

RACCOON CREEK WATERSHED INDIVIDUAL PROJECTS

AMD project reports

‘AMD project reports’ contains information about each individual acid mine drainage (AMD) project completed in chronological order per watershed. Each report displays photos of the project site pre and post construction, a description of the project and reasons for the reclamation, water quality data at the site prior to reclamation (acid/metal loading prior to construction). Water quality post reclamation is reported in the ‘Yearly Water Quality Report’ per watershed by stream reach.

Raccoon Creek Watershed comprehensive acid mine drainage projects report:

1999	Buckeye Furnace/Buffer Run	3
2001	State Route 124 Seeps	5
2004	Carbondale II Doser	7
	Mulga Run	9
2005	Hope Clay	11
	Salem Road/Middleton Run	13
2006	Flint Run East	15
	Lake Milton	17
2007	East Branch Phase I	19
2010-2011	East Branch Phase II & III	21
2012	East Branch Phase I Maintenance	23
	Jackson Area AMD Maintenance (Flint Run and Lake Milton)	25
2013	Orland Gob Pile	29
	Harble Griffith	31
	Pierce Run	33
2014	Lake Morrow	35
	Middleton Run Reclamation II	37
2015	Flint Run Wetland Enhancement	39
2018	Daniels Reclamation Project	41

Raccoon Creek Watershed - Buckeye Furnance

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 6/20/1999 ODNR Project Number: Jk-MI-18

Pre-construction



Mine waste in valley
Photo by Raccoon Creek Partnership

Post-construction

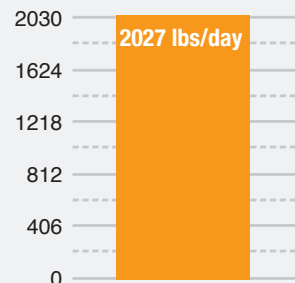


Successive Alkaline Producing System (SAPS),
Photo by Ben McCament

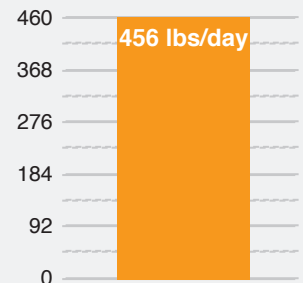
Buckeye Furnace and Buffer Run Project is located in Section 25 of Milton Township in Jackson County and lies within the 12-digit HUC unit #050901010403. The site is 65 acres and is located in the Little Raccoon Creek subwatershed. Deep mining of the area resulted in continuous AMD discharge from underground mines to Buffer Run, a tributary to Little Raccoon Creek. This area was also strip mined and used for a wash plant facility for a deep mine operation, resulting in several unreclaimed coal refuse areas and slurry ponds draining to Buffer Run. The design was completed by BBC&M Engineering Inc. for \$125,000. The treatment approach for this site was to eliminate strip pits, reclaim the gob pile, and install a Successive Alkaline Producing System (SAPS) a passive treatment system. The major considerations for this project was mostly source control and but also constructing a passive treatment system. The goal of the design was to reduce 75 percent of the acidity discharging into Little Raccoon Creek. Construction was complete June 20, 1998, by Earth Tech Inc. for a cost of \$1,090,530. The funding source for the project design was ODNR-DMRM, and for construction the sources were ODNR-DMRM, OEPA and OSM. Pre-treatment acid and metal loadings at site BR0010 are shown in figure 1.

SITE: BR0010

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Raccoon Creek Watershed - State Route 124 Seeps

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 6/18/2001 ODNR Project Number: JK-MI-47

Pre-construction



Between pond and seep
Photo by Brent Miller

Post-construction



Sr 124 hillside limestone channel
Photo by Chip Rice

State Route (SR) 124 Seeps Project is located in Section 15 of Milton Township in Jackson County and lies within the 12-digit HUC unit #050901010403. The site is 7 acres and is located in the Little Raccoon Creek subwatershed. This area consisted of an abandoned surface coal mine with an acidic surface pit. This un-reclaimed mine, resulted in seeps which drained directly into Little Raccoon Creek adjacent to SR 124. The site was reclaimed, pit was drained and regraded, and an open limestone channel was installed to collect drainage before discharging off site. The design was completed by ATC Associates Inc. for \$80,000. The treatment approach for this site was to install several open limestone channels and conduct basic reclamation. The major consideration for this design was to establish positive drainage, remove several highwall impoundments, cover toxic materials, establish vegetations, and add alkalinity through the limestone channels. The goal of the design was to remove acidity from entering into Little Raccoon Creek. The project goal was met by 100 percent. Construction was complete June 18, 2001, by Oldtown Coal Company for a cost of \$315,490. The major responsibility of the construction company was to complete all reclamation activities described in the project design. The funding source, for the project design and construction were ODNR-DMRM and Ohio EPA. Pre-treatment acid and metal loadings at site OTF0010 are shown in figure 1.

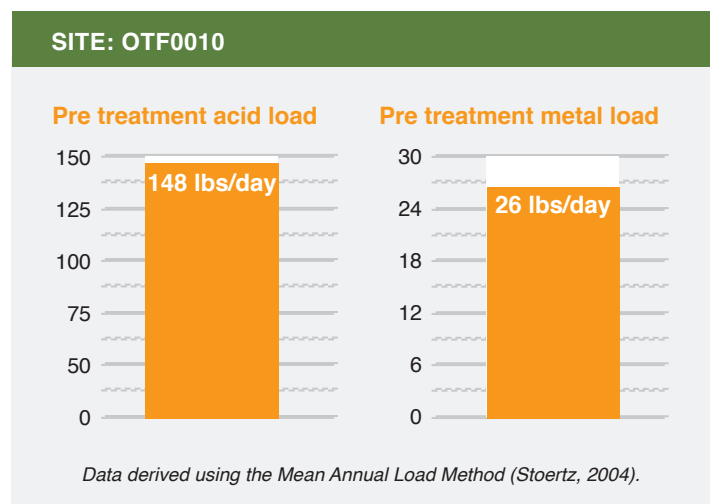


Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Raccoon Creek Watershed - Carbondale II Doser

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 2004 ODNR Project Number: AT-WI-05

Pre-construction



Carbondale East Seep
Photo by Brett Lavery

Post-construction

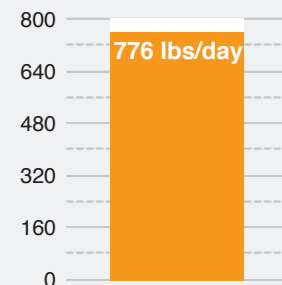


Carbondale II Project Doser
Photo by JT Kneen

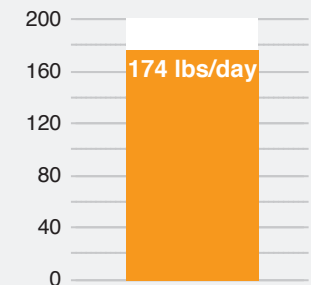
Carbondale II Wetland is located in Section 30 of Waterloo Township in Athens County and lies within the 12-digit HUC unit #050901010301. The site is seven acres and located in the subwatershed Hewett Fork of Raccoon Creek Watershed. The majority of AMD in Hewett Fork originates from abandoned underground coal mines near Carbondale. ODNR-DMRM installed a passive wetland treatment system to reduce the acid and metal load from two mine portals in this area in the mid 1990's. This wetland was effective at reducing metal and acid loads but was not efficient enough to produce improvements in Hewett Fork. The Carbondale Doser was implemented as Phase II at the site to remediate the entire acid load from the mine discharge in 2004. The design was completed by ATC Associates for \$48,023. The treatment approach for this site was to install an Aqua-fix lime-dosing unit. The major considerations in this design were the metal precipitates discharge into Hewett Fork because of the limited space for storage ponds on site. The goal of the design was to reduce 100 percent of the acid load discharging from the Carbondale mine seeps. One problem encountered at this site was the dosing material performance. Initially lime kiln dust was used, but the material bridges in the dosing unit. The material was switched to calcium oxide, a more expensive material but one with greater neutralizing potential. Therefore the doser now has the ability to over-treat and neutralize acid mine drainage from downstream sources. Construction was complete April 1, 2004, by Law General Contracting for a cost of \$389,637. The major responsibility of the construction company was to remove

SITE: HF131

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

existing metal retention wetlands and install the doser and a concrete mixing channel. The funding source for the project design was ODNR-DMRM, and for construction the sources were ODNR-DMRM, OEPA, and OSM-ACSI. Pre-treatment acid and metal loadings at site HF131 are shown in figure1.

Intentional blank page

Raccoon Creek Watershed - Mulga Run

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 8/30/2004 ODNR Project Number: JK-MI-51

Pre-construction



Underground mine entrance
Photo by Brett Laverty

Post-construction



Jaymar Steel Slag Leach Bed
Photo by Brett Laverty

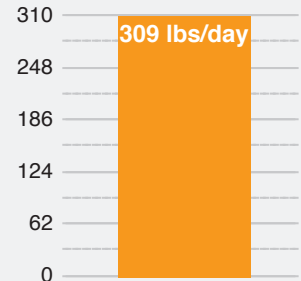
Mulga Run Reclamation Project is located in Section 10 of Milton Township in Jackson County and lies within the 12-digit HUC unit #050901010403. The site is 6.8 acres and is located in the Little Raccoon Creek subwatershed. Mulga Run is considered the third largest contributor of acid mine drainage to this subwatershed according to the AMDAT in 2001. Due to drainage from abandoned deep mines and un-reclaimed coal refuse piles throughout, a basin wide treatment approach was used to reduce acid and metal loads to Little Raccoon Creek. The design was completed by ATC Associates for \$247,127. The treatment approach for this site was to install two steel slag leach beds and conduct a wetland enhancement project. The major consideration for this design was to attempt to treat entire basin with steel slag leach beds and wetland instead of treating all acid mine drainage sites in the basin. Mulga Run discharge was sometimes net alkaline; however, the site was also capable of producing acid spikes (3000 lbs/day) throughout the year. The goal of the design was to reduce 100 percent of the acid spikes and create consistent net alkaline water discharging into Little Raccoon Creek. The project goal was met by 100 percent. A private residence height was increased to reduce the flood risk adjacent to the project site. Construction was complete August 30, 2004, by Stockmeister Enterprises for a cost of \$440,783. The funding source, for this the project design were Ohio EPA and ODNR-DMRM and for construction the sources were ODNR-DMRM, OEPA and OSM-ACSI. Pre-treatment acid and metal loadings at site MR0010 are shown in figure 1.

SITE: MR0010

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Raccoon Creek Watershed - Hope Clay

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 2005 ODNR Project Number: NA

Pre-construction



Unreclaimed gob pile,
Photo by Raccoon Creek Watershed Partnership

Post-construction



Regraded and resoiled gob pile
Photo by Ben McCament

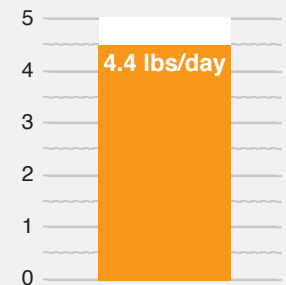
Hope Clay is located in Section 23 of Brown Township in Vinton County and lies within the 12-digit HUC unit #050901010205. The project discharge was measured at the Hope Clay Project tributary. The design was completed by ODNR-DMRM for \$5,000. The treatment approach for this site was to install an open limestone channel (OLC) and to conduct basic reclamation. The major consideration for this site was erosion control. The goal of the design was 100 percent acidity reduction and erosion control. The project goal was met by 100 percent. The construction was complete June 1, 2005, by Hocking College Environmental Program for a cost of \$67,000. The major responsibility of the Hocking College Environmental Program was to conduct site reclamation. The funding sources for this project were ODNR-DMRM and OSM ACSI for construction. Approximately 21.53 lbs/day of acid and 3.77 lbs/day of metals were prevented from entering into Raccoon Creek as a result of this AMD reclamation project. Pre-treatment acid and metal loadings at site HC001 are shown in Figure 1.

SITE: HC001

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Raccoon Creek Watershed - Salem Road/Middleton Run

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 2005 ODNR Project Number: JK-MI-51

Pre-construction



Exposed mine pit floor
Photo by Brett Lavery

Post-construction

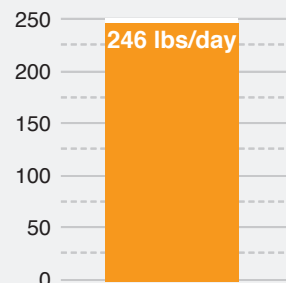


Middleton Run limestone channels
Photo by Ian Hughes

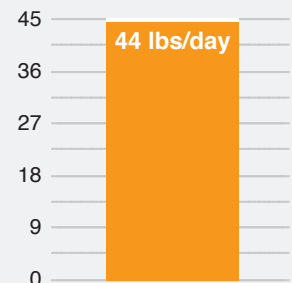
Salem Road/Middleton Run Project is located in Section 15 of Milton Township in Jackson County and lies within the 12-digit HUC unit #050901010403. The site totals 60 acres and is located in the Little Raccoon Creek subwatershed. This large area has been affected by deep mines, strip mine lands, and un-reclaimed mine spoil that was part of the Broken Aro mine. Abandoned surface mines affect about 63% of this watershed while abandoned subsurface mines affect about 5%. The main valley on the site was exposed pit floor with high amounts of clay and acidic spoil. Additionally, acidic lakes were present as well as a discharging underground mine. This project has three different drainages, all tributaries to Middleton Run. The design was completed by GAI Consultants Inc. and Bergmann Associates for \$193,283. The treatment approach for this site was to install 3 separate treatment components consisting of: open limestone channels, steel slag channels, reclamation, J-trenches, and a limestone leach bed (Figure 2.). The major consideration for this design was to eliminate all water storage, create contours for positive drainage, cover toxic materials, and generate alkalinity. The goal of the design was to reduce 100 percent of the acidity loading discharging into Little Raccoon Creek. Construction was complete November 15, 2005, by Stockmeister Enterprises Inc. for a cost of \$687,913. The funding source, for the project design and construction were ODNR-DMRM and Ohio EPA. Each of the three treatment components, MiR0021, MiR0032, MiR0090 were evaluated in 2008 and 2009 but this analysis was discontinued in 2010 because monitoring in 2008 to 2009 showed site MiR0021

SITE: MiR0021

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

as the only treatment functioning and providing alkalinity for Middleton Run. The other two treatment sites (MiR0032 and MiR0090) have failed due to clogging. No data collected in 2011. Salem Road/Middleton Run remains an active site and will be evaluated in 2012. Pre-treatment acid and metal loadings at site MiR0021 are shown in Figure1.

Raccoon Creek Watershed - Salem Road/Middleton Run

Generated by Non-Point Source Monitoring System
www.watersheddata.com

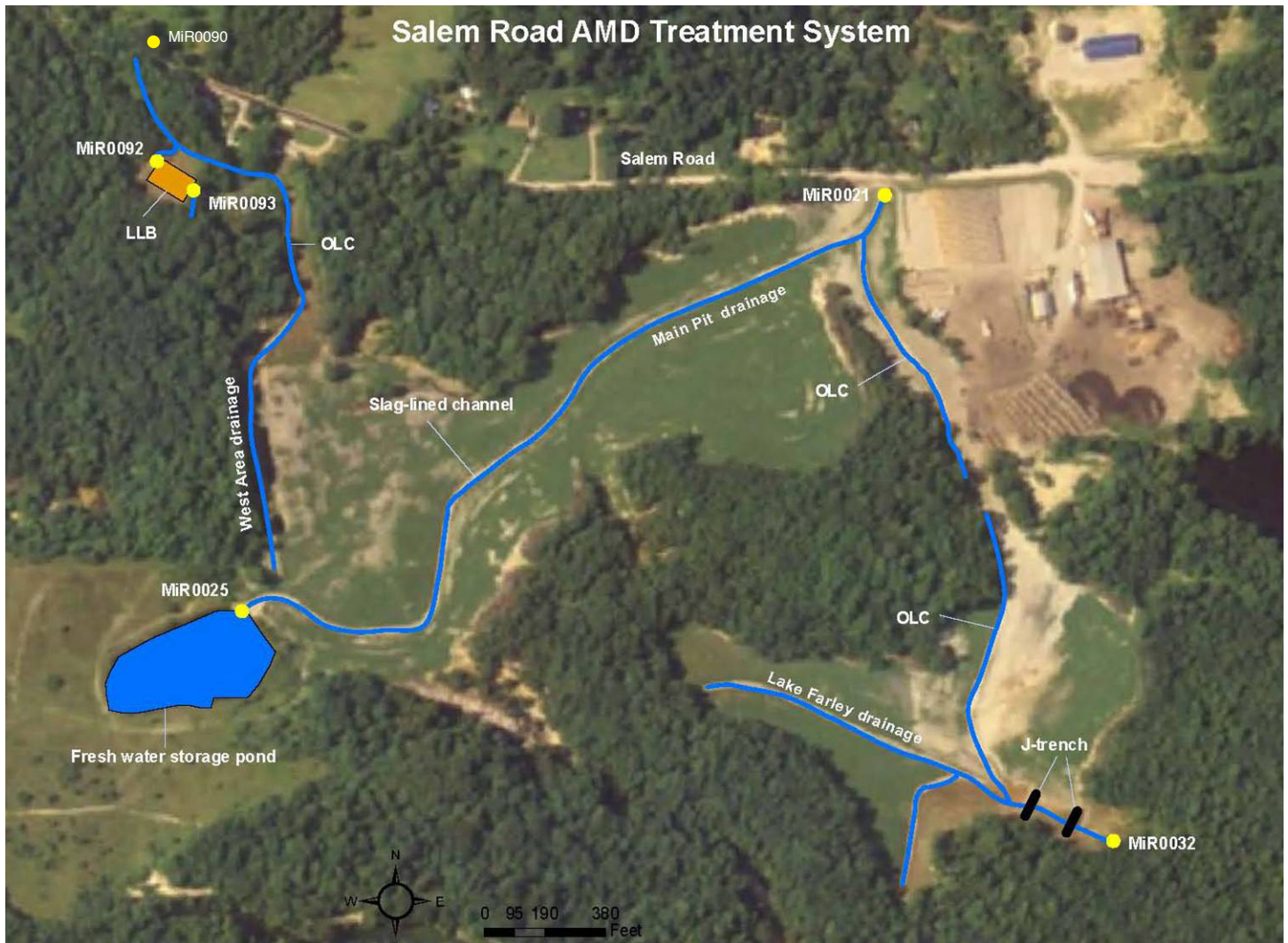


Figure 2. Map of Salem Road AMD treatment system and sites

Sample site ID	Description of the sampling station
MiR0090	Tributary draining limestone leach bed treatment, site is at crossing with Salem Road.
MiR0032	Sample site located directly below the dam at MiR0031. Two limestone J-trenches with steel slag cores (experimental). Reclamation of mine spoil and removal of acidic strip pit.
MiR0021	The site represents discharge across the former mine pit floor that was reclaimed. Sample site is at the Salem Road culvert (fresh water pond draining into a limestone and steel slag channel).

Raccoon Creek Watershed - Flint Run East

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 8/1/2006 ODNR Project Number: Jk-MI-34

Pre-construction



Flint Run East site discharge
Photo by Ben McCament

Post-construction

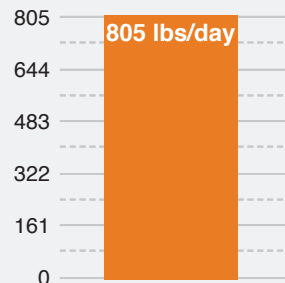


Air photo of Flint Run site near completion
Photo by Ben McCament

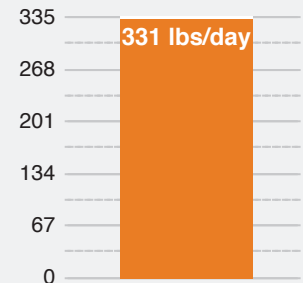
Flint Run East is located in Section 28 of Milton Township in Jackson County and lies within the 12-digit HUC unit #050901010403. The project site is 56 acres and is located in Little Raccoon Creek next to Lake Milton. Flint Run East project is Phase I of the Flint Run Reclamation Project, Lake Milton is Phase II. The project discharge was measured at the tributary draining the Flint Run East treatment site. The Flint Run sub watershed is affected by abandoned strip mine drainage and associated unreclaimed coal refuse piles mostly from the Broken Aro mine which is in the headwaters of Flint Run. This area was the coal washing and loading facility for the Broken Aro mine. The site is very complex hydrologically, the site consists of large buried slurry impoundments and surface mining pits around the rim of the main valley (Figure 2). Mead-Westvaco reclaimed the main slurry pond area with paper mill sludge in the mid 1980's. AMD seeps originate in many locations associated with the slurry impoundments and the surface mine pits. The design was completed by RD Zande for a cost of \$241,702. The treatment approach for this site was to dewater the strip pits and install passive acid mine drainage treatment systems. The major consideration during the design process was to reduce groundwater infiltration into the valley coal refuse pile. Construction was completed Aug. 1, 2006, by Berridge Reclamation for a cost of \$1,456,106. The funding sources for this project were ODNR-DMRM for the design and ODNR-DMRM, EPA-319 and OSM ACSI for construction. Pre-treatment acid and metal loadings at site FR0126 are shown in figure 1.

SITE: FR0126

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Treatment Installed	Quantity & Units
Earthwork	56 acres
Erosion Control	13,000 linear feet
Dewatering Existing Impoundments	12,827,200 gallons of water
Sediment Pond	87,400 square feet
Steel Slag Leach Bed	32,500 square feet
Fresh Water Storage Pond	84,800 square feet
Limestone Leach Bed	10,400 square feet
Wetland, passive	4,800 square feet
Successive Alkaline Producing Systems (SAPS)	32,500 square feet
Open Limestone Channel	13,650 linear feet

Raccoon Creek Watershed - Flint Run East

Generated by Non-Point Source Monitoring System
www.watersheddata.com

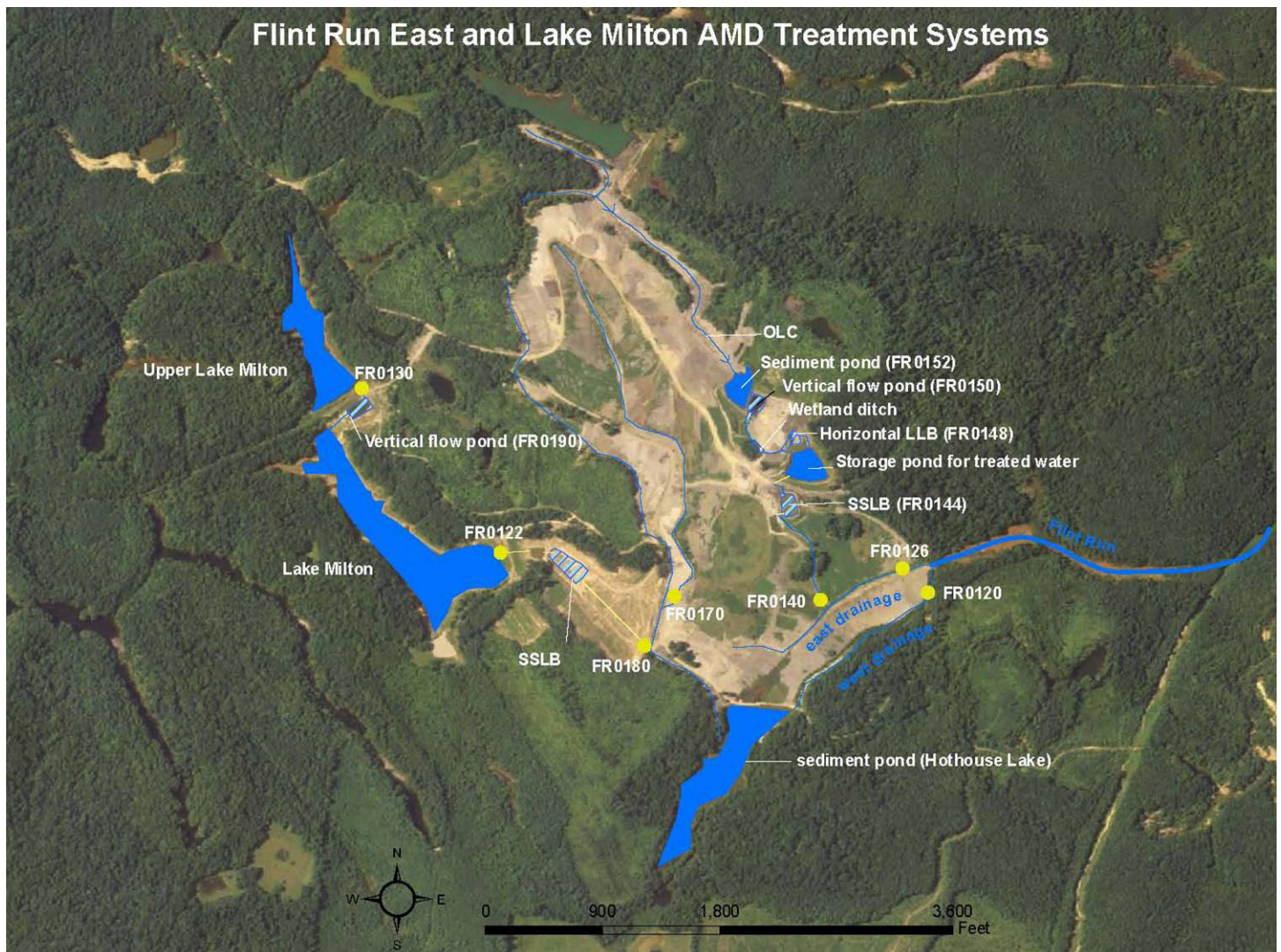


Figure 2. Flint Run East and Lake Milton treatment system and site

Raccoon Creek Watershed - Lake Milton

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 9/5/2006 ODNR Project Number: Jk-MI-113

Pre-construction



Lake Milton - 25 acre acidic lake
Photo by Ben McCament

Post-construction

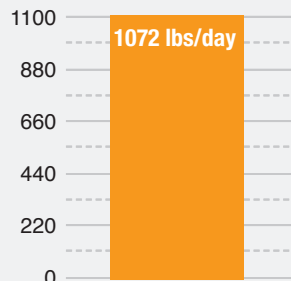


Steel slag bed downstream Lake Milton
Photo by Ian Hughes

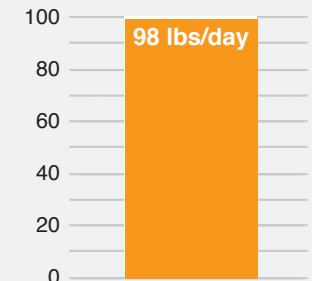
Lake Milton is located in Section 28 of Milton Township in Jackson County and lies within the 12-digit HUC unit #050901010403. The project site is 155 acres and is located in Little Raccoon Creek next to the Flint Run East Project. The Lake Milton Project is Phase II of the Flint Run Reclamation Project. The project discharge was measured at the outlet from Hothouse Lake. Lake Milton is part of a manmade drainage system that was used during mining operations for coal washing by the Broken Aro mine. Lake Milton is adjacent to the Flint Run East site and is a 15 acre lake with a small watershed area. AMD originates in spoil areas near Upper Lake Milton (separated by railroad embankment) before flowing into Lake Milton. Additional AMD is generated after Lake Milton discharges into coal slurry waste in the valley downstream of the lake dam. Lake Milton drains into Hothouse Lake before entering into Flint Run. The design was completed by Bergmann Associates and GAI Consultants Inc. for a cost of \$416,000. The treatment approach for this site was to repair the Lake Milton, dam and to install a Successive Alkaline Producing System (SAPS) and a steel slag leach bed. The major consideration during the design process was the crucial need to treat the acid mine drainage in Upper Lake Milton to drain to Lake Milton before running into the steel slag bed downstream of Lake Milton. The goal of the design is to reduce 600 lbs/day of acid loading. Problems occurred with the valves in 2007, therefore this project only worked intermittently until Sept. 2007. Construction was complete September 5, 2006 by Stockmeister Enterprises Inc. for a cost of \$961,536. The

SITE: FR0120

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Treatment Installed	Quantity & Units
Water Treatment in Lake Milton	50 million gallons
Open Limestone Channel	2,300 linear feet
Steel Slag Leach Bed	74,000 square feet
Successive Alkaline Producing Systems (SAPS)	16,000 square feet
Repair Dam with Slurry Wall	75,000 square feet

funding sources for this project were ODNR-MRM, EPA-319 and OSM ACSI for both the design and construction. Pre-treatment acid and metal loadings at site FR0120 are shown in Figure 1.

Intentional blank page

Raccoon Creek Watershed - East Branch Phase I

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 12/31/2007 ODNR Project Number: HC-ST-13

Pre-construction



East Branch EB200 Nov. 2003
Photo by Brett Laverty

Post-construction



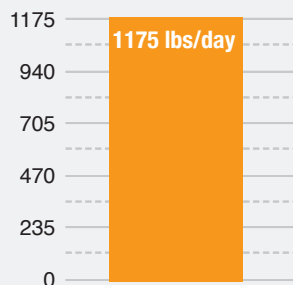
Site #3 steel slag leach bed full of water 2-7-08
Photo by Amy Mackey

East Branch Phase I Reclamation Project is located in Section 14 and 15 of Starr Township in Hocking County and lies within the 12 digit HUC unit #050901010201. There are eight separate sites spread out over three headwater drainages of the East Branch of Raccoon Creek, project footprint of the eight sites is approximately 27 acres. East Branch is the largest contributor of acid mine drainage to the headwaters of Raccoon Creek. Large areas of strip mined land, some has been reclaimed under the 1972 Act, coupled with few deep mine discharges resulting in seeps, contribute to the AMD which affects East Branch and its tributaries. The AMD is diffuse throughout the area due to the extensiveness of surface mining and has required a basin wide approach that focuses on reducing acid and metal load to Raccoon Creek. The design was completed by ATC Associates Inc. for \$65,438. The treatment approach for this site was to install eight steel slag leach beds (16,251 sq. ft), 1,100 linear feet of open limestone channels, reclaim 4.8 acres of gob piles, and install two passive settling ponds with limestone berms (42,000 square feet)(Figure 2). The goal of the design was to reduce acid at the mouth of the East Branch (EB010). Construction was complete December 31, 2008 by Tucson Inc. for a cost of \$918,401. The funding source for the project design was Ohio EPA 319 grant and for construction the sources were ODNR-DMRM and Ohio EPA 319. Pre-treatment acid and metal loadings at site EB210 are shown in figure 1 and EB160 in figure 2.

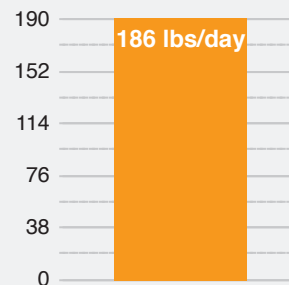
Note: EB210 site does not take into account 1 SLB site #8 (EB160)

SITE: EB210

Pre treatment acid load



Pre treatment metal load

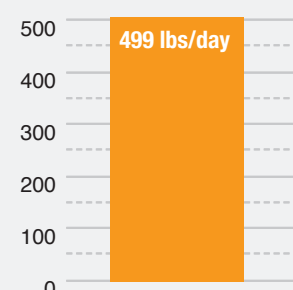


Data derived using the Mean Annual Load Method (Stoertz, 2004).

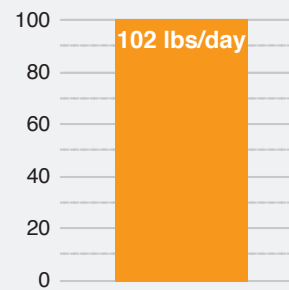
Figure 1. Estimated acid and metal loadings prior to treatment

SITE: EB160

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 2. Estimated acid and metal loadings prior to treatment

Generated by Non-Point Source Monitoring System
www.watersheddata.com



Raccoon Creek Watershed - East Branch Phase II and III

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: 2010-2011 ODNR Project Number: HC-St-14 HC-St-18

Pre-construction



Kern Hollow SLB site
Photo by Amy Mackey

Post-construction



Steel slag bed at Kern Hollow
Photo by Amy Mackey

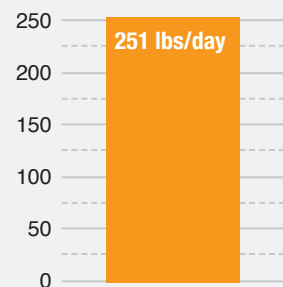
Post-construction EB III



EB III Winifred SLB Photo by Amy Mackey

SITE: EB190

Pre treatment acid load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment.

East Branch Phase II and III (EB II and III) are located in Section 14 of Starr Township in Hocking County and lies within the 12 digit HUC unit #050901010201 just southeast of Union Furnace. EB II and III project discharge, site EB190, is located just upstream of Laurel Run Road bridge. East Branch Phase II (EB II) project, completed in Dec. 2010, consists of constructing three steel slag beds in the project area: Kern Hollow, Northwood, and Forrest. East Branch Phase III (EB III) constructed in spring 2011, consists of one 7,800 square foot steel lag bed, minimal surface reclamation (2 acres), and a 520 ft open limestone channel. All of these projects lie on Wayne National Forest property. The designs were completed by ODNR-DMRM in-house EB Phase II \$49,343 and EB Phase III \$26,705. The treatment approach

for this site is to install four steel slag leach beds (SLB) to add alkalinity to East Branch. At EB III in spring 2012, sediment washed in from heavy rainfall, sediment was scraped off to unclog the SLB. The goal of the design is to reduce acid at the site EB190. During high flow, precipitated metals are evident at EB190 with high levels of aluminum. Therefore, metal load reductions are not occurring at site EB190. Construction was completed fall 2010 at EB II by Stimmel Construction for a cost of \$671,788. EB III was completed in spring 2011 by Tuscon Inc. for \$323,036. Funding source for the project design and construction is ODNR-DMRM and OSM. Pre-treatment acid and metal loadings at site EB190 are shown in figure 1.

Intentional blank page

Raccoon Creek Watershed - East Branch Phase I Maintenance Project (Nelsonville UPC)

*Generated by Non-Point Source Monitoring System
www.watersheddata.com*

Project Status: maintenance complete 5-17-2012 ODNR Project Number: UP-HC-11

Pre-construction



*EB Phase I site 8 slag bed
Photographer: Amy Mackey*

Post-construction



*EB Phase I site 8 slag bed
Photo by Amy Mackey*

East Branch Phase I Project is located in Section 14 and 15 of Starr Township in Hocking county and lies within the 12-digit HUC unit # 050901010201. The East Branch Phase I project was originally completed in December of 2007. Several of the beds clogged within a few months of project completion. Most of the valves leaked or did not work correctly (figure 1 and 2 – year 2011). By 2011, the clogging had increased and the alkalinity being produced had decreased (slag was exhausted). Therefore, new Slag was installed at sites 1 (368 tons), 3 (240 tons) , 5 (480 Tons), 7 (495 tons), and 8 (1140 tons). Under drain piping was extended (linear footage listed below):

Site 1 – 240 lf of 4" underdrain
Site 3 – 250 lf of 4" underdrain
Site 5 – 265 lf of 4" underdrain
Site 7 – 225 lf of 4" underdrain
Site 8 – 600 lf of 4" underdrain

Valves were replaced at all sites except Site 8. Site 6 was abandoned. Design were completed in-house by ODNR-DMRM. Maintenance construction started 11-3-11 and was complete 5-17-2012. Stimmel Construction completed the maintenance construction, \$240,378. Figure 1 and 2 show the yearly acid and metal load reductions. Year 2011 data shows acid reduction at 53 % with no metals reduction. Year 2012 data shows the initial results of the maintenance project with 100% acid reduction and 52%

Raccoon Creek Watershed - East Branch Phase I Maintenance Project (Nelsonville UPC)

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Figure 1. Yearly acid load reductions

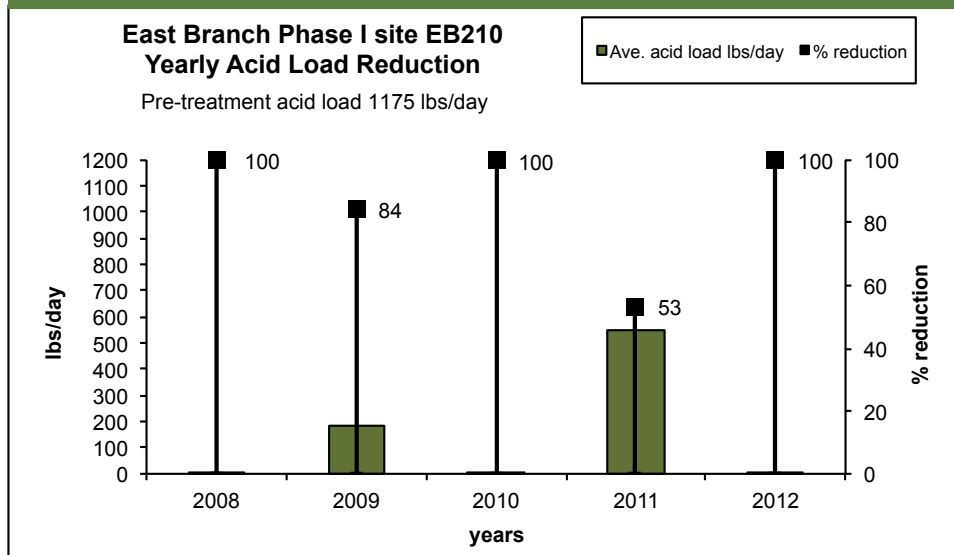
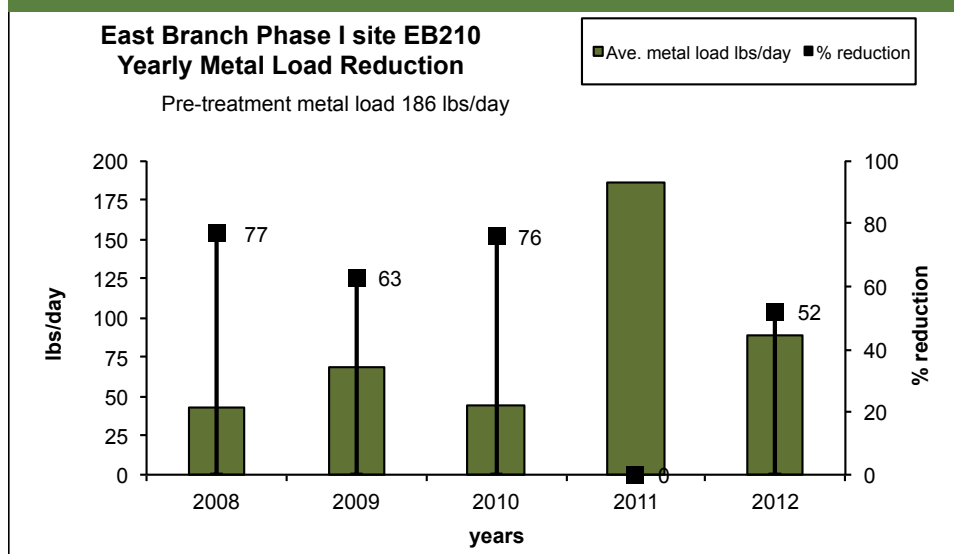


Figure 2. Yearly metal load reductions



Raccoon Creek Watershed - Flint Run & Lake Milton Maintenance project (Jackson Area UPC)

*Generated by Non-Point Source Monitoring System
www.watersheddata.com*

Project Status: Complete: 6/30/2012 ODNR Project Number: UP-JK-11

Post-construction



*New steel slag bed discharge for Flint Run East at the acid source
Photo by Amy Mackey*

Post-construction



*New slag at Lake Milton
Photo by Amy Mackey*

Flint Run and Lake Milton located in Section 28 of Milton Township in Jackson County lie with the 12 digit HUC unit #050901010403. Both projects were originally constructed in 2006. The Lake Milton Project was not producing enough alkalinity to buffer the acidity in the valley (slag was exhausted). Both alkalinity concentration and flow had decreased from the bed. Valves at Lake Milton and between project components were faulty. Also there were acidic, barren areas of soil with no vegetation around the project area.

At Flint Run East the intake to the SAPS had become clogged as the intake pipe was too close to the pond edge and was covered by cat tails. The Flint Run East project was not producing enough alkalinity to buffer the acidity in the valley (slag was exhausted). The Flint Run East SLB discharged into a limestone channel and then flowed down to the acid source. Much of the alkalinity was wasted in the limestone channel before reaching the acid source.

To address these maintenance issues at Lake Milton the slag was replaced while 3 foot of old slag was removed. The clogged and crushed under drains were replaced and extended. The faulty valves controlling Lake Milton outflow and inflow to SLB were replaced. Bypro and seed in the

barren areas of soil around the project site was applied. A weir to measure flow in overflow channel and a Parshall flume to measure flow of the acid source in the valley were installed. At Flint Run East the SAPS intake pipe was installed away from vegetation and the edge of the pond, the slag was replaced while 3 foot of old slag was removed. Under drain pipes were extended and SLB discharge was piped down to acid source for more direct and immediate contact.

Designs were completed in-house by ODNR-DMRM. Maintenance construction started 11-3-11 and was complete 6-30-2012. E & R Excavating completed the maintenance construction, \$270,770. Figure 1 and 2 show the yearly acid and metal load reductions at Flint Run. Year 2011 data shows acid reduction at 32% and 24% for metals. Year 2012 data shows the initial results of the maintenance project with 100% acid reduction and 62% metals reduction. Figure 3 and 4 show the yearly acid and metal load reductions at Lake Milton. Year 2011 data shows acid reduction at 60% and 76% for metals. Year 2012 data shows the initial results of the maintenance project with 89% acid reduction and 68% metals reduction. Funding source for the project design and construction is ODNR-DMRM.

Raccoon Creek Watershed - Flint Run & Lake Milton Maintenance project (Jackson Area UPC)

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Figure 1 Yearly acid load reductions at Flint run

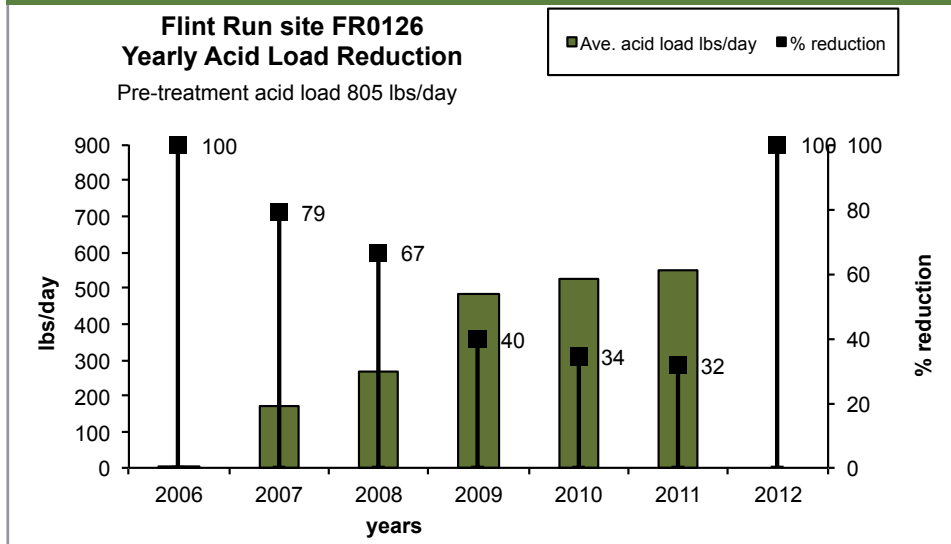
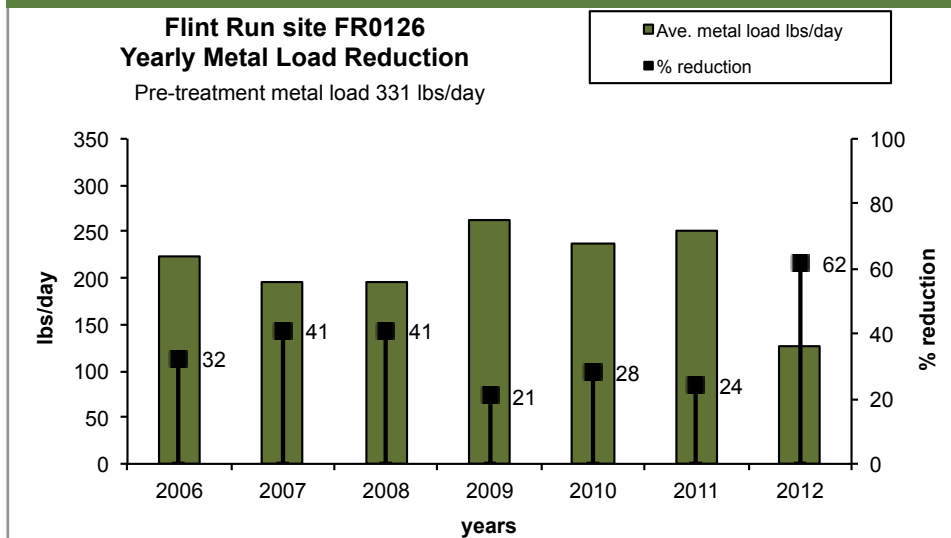


Figure 2. Yearly metal load reductions at Flint run



Raccoon Creek Watershed - Flint Run & Lake Milton Maintenance project (Jackson Area UPC)

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Figure 3 Yearly acid load reductions at Lake Milton

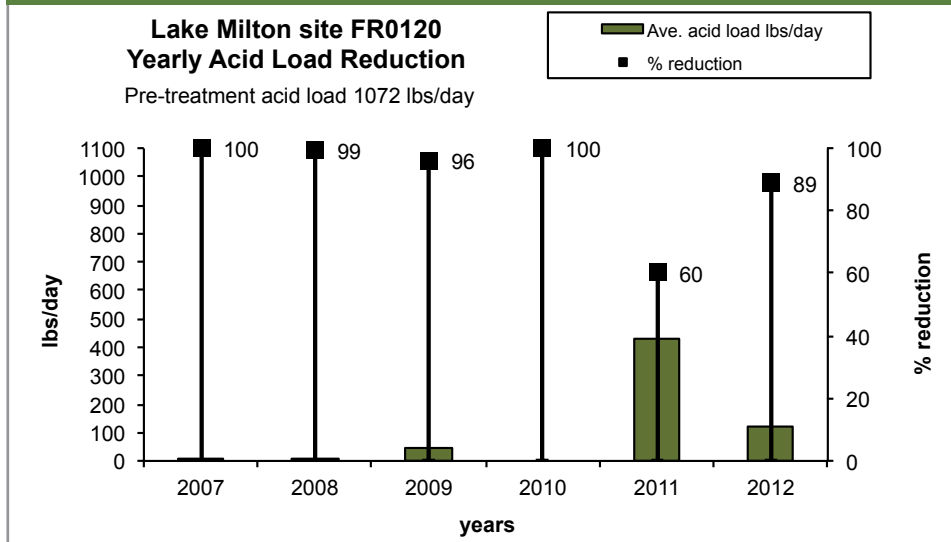
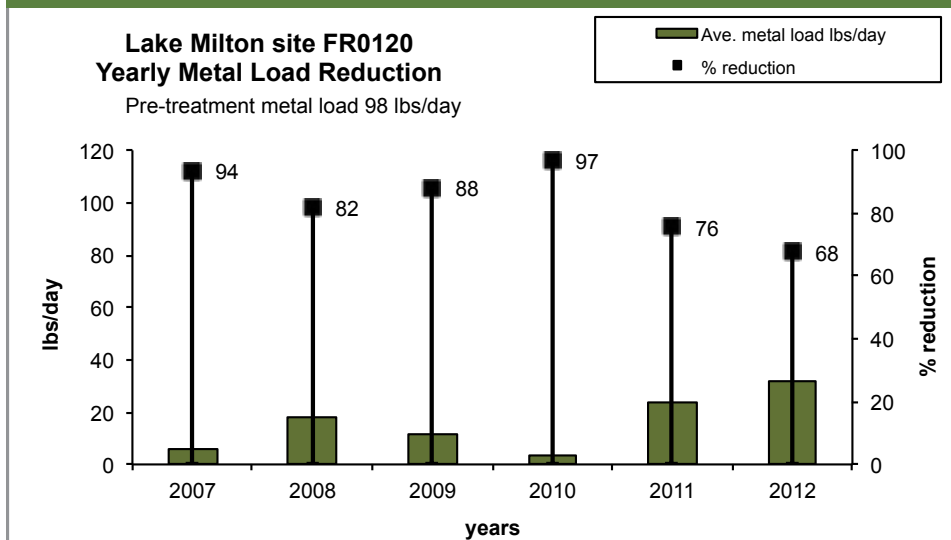


Figure 4. Yearly metal load reductions at Lake Milton



Intentional blank page

Raccoon Creek Watershed - Orland Gob Pile

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Completed 5/14/12 ODNR Project Number: VN-Sw-02

Pre-construction



Gob Pile with erosional gullies
Photo by Amy Mackey

Post-construction

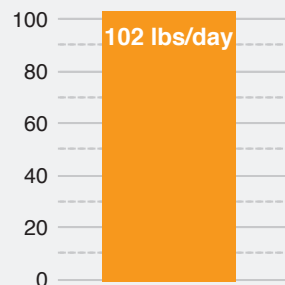


Re-graded and re-vegetated hillside where Orland Gob Pile previously stood, Photo by Amy Mackey

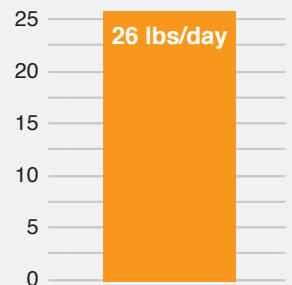
Orland Gob Pile project is located in Section 2 of Swan Township in Vinton County and lies within the 12 digit HUC unit #050901010202. The Orland Gob Pile project discharge, site WB050, is located on an unnamed tributary that drains to the West Branch of Raccoon Creek at river mile 2.0 (figure 2). The project consists of approximately a six acre refuse (gob) pile. The exposed gob pile generates acid mine drainage and erodes coal fines into the West Branch of Raccoon Creek. The treatment approach for this site consists of incorporating lime into the gob and re-soil material, grading the gob pile to obtain positive drainage, covering the gob with suitable re-soil material, installing a limestone diversion channels (975 linear feet) around the site and establishing vegetation. The goal of the design is to reduce approximately 60 lbs/day of acid loads and 14 lbs/day of metal loads from entering the West Branch of Raccoon Creek. The design was completed by ODNR-DMRM in-house, \$34,940. Construction was completed by Seifert Construction for \$197,535. Funding source for the project design and construction is ODNR-DMRM and OSM. Pre-treatment acid and metal loadings at site WB050 are shown in Figure 1.

SITE: WB050

Pre treatment acid load



Pre treatment metal load



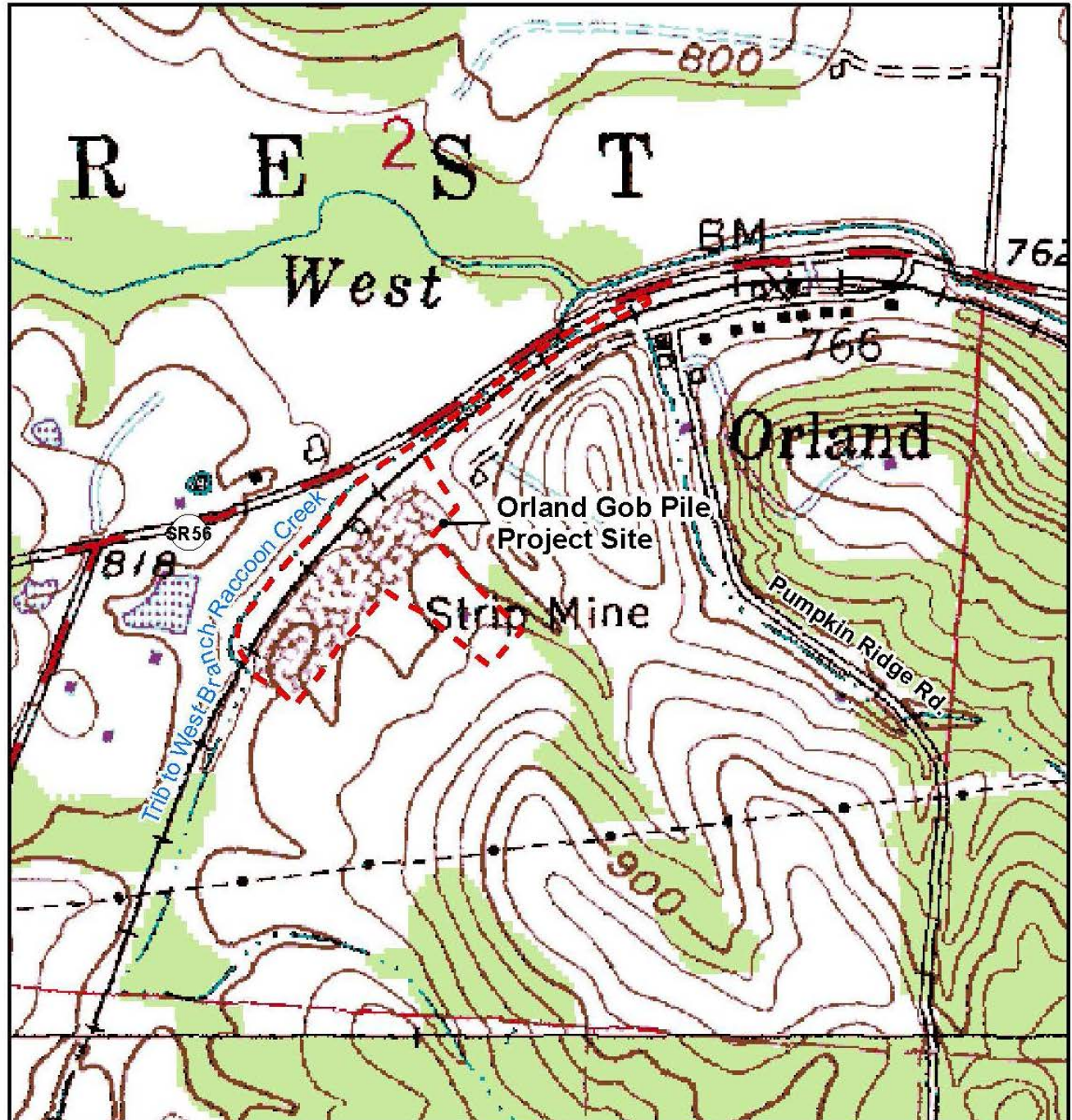
Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Raccoon Creek Watershed - Orland Gob Pile

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Orland Gob Pile Project Site Vinton County, Swan Township, Section 2



0 190 380 760 1,140 1,520 Feet



Map prepared by Kaabe Shaw, ODNR-DMRM 10-14-10

Figure 2. Orland Gob Pile Project Site

Raccoon Creek Watershed - Harble Griffith

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 5/29/12 ODNR Project Number: HC-Ws-17

Pre-construction



Gob and spoil pile with standing water
Photo by Amy Mackey

Post-construction

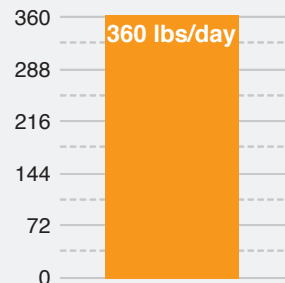


Recontoured and seeded hillside after removal of gob and spoil piles
Photo by Amy Mackey

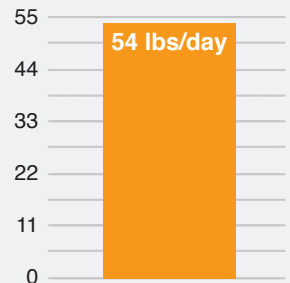
Harble Griffith project is located in Section 33 of Washington Township in Hocking County and lies within the 12 digit HUC unit #050901010202 just north of Mt. Pleasant. The Harble Griffith project discharge sites WB086, WB084 and WB094 all drain reclaimed areas (Figure 2). The project consists of approximately 30 acres of abandoned (pre-SMCRA) coal mine spoil located east of Harble Griffith Road. There are three large surface water pits that hold approximately 2 million gallons of AMD water and 29 acres of spoil. Due to poor surface water drainage throughout the project site most precipitation is directed inward to remnant ponds left by surface mining. These pits increase contact time with water and spoil and increase AMD generation. The treatment approach for this site consists of standard reclamation, re-grading, and re-vegetation of the 29 acre site. The pits will be drained and re-graded. Limestone channels (1100 linear ft.) are installed to treat residual drainage from the site along with a 10 acre passive wetland for metal retention. The goal of the design is to reduce approximately 300 lbs/day of acid loads and 50 lbs/day of aluminum loads from entering the West Branch of Raccoon Creek. The design was completed by ODNR-DMRM in-house, \$42,145. Construction was completed fall 2012 by Redd Malcuit \$1,202,607. Funding source for the project design and construction is ODNR-DMRM, OSM, and OEPA 319. Pre-treatment acid and metal loadings at sites WB086, WB084, and WB094 are shown in Figure 1.

SITE: WB086, WB084, WB094

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Raccoon Creek Watershed - Harble Griffith

*Generated by Non-Point Source Monitoring System
www.watersheddata.com*

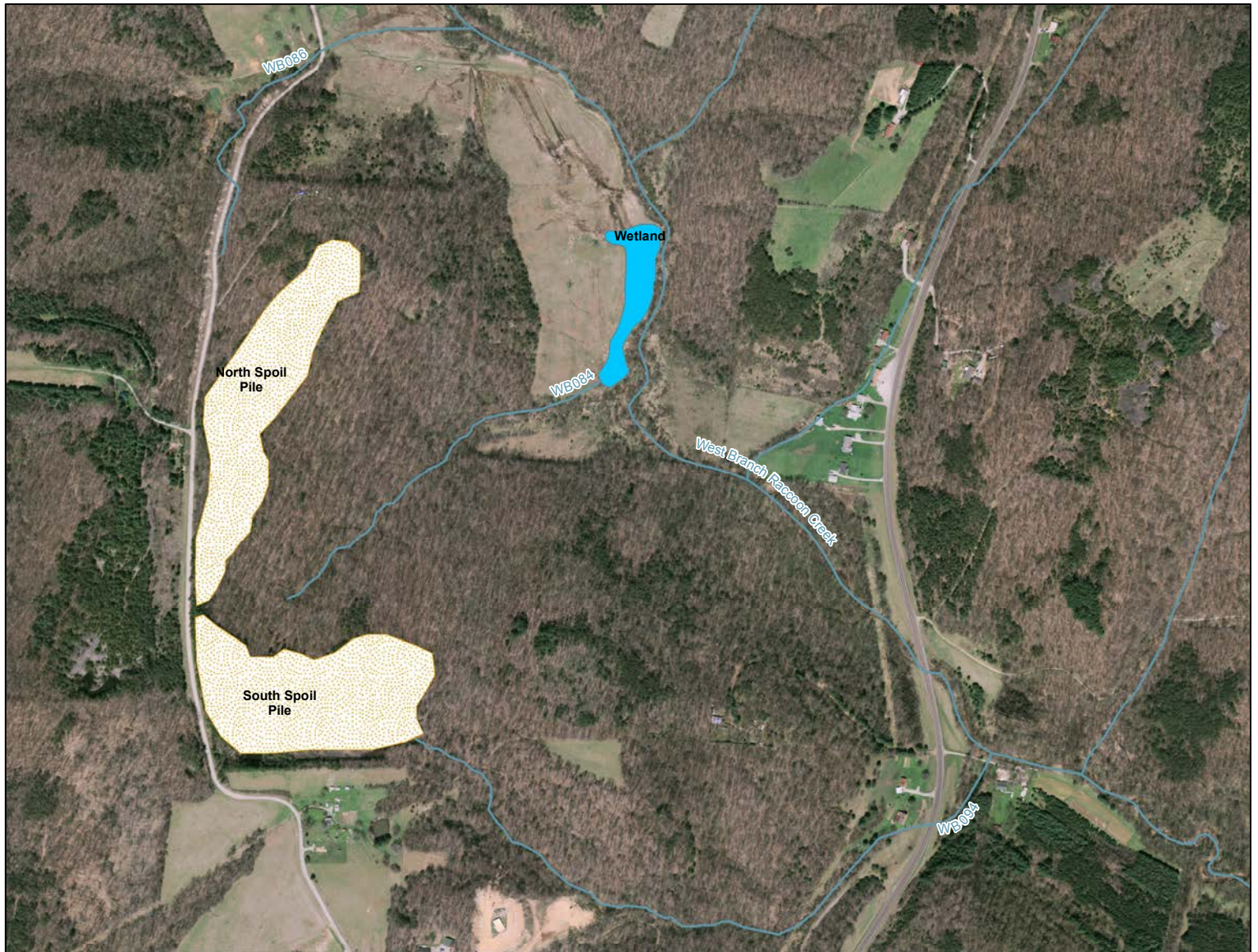


Figure 2: West Branch Raccoon Creek - Harble Griffith project discharge sites

Raccoon Creek Watershed - Pierce Run

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: completed 12/5/12 ODNR Project Number: VN-Vn-06 and VN-Vn-07

Pre-construction



Oreton Seep, the major acid mine drainage discharge
Photo by Ben McCament

Post-construction

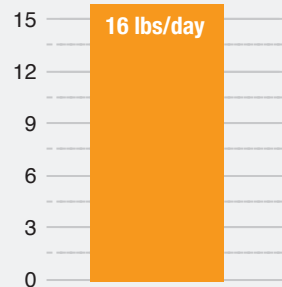


Freshwater pond overflow at Pierce Run
Photo by Raccoon Creek Partnership

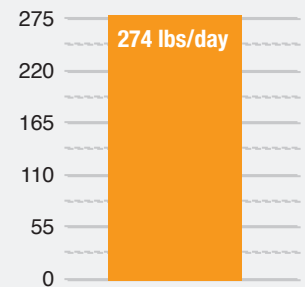
Pierce Run Reclamation Project is located in Section 19 of Vinton Township in Vinton County and lies within the 12 digit HUC unit #050901010501. The Oreton Seep is located in the former town of Oreton along SR 160 in Vinton County and is the most consistent and largest acid loader within the Pierce Run watershed. The source of the seep is a 116 acre underground coal mine (Clarion 4a seam) which was abandoned by the Oreton Mining Company in October of 1924. The seep appears to originate from a collapsed abandoned entry in an upper valley of a small unnamed tributary. The design was completed by ATC Associates Inc. and ODNR-DMRM for a cost of \$225,815. The treatment approach for this site is to install one large steel slag leach bed. The goal of the design is to reduce acid at the mouth of the Pierce Run (PR0010) before entering into Raccoon Creek. Initial construction was complete Fall 2010 by Seals Construction for a cost of \$587,754. Funding source for the project design was Ohio EPA 319 grant and for construction the sources were ODNR-DMRM, Ohio EPA 319, and OSM. However, modifications to the dam and pipes were needed. In 2011, ODNR completed the design for the slurry wall that will prevent water from seeping around and under the dam. This design also included improvements to the primary outlet (standpipes) that failed after initial construction in Fall 2010. In 2012, King Environmental Group was awarded \$442,395 (substantial cost) to complete the construction of the secondary improvements. Project was complete 12/45/12. Mainstem Pierce Run downstream of acid mine drainage sources show acid and metal loadings at site PR0010 to be 16 lbs/day and 274 lbs/day (figure 1).

SITE: PR0010

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Raccoon Creek Watershed - Lake Morrow

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: completed 9/8/2014 ODNR Project Number: JK-ML-62

Pre-construction



Lake Morrow pre-construction
Photo by Sarah Landers

Post-construction

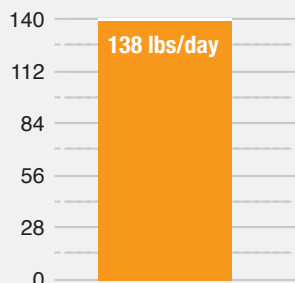


Lake Morrow post construction
Photo by Sarah Landers

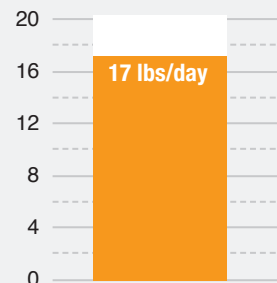
Lake Morrow is located in Section 16 of Milton Township in Jackson County and lies within the 12 digit HUC unit #050901010403. It discharges into Flint Run a tributary to Little Raccoon Creek. The Flint Run sub watershed is affected by abandoned strip mine drainage and associated unreclaimed coal refuse piles. This area was the coal washing and loading facility for the Broken Aro mine. The site is very complex hydrologically, the site consists of large buried slurry impoundments and surface mining pits around the rim of the main valley. The Lake Morrow AMD Reclamation Project involves reclaiming the strip lake and adjacent spoil piles resulting from underground and surface mining that occurred from 1943-1975. AMD was generated from lake water seeping through the mine spoil embankment and leaching out metals and acid into Flint Run. The treatment of Lake Morrow was designed to drain the lake, create positive drainage and bypass the spoil embankment. Design was completed in-house by ODNR-DMRM. Construction started in July 2013 and was complete in September 2014. Environmental Remediation Contractor (ERC) completed construction, 9-8-2014, at a cost of \$667,006. Funding source for the design is ODNR-DMRM and construction is ODNR-DMRM and OSM. Prior to construction, Lake Morrow site, FR0110, showed acid and metal loadings to be 138 lbs/day of acid and 17 lbs/day of metals (Figure 1).

SITE: FR0110

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Raccoon Creek Watershed - Middleton Run Reclamation II

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: completed 12-22-2015 ODNR Project Number: JK-ML-75

Pre-construction



Middleton Run Reclamation II pre-construction trash and spoil piles
Photo by Sarah Landers

Post-construction

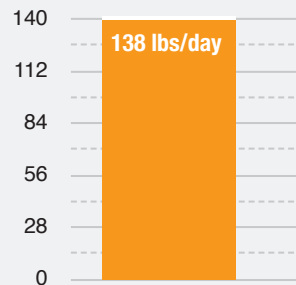


Middleton Run Reclamation II nearly finished
Photo by Sarah Landers

Middleton Run Reclamation II located in Section 16 of Milton Township in Jackson County and lies within the 12 digit HUC unit #050901010403. It lies within the Little Raccoon Creek basin approximately 1 mile east of Wellston. The primary purpose of the Middleton Run Reclamation II project is to reduce the impacts of acid mine drainage (AMD) on Little Raccoon Creek. The project was proposed to address abandoned surface coal mining of the Clarion Coal Seam – No. 4a, and the resulting AMD that has negatively impacted the entire Middleton Run Subwatershed. Our program goal is to restore Little Raccoon Creek's aquatic life use designation to Warm Water Habitat. Overall, our treatment approach was to reclaim 52 acres of spoil and 8 acres of pits that make up the project site. The strip pits contain millions of gallons of AMD that seep through the spoil and then discharge as seepage from the hillside along the coal pit floor. Design was completed in-house by ODNR-DMRM. Construction started in August 2013 and was complete in January 2014. Red Malcuit completed construction, \$1,609,396. Funding source for the project design is ODNR-DMRM and construction is ODNR-DMRM, ODOT mitigation funds, and OSM. The project was complete 5/22/2015. Prior to construction, Middleton Run site, MiR0110, show acid and metal loadings to be 138 lbs/day of acid loadings and 22 lbs/day of metal loadings (Figure 1).

SITE: MiR0110

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Raccoon Creek Watershed - Flint Run Wetland Enhancement Project

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: completed 5/29/2015 ODNR Project Number: JK-MI-76

Pre-construction



Flint Run Wetland
Photo by Amy Mackey

Post-construction



Flint Run Wetland Berm
Photo by Amy Mackey

Flint Run Wetland Enhancement project is located in Section 16 of Milton Township in Jackson County and lies within the 12 digit HUC unit #050901010403. Flint Run Wetland Enhancement project is needed to address abandoned underground and surface coal mining of the Clarion Coal Seam – No. 4a, and the resulting acid mine drainage (AMD) that has negatively impacted the entire Flint Run watershed. Typical water quality entering Little Raccoon Creek from Flint Run is pH 4.0, aluminum concentration of 7 mg/l, and iron concentrations of 13 mg/l. The project location is downstream of multiple AMD treatment projects and the bulk of the abandoned coal mining. The existing wetland was enhanced by the installation of one limestone berm across the Flint Run Valley. The cross berm will allow metals to settle out in the wetland rather than being transported downstream to Little Raccoon Creek. Design completed inhouse at DMRM (\$19,874). Construction was completed by King Environmental Construction for \$143,054. The funding source for this project was ODNR/DMRM and OSM. Pretreatment acid and metal loadings at Site FR095 are shown in Figure 1.

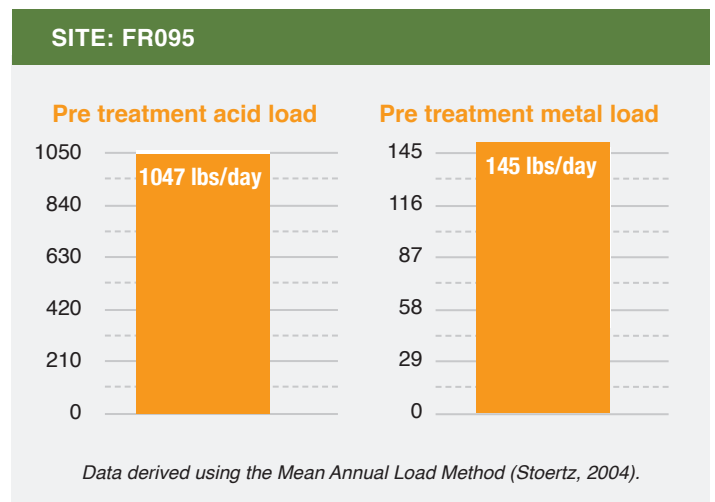


Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Little Raccoon Creek Watershed - Daniels Reclamation Project

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Completed 07/30/2018 ODNR Project Number: JK-MI-74

Pre-construction



Exposed 10 acre gob pile prior to reclamation
Photo by Amy Mackey

Post-construction



Surface reclamation complete with regrading, seeding, and limestone channel
Photo by Amy Mackey

Daniels Reclamation Project is located in Milton Township in Jackson County and lies within the 12 digit HUC unit #050901010403. The Daniels Reclamation Project is located within the Little Raccoon Creek Watershed which has been adversely affected by historic abandoned coal mines. This historic mining has resulted in the formation of Acid Mine Drainage (AMD) and sediment deposition to four unnamed tributaries to Little Raccoon Creek. Typical water quality in the pits and subsequent tributary drainage is pH between 3.1-3.5, acidity from 136-287 mg/l, iron from 2.0-18.4 mg/l, and aluminum from 16.0-31.3 mg/l. The goal of this project is to reclaim the 10 acre site composed of coal mine spoil and strip pits, eliminating these direct inputs of AMD and sediment into Little Raccoon Creek. In addition to the environmental benefits of this project, a Priority 2 Dangerous Spoil Pile will be eliminated. The treatment strategy consists of draining and filling two strip pits, grading 10 acres of spoil to obtain positive drainage, incorporating lime into the toxic spoil (20 tons/acre), covering the spoil with approximately 2' of suitable resoil material (limed at 5 tons/acre), and revegetation of the entire area. The adjacent borrow area was planted with tree seedlings to match its preconstruction land use. Three rock channels were installed to connect side drainages to their main channels (620 linear feet). The design was completed in-house at DMRM. Construction was completed by Dirt Works Express for \$222,078. The funding sources for this project were DMRM AML, DMRM Health and Safety, and OSM WCAP. Pre-treatment acid and metal loadings were not calculated for this project due to the extreme low flow conditions of headwater, small drainage areas, and the disperse nature of the drainage off the site into five tributaries.

Figure 1. Tributaries draining the Daniels Site: DaR0051, DaR0052, DaR0053, DaR0054, DaR0055, DaR0056



pH and Acidity Ranges

Pre treatment pH range
2.83 – 4.48

Pre treatment acidity range
28.1 – 287.0 mg/l

MONDAY CREEK WATERSHED INDIVIDUAL PROJECTS

AMD project reports

'AMD projects report' contains information about each individual acid mine drainage (AMD) project completed in chronological order per watershed. Each report displays photos of the project site pre- and post-construction, a description of the source of pollutants and resulting reclamation project, water quality data at the site prior to reclamation (acid/metal loading prior to construction). Water quality analysis post reclamation is reported in the 'Yearly Water Quality Report' per watershed by stream reach.

Monday Creek Watershed comprehensive acid mine drainage projects report:

1999	Rock Run Gob Pile revamped 2011	43
2001	Rock Run 24	45
2003	Grimmett Hollow	47
2004	Jobs Hollow Doser	49
	Big Four Hollow	51
	Snake Hollow	53
2006	Essex Doser	55
	Lost Run Phase I	57
2007	Lost Run Phase II	59
	Lost Run Subsidence and Portal Closures	61
2008	Shawnee Steel Slag Bed	63
2010	Jobs Hollow Doser Maintenance II	65
	Coe Hollow	67
2012	Big Four Hollow LLB	69
	Lost Run II Maintenance	71
2015	Monkey Hollow Doser	73
	Big 4 Wetland	75

Monday Creek Watershed - Rock Run Gob Pile

*Generated by Non-Point Source Monitoring System
www.watersheddata.com*

Project Status: Complete: 9/1/1999, Revamp: 2011

ODNR Project Number: PR-Co-19

Pre-construction



*Rock Run Gob Pile
Photo by Monday Creek Restoration Project*

Post-construction



*Rock Run Gob Pile
Photo by Monday Creek Restoration Project*

Rock Run Gob Pile which was actually a slurry impoundment is located in Section 20 of Coal Township in Perry County and lies within the 12 digit HUC unit #050302040502. The Rock Run Gob Pile is stretched over 17 acres and was located on the north side of the Rock Run tributary. The design was completed by ODNR-DMRM and Damariscotta for \$15,000. The treatment approach for this site was to cover the 17 acre gob pile using standard reclamation methods, covering the gob with a layer of flue gas desulfurization, and installing a 3,200 Sq. ft. Successive Alkalinity Producing System (SAPS) was used to treat the acid mine drainage emitting from a deep mine at the back of the property. The goal of the design was to reclaim the gob pile and reduce metals and acid loadings from the mine drainage. The project goal was met by reducing acidity to net alkaline conditions at station RR02100 and increasing the pH. A major considerations encountered during the design process was that mine drainage exiting the SAPS (approximately 10% of the water exiting the site) couldn't be separated from the gob pile reclaim. The valley was too small to accommodate and separate the run off from the SAPS treatment cells so a

OLC was lined to carry the drainage off site after treatment. Construction was completed 9/1/1999 by Stimmel Brothers Construction for a cost of \$274,500. The funding sources for this project were for both the design and construction: ODNR-DMRM, EPA-319, and OSM-ACSI. Load reductions are not calculated due to lack of pre-construction data.

The Rock Run Gob Pile project was revamped during 2011 and completed on 8/30/2011. The successive alkaline producing system (SAPS), initially installed in 1999, became clogged with metals and debris. Untreated water was bypassing the system through the emergency spillway. Therefore maintenance was needed. The old compost and limestone was removed and replaced in the SAPS. In addition new piping was installed in the SAPS. A third settling pond was installed to improve settling and a by-pass channel was installed to route overflow storm water around the SAPS. Construction was completed by Tuscon Inc. for \$196,702 and design was conducted in-house by ODNR-DMRM for \$14,463.

Intentional blank page

Monday Creek Watershed - Rock Run 24

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 3/31/2006 ODNR Project Number: PR-SI-

Pre-construction



Rock Run 24

Photo by Monday Creek Restoration Project

Post-construction



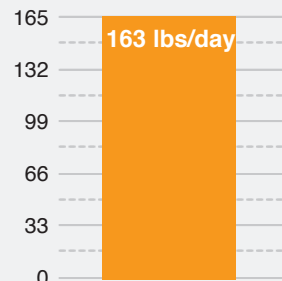
Rock Run 24

Photo by Monday Creek Restoration Project

Rock Run 24 is located in Section 20 of Coal Township in Perry County and lies within the 12-digit HUC unit #050302040504. The site is located on the north side of the headwaters of Rock Run tributary. An abandoned deep mine seep originated in a side hollow and then discharged into Rock Run. The design was completed by Red Wing Engineering for \$25,840. The treatment approach for this site was to install 800 linear feet of open limestone channel (OLC). The goal of the design was to reduce acidity concentration by 36 percent. The project goal was met 100 percent at station MC00800, 1.5 miles downstream. However, at the project discharge RR00780, acidity concentrations only decreased by 29 percent. Major considerations encountered during the design process were landowners concerns and less than 10 percent slope for OLC. The original design was changed from a Reverse Alkaline Producing System (RAPS) to an OLC due to private landowner and U.S. Forest Service liability issues (i.e. flooding). Construction was complete Sept. 17, 2001, by Burr Oak Excavating for a cost of \$71,281. The funding sources for this project were ODNR-DMRM and OSM-ACSI for both the design and construction. Pre-treatment acid and metal loadings at site RR00820 are shown in figure 1.

SITE: RR00820

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Monday Creek Watershed - Grimmatt Hollow

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 12/31/2003 ODNR Project Number: PR-SI-14

Pre-construction



Grimmett Hollow
Photo by Monday Creek Restoration Project

Post-construction

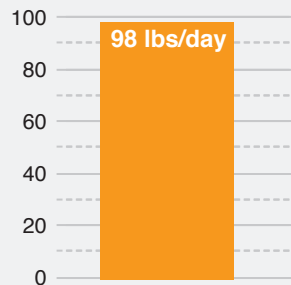


Grimmett Hollow
Photo by Monday Creek Restoration Project

Grimmett Hollow is located in Section 4 of Salt Lick Township in Perry County and lies within the 12-digit HUC unit #050302040502. The project site is five acres and located on Grimmatt's Property in the headwaters of Jobs Hollow, the project discharge is measured at the bridge on CR223. This area was affected by abandoned strip mining, deep mining, and a remnant gob pile. The valley contained a wetland that received water from both strip pits and deep mines in the area. The gob pile was situated in the stream channel downstream of the wetland. The design was completed by Red Wing Engineering for \$19,000. The treatment approach for this site was to enhance an existing 1.3-acre wetland with two rock dams (300 linear feet), incorporated with alkaline material (LKD) as well as install (500 linear feet) open limestone channels (OLC) at seep locations and regrade, soil and vegetate a gob pile (0.15 acres). A stream was routed away from the gob pile via the open limestone channel. The goal of the design was to decrease acidity by 13.6 tons per year. The project goal was met by 100 percent. Major considerations encountered during the design process were the diffuseness of the AMD sources from above drainage underground mines, numerous seep discharges in the basin, gob pile and spoil deposited in wetland, and a stream flowing through the gob pile. Construction was complete Dec. 31, 2003 by Perry Reclaiming Inc. for a cost of \$160,000. The funding sources for this project were ODNR-MRM and EPA-319 for both design and construction. Pre-treatment acid and metal loadings at site JH09020 are shown in figure 1.

SITE: JH09020

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Monday Creek Watershed - Jobs Hollow Doser

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 7/20/04 ODNR Project Number: PR-SI-13

Pre-construction



Jobs Hollow
Photo by Monday Creek Restoration Project

Post-construction



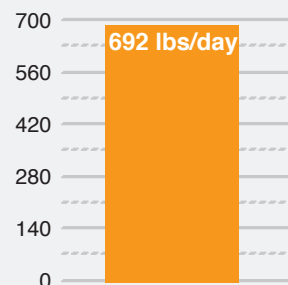
Jobs Hollow Doser
Photo by Monday Creek Restoration Project

Jobs Hollow Doser is located in Section 5 of Salt Lick Township in Perry County and lies within the 12-digit HUC unit #050302040502. The site is located in the headwaters of Monday Creek Watershed downstream of Jobs Hollow at the bridge on Portie Flamingo Road (CR 12). This basin contains approximately 13 small tributaries, most of which are affected by acid mine drainage. The major contributors of acidity are from diffuse deep mine seeps and numerous gob piles. Due to the diffuse and abundant AMD sources and their inaccessibility, a doser was the most practical and efficient method for treatment.

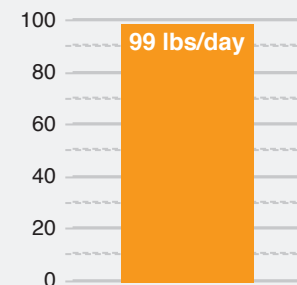
The design was completed by ATC Associates for \$66,916.50. The treatment approach for this site was to install a lime doser. The goal of the design was to decrease acid load from the headwaters of Monday Creek by 54 percent. The project goal was met 100 percent. One major consideration encountered during the design process was that the dosing unit is located adjacent to an intermittent tributary of Monday Creek. Therefore a retention pool was created to create a constant supply of water to the doser. Construction was complete July, 20, 2004 by Tuson Inc. for a cost of \$319,066.50. Funding sources for this project were ODNR-MRM, OSM-ACSI and OEPA-319 for design and ODNR-DMRM and OSM-ACSI for construction. Pre-treatment acid and metal loadings at site JH00500 are shown in figure 1.

SITE: JH00500

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Monday Creek Watershed - Big Four Hollow

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 10/29/2004 ODNR Project Number: HC-Wr-20

Pre-construction



Big Four Hollow
Photo by Monday Creek Restoration Project

Post-construction



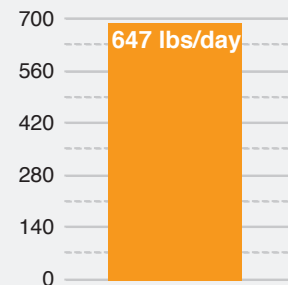
Big Four Hollow
Photo by Monday Creek Restoration Project

Big Four Hollow is located in Section 14 of Ward Township in Hocking County and lies within the 12-digit HUC unit #050302040504. The project site covers 285 acres of a 410 acre sub-watershed (Big Four Hollow) draining to Monday Creek. Big Four Hollow is underlain by deep mines and has been surface mined around the hills where the coal crop was accessible causing many AMD seeps to discharge in the basin.

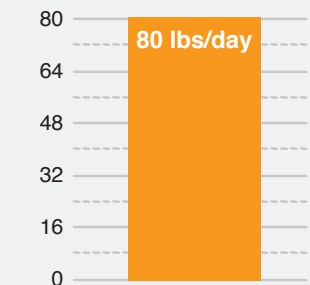
The design was completed by USFS and TN & A for \$19,000. The treatment approach for this site was to install two limestone leach beds (3000 sq. ft) and approximately 1,400 linear feet of limestone channel (OLC). The goal of the project was to decrease acidity concentrations by 82% at station BF00400. However only 37% of the acidity concentration has been decreased at site BF00100. Construction was complete Sept. 17, 2001, by Pangea for a cost of \$320,000. The funding sources for this project were USFS for the design and MCRP, ODNR-DMRM and USFS for construction. This project was designed to reduce acidity, not metals, but the natural wetland at the mouth of Big Four Hollow retains some metals. Pre-treatment acid and metal loadings at site BF00100 are shown in figure 1.

SITE: BF00100

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Monday Creek Watershed - Snake Hollow

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 12/31/2004 ODNR Project Number: HC-Wr-19

Pre-construction



Snake Hollow
Photo by Monday Creek Restoration Project

Post-construction



Snake Hollow
Photo by Monday Creek Restoration Project

Snake Hollow is located in Section 18 of York Township in Athens County and lies within the 12-digit HUC unit #050302040504. The site encompasses the entire Snake Hollow subwatershed, approximately 500 acres in size. Snake Hollow is a tributary to Monday Creek. Numerous deep mine discharge sites are located on the hillsides around the headwaters and along the stream. The area was stripped at the outcroppings along the ridges where the coal portals from the deep mining had originally been. The design was completed by the U.S. Forest Service (Wayne National Forest). The treatment approach for this site was to construct approximately two miles of limestone channels (OLC) and two slag leach beds, close nine subsidence holes and two portals and enhance the existing one acre wetland with limestone rock dams. The goal of the design was to reduce acid and metals concentrations discharging into Monday Creek. A major consideration encountered during the design was the documented capture of the Indiana Bat. During the design process, access road costs doubled. Construction was complete Dec. 31, 2004, by Environmental Quality Management for a cost of \$740,000. The funding sources were ODNR-DMRM and USFS for both design and construction. Pre-treatment acid and metal loadings at site SH00100 are shown in figure 1.

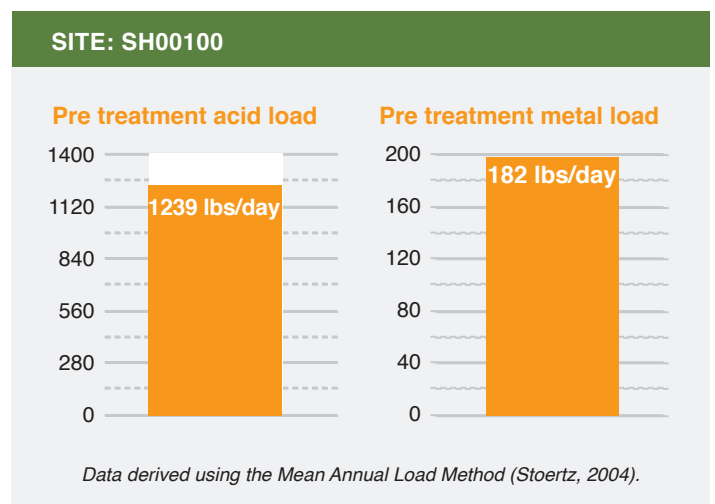


Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Monday Creek Watershed - Essex Doser

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Completed 3/31/2006 ODNr Project Number: HC-Wr-03

Pre-construction



Essex Doser
Photo by Monday Creek Restoration Project

Post-construction

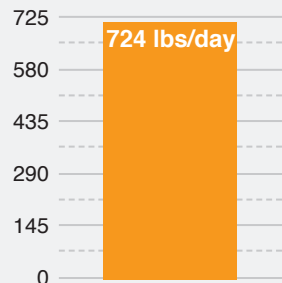


Essex Doser
Photo by Monday Creek Restoration Project

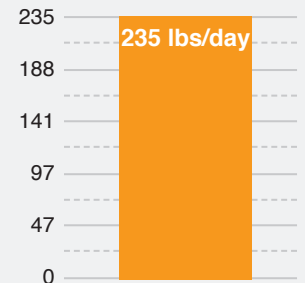
Essex Doser is located in Section 18 of Ward Township in Hocking County and lies within the 12 digit HUC unit #050302040503. The site is located along Sycamore Hollow, State Route 216. Abandoned underground deep mines and subsidence captures surround the area and discharge AMD into Sycamore Run through an open mine portal adjacent to State Route 216. Sycamore Hollow is a tributary to Snow Fork. The design was completed by ATC Associates for a cost of \$32,320. The treatment was to install a lime doser. Funding for this project was originally intended to address Murray City Seeps. However the village of Murray City would not sign a right-of-entry form, so the project was moved to Essex Mine, further upstream of Murray City. The goal of the design was to neutralize acidity discharging from Essex Mine. The project goal, as indicated from initial post-construction sampling, has been met 100 percent. A major consideration encountered during the design was the close proximity of the doser to State Route 216. Construction was complete March 31, 2006, by AWT Services Inc. for a cost of \$287,400. The funding sources for this project were ODNr-DMRM and EPA-319 for both the design and construction. The doser was turned off during 2008 and is planned to be moved elsewhere in the Monday Creek Watershed. Pre-treatment acid and metal loadings at site SY00706 are shown in figure 1.

SITE: SY00706

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Monday Creek Watershed - Lost Run Phase I

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Completed 10/13/2006 ODNR Project Number: HC-Wr-30

Pre-construction



Lost Run Seep (1W2 Seep)
Photo by Monday Creek Restoration Project

Post-construction

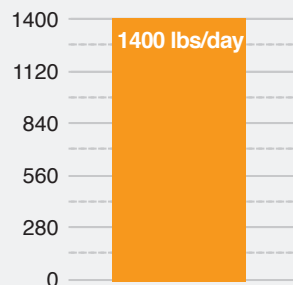


Lost Run Seep (1W5 Seep)
Photo by Monday Creek Restoration Project

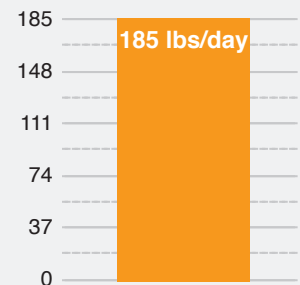
Lost Run Phase I is located in Section 36 of Ward Township in Hocking County and lies within the 12 digit HUC unit #050302040502. The site is located at the mouth of the first tributary to the west in the Lost Run subwatershed. Project area is less than five acres. Lost Run is a tributary to Monday Creek at river mile 16.08. The Lost Run area was providing recharge to underground mine complexes. The majority of AMD discharging in the lower portion of Lost Run occurred beneath the abandoned high walls, or near the perimeter of surface mine reclamation areas at the coal crop line. Seeps also occur in areas where overburden was deposited. The design was completed by Ohio Department of Natural Resources – Division of Mineral Resources Management (\$35,000). The treatment consisted of constructing a 13,700 square foot limestone leach bed and installing 3,540 linear feet of limestone channels to treat acid mine drainage from five locations. The goal of the design was to reduce acid and metal concentrations discharging into Monday Creek. Construction was completed 10/13/2006 by Tucson Inc. for a cost of \$456,087. Problems with the limestone leach bed were encountered summer of 2007. The system was modified and repaired August 2007. The funding sources for this project were ODNR-DMRM for the design and for construction was MCRP, ODNR-DMRM and Ohio EPA 319. Pre-treatment acid and metal loadings at site LR01020 are shown in figure 1.

SITE: LR01020

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Monday Creek Watershed - Lost Run Phase II

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 8/14/2008 ODNR Project Number: HC-Wr-34

Pre-construction



Lost Run Seeps
Photo by Nate Schlater

Post-construction

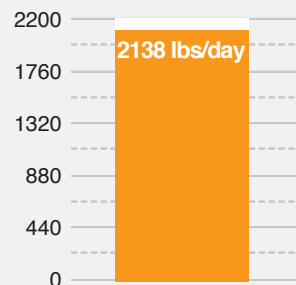


Lost Run limestone leach bed site (4W)
Photo by Monday Creek Restoration Project

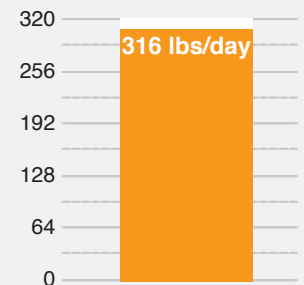
Lost Run Phase II is located in Section 30 of Ward Township in Hocking County and lies within the 12 digit HUC unit #050302040502. Upstream AMD is generated from subsidence features, spoil blocks in side drainages of intermittent streams, fractured high walls, and slumped drift mine entries. Phase II of the Lost Run reclamation project consists of numerous alkaline addition systems spread throughout the headwaters of the Lost Run basin to buffer numerous AMD sources throughout the basin. Post construction monitoring is being collected at site LR00040. However, no pre-construction data was collected at this site. Therefore, reclamation results for this report are evaluated at the mouth of Lost Run (site LR00020). This site also represents water quality from Lost Run Phase I. For this report, both Phase I and II of Lost Run are evaluated at the mouth of Lost Run at site LR00020. The design was completed by ODNR – DMRM (\$63,979). The treatment consisted of constructing a 7,650 square foot limestone leach bed, installing 1,300 linear feet of limestone channels, 140 linear feet of Limestone J-trenches, 14,250 square ft. of steel slag leach bed, and 197 linear feet of a steel slag berm to add alkalinity to buffer acidity generated in Lost Run. The goal of the design was to reduce acid and metal concentrations discharging into Monday Creek. Construction was complete 8/14/2008 by Stimmel Construction for a cost of \$430,468. One of the planned steel slag berms could not be constructed due to private landowner denying permission.

SITE: LR00020

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

The funding sources for this project were for the design was ODNR-DMRM and for construction was MCRP, ODNR-DMRM and Ohio EPA 319. Pre-treatment acid and metal loadings at site LR00020 are shown in figure 1.

Intentional blank page

Monday Creek Watershed - Lost Run Subsidence and Portal Closures

*Generated by Non-Point Source Monitoring System
www.watersheddata.com*

Project Status: Complete: 2007 ODNR Project Number: AG-55N9-C-07-0002

During Construction



*Lost Run Subsidence (site CDE) in-progress closure
Photo by Mike Grebeck*

During Construction



*Lost Run subsidence (site CDE) closed. OLC in progress.
Photo by Mike Grebeck*

Lost Run Subsidence and Portal Closures are located in Section 33 of Coal Township in Perry County and lies within the 12 digit HUC unit #050302040502. The site footprint is approximately 250 acres and is located in the Lost Run subwatershed a tributary to Monday Creek. The Wayne National Forest partnered with the Monday Creek Restoration Project and the ODNR-DMRM to close ten subsidence and portal features in this subwatershed. The design was completed by USFS engineers for approximately \$7,000. The treatment approach was to seal the mine entries for safety purposes and to keep water on the surface. The goal of the design was to keep water out of the underground mine complexes, eliminating the generation of acid mine drainage. Approximately 100 acres of drainage area were restored from captures and 3,280 linear feet of limestone channels were installed. During the design process two additional holes opened up, engineers changed the design to allow for additional work. By closing these ten features (figure 1) 100- acre drainage area was restored, allowing clean surface water to return to Lost run and decrease 35,000,000 gallons/yr of water from entering the deep mine and becoming acid mine drainage at deep mines discharges in Lost Run and Sycamore Hollow. The project goal was met by 100 percent. Construction was complete November 1, 2007 by D. J. Group for a cost of \$321,900. The major responsibility of the construction company was to perform tasks outlined in the plans and specifications to close all subsidence and portals. The funding sources for this project were for both the design and construction was the USFS.

Post-Construction Estimated Effects

Amount of water returned to the stream
and diverted from entering the deep mine and
generating acid mine drainage

Gallons/yr = 35,000,000

Monday Creek Watershed - Lost Run Subsidence and Portal Closures

Generated by Non-Point Source Monitoring System
www.watersheddata.com

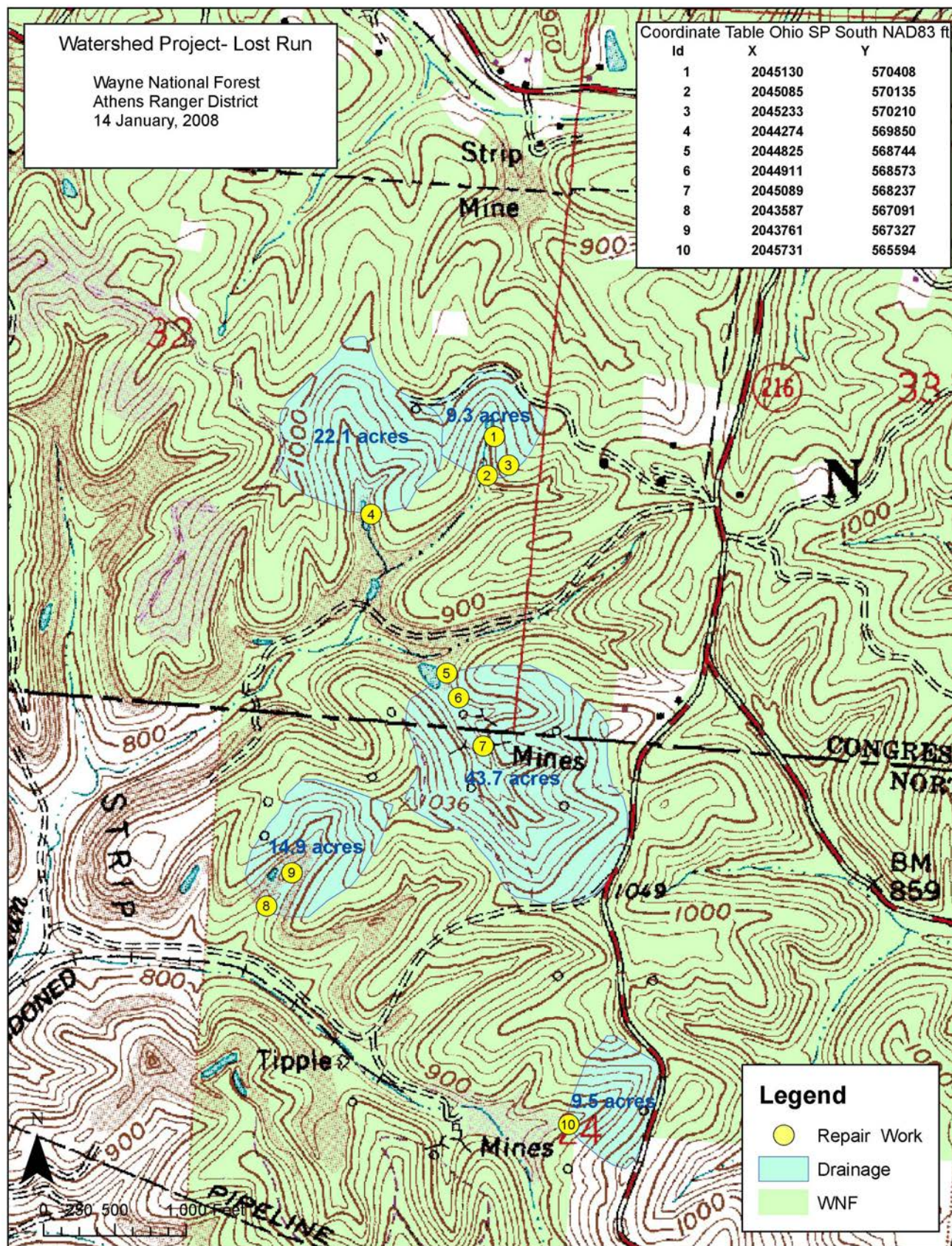


Figure 1. Lost Run Subsidence and Portal Closures map

Monday Creek Watershed - Shawnee Steel Slag Bed

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Completed 9/23/2008 ODNR Project Number: PR-SL-19

Pre-construction



Shawnee Waste Water Plant
Photo by Monday Creek Restoration Project

Post-construction

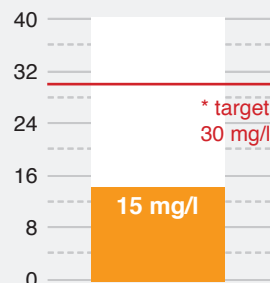


Shawnee Waste Water Plant Post construction
Photo by Monday Creek Restoration Project

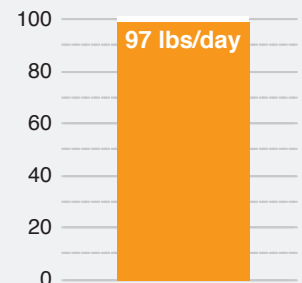
Shawnee Steel Slag Bed is located in Section 17 of Salt Lick Township in Perry County and lies within the 12 digit HUC unit #050302040502. Shawnee Steel Slag Bed reclamation project consists of constructing a steel slag leach bed at the effluent from the Shawnee waste water treatment plant to add alkalinity to Monday Creek. The design was completed by Ohio Department of Natural Resources Division of Mineral Resources Management (\$20,000). The treatment consists of one 22,800 square foot steel slag bed, 190 linear feet of open limestone channel, and a sand filter to collect suspended solids and algae before entering the steel slag bed. The goal of the design is to boost net alkalinity on the mainstem to meet an alkalinity target of 30 mg/l and maintain a pH in the 6-9 range for approximately four miles downstream. Although the goal of this project is to add alkalinity to Monday Creek, reductions in metal loadings were observed. Construction was complete 9/23/2008 by Tucson, Inc, for a cost of \$231,498, but shut down to address an algae and suspended solids problems after approximately one month of being online. To solve the problems, a sand filter and algae removal system were installed October 2009. The systems began discharging treated water into Monday Creek November 2009. The SSLB was shut down during the fall of 2010 to allow for a maintenance project to help repair clogging issues that have occurred in the bed. The maintenance project was completed March 2011. The funding sources for the project was ODNR-DMRM for the design and Ohio EPA 319, ODNR-DMRM, and MCRP for

SITE: MC00900

Pre treatment net
alkaline concentration*



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated net alkaline concentration and metal loading prior to treatment.

construction. Maintenance projects were funded by DMRM. Pre-treatment net alkaline concentration and metal loading at site MC00900 are shown in figure 1.

Intentional blank page

Monday Creek Watershed - Jobs Hollow Maintenance II Project

*Generated by Non-Point Source Monitoring System
www.watersheddata.com*

Project Status: Maintenance complete July 2010 ODNR Project Number: PR-SL-23

Pre-construction



*New ladder installed on Jobs Hollow Doser
Photo by Nate Schlater*

Post-construction



*New manhole installed on top of Jobs Hollow Doser
Photo by Nate Schlater*

Jobs Hollow Doser is located in Section 5 of Salt Lick Township in Perry County lie with the 12 digit HUC unit #050302040502. The Jobs Doser was originally installed in 2004. Over time sediment accumulated within the Jobs Doser source pond, clogging up the inlet riser pipe and reducing flow to the doser. All pipes delivering water to the doser, as well as treated water to the stream were becoming clogged with sediment and metal precipitate. In addition to the clogging pipes, Monday Creek Restoration Project (MCRP) and DMRM personnel maintaining the level of calcium oxide (CaO) in the doser silo couldn't access the top of the doser silo to check CaO level. To address these two issues the following activities were completed:

First, to allow the unobstructed flow of water to the doser, the source pond was dredged of approximately 260 cubic yards of sediment and iron precipitate, disposal of the sediment on-site, and re-vegetation of the disposal area. Cleanout of

the supply and discharge pipes included removing sediment or other obstructions from approximately 475-linear feet of 4-inch PVC pipe as well as cleaning out the inlet riser in the storage pond.

Secondly, a steel access ladder, safety cage and access hatch were installed on the existing silo to allow MCRP and DMRM personnel safe access to the top of the doser unit in order to check the CaO level.

Maintenance designs were completed in-house by ODNR-DMRM. Maintenance construction started 4/27/2010 and was completed 7/1/2010. Zemba Brothers Construction completed the maintenance construction, \$17,529.75. Figure 1 and 2 show the yearly acid and metal load reductions at Jobs Doser through time. Funding source for the project design and construction is ODNR-DMRM.

Monday Creek Watershed - Jobs Hollow Maintenance II Project

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Figure 1. Yearly acid load reductions

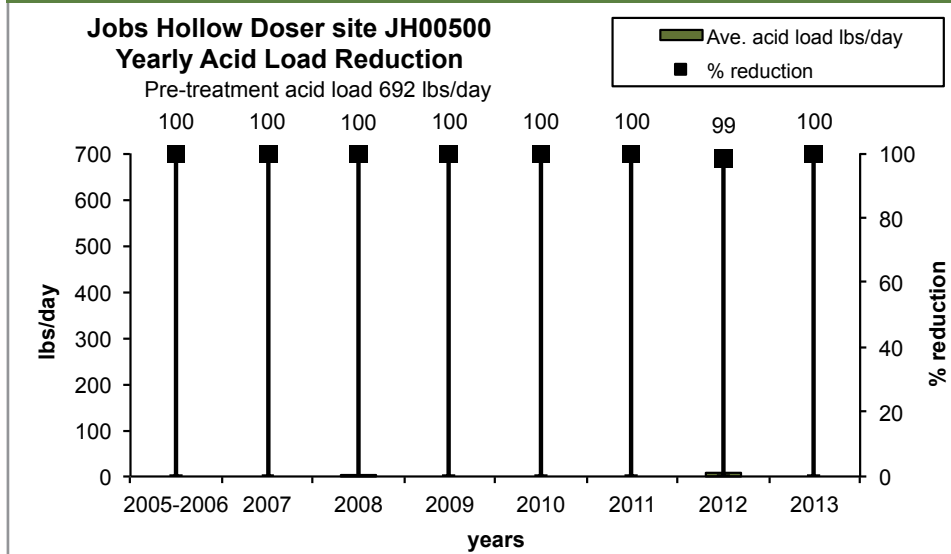
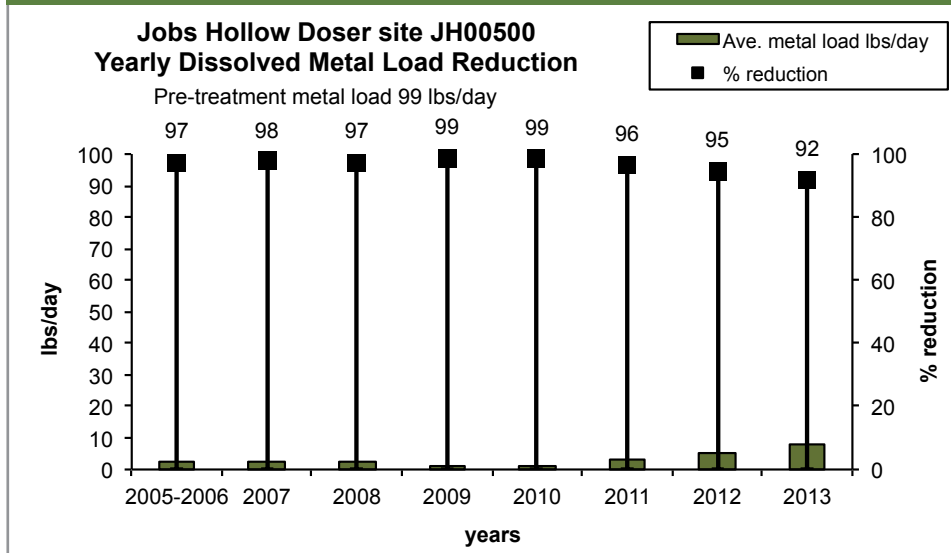


Figure 2. Yearly metal load reductions



Monday Creek Watershed - Coe Hollow

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 9/6/2010

ODNR Project Number: NA

Pre-construction



Coe Hollow pre-construction
Photo by Mike Nicklow (USFS)

Post-construction

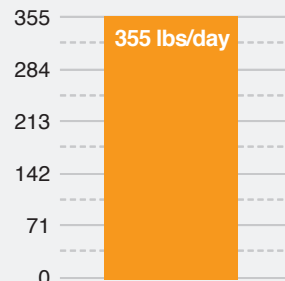


Coe Hollow Limestone Leach Berms (USFS)
Photo by Monday Creek Restoration Project

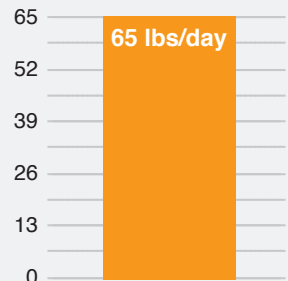
Coe Hollow is located in Section 11 of York Township in Athens County and lies within the 12 digit HUC unit #050302040504. Coe Hollow reclamation project was a collaboration between the US Forest Service, Ohio Department of Transportation (ODOT), and the Monday Creek Restoration Project. Coe Hollow is located in the southern part of the Monday Creek Watershed between the city of Nelsonville and the village of Buchtel. While the sub-basin is small (131 acres), approximately 58% of Coe Hollow contains underground-mined areas. Accordingly to the AMDAT report (2005), field reconnaissance performed in 2001 documented numerous slumps on hillsides, dissipating or losing streams, one subsidence hole in the main-stem and north tributary, slumped mine entries, a small gob pile located in and adjacent to the stream channel, as well as several seeps discharging AMD at stream level. The treatment goal for this project was to reduce acid and metal loadings to Monday Creek by at least 80%. The design was completed by Redwing, Wayne National Forest, ODOT, and RJM (\$41,000). The treatment consists of a series of limestone leach ponds (54,320 sq. ft.) between limestone berms (276 linear ft.) with approximately 6 inches of limestone on the bottom, to add alkalinity. Of the 9.2 acres of wetlands constructed, 1.5 acres were constructed downstream from the USFS project to capture precipitate metals, the other 7.7 acres were constructed on the other side of the road and are clean water. Of the 7.7 acres, 3.4 acres are used to supply the 13,608 sq. ft. steel slag leach bed. Two subsidence stream captures

SITE: CH00100

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

were sealed, reconnecting 80 acres of surface drainage back to the receiving stream. Construction was complete 9/6/2010 by DJ Group, Wayne National Forest (\$409,000), and ODOT (\$1,298,466) for a total cost of \$1,707,446. The funding sources for this project were ODOT and USFS. Pre-treatment acid and metal loadings at site CH00100 are shown in figure 1.

Intentional blank page

Monday Creek Watershed - Big Four Hollow LLB Project

*Generated by Non-Point Source Monitoring System
www.watersheddata.com*

Project Status: Completed 6/26/2012 ODNR Project Number: HC-Wr-37 and HC-Wr-41

Pre-construction



Post-construction



Big Four Hollow is located in Section 14 of Ward Township in Hocking County and lies within the 12 digit HUC unit #050302040504. Big Four Hollow is underlain by deep mines and has been surface mined around the hills where the coal crop was accessible causing many AMD seeps to discharge in the basin. The goal of the previous Big Four Project was to decrease acidity concentrations by 82% at station BF00400. However only 27% of the acidity concentration had been decreased at site BF00400. Therefore three additional limestone leach beds were installed in 2012 to reduce acidity at Big 49 seep and the mainstem of Big 4 Hollow. Design was completed in-house at DMRM (\$15,074). Construction was completed by Stimmel (HC-Wr-41) and SJM (Hc-Wr-37) for \$525,693 (Big4=\$361,923, Big49=\$163,770). The funding sources for this project were DMRM, OSM, and ODOT. Pre-treatment acid and metal loadings at Site BF00400 are shown in Figure 1.

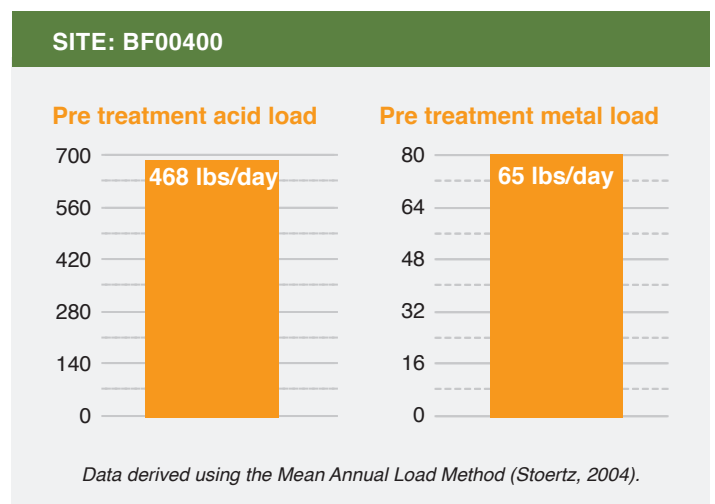


Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Monday Creek Watershed - Lost Run II Nelsonville Area Maintenance project

*Generated by Non-Point Source Monitoring System
www.watersheddata.com*

Project Status: Maintenance completed 5/17/12 ODNR Project Number: UP-HC-11

Post-construction



*New slag being added to the Lost Run slag bed
Photo by Nate Schlater*

Lost Run II is located in Section 30 of Ward Township in Hocking County and lies within the 12 digit HUC unit #050302040502. The Lost Run II project was originally constructed in 2007. The Lost Run II Steel Slag Bed was experiencing problems related to water delivery from the two source ponds to the slag bed, as well as effective water flow through the slag bed. Over time steel slag slowly loses its ability to produce highly alkaline water that is capability of treating downstream AMD source. Both volume and concentrations of alkalinity loading discharging from the slag bed were below targeted loadings, therefore the system was rehabilitated to improve overall treatment efficiency. The goal of this project was to improve the treatment efficiency of the entire system which includes two clean source water

ponds and one steel slag leach bed. Water delivery to the steel slag leach bed was improved in the upper pond and a rock shield was installed in the lower pond to allow for easier maintenance of the system. Maintenance to the slag bed included removing the top crust of steel slag, adding 1,930 tons of new steel slag to the existing bed, and installing additional perforated pipe within the slag bed under drain system. Maintenance design was completed in-house by ODNR-DMRM. Maintenance construction started 11-3-2011 and was completed 5-21-2012. Stimmel Construction Company completed the maintenance construction, \$116,343. Figure 1 and 2 show the yearly acid and metal load reductions at Lost Run through time. Funding source for the project design and construction is ODNR-DMRM.

Monday Creek Watershed - Lost Run II Nelsonville Area Maintenance project

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Figure 1. Yearly acid load reductions

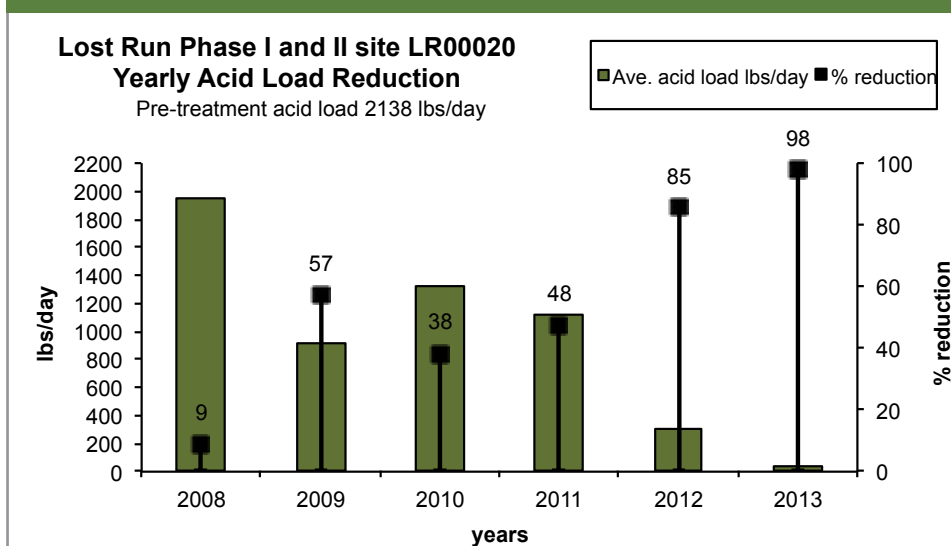
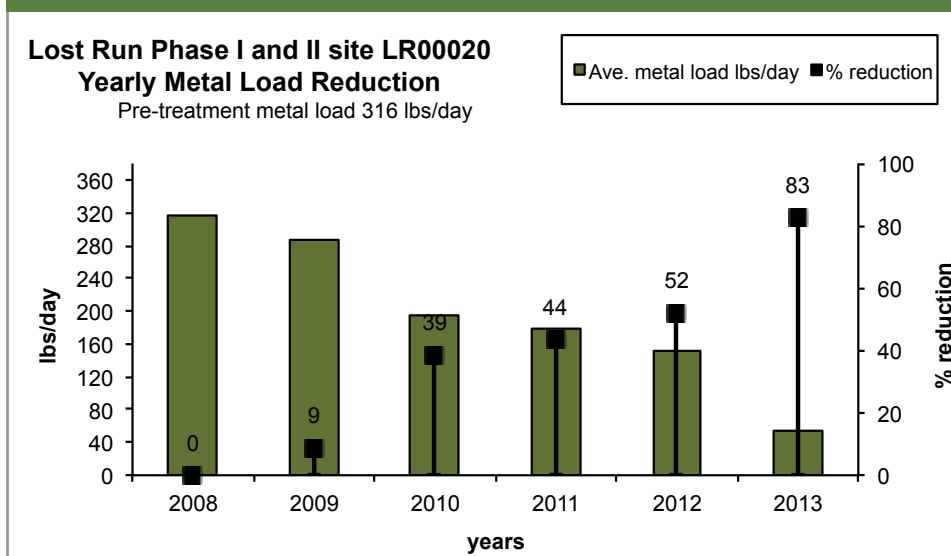


Figure 2. Yearly metal load reductions



Monday Creek Watershed - Monkey Hollow Doser Project

*Generated by Non-Point Source Monitoring System
www.watersheddata.com*

Project Status: Completed 7/2/2015 ODNR Project Number: HC-Wr-44

Pre-construction



*Monkey Hollow acid mine drainage seeps to be treated by doser
Photo by Kaabe Shaw*

Post-construction

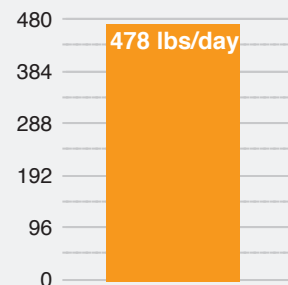


*Monkey Hollow Doser
Photo by Kaabe Shaw*

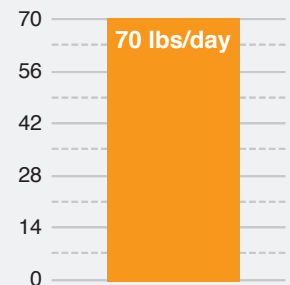
Monkey Hollow Doser is located in Section 26 of Ward Township in Hocking County and lies within the 12 digit HUC unit #050302040504. Monkey Hollow contributes acidity and metals from abandoned coal mine drainage directly into Monday Creek. On average this contribution is 706 lbs/day acidity, 82 lbs/day Al, and 370 lbs/day of Fe. The treatment strategy of the Monkey Hollow Doser Project, is to install a 35 ton calcium oxide dosing unit to lessen downstream impairment and increase Monday Creek's buffering capacity since additional acidity enters downstream at Big Four Hollow, Snake Hollow and Snow Fork. Situating the calcium oxide dosing unit on Monkey Hollow will address the reduction in biology scores seen in Monday Creek downstream of the Monkey Hollow confluence. Design completed in-house at DMRM (\$35,147). Construction was completed by Moderalli Excavating Inc. for \$411,245. The funding sources for this project were DMRM and OSM. Pre-treatment acid and metal loadings at Site MH00100 are shown in Figure 1.

SITE: MH00100

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Monday Creek Watershed - Big 4 Wetland Project

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Completed 11/19/2015 ODNr Project Number: HC-Wr-43

Pre-construction



Diverted stream into proposed wetland cell #3
Photo by Kaabe Shaw

Post-construction



Wetland cell #3
Photo by Kaabe Shaw

Big 4 Wetland is located in Section 14 of Ward Township in Hocking County and lies within the 12 digit HUC unit #050302040504. Big Four Hollow contributes acidity and metals from abandoned coal mine drainage directly into Monday Creek. There is an existing BMP on-site to treat acid mine drainage in the headwaters of Big Four Hollow located upstream of site BF00400. The treatment strategy of the three cell wetlands in Big Four Hollow is to add metal retention capability. The wetland project is designed to increase surface area and promote wetland vegetation thus improving the metal uptake process for iron and aluminum. The three wetlands together total 2.1 acres (0.7, 0.5, 0.9 acres). Design completed in-house at DMRM (\$38,805). Construction was completed by JR General Construction for \$143,188. The funding source for this project was ODNr/DMRM. Pre-treatment acid and metal loadings at Site BF00100 are shown in Figure 1.

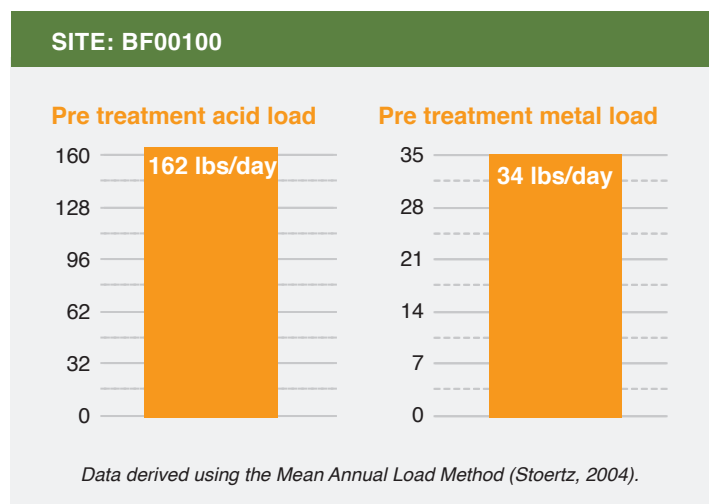


Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

SUNDAY CREEK WATERSHED INDIVIDUAL PROJECTS

AMD project reports

'AMD project reports' contains information about each individual acid mine drainage (AMD) project completed in chronological order per watershed. Each report displays photos of the project site pre and post construction, a description of the project and reasons for the reclamation, water quality data at the site prior to reclamation (acid/metal loading prior to construction). Water quality post reclamation is reported in the 'Yearly Water Quality Report' per watershed by stream reach.

Sunday Creek Watershed comprehensive acid mine drainage projects report:

2004	Congo Stream Capture	79
2007	Pine Run Stream Capture	81
	Corning Gob Floodplain	83
	Rodger's Hollow Stream Capture	85
2009	Little Hocking Stream Capture CR 11	87
2010	West Branch 43 Stream Capture	92
	Pine Run Stream Capture Maintenance	93
	West Branch Sunday Creek Headwaters Phase I & II.	95
2011	West Rendville Stream Capture	97
2013	Pine Run Doser	99
2014	Drake Wetland Enhancement.	101

Sunday Creek Watershed - Congo Stream Capture

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Completed 2004 Project Number: PR-Mn-13

Pre-construction



Stream capture at highwall
Photo by Bill Jonard

Post-construction



New channel created above old stream capture
Photo by Bill Jonard

Congo Stream Capture (CR-15) is located in Section 17 of Monroe Township in Perry County and lies within the 12-digit HUC unit #050302040703. The site is located in Congo Run subwatershed near the town of Congo. The deep mine opening and stream capture is located east of the Congo Strip Lakes and southwest of the town of Congo. The design was completed by ODNR-DMRM. The treatment approach was to seal the mine entry at the abandoned highwall and fill in the pit to allow the stream discharge, of the 72-acre drainage area, to reach Congo Run (figure 1). The goal of the design was to close the stream capture hole and return 100 percent of the stream flow to Congo Run, thus allowing clean surface water to return to Congo Run and preventing 24 million gallons/yr of water from entering the deep mine and becoming acid mine drainage at surrounding deep mines discharges. The project goal was met by 100 percent. Construction was complete July 9, 2004, by Perry Reclaiming for a cost of \$35,522.60. The major responsibility of the construction company was to perform tasks outlined in the plans and specifications to eliminate the stream capture and create a channel to carry flows to Congo Run. The funding sources for this project were ODNR-DMRM for the design and OSM-ACSI for construction.

Post-Construction Estimated Effects

Estimated amount of water diverted from
generating acid mine drainage.

Gallons/yr = 24,000,000

Estimated amount of alkalinity loading added
to the streams, thus providing buffering capacity
to the watershed.

Alkalinity load = 60 lbs/day

Sunday Creek Watershed - Congo Stream Capture

Generated by Non-Point Source Monitoring System
www.watersheddata.com

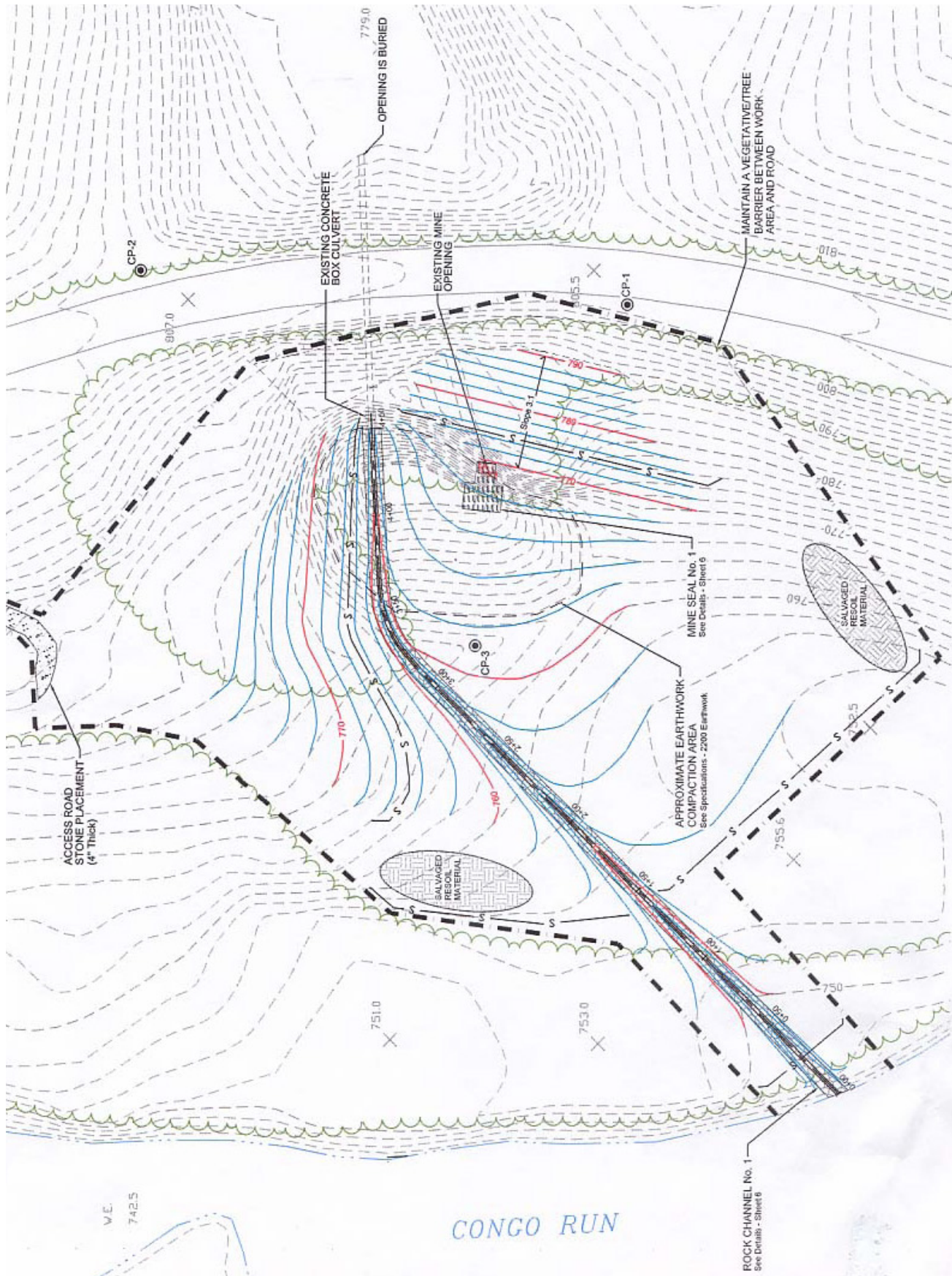


Figure 1. Congo stream capture design map

Sunday Creek Watershed - Pine Run Stream Capture

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Completed 2007 Project Number: PR-SI-15

Pre-construction



*Pine Run Subsidence under wet conditions
Photo by Sunday Creek Watershed Group*

Post-construction



*Pine Run newly constructed channel
Photo by Sunday Creek Watershed Group*

Pine Run Stream Capture is located in Section 14 of Salt Lick Township in Perry County and lies within the 12-digit HUC unit #0503020407030. The site is located in Pine Run subwatershed near Sulphur Springs. There are three subsidence features at the project site. Of the three subsidence features one is a stream capture, while the other two features occur in the valley floor rather than the stream bed, therefore only capturing water during high flow events (figure 1). Aside from the subsidence caused from the underground mines several seeps also occur including one at the main drift entrance of the mine and an exposed coal that was disturbed when the road was built. The design was completed by ODNR-DMRM for a cost of \$36,544. The treatment approach is to create a natural stream channel for fresh water, divert flow into a new channel and to close stream captures and subsidence features to reduce flow into the deep mine. Currently 138 acres of surface water drains into the deep mine complex creating acid mine drainage that discharges, down-dip at mine portals and seeps. The goal of the design is to prevent stream flow into the mine complex Py-76 to reduce flow at down-dip discharges and add alkaline water into Pine Run. Major considerations for this design were to minimize impact to large trees, use a natural stream design and minimize impact on a county road. The construction for this project was completed by Maiden and Jenkins for a cost of \$71,981. The major responsibility of the construction company was to close three subsidence features and create natural channel for positive drainage to

Post-Construction Estimated Effects

Expected amount of water to return to the stream and divert from entering the deep mine and generating acid mine drainage is:

Gallons/yr = 50,867,000

Expected amount of alkalinity loading added to the streams thus providing buffering capacity to the watershed is:

Alkalinity load = 46 lbs/day

Pine Run. The funding sources for this project are ODNR-DMRM for design and OEPA 319 and ODNR-DMRM for construction.

Sunday Creek Watershed - Pine Run Stream Capture

Generated by Non-Point Source Monitoring System
www.watersheddata.com

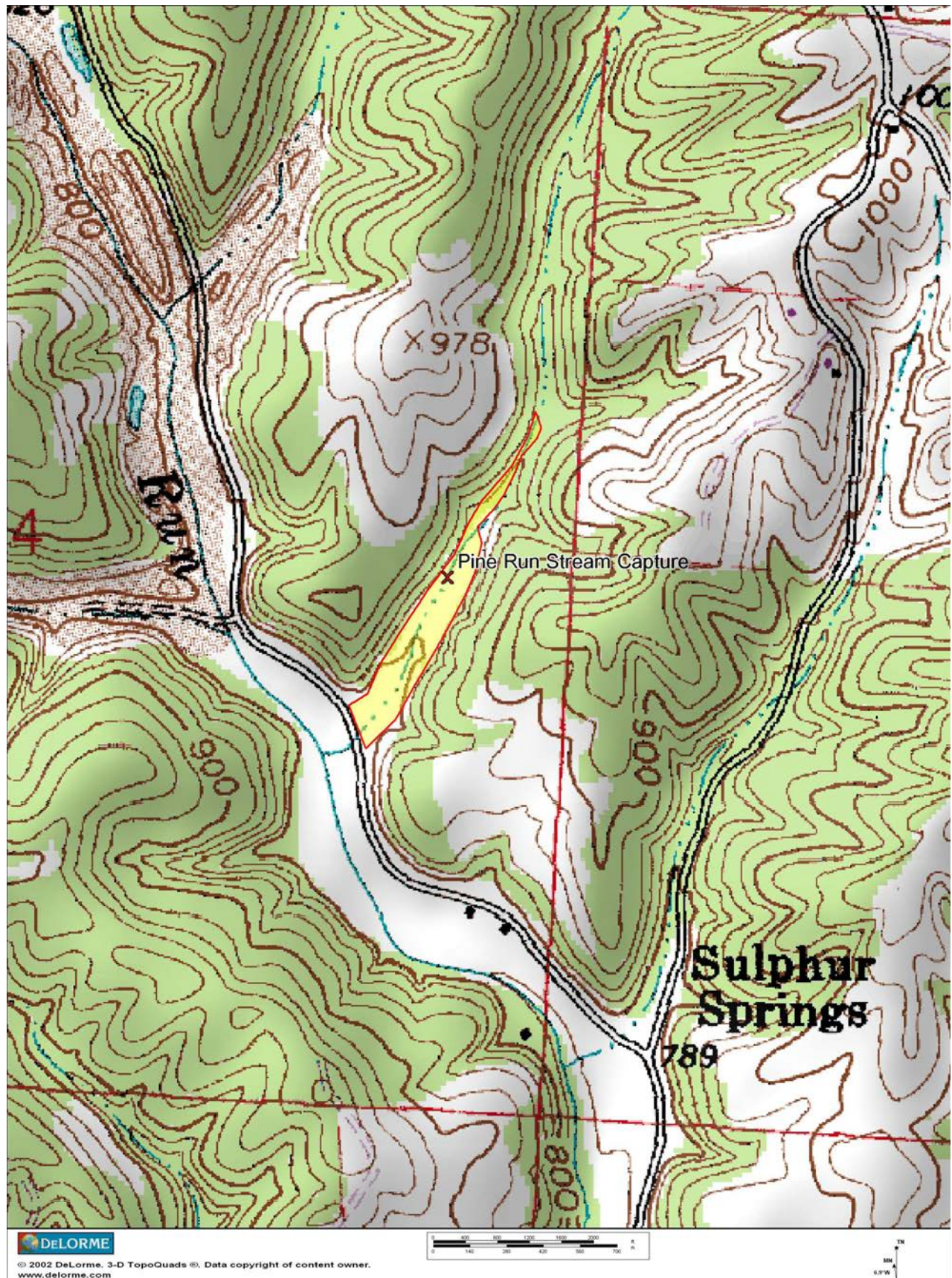


Figure 1. Pine Run Stream Capture Map

Sunday Creek Watershed - Corning Gob Floodplain

*Generated by Non-Point Source Monitoring System
www.watersheddata.com*

Project Status: Completed 2007 Project Number: PR-Mn-12

Pre-construction



*Coal Refuse along stream bank
Photo by Bill Jonard*

Post-construction



*Vegetation established on reclaimed gob pile
Photo by Kaabe Shaw*

Corning Gob Pile is located in Section 4 of Pleasant Township in Perry County and lies within the 12 digit HUC unit #050302040702. The project site is 5 acres and is located in the Headwaters of Sunday Creek north of Rendville (figure 1). Due to the lack of vegetative cover, the 5 acre gob pile is eroding along the slopes and creating AMD discharge into the Headwaters of Sunday Creek. The upper and lower gob piles are the result of underground mining that occurred east of the area. One AMD seep occurs within the eastern portion of the site at an abandoned entry, but rarely discharges water into Sunday Creek. Project discharge was measured at the pond discharge from coal refuse area

(CG02). The design was completed by ODNR-DMRM for a cost of \$1,710. The treatment approach for this site is to remove all coal refuse located in the floodplain and along the stream bank of Sunday Creek. The major consideration for this project was not to impact the stream configuration, re-establish a floodplain, move refuse to higher elevation and cover with soil to reduce contact with air and water. The goal of the design is to reduce metal loadings from headwaters of Sunday Creek. Funding for this project was ODNR-DMRM in house design in conjunction with Federal AML Program site and Ohio EPA 319 for construction. The construction was completed by McMillan on 11/19/2007 for a cost of \$130,069.

Sunday Creek Watershed - Corning Gob Floodplain

Generated by Non-Point Source Monitoring System
www.watersheddata.com

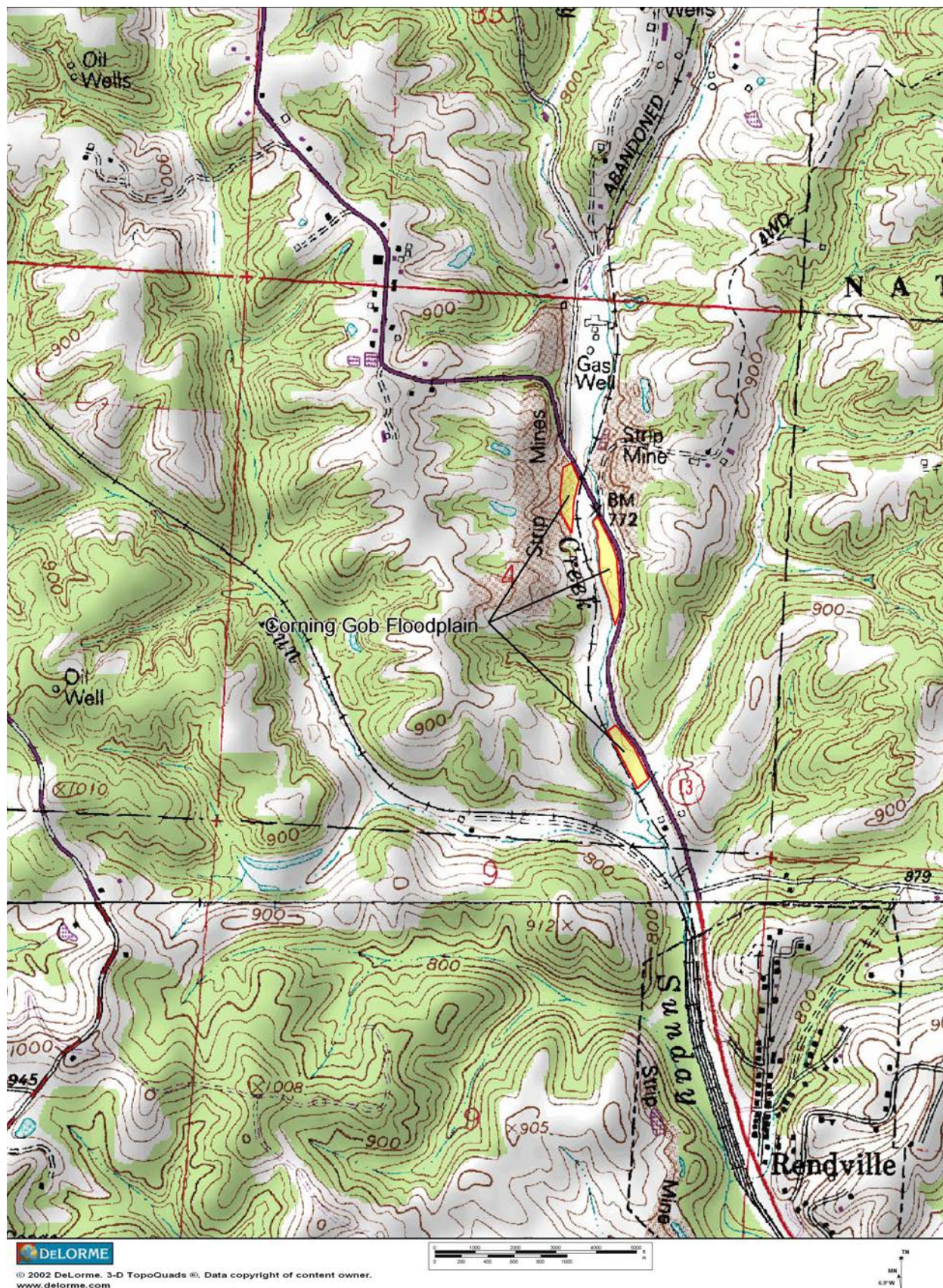


Figure 1. Corning Gob Floodplain project map

Sunday Creek Watershed - Rodgers Hollow Stream Capture

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete: 12/14/2007 ODNR Project Number: PR-Mn-16

Pre-construction



One of Rodger's Hollow primary stream captures during wet conditions, Photo by Sunday Creek Watershed Group

Post-construction

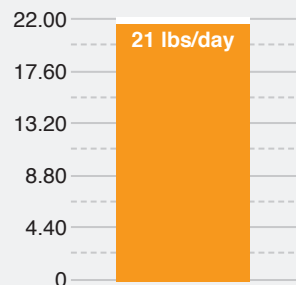


Completed natural channel stream
Photo by Kaabe Shaw

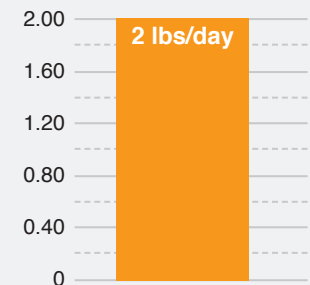
Rodger's Hollow Stream Capture is located in Section 17 of Monroe Township in Perry County and lies within the 12 digit HUC unit #050302040703. The site is located in Congo Run subwatershed north of Drakes. There are two primary and four secondary stream captures (figures 2). The design was completed by Fuller, Mossbarger, Scott, May Engineers, Inc. for a cost of \$109,725. The treatment approach was to close primary and secondary stream captures and divert the channel, using natural stream design concepts (900 linear feet), away from the existing location which is an unstable abandoned coal pit along a highwall as well as add 879 linear feet of open limestone channels. Currently 1,600 acres (2.5 square miles) of surface water drains into the deep mine complex creating acid mine drainage at down-dip seep discharges in Drakes (WB 49 and 49/36). The goal of the design is to return 100 percent of stream water back into Congo Run thus adding alkalinity to Rodger's Hollow/Congo Run and reducing acid mine discharges in Drakes. Construction was completed December 14, 2007 by Tucson Inc. for \$275,490. The funding source for the project design was ODNR-DMRM and construction was OEPA 319. Reduction of acid and metals from the Drakes wetlands (site 36 and 49/36) has not been documented due to changes in flow route. However, WB 49 is seen as the primary source of AMD in Drakes and has seen a 81% reduction in flow following the subsidence closures. In addition Congo Run the receiving stream from the Rodgers Hollow project as expected has seen, on average, an increase in pH from 6.71 to 6.96, a decrease in net acidity from -39.01 to -47.35 mg/l

SITE: WB 49

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Post-Construction Estimated Effects

Expected amount of water to return to the stream and be diverted from entering the deep mine generating acid mine drainage is:

**Gallons/yr
= 589,290,000**

Expected amount of alkalinity loading added to the streams providing buffering capacity to the watershed:

**Alkalinity load
= 758 lbs/day**

and an increase in flow from 0.69 to 1.30 cfs as of 2009. Pre-treatment acid and metal loadings at site WB 49 are shown in figure 1.

Sunday Creek Watershed - Rodgers Hollow Stream Capture

Generated by Non-Point Source Monitoring System
www.watersheddata.com

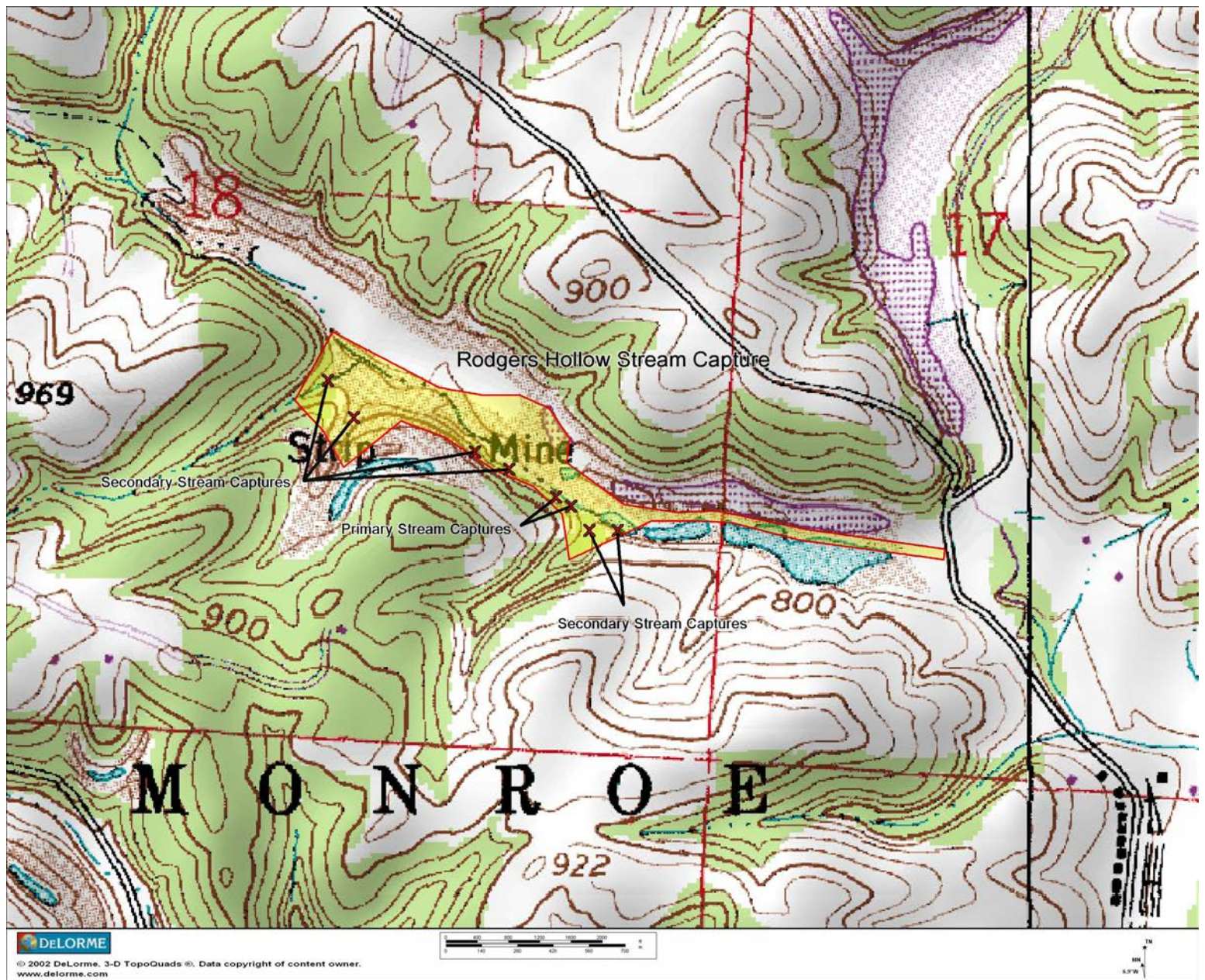


Figure 2. Rodgers Hollow Stream Captures

Sunday Creek Watershed - Little Hocking Stream Capture CR 11

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Completed 2009 Project Number: PR-Mn-17

Pre-construction



Primary stream capture
Photo by Sunday Creek Watershed Group

Post-construction



Closure of primary stream capture
Photo by Dave Agnor

Little Hocking stream capture CR-11 is located in Section 18 of Monroe Township in Perry County and lies within the 12-digit HUC unit #050302040703. The site is located in the Congo Run sub-watershed near the town of Congo. It discharges into Congo Run on the back side of the strip ponds that make up the mainstem of Congo Run. Congo Run CR 11 consists of a large subsidence that captures the flow from an intermittent stream that drains approximately 0.4 square miles (286 acres)(figure 1). The treatment approach is to seal off the subsidence hole, create new channels to re-connect the headwater stream to the receiving stream (figure 2). Thus preventing a net alkaline stream from entering the abandoned mine complex via the subsidence feature. The design was completed by ODNR-DMRM for a cost of \$194,565. The treatment consisted of 964 linear feet of limestone channel and 286 acres of restored stream capture area. The goal of the design was to eliminate net alkaline water from entering the abandoned mine complex and re-connect the stream to Congo Run, adding alkalinity. Construction was complete in December of 2009 by Tucson, Inc. for a cost of \$230,145. The funding sources for this project were ODNR/DMRM set-aside funds and OSM direct grant for the design and OSM Clean Streams Initiative and ODNR-DMRM for construction.

Post-Construction Estimated Effects

Expected amount of water to return to the stream and divert from entering the deep mine and generating acid mine drainage is:

Gallons/yr = 105,400,00

Expected amount of alkalinity loading added to the streams thus providing buffering capacity to the watershed is:

Alkalinity load = 122 lbs/day

Sunday Creek Watershed - Little Hocking Stream Capture CR 11

Generated by Non-Point Source Monitoring System
www.watersheddata.com

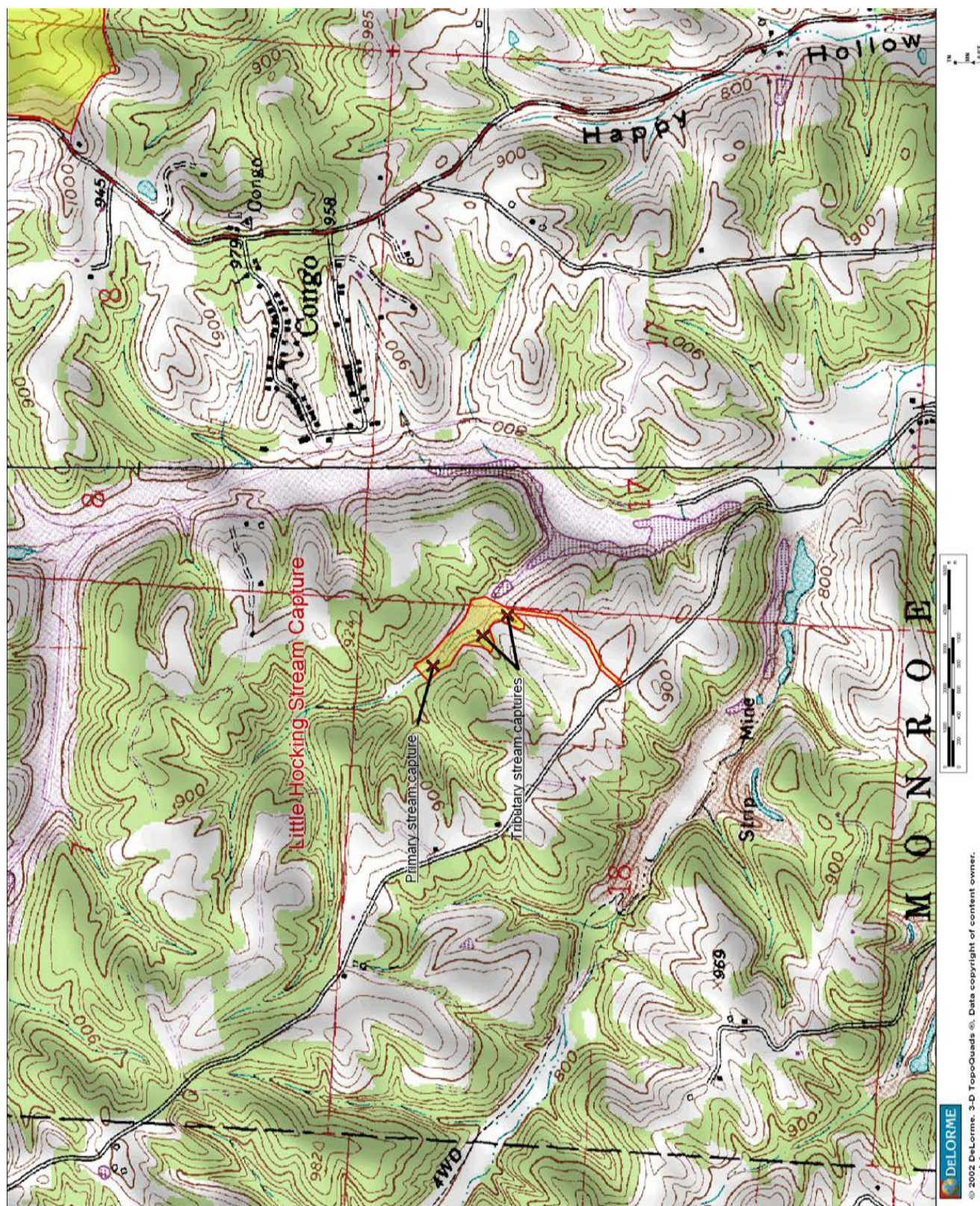


Figure 1. Little Hocking Stream Capture CR 11 Map

Generated by Non-Point Source Monitoring System
www.watersheddata.com



Intentional blank page

Sunday Creek Watershed - West Branch 43 Stream Capture

*Generated by Non-Point Source Monitoring System
www.watersheddata.com*

Project Status: Completed 2010 ODNR Project Number: Pr-Mn-18

Pre-construction



*Sunday Creek West Branch WB 43 stream capture at highwall
Photo by Bill Jonard*

Post-construction



*WB 43 site of closed primary stream capture
Photo by Sunday Creek Watershed Group*

West Branch 43 stream capture is located in Southwest corner of Section 19 of Monroe Township in Perry County and lies within the 12-digit HUC unit #050302040703. The site is located in a unnamed tributary draining to West Branch of Sunday Creek just east of the village of Hemlock. WB 43 subsidence hole is located on the edge of a surface mine and corresponds to underlying deep mine PY-48. The site captures a drainage area of 0.11 square miles (65 acres). The treatment approach was to re-establish the drainage channel that discharged into a final pit area and then into the abandoned deep mine complex. Seal off the deep mine access area at the highwall and backfill as much of highwall as possible. Construct a new channel to deliver water from the sealed mining area to West Branch. The treatment consisted of 300 linear feet of limestone channel, 288 linear feet of grass-lined channel, 3 acres surface reclamation, and 64 acres of restored stream capture area. The goal of the design was to eliminate net alkaline water from entering the abandoned mine complex and re-connect the stream to West Branch Sunday Creek, adding alkalinity. Design completed in-house by ODNR-DMRM for \$19,129. Construction was complete in September 2010 by Dirt Works Express for a cost of \$45,536. The funding sources for this project were ODNR/DMRM AML set-aside funds.

Post-construction Estimated Effects

**Expected amount of water to return
gallons/yr = 26,000,000**

Sunday Creek Watershed - West Branch 43 Stream Capture

Generated by Non-Point Source Monitoring System
www.watersheddata.com



Figure 1. West Branch 43 Stream Capture Map

Sunday Creek Watershed - Pine Run Stream Capture Maintenance Project

*Generated by Non-Point Source Monitoring System
www.watersheddata.com*

Project Status: Maintenance complete 9/25/2010 ODNR Project Number: Archived PR-SL-24

Post-construction



Pine Run Stream Capture is located in Section 14 of Salt Lick Township in Perry County and lies within the 12-digit HUC unit #050302040703. The site is located in Pine Run subwatershed near Sulphur Springs. There were originally three subsidence features at the project site; one was a direct stream capture in the channel, while the other two features occurred in the valley floor rather than the stream bed, only capturing water during high flow events. These subsidence features were closed and reclaimed in 2007. Over time, the built stream channel that reconnected water from the tributary to the Pine Run began to show signs of undercutting. With the mine complex located relatively close in elevation to the bottom of the stream channel, this

maintenance effort was needed to stop the undercutting of the channel in an attempt to prevent the formation of another stream capture. Four separate limestone berms were installed in the stream channel to slow down the flow of water and allow sediments flowing down the channel during storm events to drop out and fill in the undercut segments of the previously constructed stream channel. Design was completed in-house by ODNR-DMRM. Maintenance construction started 8-10-10 and was complete 9-25-2010. Stimmel Construction completed the maintenance construction, \$7,446. Funding source for the project design and construction is ODNR-DMRM.

Intentional blank page

Sunday Creek Watershed - West Branch Sunday Creek Headwaters Phase I & II

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Completed Fall 2010 ODNR Project Number: Pr-SI-16/Pr-SI-25

Pre-construction



1.3 acre gob pile along West Branch Headwaters
Photo by Dave Agnor, OSM

Post-construction



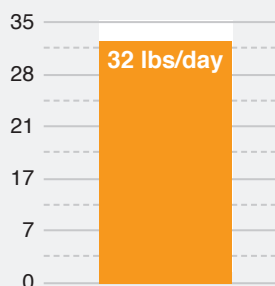
West Branch Sunday Creek Phase I post reclamation featuring a limestone channel. Photo by Sunday Creek Watershed Group

SITE: WBHW 03

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Post-construction



West Branch Headwaters limestone leach bed.
Photo by Michelle Shaw

Figure 1. Estimated acid and metal loadings prior to treatment.

West Branch Headwaters Phase I is located in Section 24 of Salt Lick Township in Perry County and lies within the 12-digit HUC unit #0503020407030. The West Branch Headwaters (WBHW 03) meets with tributary Pine Run to form the West Branch of Sunday Creek at site WB004. The West Branch Headwaters (WBHW) project area consists of several subsidence features, gob and spoil piles (approx. 8 acres), one large deep mine discharge, and several smaller AMD seeps. The treatment approach for this project area has been split into two phases. Phase I included approximately 2,200 linear feet of limestone channel for new drainage at the four subsidence features, additional earthwork reclaimed one acre of gob, seven acres of spoil, two acres of pit impoundments, and 1,200 linear feet of highwall. The design was completed in-house by ODNR-DMRM Phase I Design

\$31,160 (inhouse) and Phase II Design \$27,886 (in-house). The goal of the design for phase II will reduce the amount of AMD being produced while phase II will add alkalinity and reduce metals at WBHW 17 and 19 AMD discharge locations. Phase I construction completed 2010 by McMillan Inc. for a cost of \$253,682. Phase II construction completed late 2011 installed a 12,544 sq. ft. limestone leach bed and a small 0.1 acre wetland to settle metals. Construction costs for Phase II were \$346,616. The funding sources for this project are ODNR/DMRM for the design and OSM Clean Streams and OEPA 319 grant for construction. While acid and metal load reductions are not being observed at site WBHW 03, further downstream at site WB 003 pH values have increased with net alkaline conditions. Pre-treatment acid and metal loadings at site WBHW 03 are shown in figure 1.

Intentional blank page

Sunday Creek Watershed - West Rendville Stream Capture

*Generated by Non-Point Source Monitoring System
www.watersheddata.com*

Project Status: Completed 2011 ODNR Project Number: Archived PR-Mn-19

Pre-construction



*West Rendville subsidence stream capture with Michelle Shaw collecting a sample of water prior to stream loss underground
Photo by Dave Agnor*

Post-construction



*West Rendville newly constructed connector channel
Photo by Michelle Shaw*

West Rendville stream capture is located in Section 15 of Monroe Township in Perry County and lies within the 12-digit HUC unit #050302040703. The site is located in an unnamed tributary draining to the mainstream of Sunday Creek north of Corning. The West Rendville sites consists of two subsidence holes, one on each branch of a small-unnamed tributary to Sunday Creek (figure 1). The site captures a drainage area of 0.38 square miles (240 acres). The treatment approach was to seal off the deep mine access areas and direct stream flow from the two drainages into one stream and re-establish hydrologic flow to Sunday Creek mainstem thus by-passing the subsidence holes that allowed fresh water to enter the deep mine. The design was completed by ODNR-DMRM for a cost of \$33,588. The treatment consisted of 14 acres of extensive earthwork and re-vegetation. Landowners requested a grass-lined channel as opposed to a rock channel. As a result, erosional features are developing and will be addressed. The goal of the design was to eliminate net alkaline water from entering the abandoned mine complex and re-connect the stream to mainstem Sunday Creek, adding alkalinity directing to Sunday Creek while circumventing the generation of acid mine drainage in the deep mine complex underlying Corning. The deep mine discharge located at the Corning Park (site SC 078) is being monitored for changes in volume of flow and chemical water quality in response to the West Rendville subsidence closure project. Construction was completed in October 2011 by Stimmel for a cost of \$322,632. The funding sources for this project were ODNR/DMRM and OSM.

Post-construction Estimated Effects

**Expected amount of water to return
gallons/yr = 88,464,000**

Sunday Creek Watershed - West Rendville Stream Capture

Generated by Non-Point Source Monitoring System
www.watersheddata.com

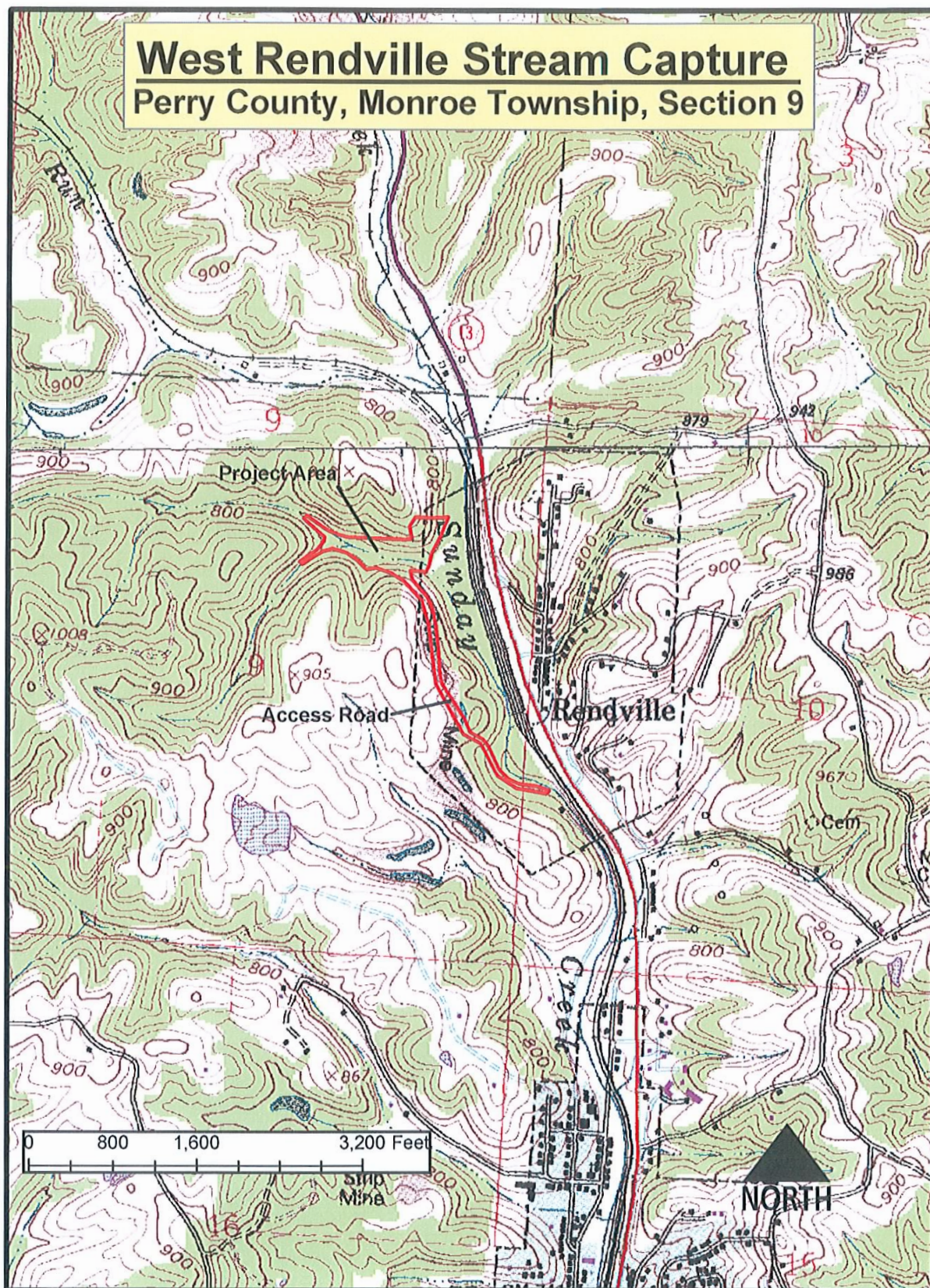


Figure 1: West Rendville Stream Capture Map

Sunday Creek Watershed - Pine Run Doser Project

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete 1/9/2013 Project Number: PR-SL-27

Pre-construction



Pine Run Bat Gate Seep pre-construction
Photo by Sunday Creek Watershed Group

Post-construction

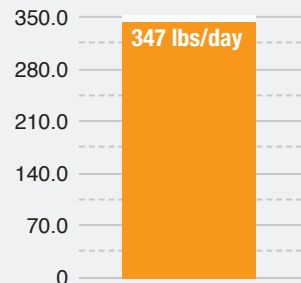


Pine Run Doser post-construction photo
Photo by Sunday Creek Watershed Group

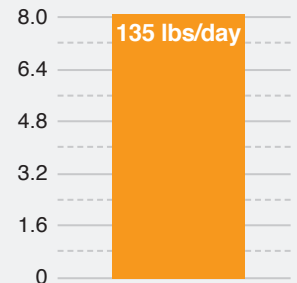
Pine Run Doser Project is located in Section 24 of Salt Lick Township in Perry County and lies within the 12 digit HUC unit #050302040703. Pine Run being one of the largest contributors of acid and metal loadings in the Headwaters of West Branch of Sunday Creek contains deep mines and has been surface mined as well. The purpose of the Pine Run Doser is to introduce alkaline material in the form of pebble quicklime into Pine Run to buffer the acidic water discharging from Pine Run and precipitate any metals prior to entering Sunday Creek. There were concerns about the soil with regard to the doser foundation, therefore helical piling was included in the design for stability of the foundation. The design was completed in-house at DMRM (\$37,650). Construction was completed by Stimmel Construction for \$244,566 on 11-18-12. The doser was in full operation on 1-9-13. The funding source for this project was ODNR-DMRM. Pre-treatment acid and metal loadings at site PR 001 are shown in Figure 1.

SITE: PR 001

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Sunday Creek Watershed - Drake Wetland Enhancement Project

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete 10/30/2014 Project Number: PR-Mn-22

Pre-construction



Drakes Wetland prior to construction
Photo by Mike Gosnell

Post-construction



Drakes Wetland Enhancement Completion sign
Photo by Mike Gosnell

Drakes Wetland Enhancement Project located in Section 20 of Monroe Township in Perry County and lies within the 12 digit HUC unit #050302040703. It drains to the West Branch of the Sunday Creek west of Corning. The primary purpose of the Drakes Wetland Enhancement project consists of maintaining the existing 0.8 acre wetland by removing excess buildup of iron precipitates to maximize its effectiveness in treating acid mine drainage from the Drakes mines. The wetland maintenance consists of removing approx. 1,800 C.Y. of iron precipitates and burying on an offsite waste area located approx. 1 mile from the project site. The wetland maintenance consists of approx. 2,600 C.Y. of earthwork and approx. 150 C.Y. of compacted fill. The project also consists of the installation of limestone berms to create consistent water elevations within wetland cells to allow for better treatment of acid mine drainage within the wetland. Design was completed in-house by ODNR-DMRM. Construction of the enhancement project was complete in October 2014. Environmental Enterprises Inc. completed construction, \$127,500. Funding source for the project design is ODNR-DMRM and construction is ODNR-DMRM and OSM. Acid loading and metal loading were already very low prior to the enhancement project, since the goal of this project is to maintain the longevity of the wetland, WB 36, show acid and metal loadings to be net alkaline with 0 lbs/day of acid loadings and only 2 lbs/day of metal loadings (Figure 1).

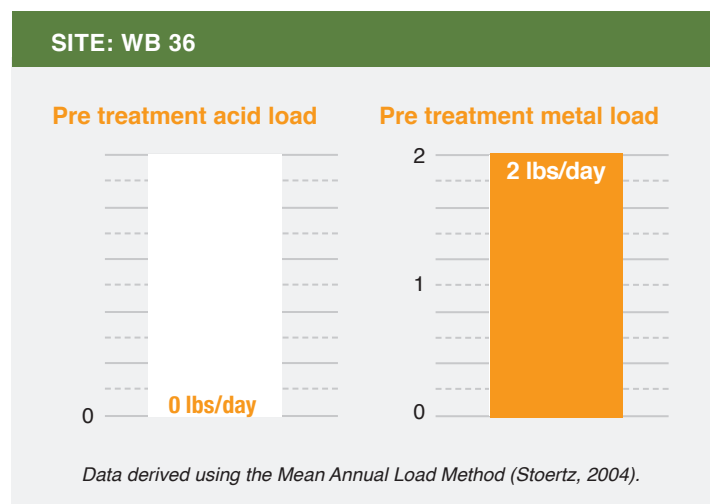


Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

HUFF RUN WATERSHED INDIVIDUAL PROJECTS

AMD project reports

AMD projects report

'AMD project reports' contains information about each individual acid mine drainage (AMD) project completed in chronological order per watershed. Each report displays photos of the project site pre and post construction, a description of the project and reasons for the reclamation, water quality data at the site prior to reclamation (acid/metal loading prior to construction). Water quality post reclamation is reported in the 'Yearly Water Quality Report' per watershed by stream reach.

Huff Run Watershed comprehensive acid mine drainage projects report:

2003	Farr Project	105
	Linden Bioremediation Project	107
2004	Acid Pit #1 Project	109
2005	Lyons Project	111
	Lindentree Project	113
2006	Harsha North Project	115
2008	Fern Hill HR-42 Pits A, B, & C	117
	Belden and Belden Gob Pile Project	119
2009	Mineral Zoar	120
2010	Thomas Project	123
2011	Lyons II maintenance Project	125
2013	Hilltop Energy Project	127
2015	JS&L AMD Reclamation	129

Huff Run Watershed - Farr Project

*Generated by Non-Point Source Monitoring System
www.watersheddata.com*

Project Status: Complete 2003 Project Number: TS-SN-06 and TS-SN-20

Pre-construction



*Farr AMD discharge pre-construction
Photo by Huff Run Watershed*

Post-construction



*View from finishing cells looking upstream
Photo by Douglas Leed*

Site: Pre FAR01/02

The Farr Project is located in Sandy Township in Tuscarawas County. The site is located at the open limestone channel before entering Huff Run. The Farr Project discharges into Huff Run at river mile 1.0. This area was affected by unreclaimed gob piles and an impoundment fed by deep mine discharge. The design was completed by Gannett Fleming for \$30,976. The treatment approach was to passively treat deep mine discharge with a anoxic limestone system. The treatment consisted of installing 500 linear feet of limestone channels, a 10,000 cubic foot anoxic limestone drain, a 0.5 acre wetland and complete 1.2 acres of surface

reclamation. The goal of the design was to reduce high metals from deep mine discharges to the mainstem of Huff Run. Construction was complete May 2003 by Tucson Inc. for a cost of \$150,000. Problems with the construction were unexpected high flows versus design flow of system, inadequate retention in system, continue high metal output, limited space for reconstruction or improvements. The funding sources for this project were, ODNR-DMRM for the design and for construction was OSM Clean Streams, ODNR/DMRM and Ohio EPA. Pre-construction data is not available for this site.

Intentional blank page

Huff Run Watershed - Linden Bioremediation Project

*Generated by Non-Point Source Monitoring System
www.watersheddata.com*

Project Status: Complete 2003 Project Number: CR-RS-04

Pre-construction



*Farr AMD discharge pre-construction
Photo by Huff Run Watershed*

Post-construction

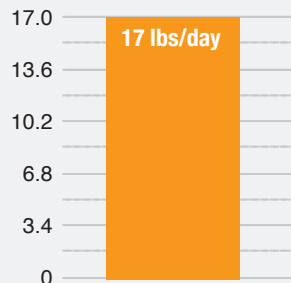


*Huff Run Awareness Day 2003
Photo by Huff Run Watershed*

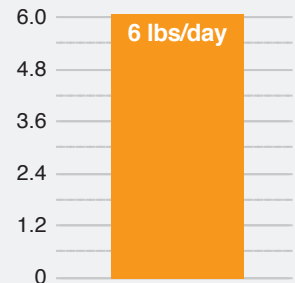
Linden Bioremediation Project is located in Rose Township in Carroll County. The Linden project discharges into Huff Run near river mile 4.6. The Linden project consists of treating a deep mine discharge by directing the water sequentially through a flow control system with a wetland to reduce metal concentrations and provides microbial nutrients. This water then flows through an inoculated Pyrolusite limestone treatment bed, discharge structures, and diversion ditches, before being discharged to the receiving stream. The design was completed by Office of Surface Mining (OSM) engineers at no cost. The treatment consisted of installing a 0.5 acre Pyrolusite limestone bioremediation treatment bed and a 0.3 acre passive wetland. The goal of the design was to generate alkalinity in the upper reaches of Huff Run, with the potential for reduction in metals requiring low maintenance. Construction was complete June 16, 2003 by Tucson Inc. for a cost of \$321,619. Problems encountered included complications with the bedrock for liner installation, unknown pre-existing gas well in location of treatment bed, and high expense of the inoculant. The funding sources for this project were Ohio EPA, OSM, and ODNR/DMRM. Pre-treatment acid and metal loadings at site LIN01 are shown in figure 1.

SITE: PRE LIN01

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

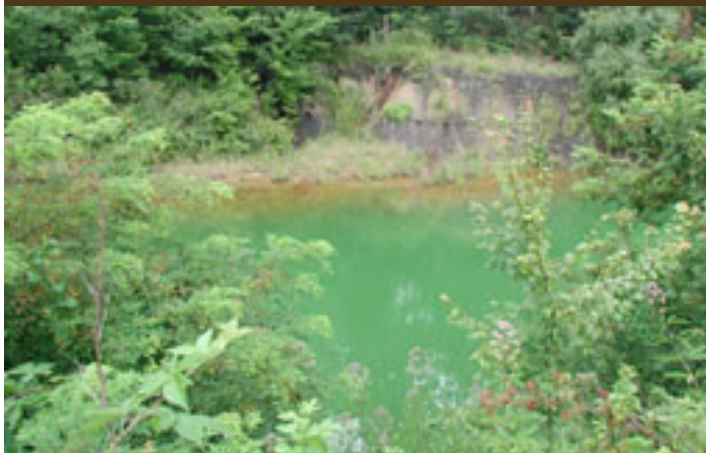
Intentional blank page

Huff Run Watershed - HRWRP Acid Pit #1 Project

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete 2004 Project Number: TS-SN-28

Pre-construction



Acid pit completed project
Photo by Jim Gue

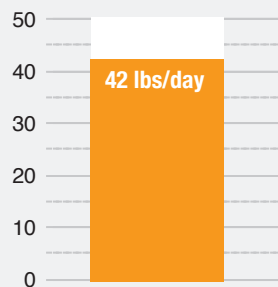
Post-construction



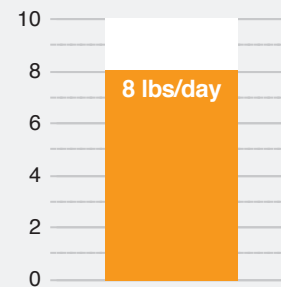
Acid Pit #1 is located in Rose and Sandy Township in Tuscarawas County. The site is located at the effluent from Acid Pit #1. The Acid Pit #1 discharges into Huff Run at river mile 3.78. The design was completed by Ohio Department of Natural Resources – Division of Mineral Resources Management for a cost of \$14,000. The treatment approach was to eliminate the acid-filled impoundments, reclaim the mine spoil, eliminate the recharge through the spoil and provide positive drainage. The treatment consisted of installing 2000 linear feet of limestone channels and reclaim 15 acres of gob spoil. The goal of the design was to eliminate the recharge of extremely acidic water through spoil material and draining into the mainstem Huff Run. Construction was complete March 2004 by Tucson Inc. for a cost of \$150,000. The problem encountered during construction was the lack of solid base (underclay), to effectively place underdrains for subsurface collection of mine drainage flows. The funding sources for this project were for the design was ODNR-DMRM and for construction was OSM Clean Streams, ODNR/DMRM. Pre-treatment acid and metal loadings at site ACP01 are shown in figure 1.

SITE: ACP01

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Huff Run Watershed - Lyons Project

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Completed 2005 Project Number: TS-SN-3

Pre-construction



Overview of gob on the project site
Photo by Brent Miller

Post-construction



After construction major outlet
Photo by Jim Gue

Lyons is located in Sandy Township in Tuscarawas County. The project site is 35 acres. Lyons discharges into Huff Run at river mile 1.90. The Lyons site was one of the highest contributors of AMD within the lower reaches of the watershed. The AMD problems were caused by unvegetated coal refuse, highwalls, acid pits and exposed spoil. The design was completed by ATC Associates for \$53,335. The treatment approach was to reclaim eroding mine spoils, eliminate acid impoundments, install alkaline recharge with steel slag berms and open limestone channels. The treatment consisted of installing 3,000 linear feet of limestone channels and 1,500 linear feet of steel slag channel and reclaim a 15 acre of gob pile and 5 acres of surface reclamation. The goal of the design was to eliminate eroding acid spoils and impoundments, generate alkalinity to deep mine pools, decrease AMD discharges and neutralize acidic discharges prior to draining into the mainstem. Construction was complete December 2005 Malcuit for a cost of \$794,030. Problems with the construction were placement of underdrain tiles to effectively collect subsurface flows to constructed OLC/steel slag channels. The funding sources for this project were Ohio EPA and ODNR/MRM. Figure 3 & 4 (shown on page 3 of this report) estimate approximately 91 lbs/day of acid were reduced from entering into Huff Run. No reduction in metals were measured. Pre-treatment acid and metal loadings at site LYN01 are shown in figure 1.

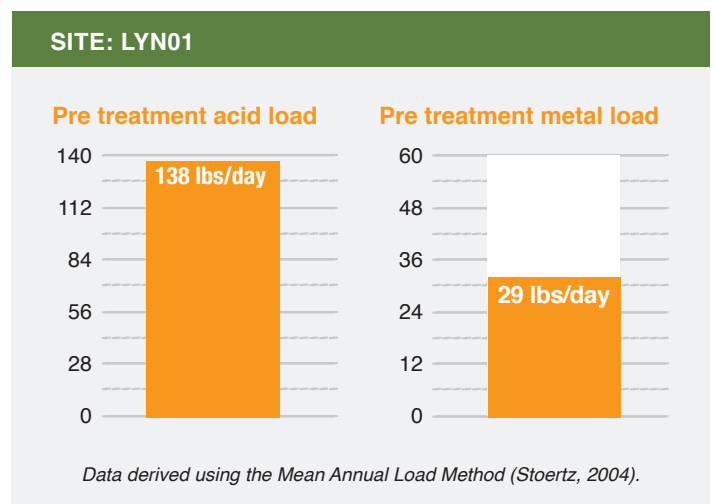


Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Huff Run Watershed - Lindentree Project

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete 2005 Project Number: CR-RS-07

Pre-construction



One of four acidic ponds on project site
Photo by Jim Gue

Post-construction

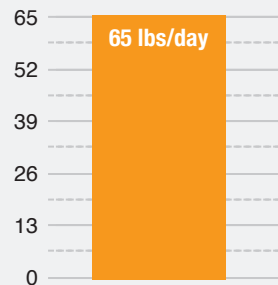


Lindentree reclamation area
Photo by Maureen Wise

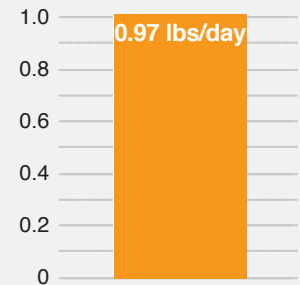
The Lindentree Project is located in Rose Township in Carroll County. The Lindentree project discharges into Huff Run near river mile 5.0 and consists of many acidic ponds, high walls, and exposed gob piles. Baker Consulting completed the design for a cost of \$60,240. The treatment approach consisted of filling the acid pits, raising alkalinity with the use of steel slag, and 100 linear feet of limestone channels. The goal of the design was to reduce acid infiltration from old impoundments, introduce alkaline recharge with steel slag and open limestone channels to upstream reaches of Huff Run. Construction was complete February 17, 2005 by Monarelli for a cost of \$210,000. The funding sources for this project were Ohio EPA and ODNR/DMRM. Figure 3 & 4 (shown on page 3 of this report) estimate approximately 65 lbs/day of acid and 0.28 lbs/day of metals were reduced from entering into Huff Run (minimum metal load at this site pre-construction). Pre-treatment acid and metal loadings at site HRT06 are shown in figure 1.

SITE: PRE HRT06

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Huff Run Watershed - Harsha North Project

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Complete 2006 Project Number: CR-RS-06

Pre-construction



Post-construction

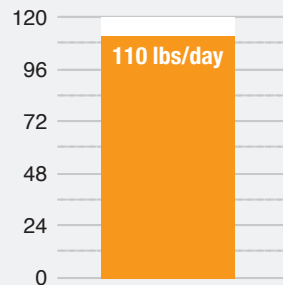


Harsha North spoil and gob pile
Photo by Jim Gue

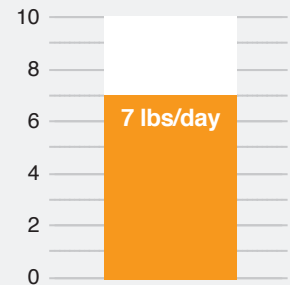
Harsha North is located in Rose Township in Carroll County. The sample site is located at the effluent from the Harsha North project. Harsha North discharges into Huff Run at river mile 4.19. The site was primarily toxic coal refuse piles and highwalls along with areas affected by deep mine drainage and unreclaimed contour surface mines. The treatment approach was to eliminate discrete acid mine drainage sources via open limestone channels and surface reclamation of acid-forming and refuse material. Major considerations were to collect diffuse acid seeps and discharges and direct them through constructed open limestone channels. The design was completed by ATC Associates for \$106,909. The treatment consisted of 22.2 acres of surface reclamation, 4,725 linear feet of limestone J-trenches, and reclaiming a 6-acre gob pile. The goal of the design was to reduce diffuse seeps to a concentrated location via open limestone channels for future passive treatment if necessary, neutralize deep mine discharges with alkaline limestone channels, and add alkalinity to streamflow. Construction was complete September 2006 by Tucson Inc. for a cost of \$686,186. Problems encountered were concerns with intended borrow/resoil material. The funding sources for this project were ODNR/DMRM, for the design, and ODNR/DMRM, 319 OEPA grant, and OSM Clean Streams grant for construction. Pre-treatment acid and metal loadings at site HAN03 are shown in figure 1.

SITE: HAN03 pre

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Huff Run Watershed - Fern Hill HR-42 Pits A, B, & C

*Generated by Non-Point Source Monitoring System
www.watersheddata.com*

Project Status: Completed 2008 Project Number: CR-RS-15 & CR-RS-21

Pre-construction



AMD plume
Photo by Maureen Wise

Post-construction

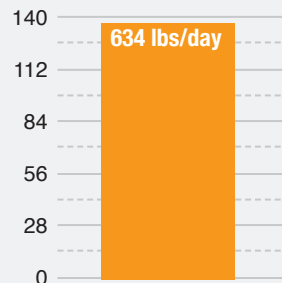


Fern Hill AMD project entrance,
Photo by Linda March

Fern Hill is located in Section 27 and 33 of Rose Township in Carroll County and lies within the 12-digit HUC unit #050400010804. Fern Hill site FRN01, discharges into Huff Run at river mile 4.9. Fern Hill HR-42 consists of a few acid pits and a large AMD plume that sits directly beside Huff Run and discharges AMD directly into Huff Run. The treatment approach was to reclaim three acidic ponds that were situated up-dip from the AMD plume on the site through basic surface reclamation and open limestone channels. Reclamation of these impoundments is believed to have diminished flow to the seep at the base of the hill. The design was completed in-house by ODNR-DMRM for \$71,925. The treatment consisted of 6.0 acres of surface reclamation reclaiming a small gob pile (1 ac.), small settling pond (200 sq. ft) and 500 linear feet of limestone channels. The goal of the design was to reduce flow of the underground mine seep and reduce acidity and metal loadings to Huff Run. Construction of first two pits was complete October 2008 by Malcuit for a cost of \$106,573.75. Construction of the final pit (pond A, "June's Pond") was completed late 2010 by Red Malcuit for a cost of \$79,836. The funding sources for this project were ODNR/DMRM for the design and OSM Clean Streams (strip pit B & C) and ODNR-DMRM for construction (strip pit A). No reduction in metals were measured. Pre-treatment acid and metal loadings at site FRN01 are shown in figure 1.

SITE: FRN01

Pre treatment acid load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Intentional blank page

Huff Run Watershed - Belden and Belden Gob Pile

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Completed 2008 Project Number: CR-RS-10 & CR-RS-20

Pre-construction



Gob pile with impounded acidic water
Photo by Huff Run Watershed

Post-construction

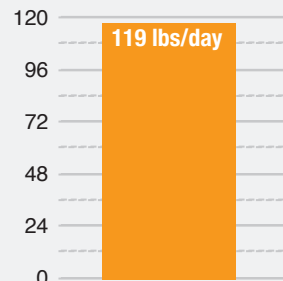


Caption: Steel Slag Bed #3,
Photo by Maureen Wise

Belden is located in Section 33 of Rose Township in Carroll County and lies within the 12-digit HUC unit #050400010804. Belden site BLD01, discharges into Huff Run at river mile 4.5. The Belden site consists of large gob piles, exposed toxic clay, and strip pits north of the former Kopp Clay Plant. These sources contributed to the degradation of a 20-acre area in the Huff Run watershed. The treatment approach was to conduct surface reclamation, install steel slag beds to boost alkalinity, and install a sediment pond to allow metals to precipitate. The design was completed by ATC Associates for \$123,000. The treatment consisted of 4.0 acres of surface reclamation, 10 acres of gob pile reclamation, install 9,600 square foot steel slag leach bed and a 7 acre settling pond. The goal of the design was to boost alkalinity and reduce iron metals and acidity from entering Huff Run. Construction was complete December 2008 by Tuscon for a cost of \$660,284. The funding sources for this project were ODNR/DMRM for the design and USEPA Targeted Watershed Grant and ODNR-DMRM for construction. The Belden Gob Pile is an addition to the Belden Project and was reclaimed in just two weeks over the summer of 2010. The project footprint was less than one acre. Twelve oak trees were planted on the crown of the hill at the request of the landowner. Less than 100 feet of limestone channel convey water at the base of the hill. The total construction cost was just \$18,773 and was constructed by Red Malcuit. The design for this project

SITE: BLD01

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

was engineered by ODNR-DMRM at a cost of \$16,052. The project was funded solely by ODNR-DMRM. Pre-treatment acid and metal loadings at site BLD01 are shown in figure 1.

Intentional blank page

Huff Run Watershed - Mineral Zoar

*Generated by Non-Point Source Monitoring System
www.watersheddata.com*

Project Status: Completed November 2009 Project Number: TS-Sn-23

Pre-construction



Future Reserve Alkaline Producing System and Aerobic Wetland site, Photo by Maureen Wise

Post-construction



Mineral Zoar Overview and Aerobic Wetland Photo by Maureen Wise

Mineral Zoar is located in Sandy Township in Tuscarawas County. The Mineral Zoar project discharge, site MZR08, is located under the railroad bed at the Mineral Zoar Road final project exit point. Mineral Zoar is the largest tributary to Huff Run and runs through the Mineral City Park. The project consists of two deep mines that discharge acidic water. The design was completed by Baker Consulting and ODNR in-house for \$53,780. The treatment approach for this site is to

treat the two deep mines with a reverse alkaline producing system (RAPS) (1,400 sq. ft) while utilizing an existing wetland and 100 linear feet of open limestone channels. The goal of the design is to reduce 100% of the acidity on site. Construction was complete Fall 2009 by Beaver Consulting for a cost of \$373,268. Funding source for the project design and construction is ODNR-DMRM and OSM.

Intentional blank page

Huff Run Watershed - Thomas Project

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Completed 2010 Project Number: CR-RS-08

Pre-construction



Southern area with large beaver ponds
Photo by Maureen Wise

Post-construction

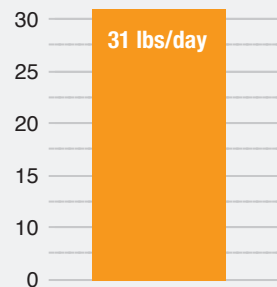


Site two settling pond
Photo by Paul Greco

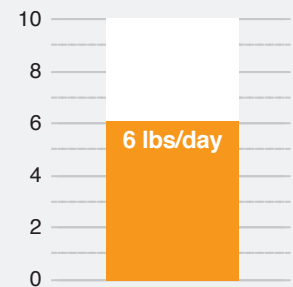
Thomas reclamation project is located in Section 33 of Rose Township in Carroll County and lies within the 12 digit HUC unit #050400010804. Thomas reclamation project discharge is site THM01. The Thomas site consists of approximately 20 acres of surface mine water impoundments and toxic mine spoil. The impoundments are recharging a shallow deep mine, allowing for metals such as iron to flow into Huff Run. The design was completed by ODNR-DMRM in-house for a cost of \$60,620. Plans for reclamation include surface mine and gob pile reclamation, limestone channels, and two settlings ponds. Construction was completed to be complete in 2010 by Red Malcuit Inc. for a cost of \$501,662. Funding source for the project design and construction is ODNR-DMRM, OEPA 319, and OSM. Thomas project contains two separate discharge points, LIN01 and THM01/THM06 both discharge/monitoring locations contain settling ponds. The site LIN01 shows acid and metal reductions, while site THM01/THM06 shows only minor metal reduction since the site was net alkaline and low metals prior to construction. Pre-treatment acid and metal loadings at site LIN01 & THM01/THM06 are shown in figure 1.

SITE: LIN01 & THM01/THM06

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Huff Run Watershed - Lyons II Maintenance Project

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Maintenance completed 9-26-11 Project Number: TS-SN-38

Pre-construction



Lyons II limestone berm in settling pond

Post-construction



Lyons II photo of steel slag bed

Lyons II is location in Sandy Township in Tuscarawas County and lies within the 12-digit HUC unit 050400010804. Lyons II discharges into Huff Run at river mile 1.90. Lyons phase I was originally completed in December of 2005. This site continued to be one of the largest sources of acid and iron load to Huff Run, therefore Lyons phase II was undertaken to attempt to improve the water chemistry of the final discharge site LYN01 (Figures 1 and 2). Phase II consisted of placement of additional slag material (460 tons), with pipe cleanouts and modification to the existing settling pond to include limestone berms. Design was completed in-house by ODNR-DMRM. Maintenance construction started 5-31-11 and was completed 9-26-11. Diamond Construction Company completed the maintenance construction, \$158,843. Figure 1 and 2 show the yearly acid and metal load reductions. Prior to the Lyons phase II project (year 2009- 2010) data shows acid reduction at 39% with no metals reduction. Year 2011-2012 data (post Lyons II construction) shows the initial results of the maintenance project with 71% acid reduction with minimal metals reduction. Funding source for the project design and construction is OSM and ODNR-DMRM.

Figure 1. Yearly acid load reductions

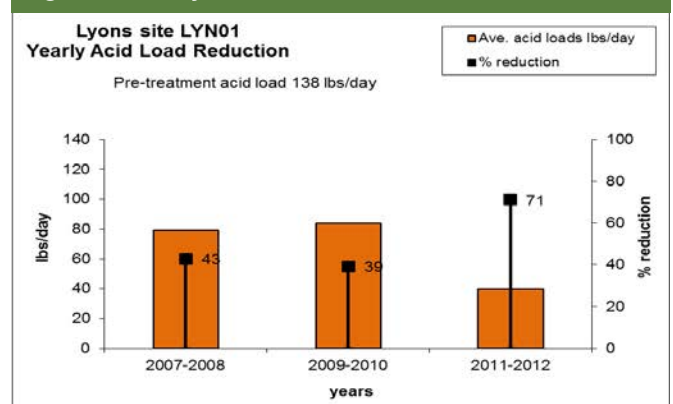
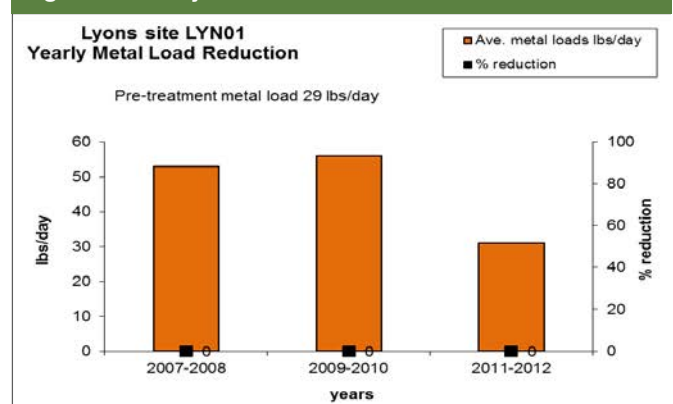


Figure 2. Yearly metal load reductions



Intentional blank page

Huff Run Watershed - Hilltop Energy Project

*Generated by Non-Point Source Monitoring System
www.watersheddata.com*

Project Status: Complete 6/25/2013 Project Number: TS-Sn-37

Pre-construction



*Hilltop Energy pre-construction
Photo by Huff Run Watershed Group*

Post-construction



*Hilltop Energy post-construction
Photo by Huff Run Watershed Group*

Hilltop Energy Project is located in Sandy Township of Tuscarawas County, Ohio and lies within the 12 digit HUC unit # 050400010804. The site access is located approximately 2.3 miles east of State Route 800 on the south side of Lindentree Road and can be accessed through the existing Hilltop Energy access drive. The intent of this project is to reduce the amount of acid mine drainage and metals laden sediment that is currently discharging into and impairing Huff Run from a 10 acre gob pile. The project consists of re-grading and capping approximately 10 acres of exposed gob, coal refuse and acidic clay, draining an existing acidic impoundment, constructing an open limestone channel (450 LF), constructing a storm water sediment pond, and installing 170 LF of perforated underdrain. The design was completed in-house at DMRM (\$76,575). Construction was completed by Red Malcuit for \$245,385. The funding sources for this project were ODNR-DMRM, OSM, and OEPA. Pre-treatment acid and metal loadings at site HRT21 are shown in Figure 1. Site HR37 is the project discharge used to evaluate post construction data for this project.

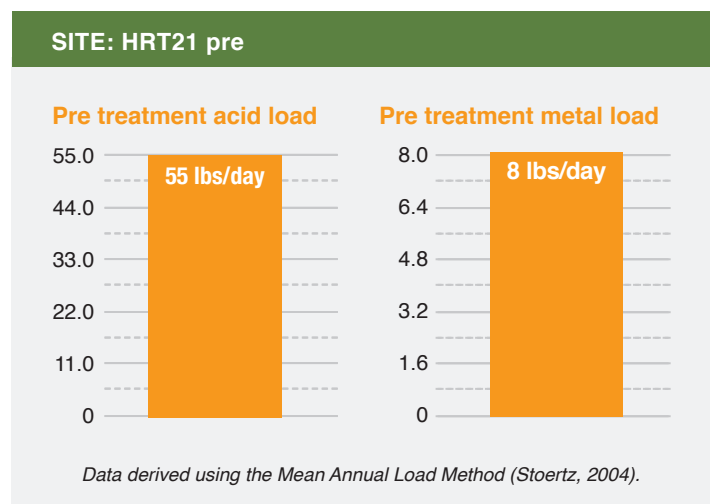


Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Huff Run Watershed - JS & L AMD Reclamation Project

*Generated by Non-Point Source Monitoring System
www.watersheddata.com*

Project Status: Complete 10/16/2015 Project Number: TS-Sn-45

Pre-construction



*Acid mine drainage emanating from abandoned coal mine
Photo by Huff Run*

Post-construction



*Sludge precipitation basin downstream of limestone leach bed
Photo by Frank Martin*

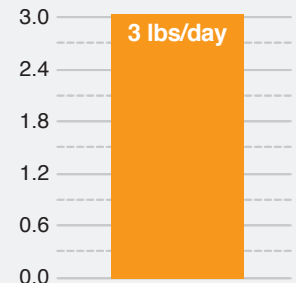
JS&L AMD reclamation project is located in Section 4 of Sandy Township in Tuscarawas County and lies within the 12 digit HUC unit #050400010804. JS&L AMD reclamation project is needed to address abandoned coal mining drainage and the resulting acid mine drainage (AMD) that has negatively impacted Huff Run. The treatment approach for this project is to capture and passively treat acid mine drainage. A 12,000 sq ft precipitation basin was constructed and 568 linear feet of limestone channels. The area located directly adjacent (south) of the existing acid mine drainage problem area, was graded (5.25 acres) to capture acid mine drainage and convey it through an engineered, passive limestone leach bed (8,000 sq ft) treatment system, before discharging into an unnamed tributary of Huff Run. The overall goal is to achieve 70% reduction of iron load and 100% reduction of the acid load. Design completed in-house at DMRM (\$56,769). Construction was completed by Red Malcuit, Inc. for \$234,321. The funding source for this project was ODNR/DMRM and OEPA. Pre-treatment acid and metal loadings at Site HR25 are shown in Figure 1.

SITE: HR25

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

LEADING CREEK WATERSHED INDIVIDUAL PROJECTS

AMD project reports

'AMD project reports' contains information about each individual acid mine drainage (AMD) project completed in chronological order per watershed. Each report displays photos of the project site pre and post construction, a description of the project and reasons for the reclamation, water quality data at the site prior to reclamation (acid/metal loading prior to construction). Water quality post reclamation is reported in the 'Yearly Water Quality Report' per watershed by stream reach.

Leading Creek Watershed comprehensive acid mine drainage projects report:

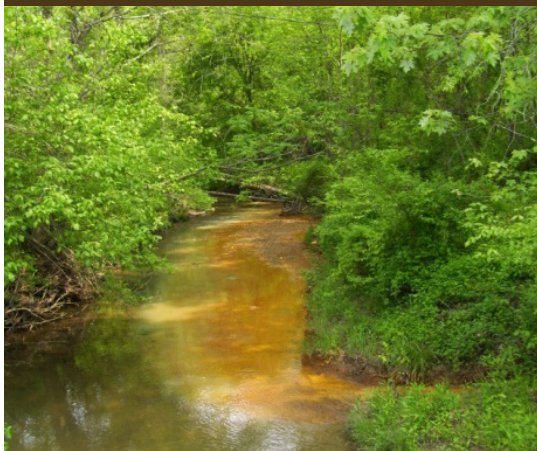
2012	Thomas Fork Doser	133
2015	Casto Doser	135

Leading Creek Watershed - Thomas Fork Doser

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project status: Completed 1/12/2012 ODNR project number: MG-Sb-83

Pre-construction



Confluence of the 'Unnamed Tributary' and Thomas Fork
Photo by Meigs SWCD Leading Creek Watershed

Post-construction

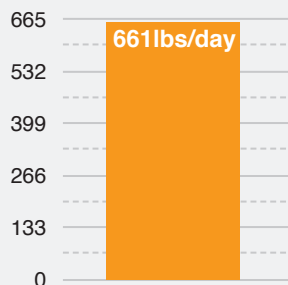


Thomas Fork doser
Photo by Meigs SWCD Leading Creek Watershed

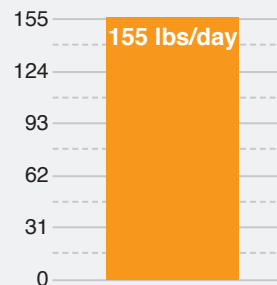
Thomas Fork Doser Project located in Fractional Section 24 of Meigs County and lies within the 12-digit HUC unit #050302020705. The project site, 0.25 acres, is located in the Thomas Fork Subwatershed of the Leading Creek Watershed. The majority of AMD in the Thomas Fork Subwatershed originates from seven surface mine drains as well as from: sub-surface mine drains, two buried / clogged drains, and two seeps draining into Thomas Fork's 15th tributary, 'The Unnamed Tributary'. The primary purpose for remediation of this tributary is the detrimental effects its level of acidity and heavy metals has on Thomas Fork's aquatic life. Project goals include restoration of aquatic communities in Thomas Fork, but do not include improvements to the 'Unnamed Tributary'. Restoration consists of constructing an active treatment calcium oxide doser to treat all the acidity produced in 'The Unnamed Tributary' by determining required lime material based on water quality monitored at the mouth (TF1502). The design was completed by ODNR staff. Construction was completed 1/12/2012 by D.V. Weber Construction, Inc. for \$407,236. Funding sources for the construction of this project are ODNR-DMRM and the US Fish and Wildlife Service. Pre-treatment acid and metal loadings at site TF1502 are shown in figure1.

SITE: TF1502

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

Leading Creek Watershed - Casto Doser Project

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project status: Completed 9/17/2015 ODNR project number: MG-Sb-81

Pre-construction



Casto Doser site location
Photo by Jim Freeman

Post-construction

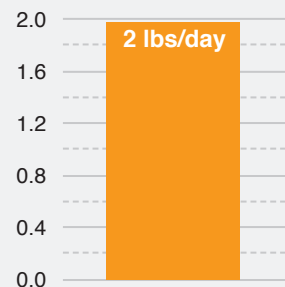


Casto Doser
Photo by Jim Freeman

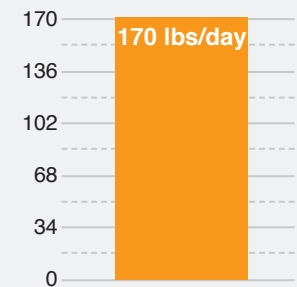
Casto Doser project is located in Section 26 of Salisbury Township in Meigs County and lies within the 12 digit HUC unit #050302020705. Casto Doser is needed to convey lime into the acidic waters of Thomas Fork. The treatment approach for this doser is to supplement the Thomas Fork doser, located upstream, adding alkalinity during periods of low flow during late summer. Thomas Fork is mostly net-alkaline when the discharge is at base flow or higher. However, during low flow Thomas Fork is net acidic; on average 288 lbs/day of acidity during low flow periods. The overall goal is to attain warm-water habitat conditions in Thomas Fork downstream at site TF0050. Design completed in-house at DMRM (\$27,931). Construction was completed by Allan Johnson and Dirtworks for \$285,113. The funding source for this project was ODNR/DMRM. Pre-treatment acid and metal loadings at Site TF0030 are shown in Figure 1.

SITE: TF0030

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Intentional blank page

OTHER WATERSHED INDIVIDUAL PROJECTS

Mud Run Watershed - Holmes AMD Wetland

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Completed 8/31/2016 ODNR Project Number: TS-Wr-36

Pre-construction



Wetland site of final limestone berm
Photo by Michael Gosnell

Post-construction

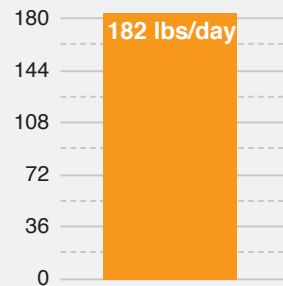


Final limestone berm in wetland
Photo by Michael Gosnell

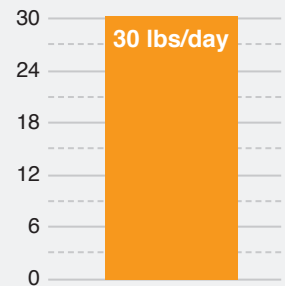
Holmes AMD Wetland is located in Wainwright Township in Tuscarawas County and lies within the 12 digit HUC unit #050400011802. Holmes AMD Wetland site pre-construction contributes acidity and high amounts of iron from the abandoned coal mine site that drains to Mud Run, a tributary of the Tuscarawas River. On average this site SC020 contributed 182 lbs/day acidity, 30 lbs/day of Al and Fe pre-construction. The treatment strategy of the Holmes AMD Wetland Project, is to add alkalinity through a passive limestone leach bed. The goal of this project is to reduce iron levels in Silver Creek. Prior to construction the acidic discharge from the site had a pH range of 3.2 to 3.5, acidity approximately 88 mg/l, and iron concentration of 95 mg/l. The design was completed in-house at DMRM. Construction was completed by King Environmental, Inc. for \$260,658. Initial maintenance was needed on the site in July 2017 to fix the seal around berm #2, King Environmental Group completed this additional work for \$24,105. The funding sources for this project were DMRM state AML funds and WCAP. Pre-treatment acid and metal loadings at Site SC020 are shown in Figure 1, post construction site data is measured from both SC020 and SCLLB, however site SCLLB has a very limited discharge and was not factored into the load reduction calculations.

SITE: SC020

Pre treatment acid load



Pre treatment metal load



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment

Yellow Creek Watershed - Jense AMD Phase II

Generated by Non-Point Source Monitoring System
www.watersheddata.com

Project Status: Completed 11/14/2017 ODNR Project Number: JF-Sp-16

Pre-construction



Wolf Run acid mine drainage
Photo by Todd Gleydura

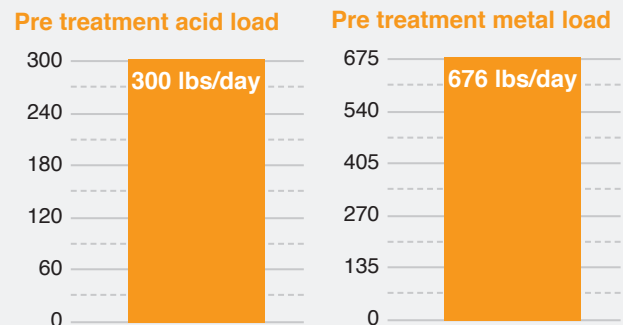
Post-construction



Wolf Run bioreactors treatment site
Photo by Todd Gleydura

Jensie AMD Phase II project is located in Section 6 of Springfield Township in Jefferson County and lies within the 12 digit HUC unit #050301010701. The Jensie AMD Phase II site contributes acidity and metals from the abandoned coal mine wash plant that drain directly to Wolf Run, a tributary of the Yellow Creek Watershed. On average this contribution is 676 lbs/day acidity, 300 lbs/day of Al and Fe. The treatment strategy of the Jensie AMD Phase II Project, is to install a buried vinyl sheet pile collection system that directs subsurface drainage to two passive anaerobic bioreactors (0.15 acres). The treated water settles in a wetland (0.42 acres) to release remaining metals and sediment before discharged to Wolf Run. A one acre gob pile was reclaimed and 800 linear feet of open limestone channels were installed on site. The goal of this project is to utilize the constructed passive treatment systems to eliminate 50% of the AMD discharging from the project site. Reducing aluminum, iron, acidity, and sulfate loads while increasing pH and alkalinity to improve the water quality of Wolf Run for 4 miles downstream. Prior to construction the acidic discharge from the site had a pH range of 3.0 to 4.6, acidity approximately 700 mg/l, and iron concentration of 150 mg/l. The design was completed in-house at DMRM. Construction was completed by Dirt Works Express for \$577,422. The funding sources for this project were DMRM state set-aside, ODOT, and Jefferson Soil and Watershed Conservation District. Pre-treatment acid and metal loadings at Site WRMS027 are shown in Figure 1.

SITE: WRMS027



Data derived using the Mean Annual Load Method (Stoertz, 2004).

Figure 1. Estimated acid and metal loadings prior to treatment.