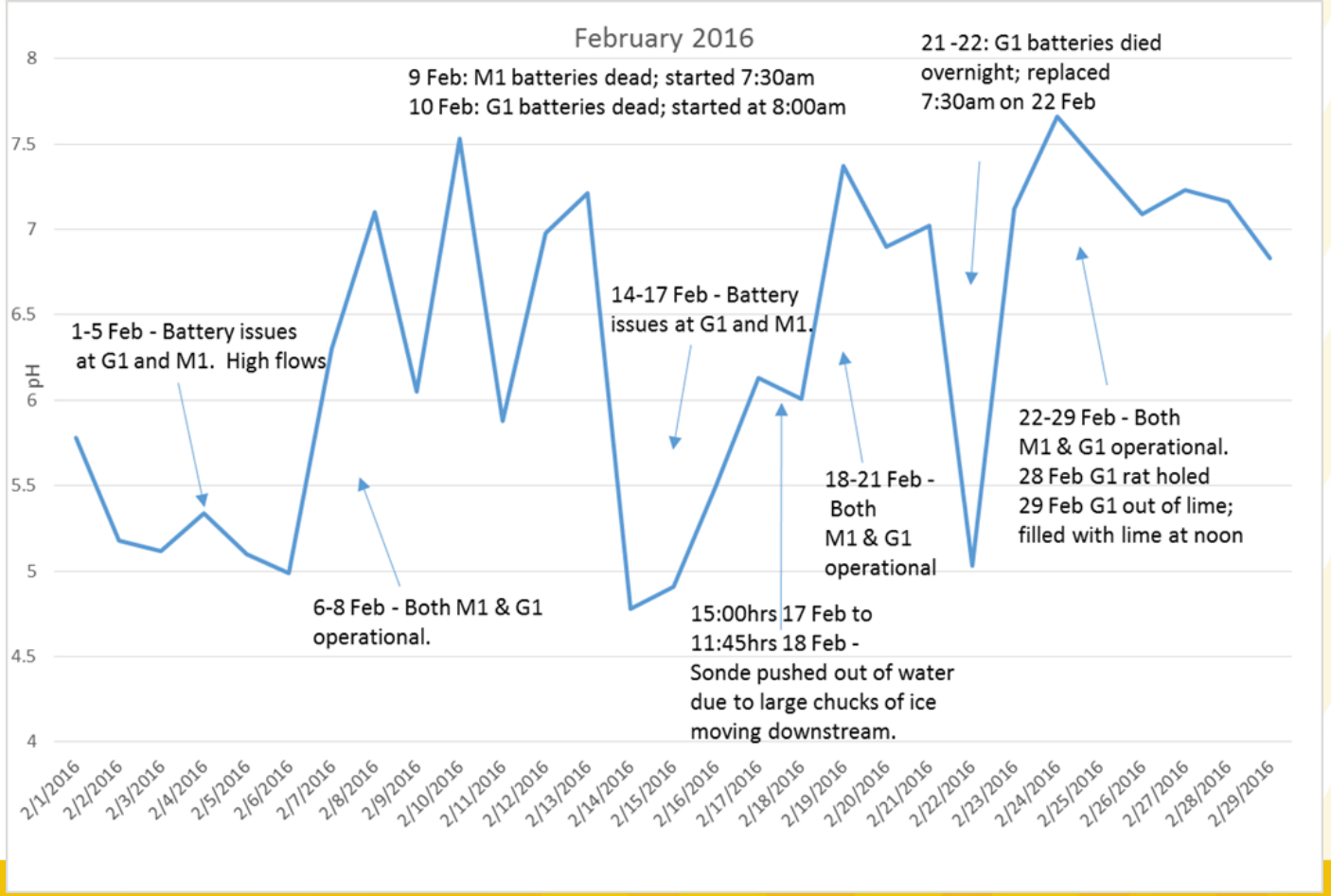
High flow



STATUS

- Power supply to the dosers is problematic
- Iron and aluminum loads in Muddy Ck have been substantially reduced
- Concentrations in Martin Ck are within restoration targets during low to mid flow stream conditions
- High flow events cause excessive turbidity in Muddy Ck and exceedance of the restoration target for iron

RESULTS


February 2016
9 Feb: M1 batteries dead; started 7:30am
10 Feb: G1 batteries dead; started at 8:00am
21 -22: G1 batteries died overnight; replaced 7:30am on 22 Feb
1-5 Feb - Battery issues at G1 and M1. High flows
6-8 Feb - Both M1 & G1 operational.
14-17 Feb - Battery issues at G1 and M1.
15:00hrs 17 Feb to 11:45hrs 18 Feb - Sonde pushed out of water due to large chucks of ice moving downstream.
18-21 Feb - Both M1 & G1 operational
22-29 Feb - Both M1 & G1 operational.
28 Feb G1 rat holed
29 Feb G1 out of lime; filled with lime at noon
pH
8
7.5
7
6.5
6
5.5
5
4.5
4
2/1/2016
2/2/2016
2/3/2016
2/4/2016
2/5/2016
2/6/2016
2/7/2016
2/8/2016
2/9/2016
2/10/2016
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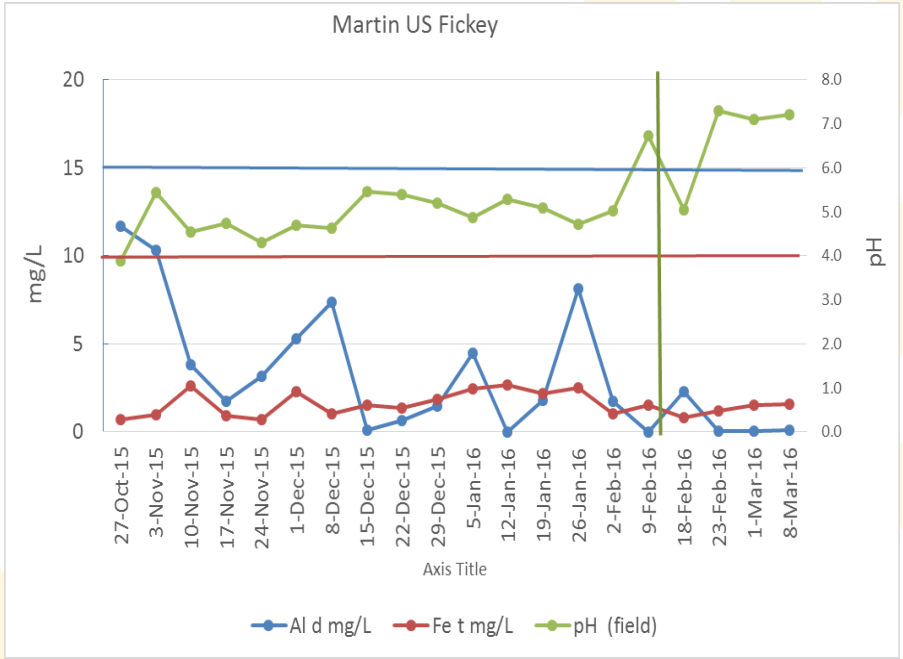
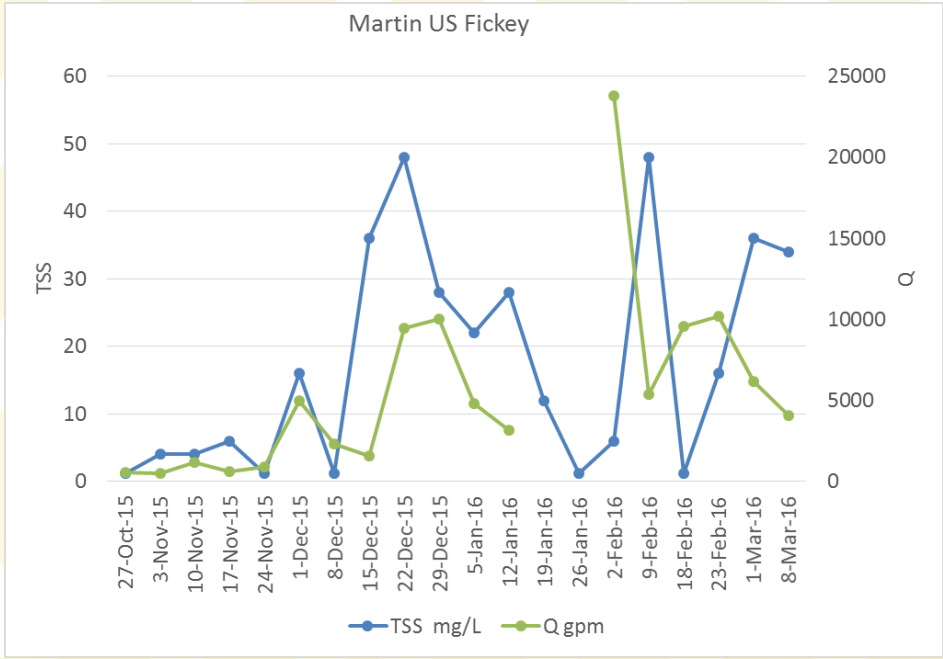
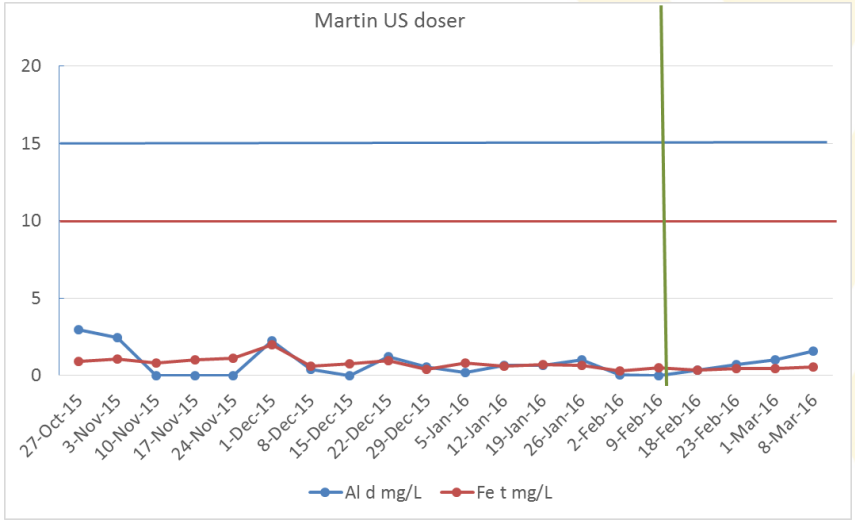
2/29/2016

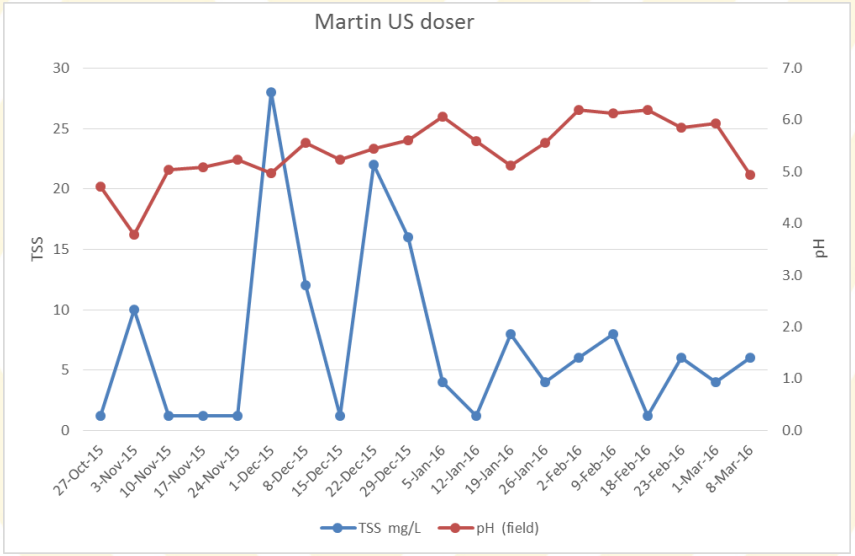
Performance against water quality variance



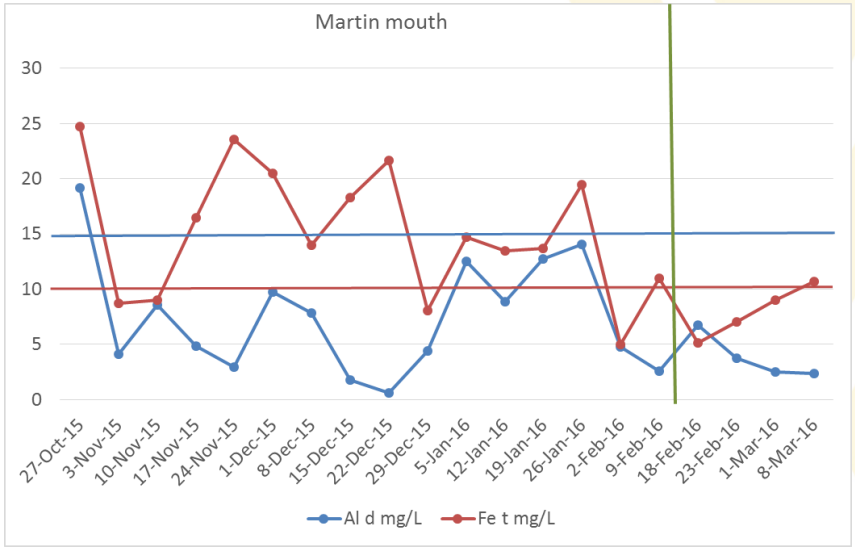


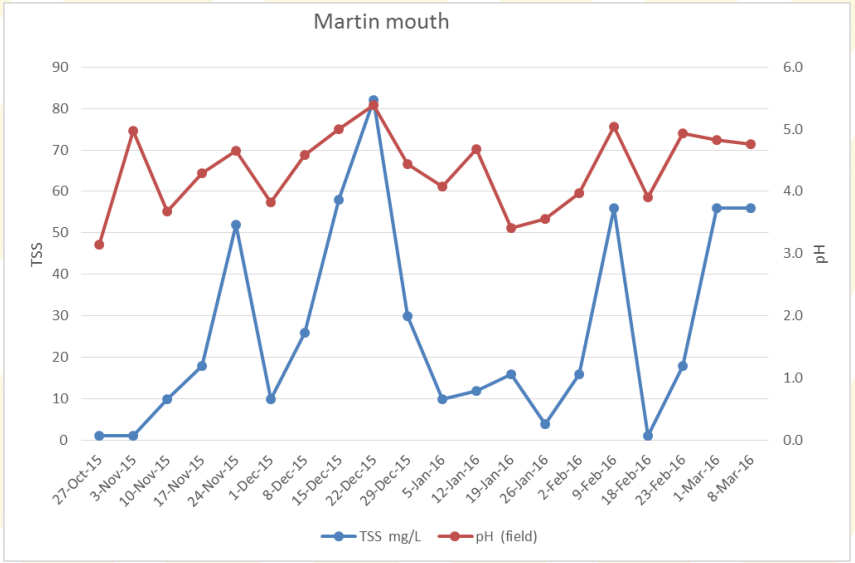
No effect from turning off the Martin Ck at-source dosers



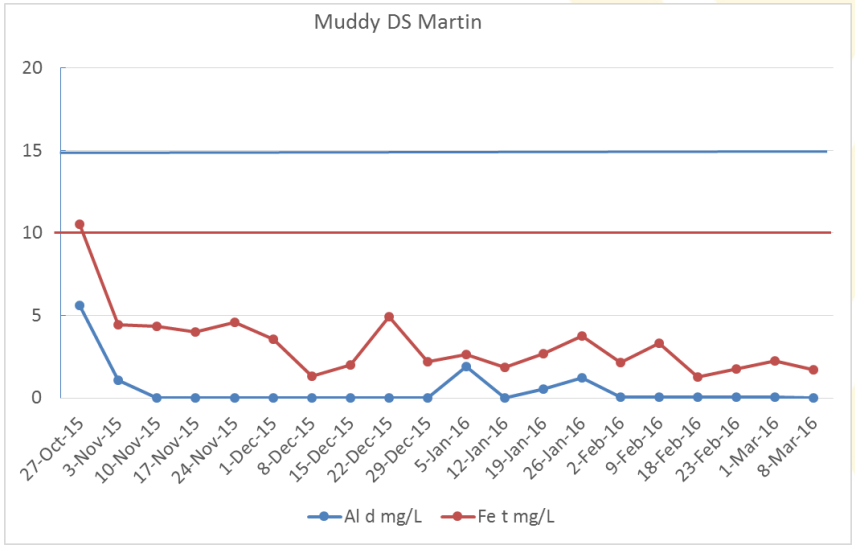


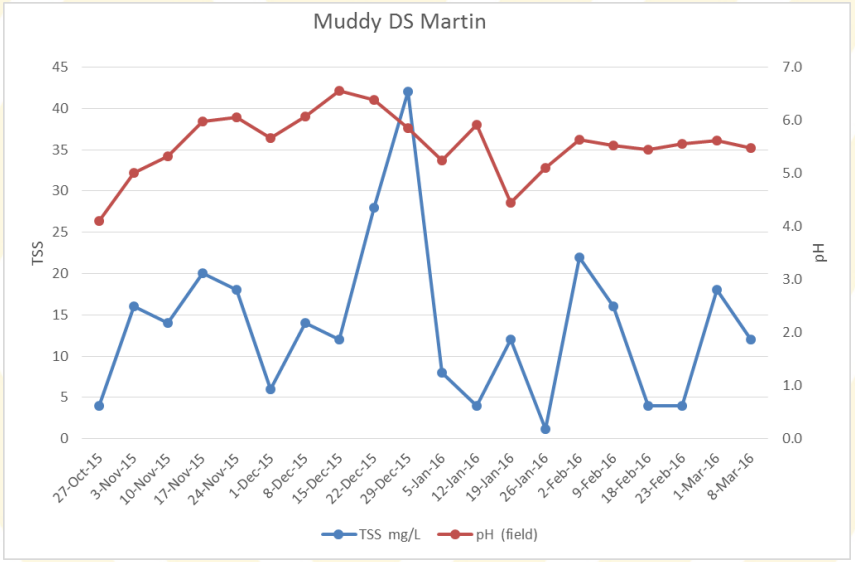
MOUTH OF MARTIN CK



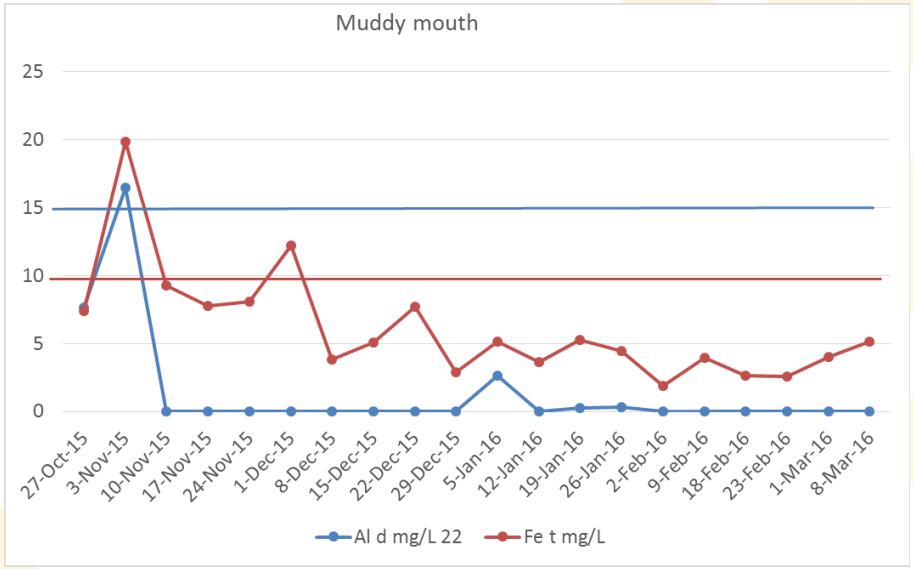


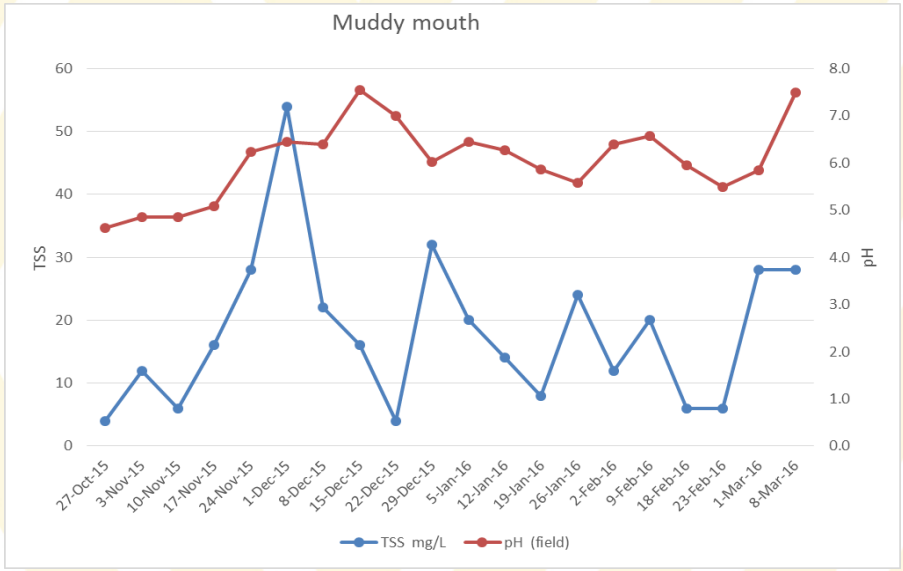
SUBSTANTIAL IMPROVEMENT IN MUDDY CK





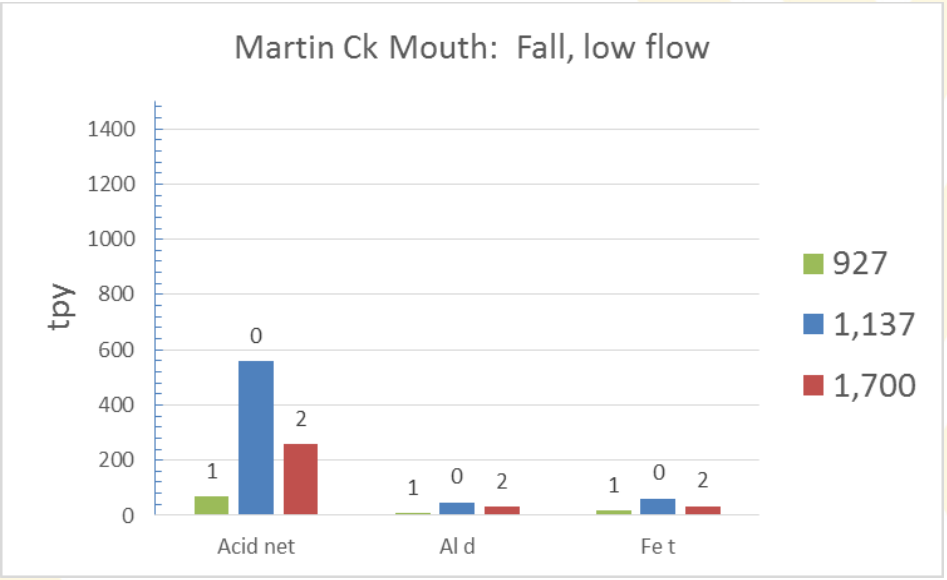
JUNCTION OF MUDDY CK AND CHEAT RIVER

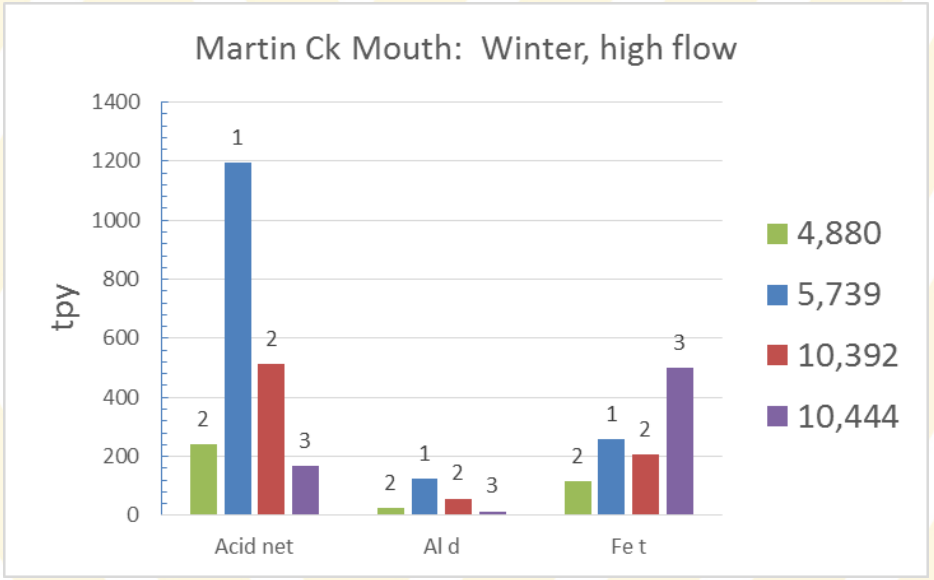




Loads at the mouth of Martin Ck.

Numbers at head of columns indicate number of operating dosers





Lime Costs: Martin Ck and Glade Run Dosers

	M1	G1	total Martin Ck.
tons	47.68	56.61	104.29
$	$ 14,781	$ 17,549	$ 32,330
days	140	140	280
tons/day	0.3	0.4	0.7
$/day	$ 105.58	$ 125.35	$ 230.93
tons/year	124.3	147.6	271.9
$/year	$ 38,536	$ 45,753	$ 84,289

LOW FLOW CONDITIONS

Pre dosing-29oct15

Post dosing-10nov15

HIGH FLOW CONDITIONS

Post dosing

29nov15-Muddy DS Martin Ck

Post dosing

29nov15-Muddy @ Beech Run

Conclusions: Oct 15 to Mar 16

- High variation in doser output
- High variation in stream flow
- Water quality variance achieved at The Martin Ck US Fickey Run compliance point
- No effect from turning off the Martin Ck at- source dosers
- Since 1 Feb 16 > 6.0 77% of the time
- opX: Lime cost about $84k/year
- capX: 2 dosers at ~ $140k each installed

Martin Ck. Conceptual Plan

Install Dosing Units on Martin Ck. and Glade Run

- Lime slurry
- Municipal water makeup
- Line power

WVDEP/OSR's Omega Site lime slurry doser

FOR MORE INFORMATION PLEASE CONTACT:

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