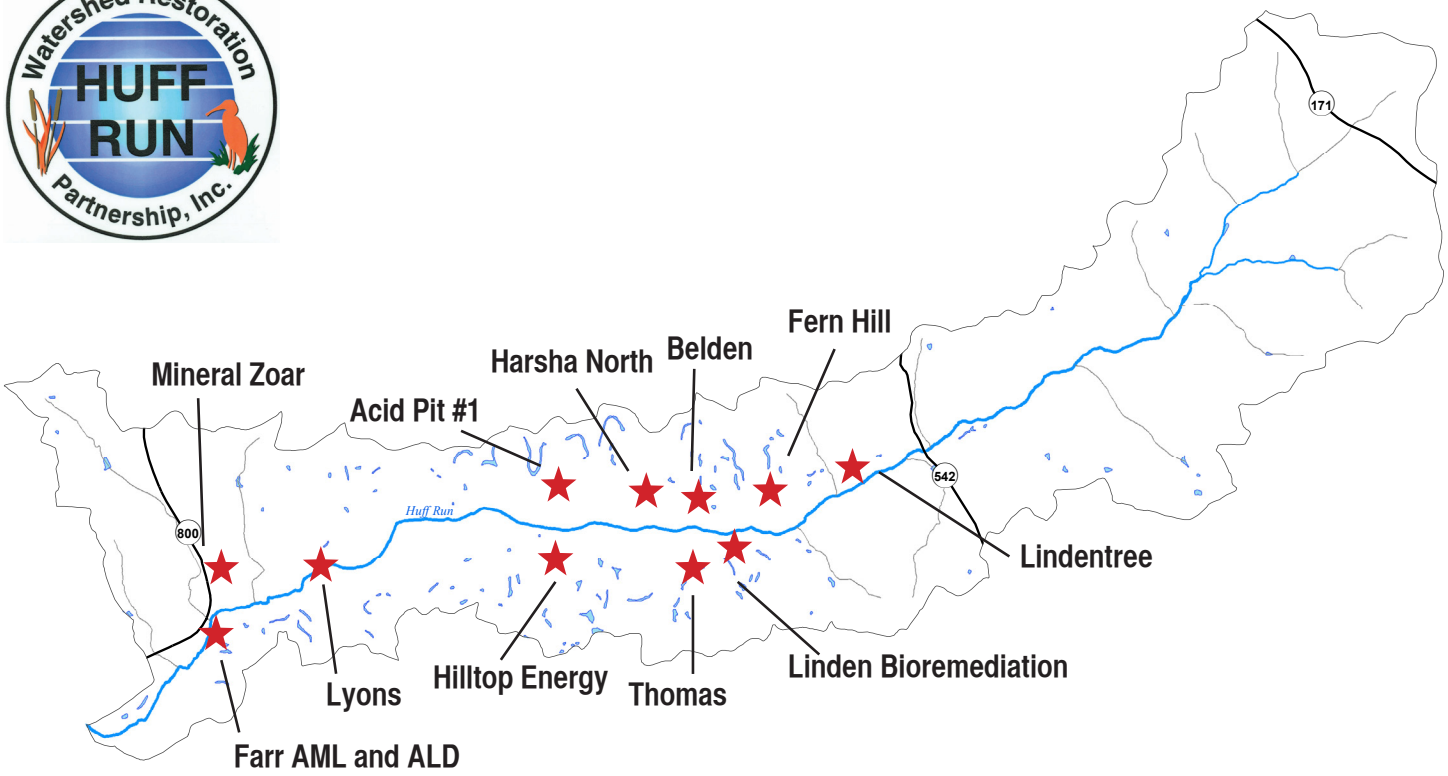
HUFF RUN
WATERSHED REPORT



Reductions

Total acid load reduction at all project sites = 1063 lbs/day

Total metal load reduction at all projects sites = 33 lbs/day

excluding Mineral Zoar and Farr

Costs

Design $667,412
(excluding Linden Bioremediation and Lyons II)

Construction $4,349,850

Total cost through 2014 =$5,017,262

Timeline of the Huff Run Watershed Project Milestones & AMD Projects

1985
- Study funded by ODNR conducted by Benatec Associates to identify acid problems in Huff Run Watershed

1988
- First abandoned mine land project, Jobes, completed in the watershed

1996
- Huff Run Watershed Restoration Partnership founded

2000
- Huff Run AMDAT completed
- Huff Run Watershed Coordinator funded for six years
- First acid mine drainage restoration project, Farr, completed in watershed

2001
- First draft of Huff Run Watershed Plan completed

2002
- Linden Bioremediation Project constructed

2003
- Acid Pit Restoration Project completed

2004
- Lindentree Restoration Project completed

2005
- Rural Action and Huff Run awarded US EPA Targeted Watershed Grant
- Rural Action adds VISTA volunteer to Huff Run staff
- Second draft of Huff Run Watershed Plan authored, endorsed by the State of Ohio
- Lyons Restoration Project constructed

2006
- Harsha North Restoration project completed

2007

2008
- Belden Restoration Project constructed
- Fern Hill (HR-42) Phase II Project constructed

2009
- Huff Run Watershed Coordinator funded for three years
- Mineral Zoar Project completed
- Rural Action adds AmeriCorps member to Huff Run staff

2010
- Thomas Project, Fern Hill Pond A & Belden Gob pile constructed

2011
- Lyons II constructed

2012
- Hilltop Restoration Project started

2013
- Completed Hilltop Restoration Project
- MWCD Partners in Watershed Management Grant awarded for environmental education and community outreach

2014
- Project development for JS&L AMD Reclamation Project and the Farr Phase II

Huff Run Projects

Acid mine drainage reclamation projects completed in Huff Run Watershed:

2003 *Farr Project* (FAR01/02) – Surface reclamation, limestone channels, anoxic limestone drains, and passive wetland*
Linden Bioremediation Project (LIN08) – Pyrolusite limestone bioremediation bed

2004 Acid Pit #1 Project (ACP01) – Drain impoundments and surface reclamation

2005 Lyons Project (LYN01) – Steel slag bed, limestone channels, drain impoundments, and surface reclamation

Lindentree Project (LNT01) – Steel slag bed, limestone channels, and fill acid pits

2006 Harsha North Project (HAN05) – Surface reclamation, limestone trenches, and reclaimed gob pile

2008 Fern Hill HR-42 Pits A, B, & C (FRN01) – Surface reclamation, limestone Channels and reclaim 3 acidic pits

Belden and Belden Gob Pile Project (BLD01) – Surface reclamation, steel slag beds, reclaim gob pile, and passive settling ponds

2009 *Mineral Zoar (MZR08) – Reverse alkaline producing systems (RAPS)*

2010 Thomas Project (LIN01/THM06) – Surface reclamation and passive settling ponds

2011 Lyons II maintenance Project (LYN01) – Additional steel slag installed, pipe clean-outs, and added limestone berms to settling pond

2013 Hilltop Energy Project (HRT21/HR37) – Reclaimed gob pile, surface reclamation, limestone channels, and settling pond

Italicized indicates projects are not actively monitored for acid and metal load reduction purposes

**Indicates no yearly trend graphs due to lack of pre or post data*

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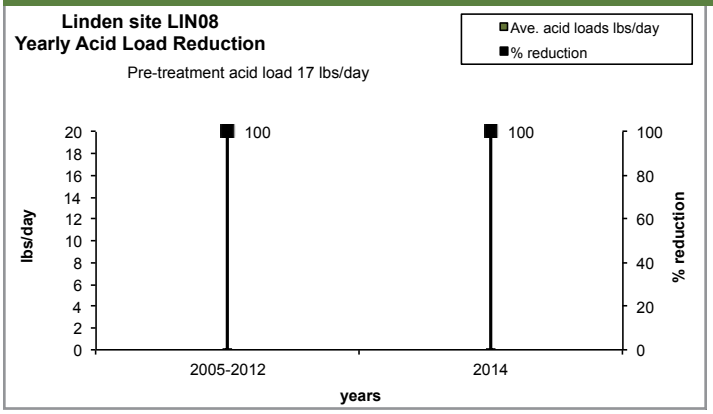
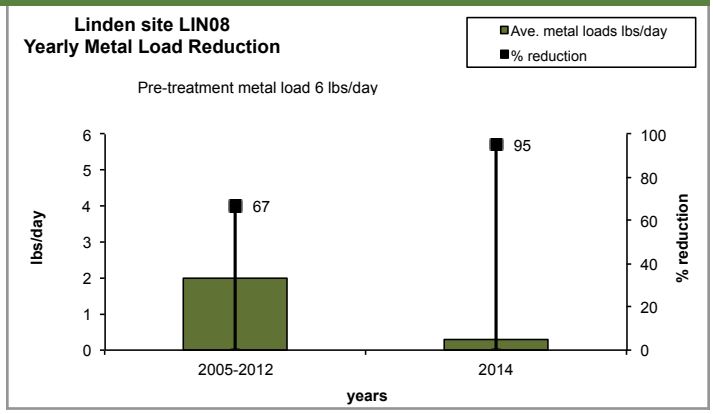
Yearly acid and metal load reduction trends per project

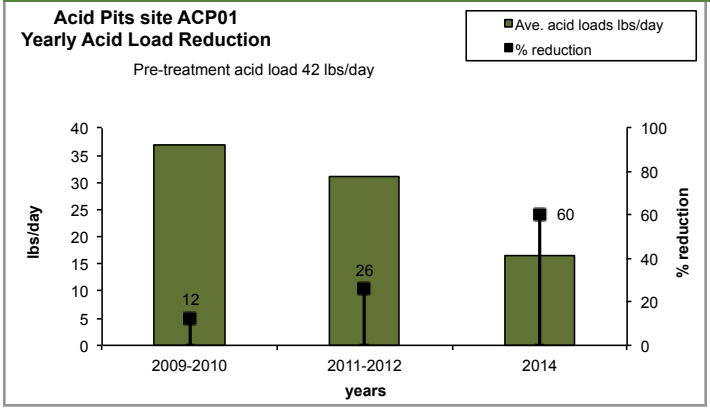
Similar to other environmental best management practices (BMPs), performance of passive acid mine drainage reclamation projects are also expected to decline with time. Active treatment systems are not expected to decline with time but sometimes need to be maintained to perform adequately. Currently, operation and maintenance plans are being designed for each existing system and are planned for future projects. The graphs below show the mean annual acid and metal load reduction using the Stoertz Water Quality Evaluation Method (Kruse et al., 2014) for each year (or group of years) during post-reclamation from the project effluent. From these graphs the rate of decline (and/or improvement) with time of the treatment system is implied. Knowing the rate of decline will aid in the implementation of operation and maintenance plans.

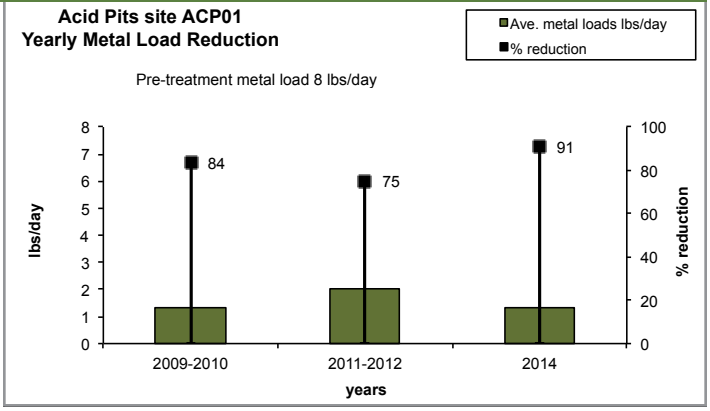
Linden site LIN08



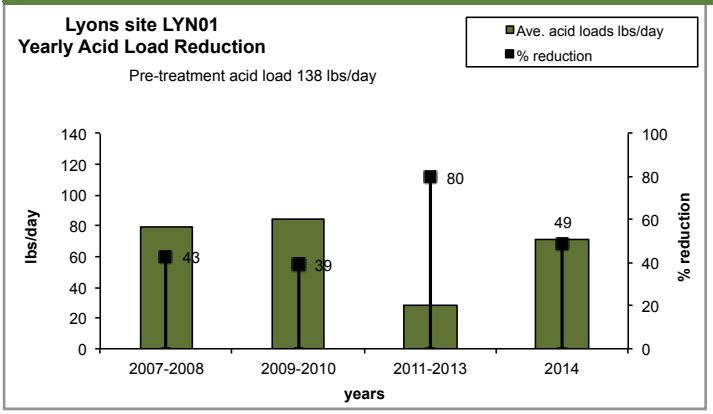


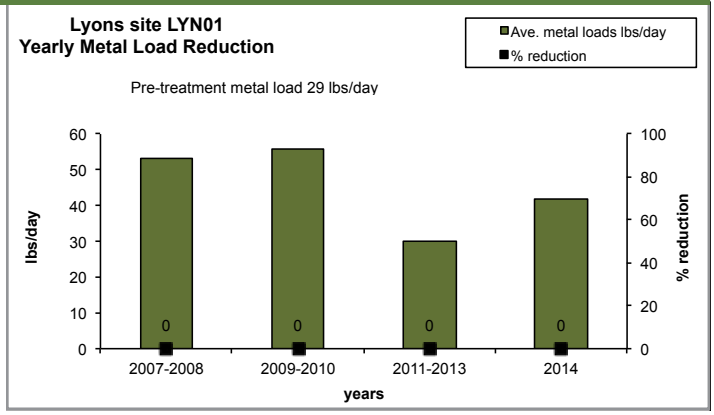
Acid Pits site ACP01





Lyons site LYN01





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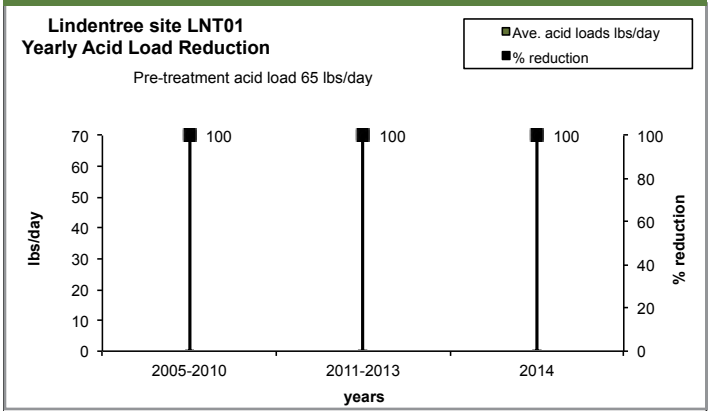
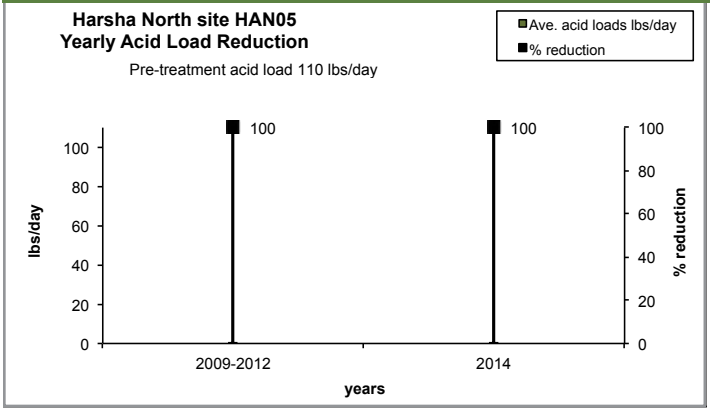
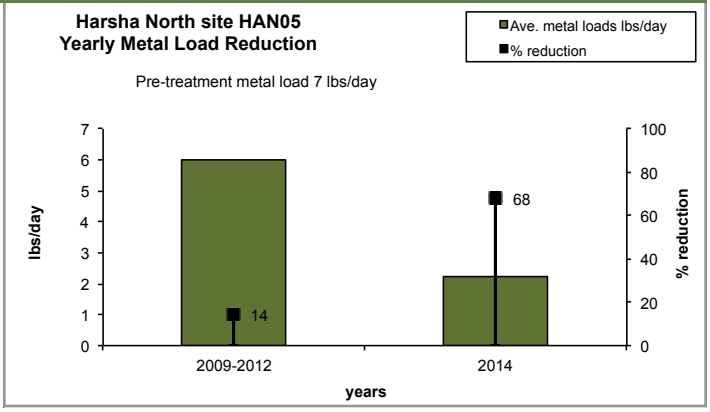
Yearly acid and metal load reduction trends per project

Lindentree site LNT01

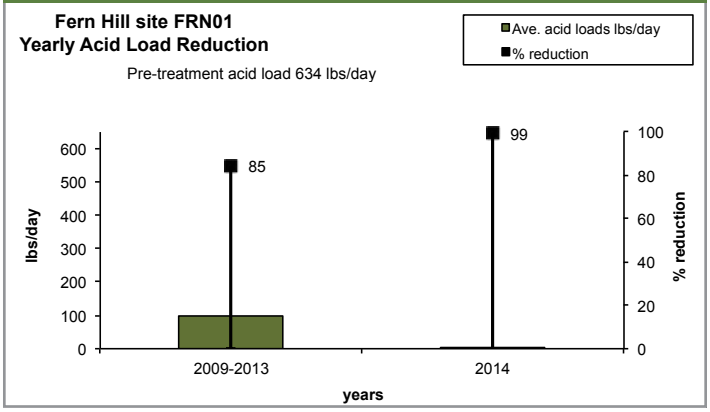


Harsha North site HAN05





Fern Hill site FRN01



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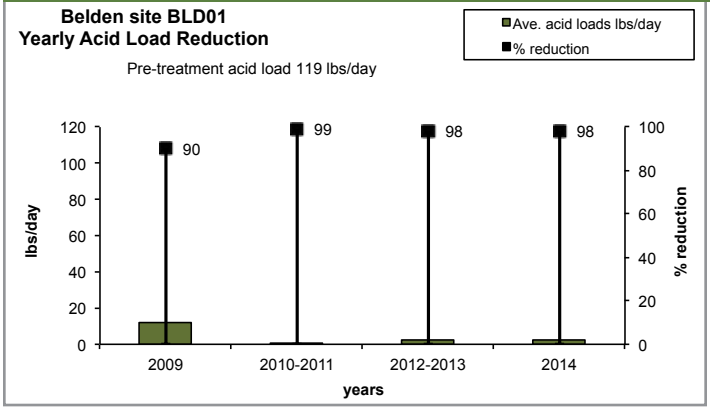
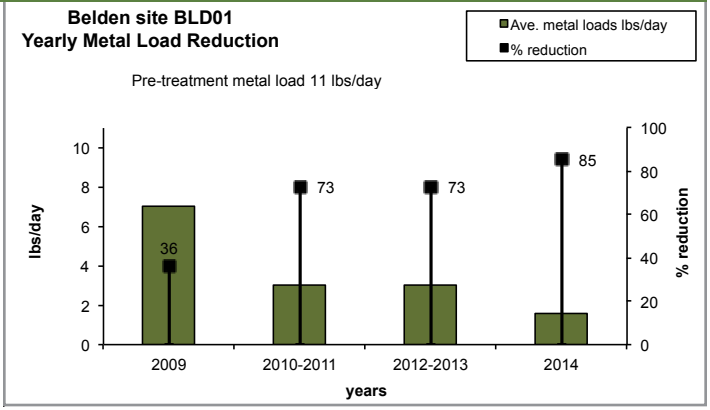
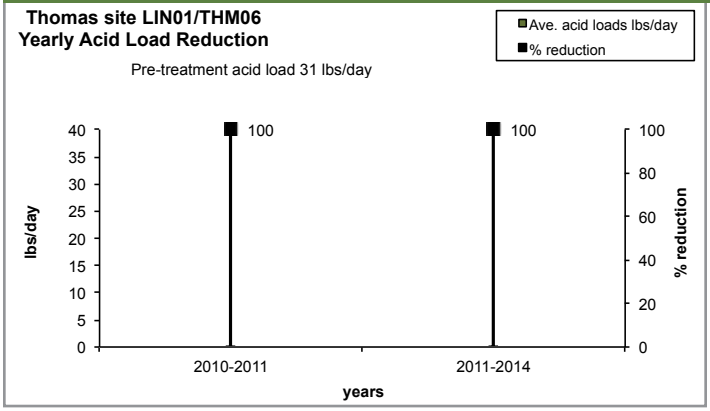
Yearly acid and metal load reduction trends per project

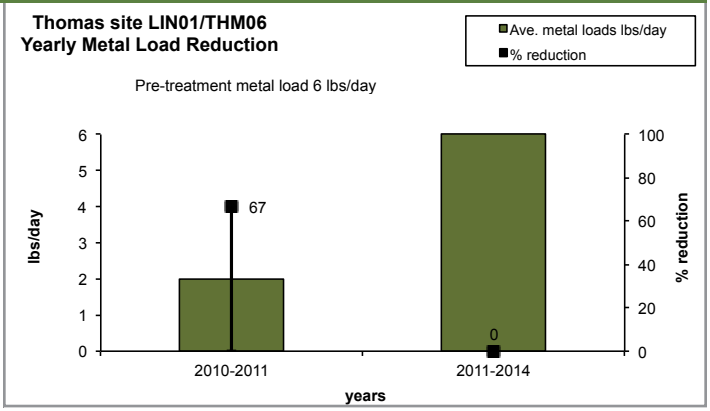
Belden site BLD01



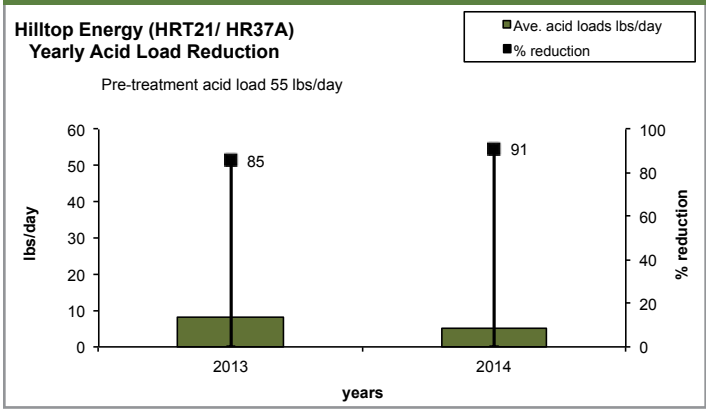


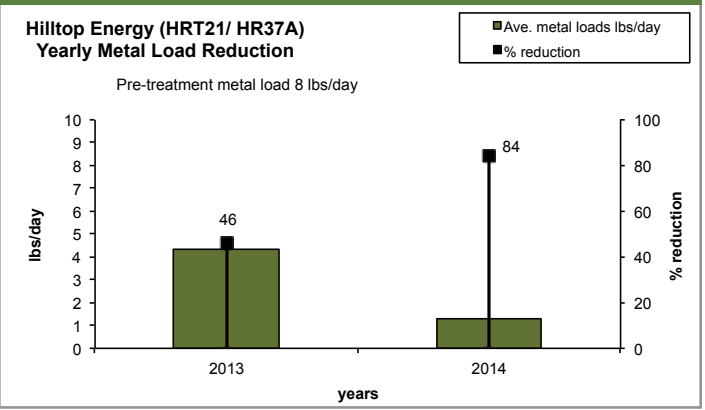
Thomas site LIN01/THM06



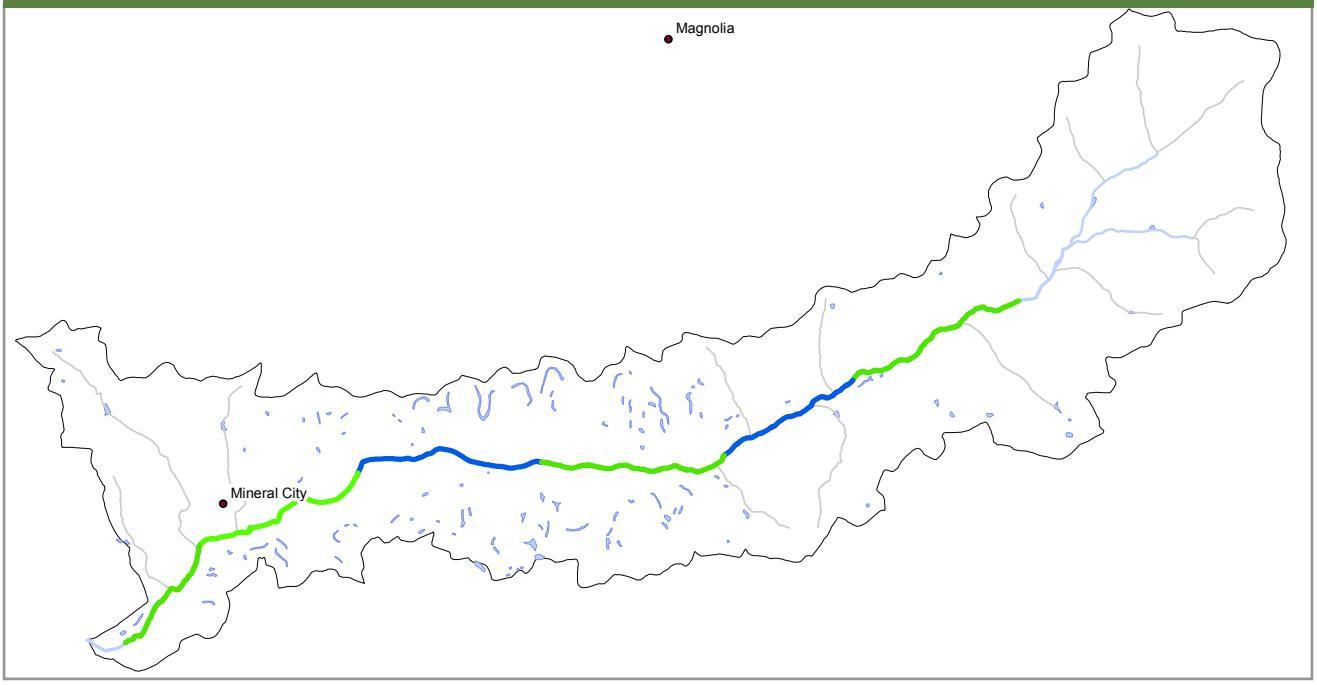


Hilltop Energy (HRT21/HR37A)

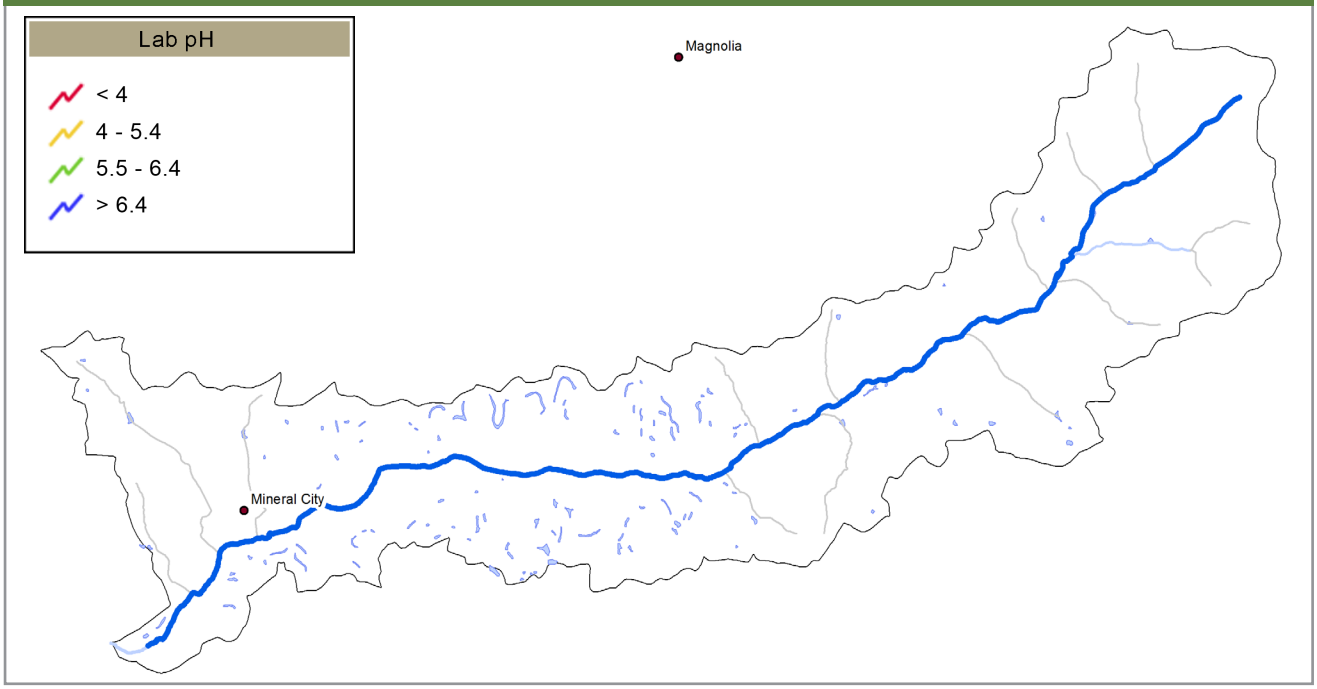




Huff Run baseline pH



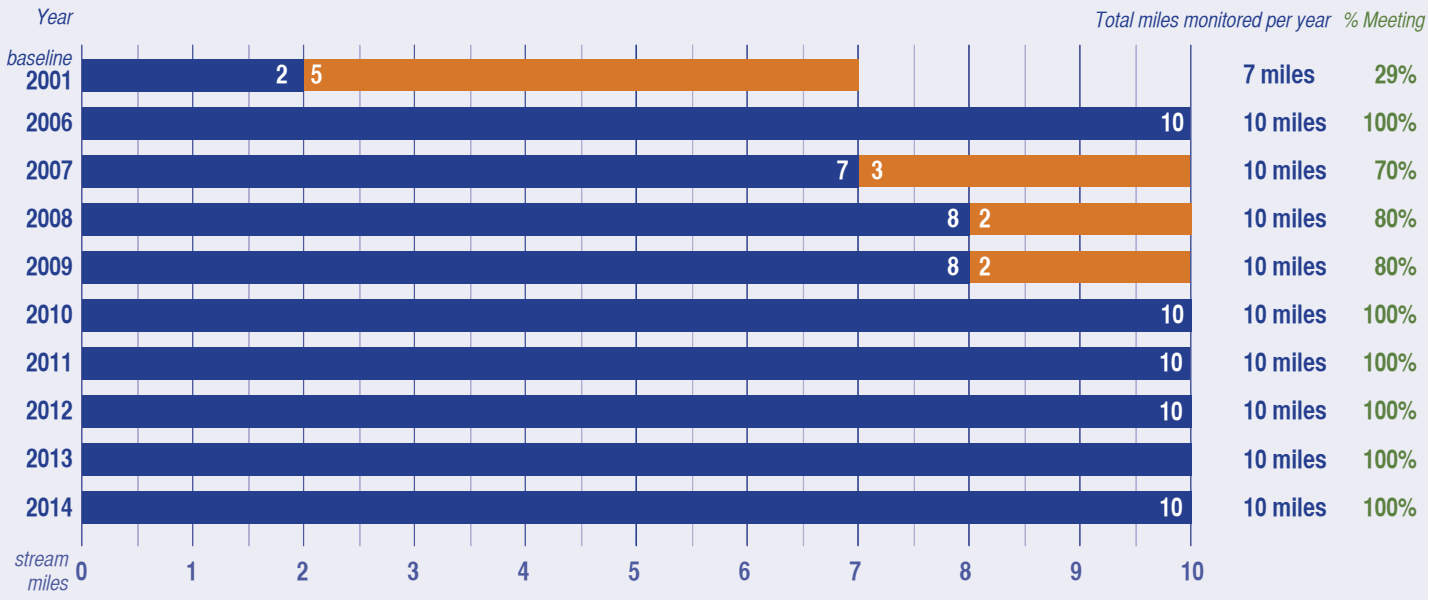
Huff Run 2014 pH



Huff Run pH values have improved from baseline conditions (1985-1998) to 2014. The entire length of Huff Run has met the pH target (6.5) for the last five years.

The mainstem of Huff Run is approximately 10 miles in length with monitoring occurring year round. In 2009, 8 miles met the pH target of 6.5 while the two downstream stream reaches (HRR08 and HRR07) fell slightly below the target with an average pH of 6.4. Since 2010 to 2014, all 10 miles met the pH target.

Huff Run pH



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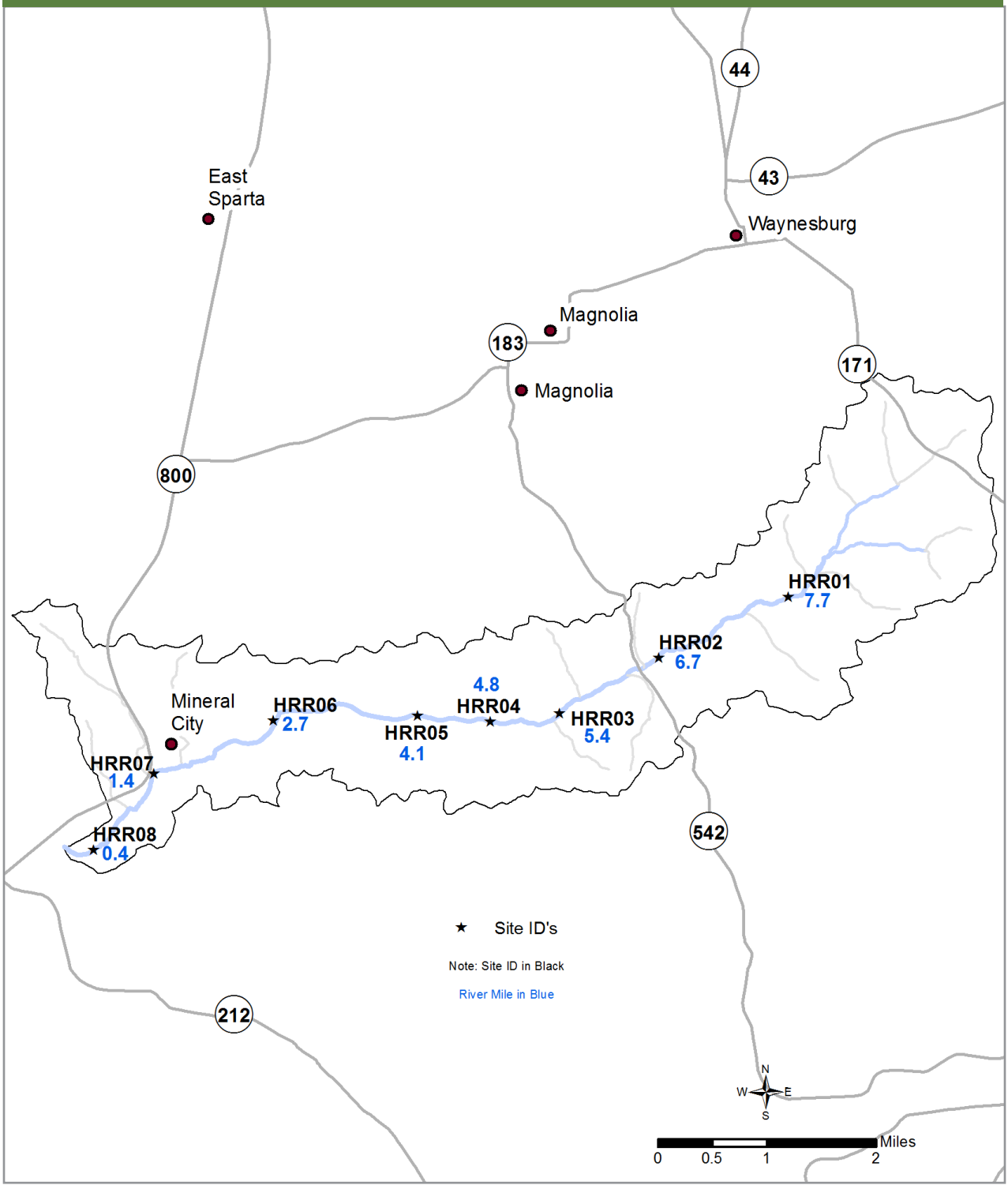
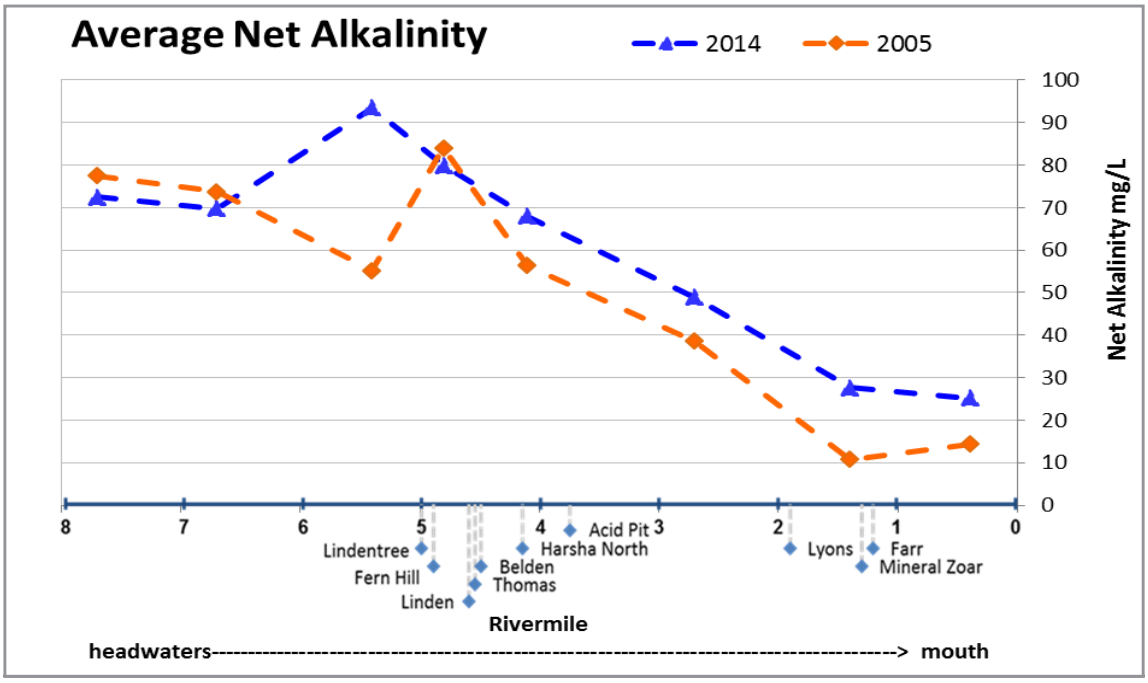
Chemical water quality analysis per stream reach

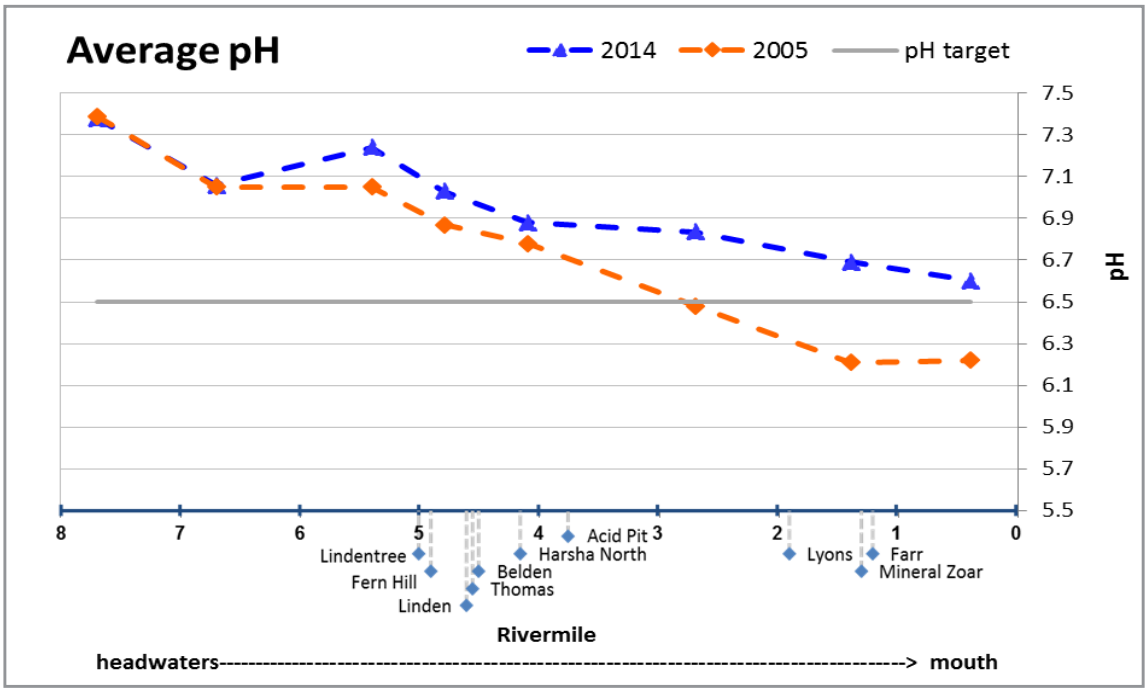
Huff Run



Chemical water quality changes along the mainstem of Huff Run are shown in the stream reach graphs below. Chemical long-term monitoring data is utilized to generate line graphs along the stream gradient from headwaters to the mouth. Along the x-axis named tributaries are shown to illustrate sources of water entering the mainstem. A list of long-term monitoring sites utilized to generate the graphs with their river miles are shown below.

Huff Run								
Site ID	HRR01	HRR02	HRR03	HRR04	HRR05	HRR06	HRR07	HRR08
Rivermile	7.7	6.7	5.4	4.8	4.1	2.7	1.4	0.4





Huff Run								
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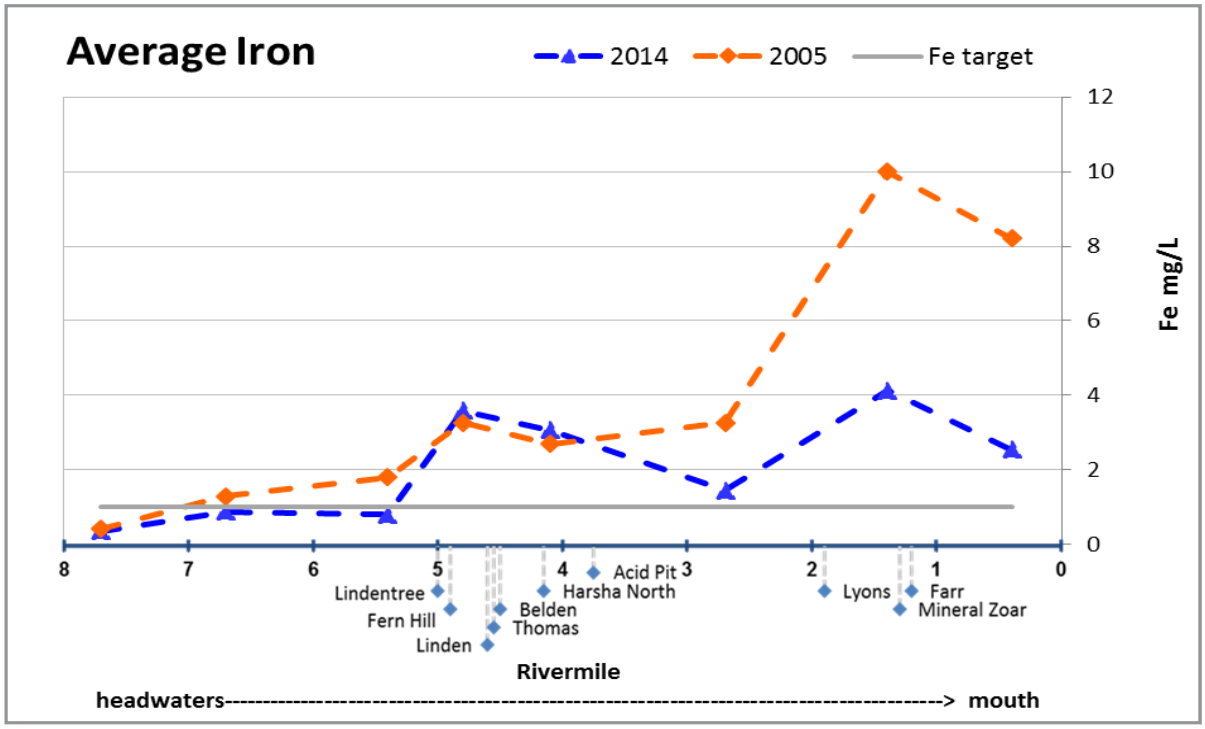
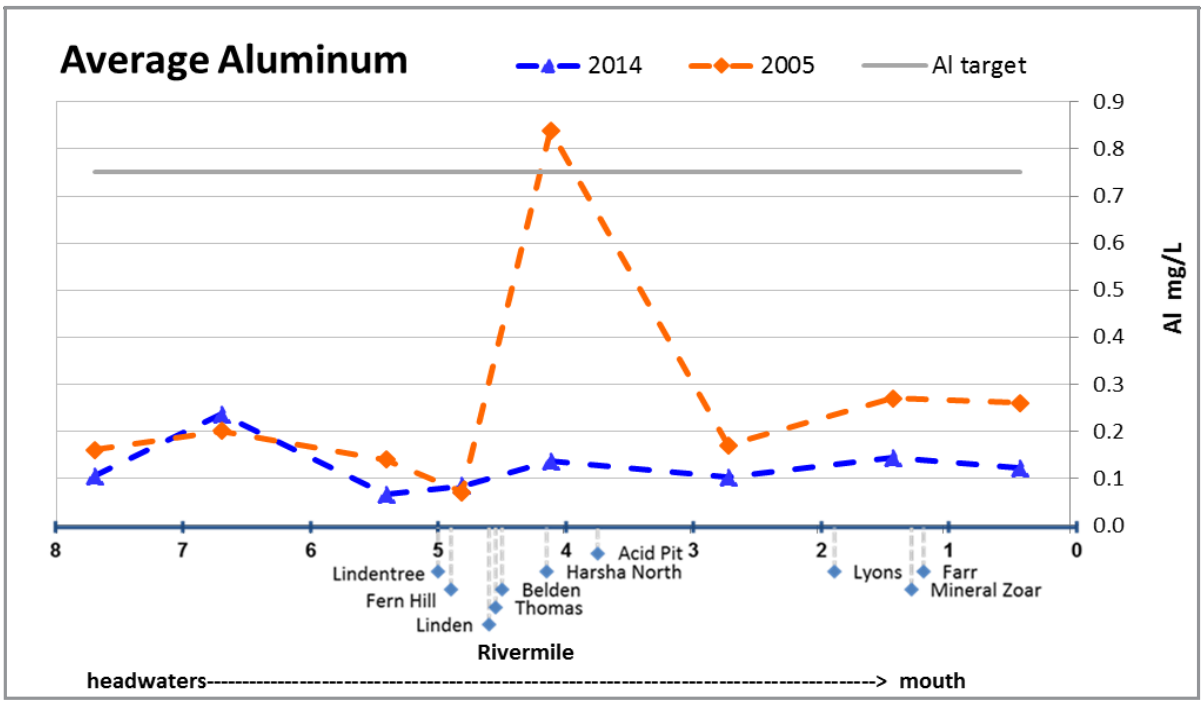
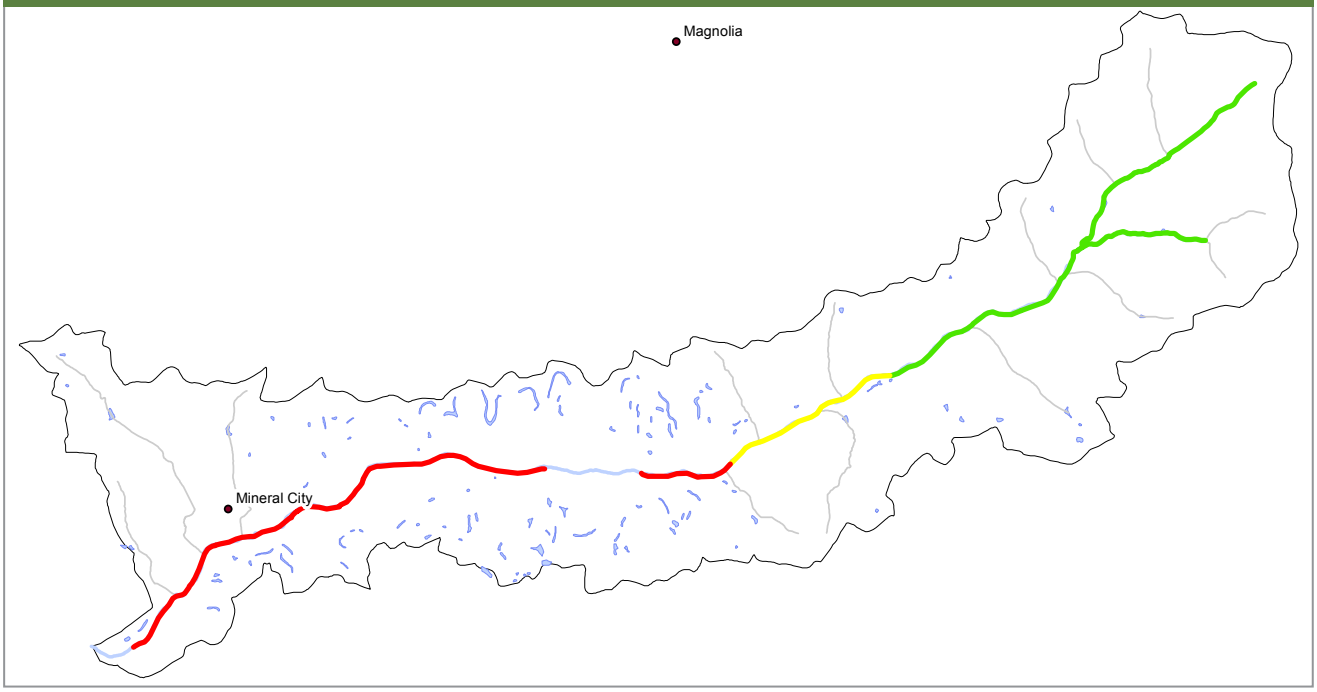
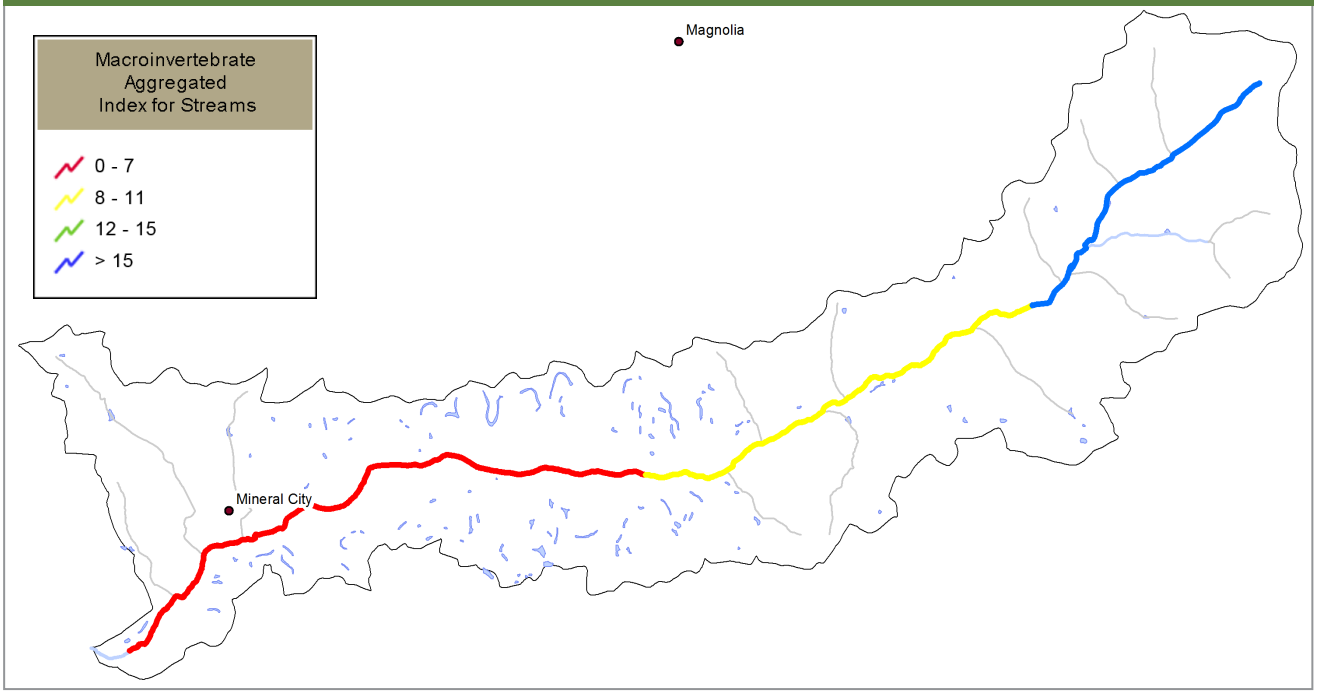




Huff Run baseline MAIS



Huff Run 2014 MAIS



Biological quality in Huff Run decreases from headwaters to the mouth.

Biological quality in Huff Run (based on macroinvertebrate data) improved modestly, but notably, along the length of the mainstem. This year for the first time since monitoring began in 2005 one of the eight monitoring sites (HRR03 at RM 5.5), improved enough to be categorized as sustained and statistically significant. Although none of the downstream impaired sites are yet meeting the target MAIS score of "12", four sites (RM 7.7, 5.4, 4.8 and 2.7) achieved new high scores this year.

Figure 1. Area of Degradation 2006-2014

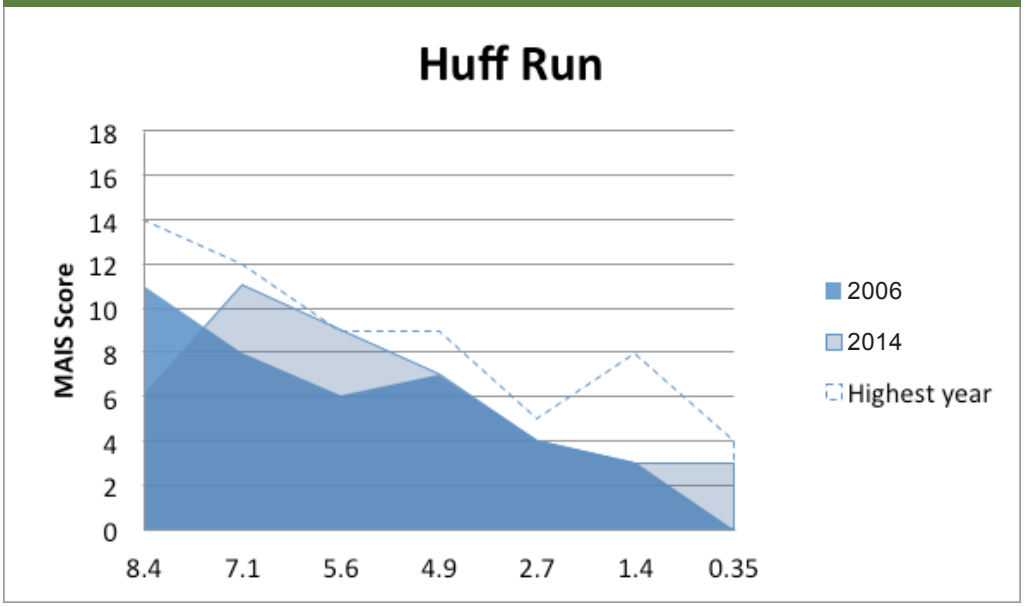


Figure 2. Huff Run MAIS Regressions

Site ID Rivermile	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	Linear trends	R square	P-value	No. of years
HRR01 RM 8.0	14	11	12	12	13	9	13	6	10	15	no change	0.040776	0.575853	10
HRR02 RM 6.7	12	8	8	8	9	11	11	11	10	9	no change	0.025479	0.659592	10
HRR03 RM 5.5	8	6	7	6	8	9	7	9	10	11	improved	0.579409	0.010544	10
HRR04 RM 4.8	6	7	9	8	9	9	6	7	9	11	no change	0.244674	0.146108	10
HRR06 RM 2.7	5	4	5	3	4	5	3	4	5.5	7	no change	0.137538	0.291414	10
HRR07 RM 1.4	2	3	3	2	8	2	2	3	5	7	no change	0.193019	0.203952	10
HRR08 RM 0.4	3	0	4	3	4	3	3	3	3	4	no change	0.145455	0.276846	10