

**SUNDAY CREEK  
WATERSHED REPORT**

# 2017–2018 NPS Report - Sunday Creek Watershed

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## Reductions

**Total acid load reduction 2016\***  
= 22 lbs/day

**Total metal load reduction 2016\***  
= 31 lbs/day

*Data derived using the Stoertz Water Quality Evaluation Method (Kruse et al. 2014)*

Acid and metal load reductions based on projects monitored during 2016 listed here: West Branch Headwaters Phase I & II, and Drakes Wetland.

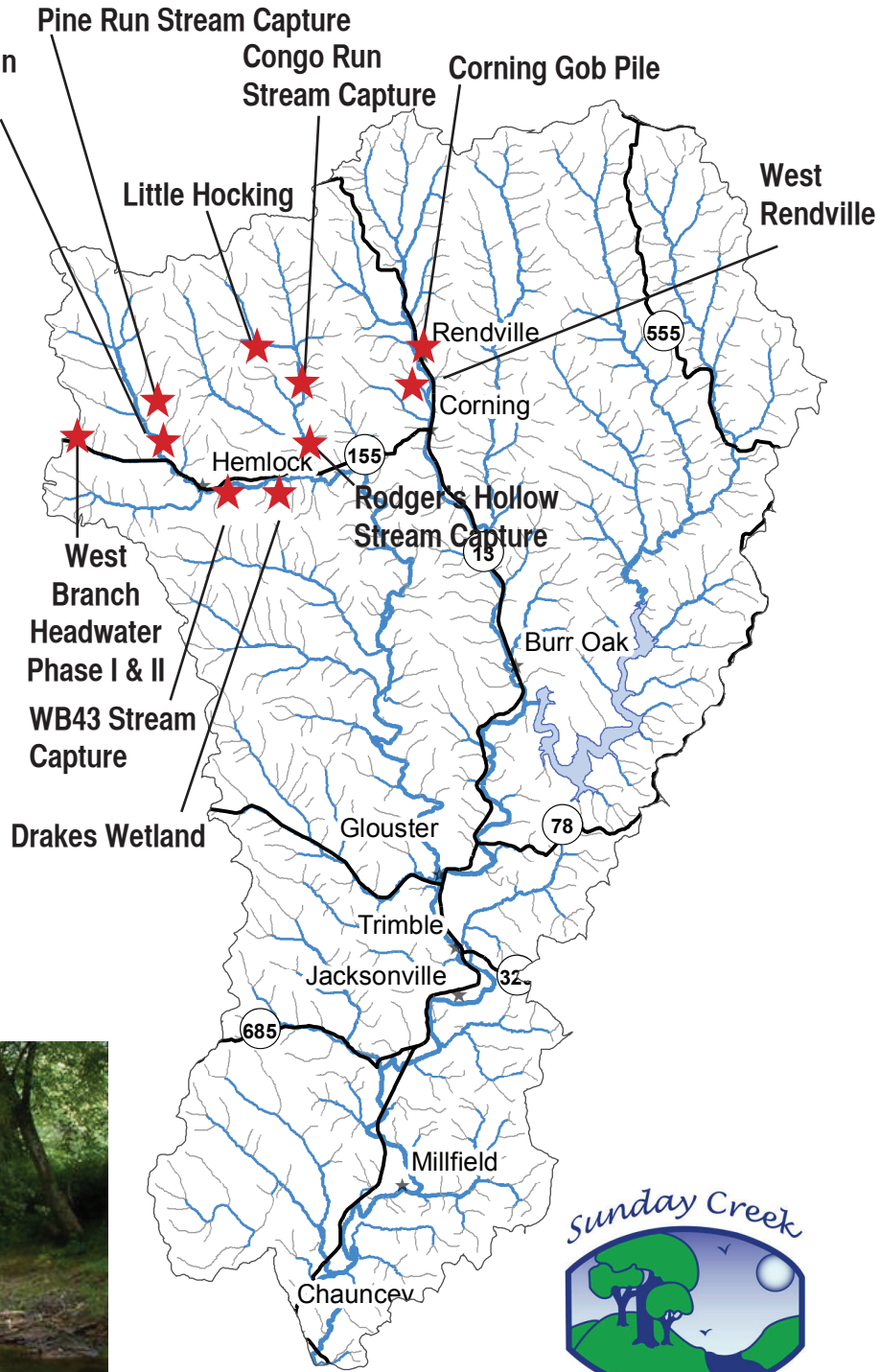
*\* Insufficient data to calculate acid and metal loads for 2017-2018 reporting period.*

## Costs

**Design = \$491,759**  
(excluding Congo Run CR-15,  
Drakes Wetland & Pine Run Stream  
Capture maintenance)

**Construction = \$2,191,186**

**Total costs through 2018 = \$2,718,273**



**Sunday Creek**



Six stream captures located in the Sunday Creek Watershed were closed and completed from 2004-2011. A total of 2,401 acres surface drainage area drained year round into the deep mines and, as a result of closing these subsidence holes, 884,021,000 gallons per year were diverted from entering into the deep mine, thus abating the generation of acid mine drainage. Expected additional alkaline loading from these closures returning clean water to the receiving streams is 986 lbs/day. As result of the Rodgers Hollow Subsidence closure, the deep mine discharge in Drakes has seen a reduction in acidity load by 18 lbs/day.

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## Timeline of the Sunday Creek Watershed Project Milestones and AMD Projects

**1999**

- Sunday Creek Watershed Group (SCWG) Founded

**2000**

**2001**

- Rural Action adds VISTA volunteer to SCWG staff

**2002**

- SCWG Hired First Watershed Coordinator, funded for six years

**2003**

- Sunday Creek Watershed AMDAT Completed
- SCWG Watershed Action Plan Conditionally Endorsed by the State of Ohio

**2004**

- Congo Subsidence/ Stream Capture Project Completed

**2005**

- Sunday Creek Watershed TMDL Study Completed

**2006**

- SCWG Coordinator funded three more years

**2007**

- Pine Run Stream Capture Project Completed
- Rodger's Hollow Stream Capture Project Completed
- Corning Gob Pile Reclamation Project Completed

**2008**

**2009**

- Congo Run (CR-11/ Little Hocking) Stream Capture Project Completed
- SCWG Coordinator funded for three more years
- Rural Action adds AmeriCorps member to SCWG staff

**2010**

- West Branch Headwaters Phase I Project Completed
- West Branch 43 Stream Capture Project Completed

**2011**

- SCWG Watershed Action Plan Officially Endorsed by the State of Ohio
- West Branch Headwaters Phase II Project Completed
- West Rendville Stream Capture Project Completed

**2012**

**2013**

- Pine Run Doser installed

**2014**

- Drakes Wetland project in the West Branch of Sunday Creek completed



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## Sunday Creek Projects

### Acid mine drainage reclamation projects completed in Sunday Creek Watershed:

- 2004** *Congo Stream Capture (CR-15) – Fill subsidence feature*
- 2007** *Pine Run Stream Capture (PR-20 and PR-21) – Fill subsidence feature and restore positive drainage in stream*  
*Corning Gob Floodplain (CG 02) – Remove gob from floodplain, gob pile reclamation on hillslope*  
*Rodger’s Hollow Stream Capture (RH 001) – Close multiple subsidence features and install natural channel*
- 2009** *Little Hocking Stream Capture (CR 11) – Close subsidence feature and reconnect stream channel*
- 2010** *West Branch 43 Stream Capture (WB 43) – Close subsidence feature and create positive drainage*  
*Pine Run Stream Capture Maintenance – installed 4 limestone berms in channel*  
West Branch Sunday Creek Headwaters Phase I & II (WBHW 03) – Limestone channels, closed 4 subsidence features, reclaimed gob pile, surface reclamation, limestone leach bed, and passive wetland
- 2011** *West Rendville Stream Capture – Close 2 subsidence features and create positive drainage*
- 2013** Pine Run Doser (PR 001) – Active calcium oxide doser
- 2014** Drakes Wetland Enhancement (WB 36) – Wetland enhancement, metals removal

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

Most of the remediation in Sunday Creek consists of source control (i.e. stream capture, gob pile capping, etc....) and aren't actively monitored for acid and metal load reductions. Therefore target restoration sites along West Branch of Sunday Creek mainstem have been selected to analyze the acid and metal loading reduction as well as loading through time, these sites include:

WBHW 03, WB 51, and WB 002. Yearly loads and load reductions for these mainstem sites are shown on the next few pages.

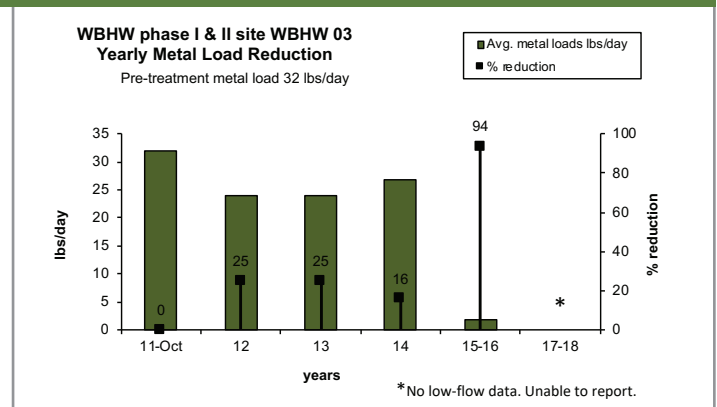
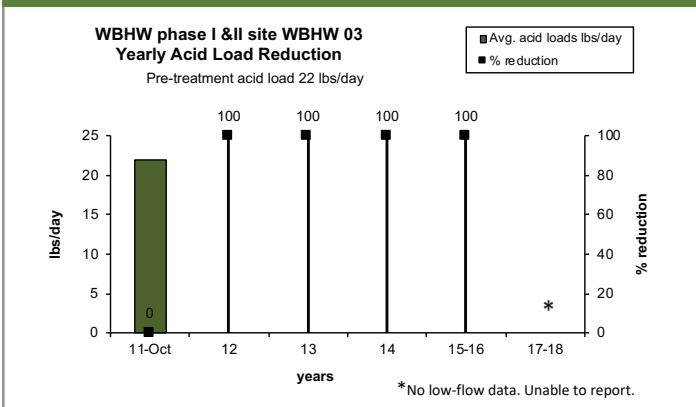
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## Yearly acid and metal load reduction trends per project

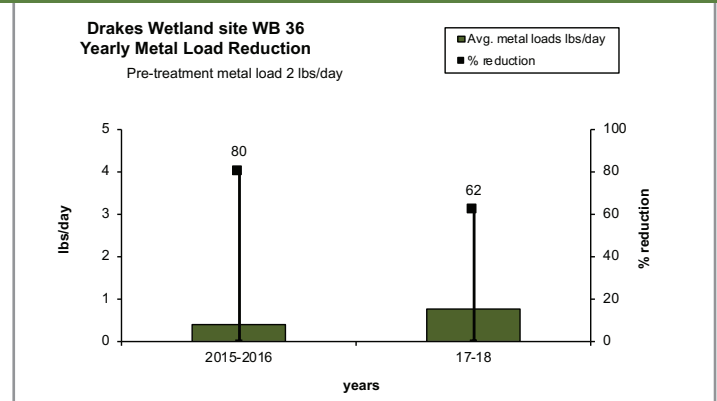
Similar to other environmental best management practices (BMPs), performance of passive acid mine drainage reclamation projects are also expected to decline with time. Active treatment systems are not expected to decline with time but sometimes need to be maintained to perform adequately. Currently,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

### WBHW phase I & II site WBHW 03



### Drakes site WB 36

**Drakes Wetland site WB 36 is net alkaline pre-treatment, Wetland was enhanced to maintain the longevity of the wetland.**

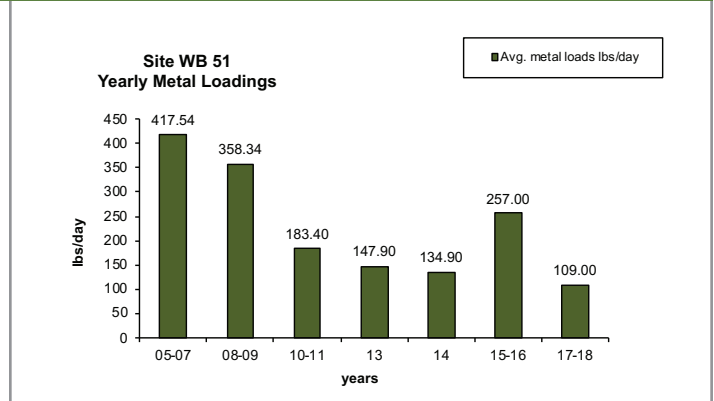
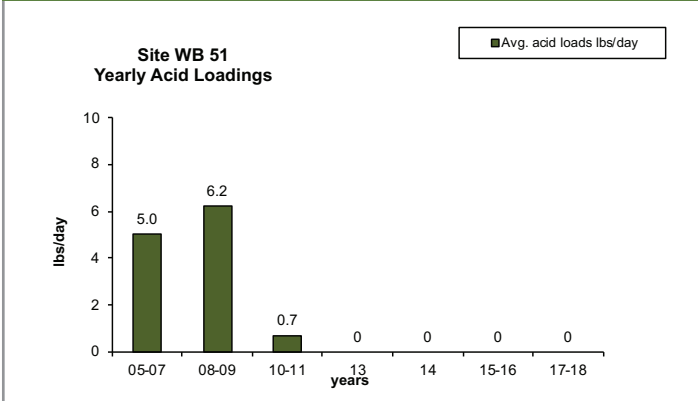


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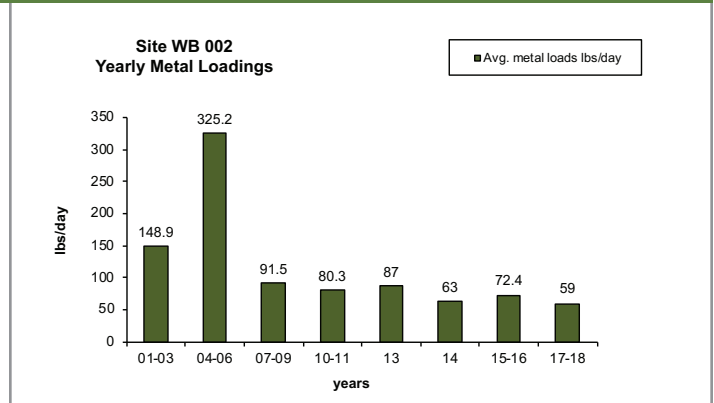
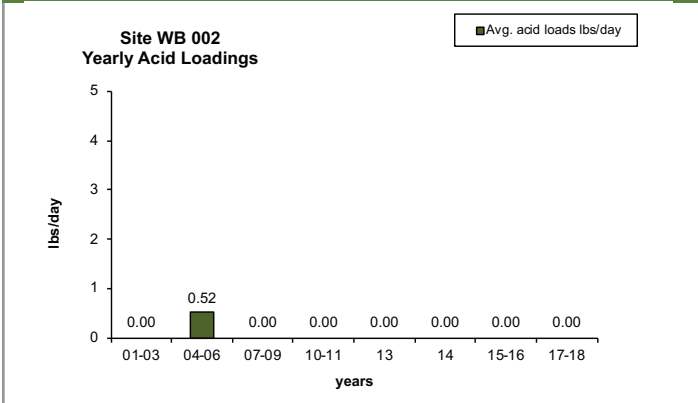
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## Yearly acid and metal load reduction trends per project

### Site WB 51



### Site WB 002



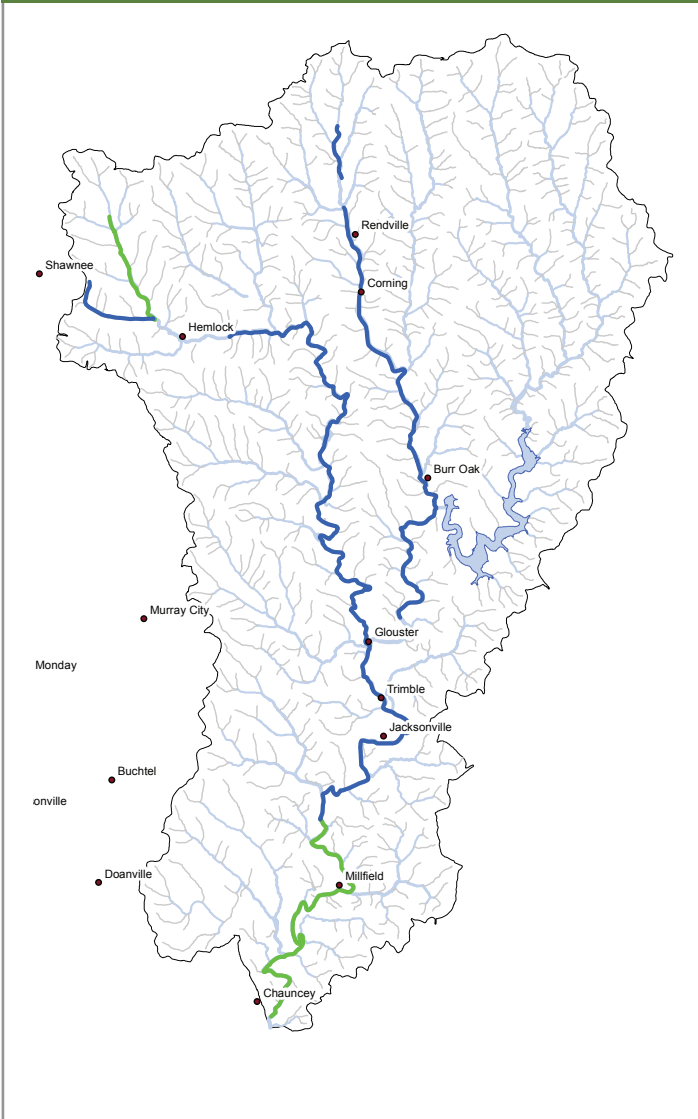
Sites WB 51 and WB 002 are reported in loads only because pre-construction loadings are not available for reduction calculation.

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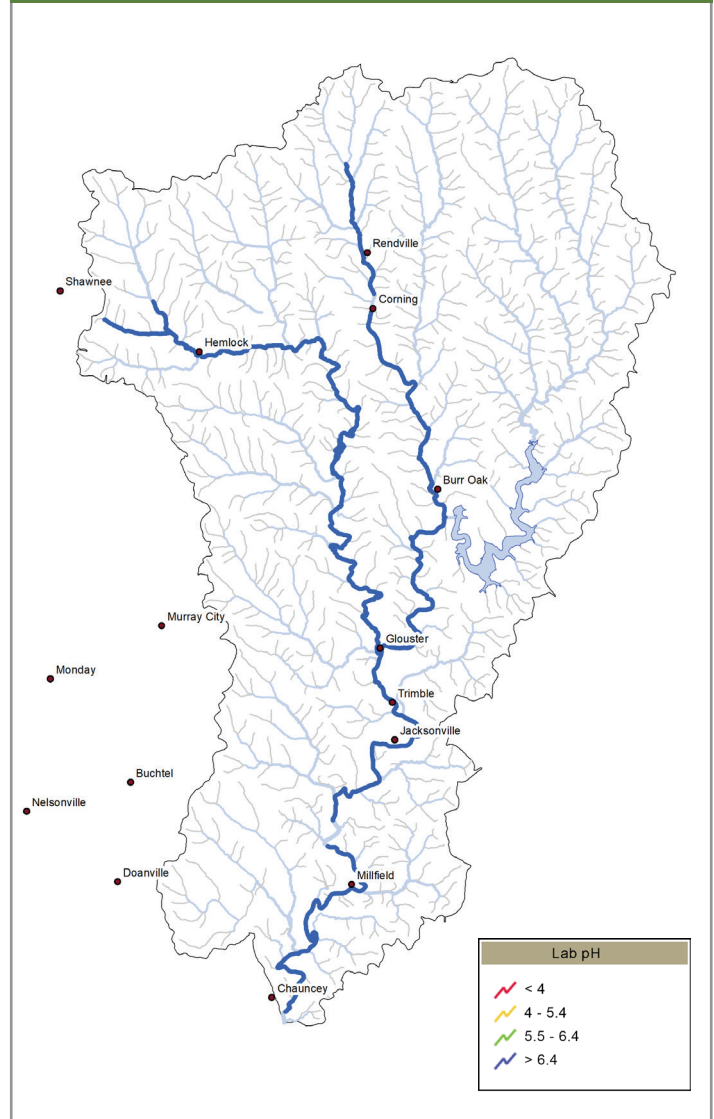
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## Chemical Water Quality

Sunday Creek baseline pH



Sunday Creek 2017-2018 pH



Water quality along the West Branch of Sunday Creek was degraded from baseline conditions in 2001 to 2007. Values of average pH dropped from  $>6.4$  to 4.0-5.4 range in 2005 to 2006 and remained constant in 2007. When the subsidence features increased in Rodger's Hollow, funneling more water into the mine that generated AMD and discharged it into West Branch of Sunday Creek, the water quality decreased. However, after the subsidence closure in Rodger's Hollow in late 2007, in 2008 data for the first time shows an increase in pH along this stream segment. As of 2018 all sites met the pH target of 6.5 except for a small less than half mile section of a stream directly downstream of the Corning discharge of the 43 miles monitored.

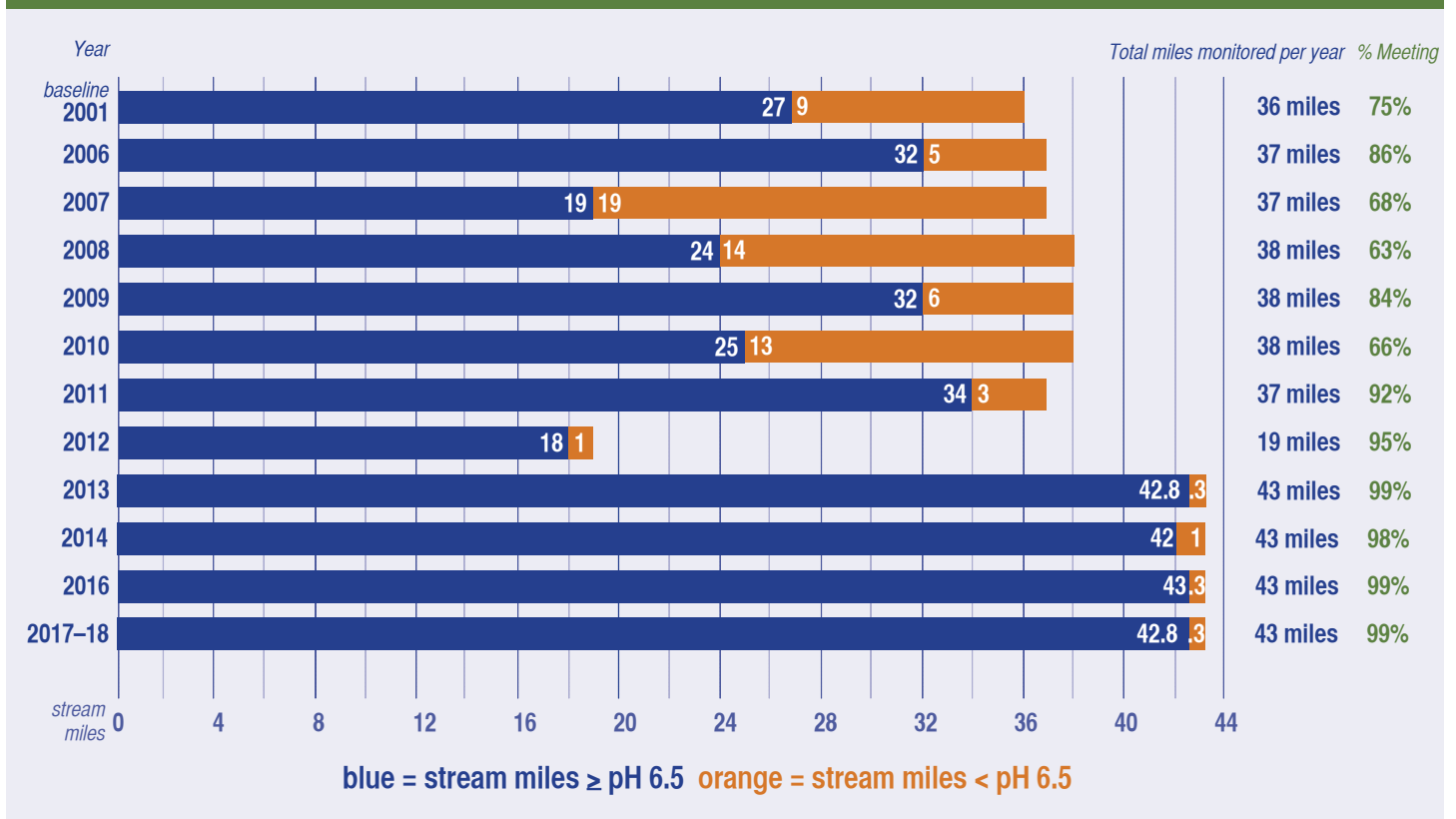
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## Chemical Water Quality

There are approximately 43 miles monitored for three years along the mainstem of Sunday Creek and major tributary West Branch, up from 38 stream miles monitored in 2010 and early. A restoration target for pH has been set to 6.5. Since 2001 there have been fluctuations in the number of stream miles that meet this target. In 2017-2018, all stream miles monitored met the target pH, except for .3 miles directly downstream of the Corning discharge, which was not sampled during the report period.

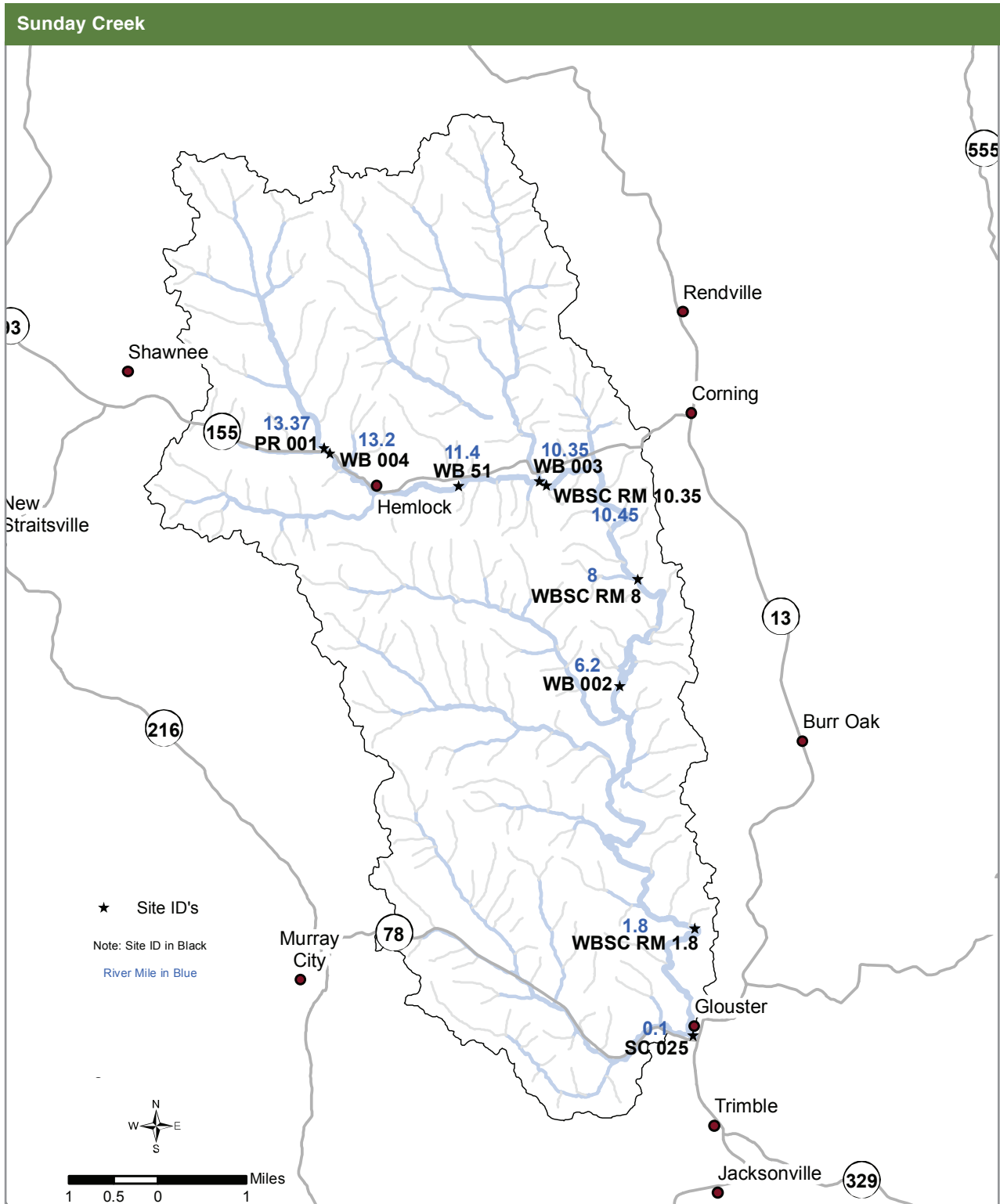
### Sunday Creek pH





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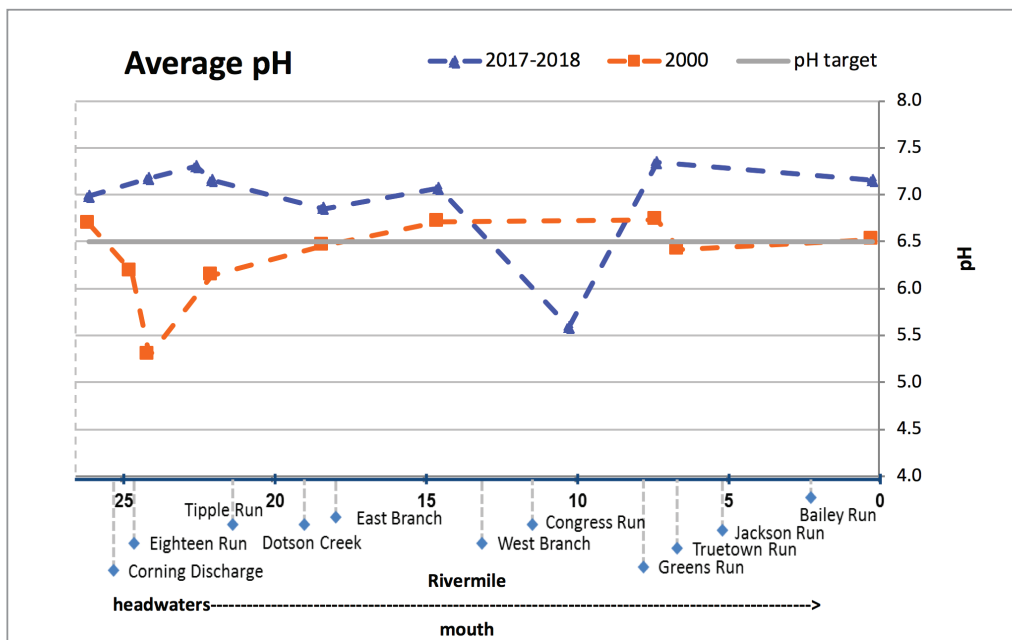
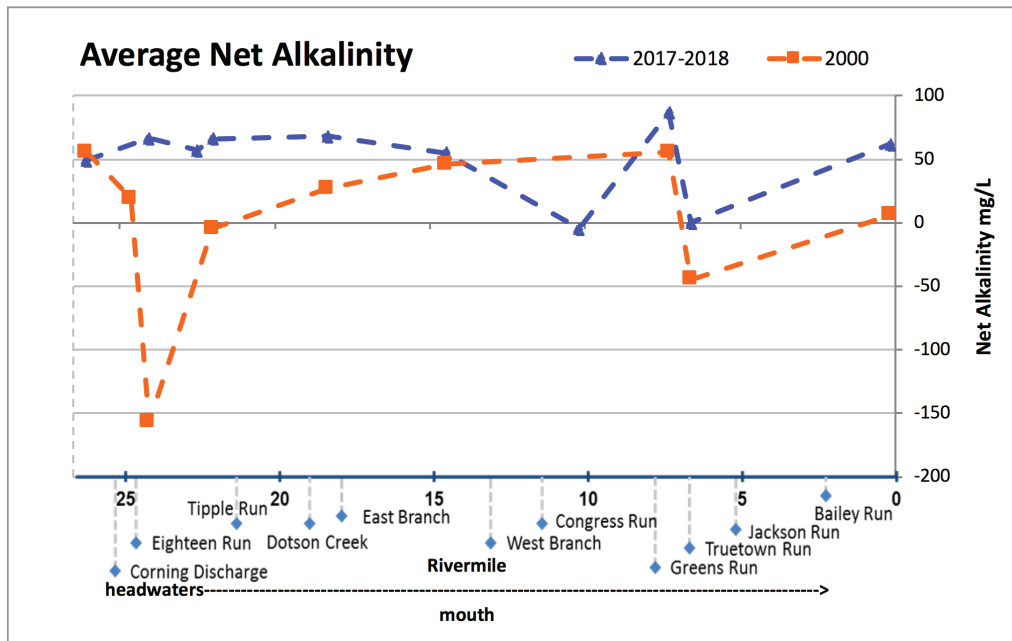


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For purposes of analyzing chemical water quality changes along the mainstem of receiving stream where AMD reclamation projects have been completed, Sunday Creek has been divided into the following stream segments: Sunday Creek Mainstem and West Branch of Sunday Creek. Within these stream reaches, chemical long-term monitoring data is utilized to generate line graphs along the stream gradient from headwaters to the mouth. Along the x-axis named tributaries are shown to illustrate sources of water entering the mainstem. A list of long-term monitoring sites utilized to generate the graphs with their river miles are shown before each set of stream reach graphs.

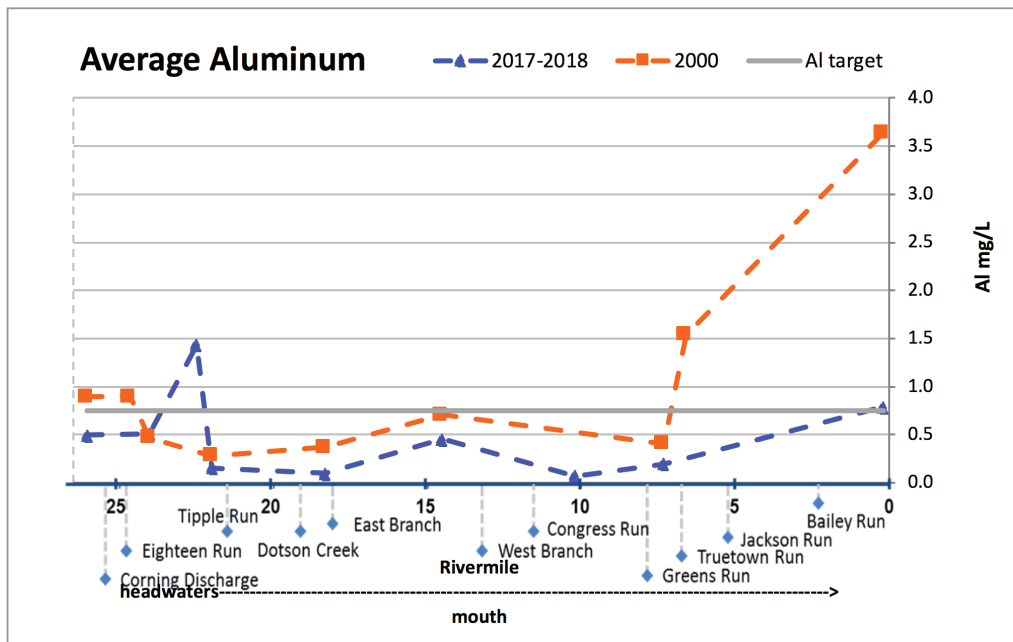
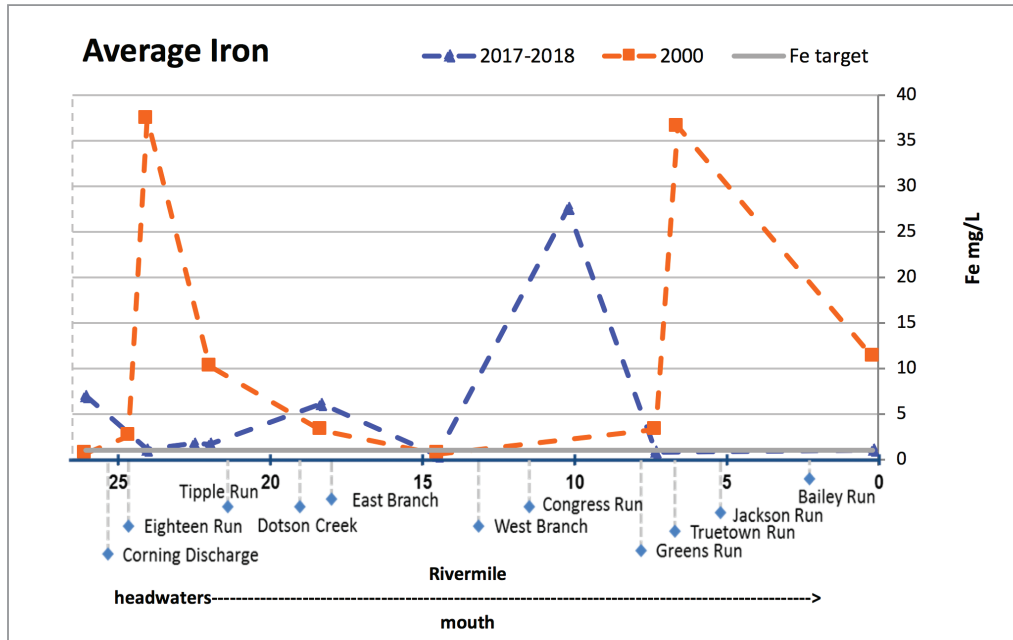
Sunday Creek Mainstem											
Site ID	SC 077	SC 079	SC 078	SC 080	SC 076	SC 075	SC 074	SCRM 10.2	SC 073	SC 072	SC 071
Rivermile	26.05	23.87	23.65	23.5	22.04	18.3	14.5	10.2	7.3	6.6	0.2



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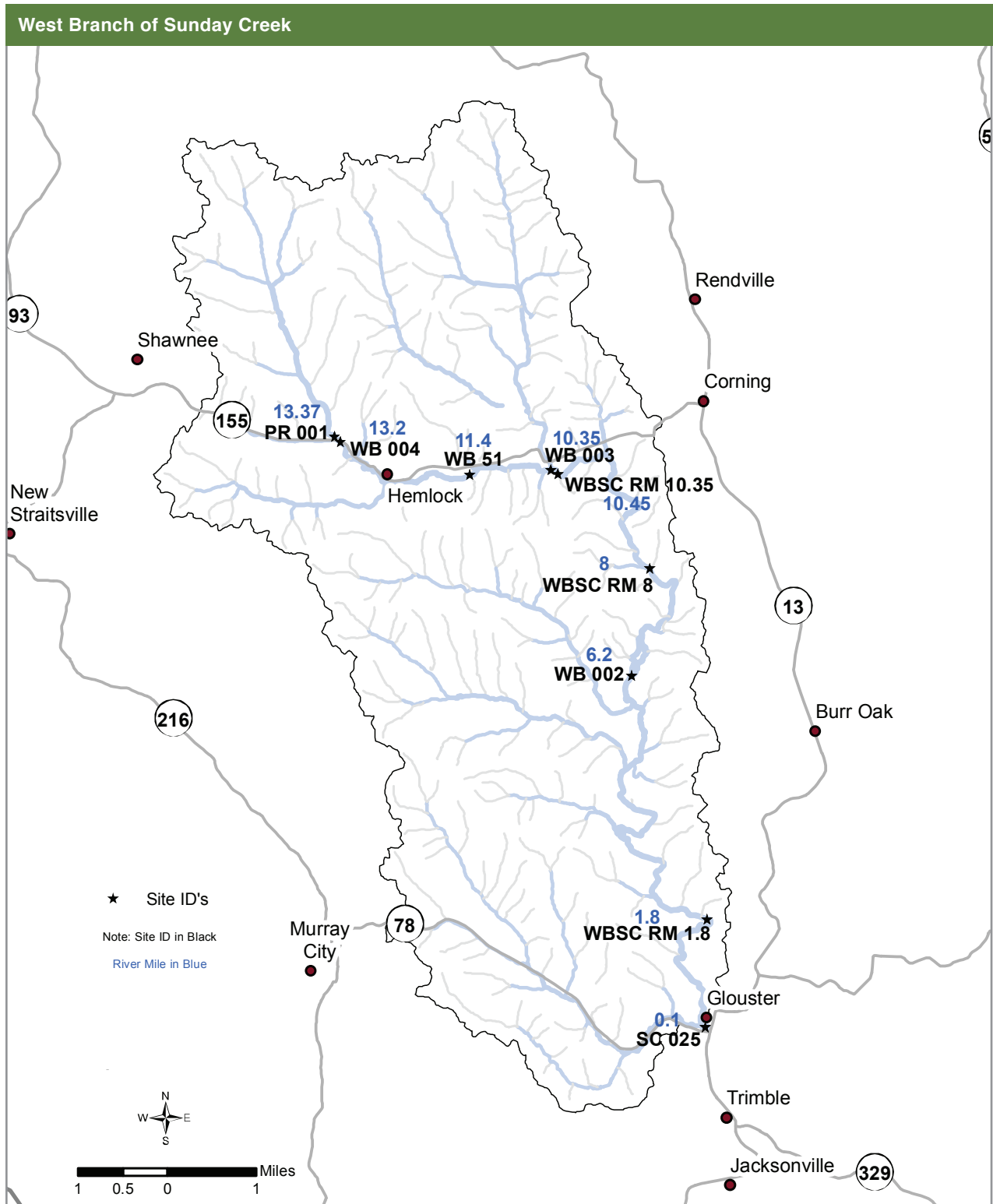
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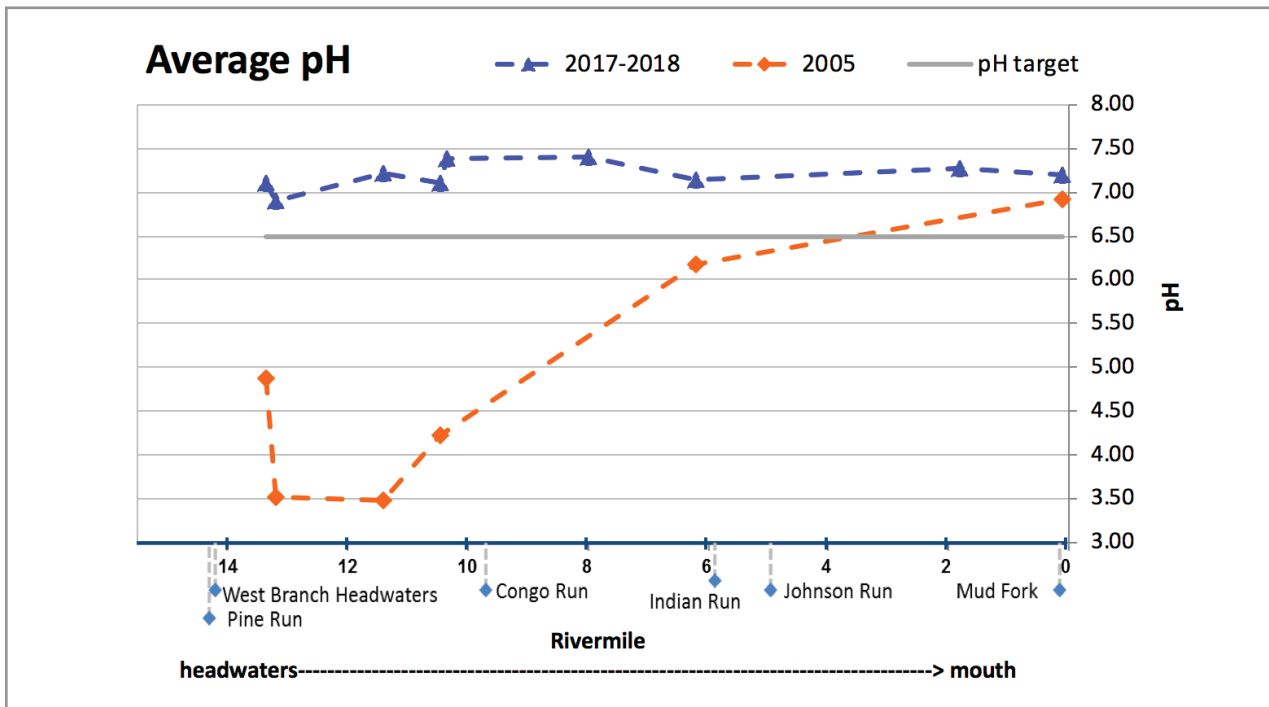
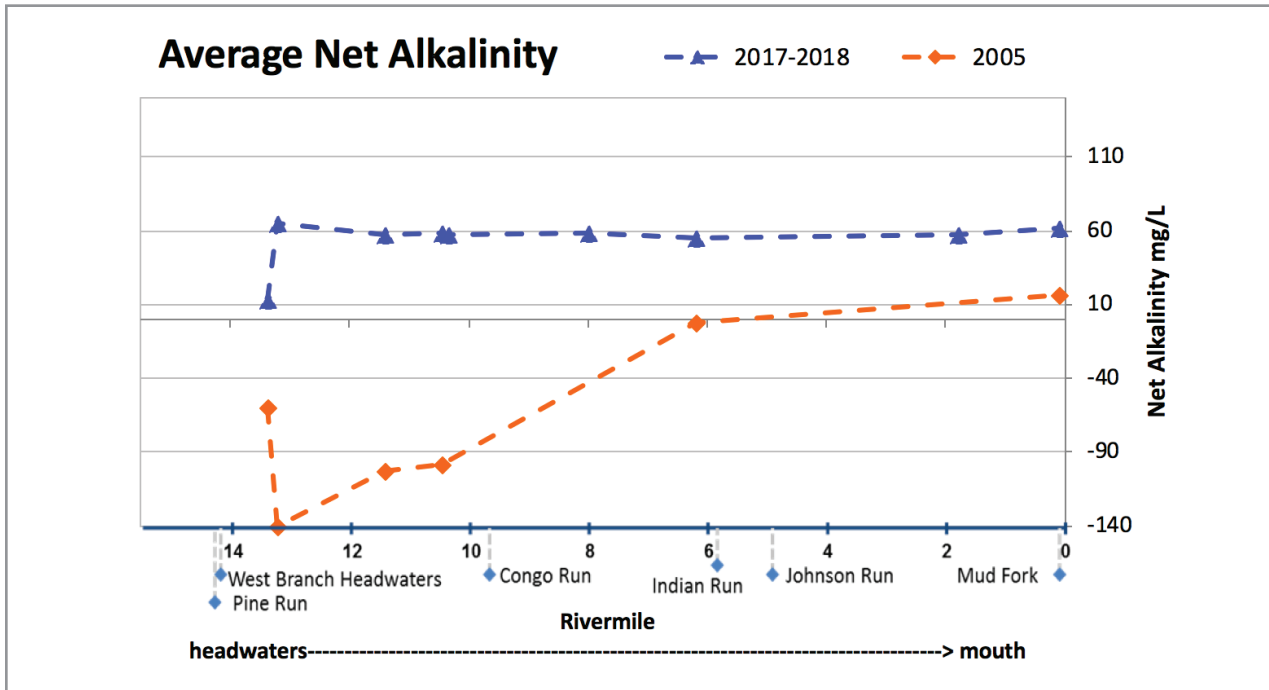


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## Chemical water quality analysis per stream reach

West Branch of Sunday Creek									
Site ID	PR 001	WB 004	WB 51	WB 003	WBSC RM 10.35	WBSC RM 8	WB 002	WBSC RM 1.8	SC 025
Rivermile	13.37	13.2	11.4	10.45	10.35	8	6.2	1.8	0.1

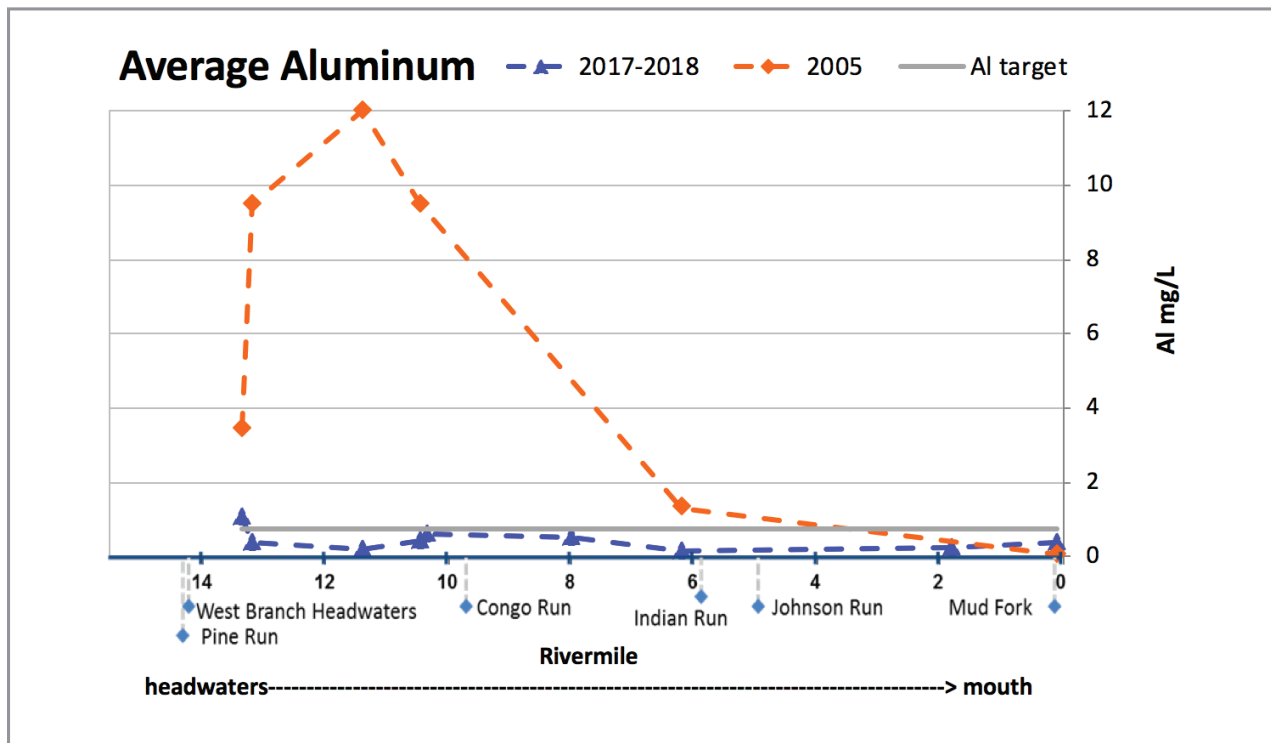
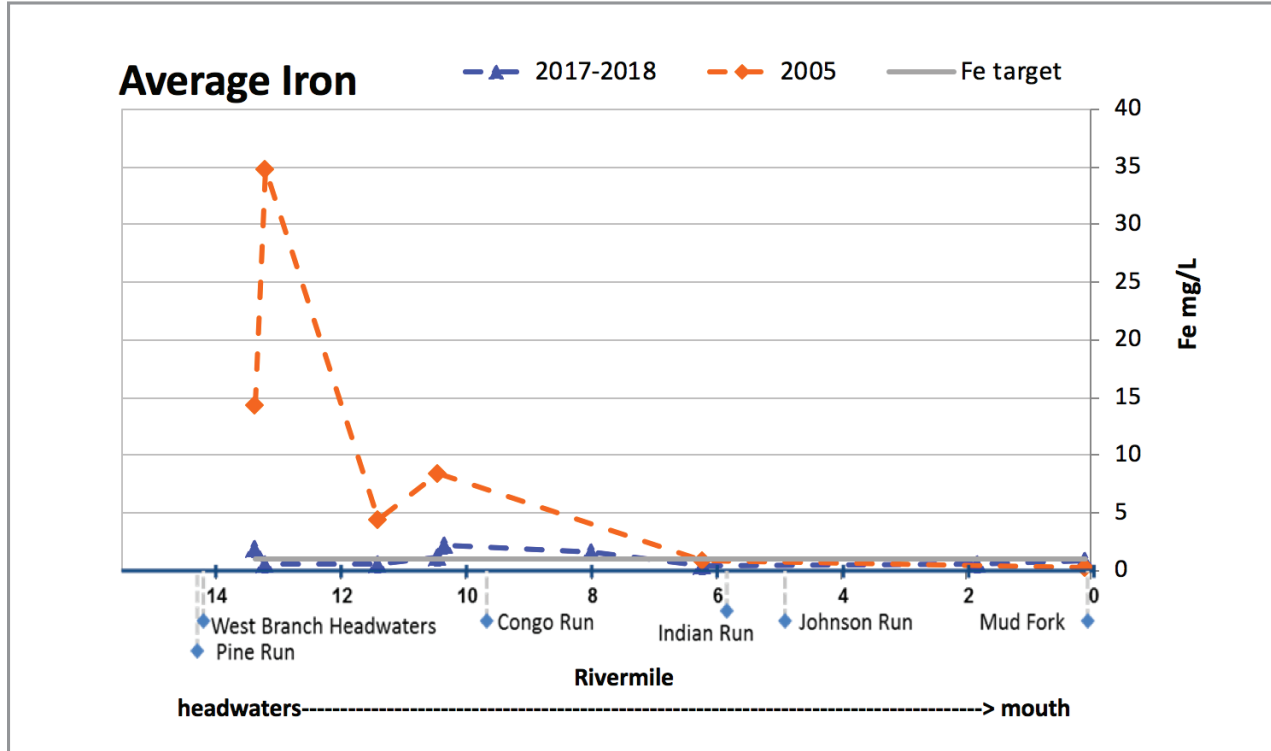


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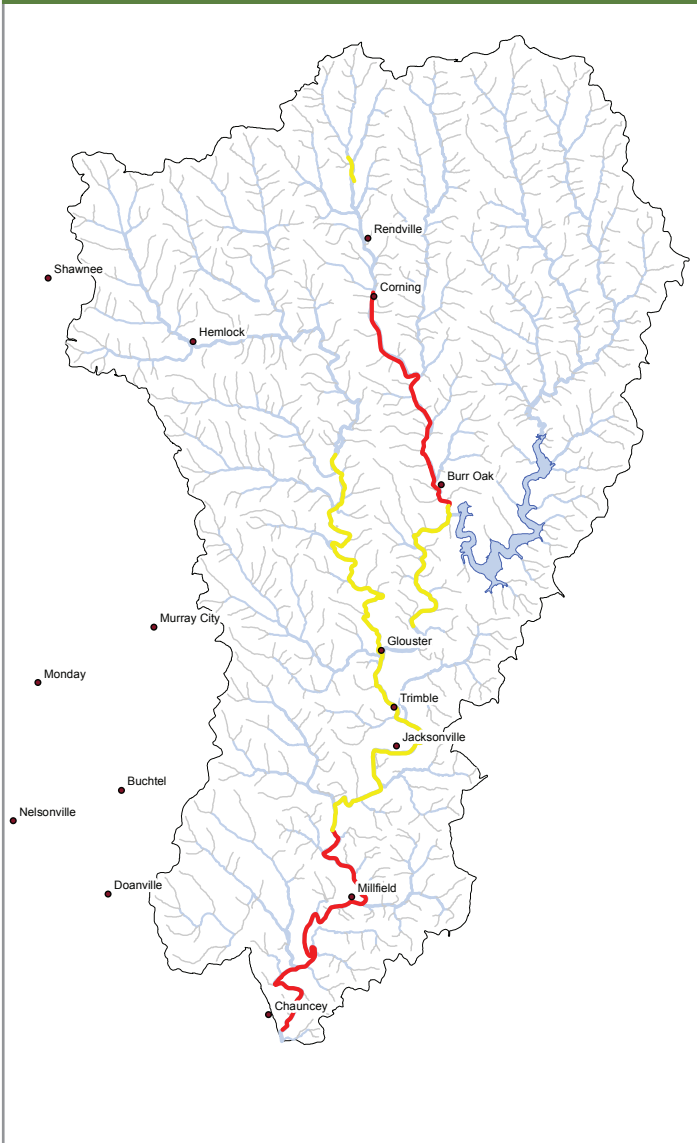


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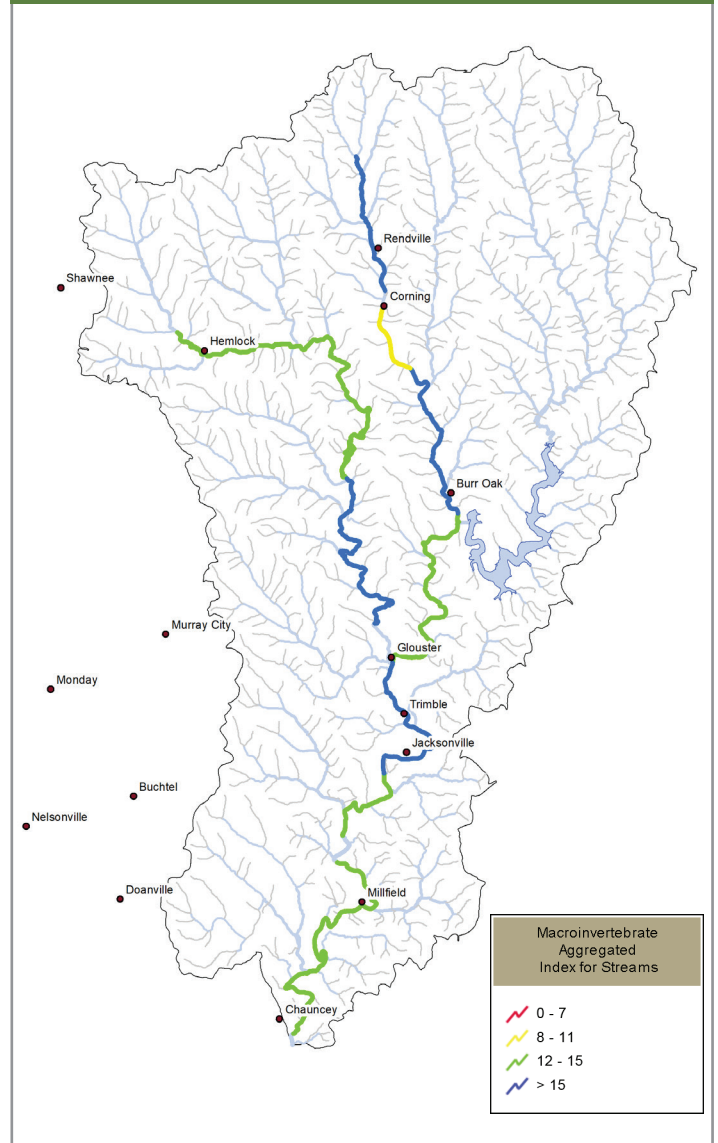
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## Biological Water Quality

Sunday Creek baseline MAIS



Sunday Creek 2017–2018 MAIS



MAIS samples were collected throughout Sunday Creek at established annual monitoring stations from 2001 through 2018.

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## Biological Water Quality

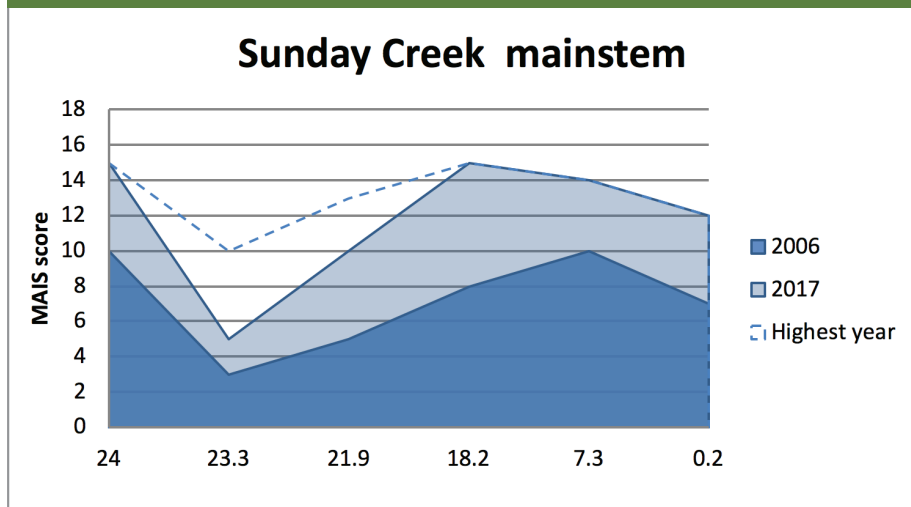
### Sunday Creek

The mainstem sites of Sunday Creek have improved since 2006, although the five mile section from RM 23.3 downstream of the Corning discharge (across from the entrance to Tom Jenkins Dam) continues to be poor quality. Although some sites in this section occasionally support high MAIS scores, in most years the section is not reaching its full recovery potential. RM 23.3 in particular has large amounts of metal precipitates which sometimes are observed at RM 21.9. This section of stream has not shown sustained improvement since 2006.

Quality in the mainstem improves further downstream, and in 2017 RM 18.1 (across the entrance to Tom Jenkins Dam) exceeded the macroinvertebrate recovery target for the first time with a MAIS score of '15'. This new high score confirms that the physical habitat at the site is capable of supporting high quality biota and that this year the water chemistry may have improved. Notable improvement in the macroinvertebrate score was also observed in 2017 at the furthest downstream monitoring site, RM 0.1. This site at the dog shelter has improved significantly since 2006, but until this year had never actually reached the target score of '12'.

It is unclear whether these improvements are due to changes in minewater discharges from Corning and Truetown, increased flow of clean water inputs, or remediation efforts in the West Branch. Improvements in the West Branch observed in 2016 (all but the most upstream site, WBHW003, scored above '12') remained in place in 2017.

### Area of Degradation 2006-2018



The blue dashed line identifies the highest MAIS score ever achieved at that site throughout the monitoring time period.

### Sunday Creek MAIS Regressions

Mainstem	RM	'01	'02	'03	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17	Linear trends	R square	P-value	No. of observations
SC RM	26.6									14	14	13	16	15	13	dry	16	no change	0.169298	0.359080	7
SC 079	24				12	10	10	14	12	13	12	11	15	14		13	15	improved	0.413344	0.024130	12
SC 080	23.3				5	3	2	7	12	5	10	4	9	4	9	5		no change			12
SC 076	21.9	2	1	2	11	5	5	9	2	3	7	5	8	8	10	6	10	improved	0.338528	0.018060	16
SC 075	18.2	5	9	8	10	8	10	5	7	8	11	10	9	9	10	11	15	improved	0.382931	0.010597	16
SC RM 10.2	10.2										17	13	15	16	14	14	16	no change	0.011904	0.815871	7
SC 073	7.3	10	11	11	11	10	10	10	12	11	14	9	11	13	13	11	14	improved	0.267747	0.040093	16
SC 071	0.2	4	2	3	8	7	3	6	11	8	10	7	9	7		8	12	improved	0.523015	0.002312	16



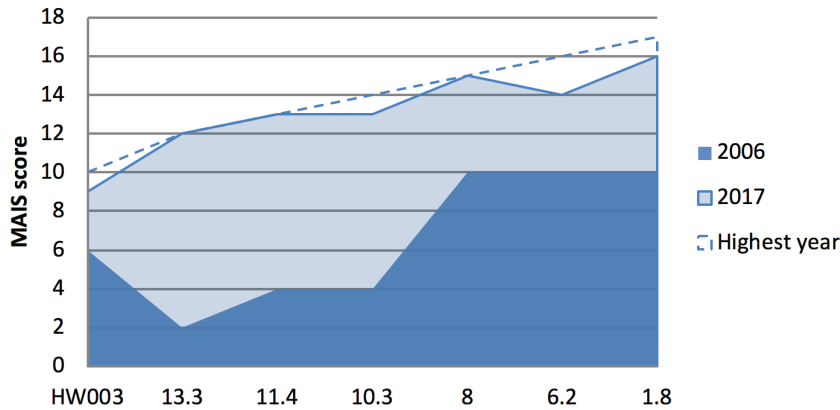
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## Biological Water Quality

### Area of Degradation 2006-2018

#### Sunday Creek West Branch



The blue dashed line identifies the highest MAIS score ever achieved at that site throughout the monitoring time period.

### Sunday Creek MAIS Regressions

Westbranch	RM	'01	'02	'03	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14	'15	'16	'17	Linear trends	R square	P-value	No. of observations	
WBHW 50	14.7					11	10	11	8	12	13	11	11	11								
WBHW 003	13.4				5	6	4	8	6	8	10	8	10	8		9						
WB 004	13.3				1	2	2	5	5	7	7	5	11	8	7	12						
WB 051	11.4				8	4	2	7	9	5	12	10	7	9		12	13	improved	0.499495	0.010174	13	
WB 003	10.3				8	4	3	4	8	4	7	7	7	11	6	14	13	improved	0.492198	0.007528	13	
WB RM8	8										14	13	15	14	15	13						
WB 002	6.2				7	10	8	10	10	13	13	15	16	15	12	15	14	improved	0.677760	0.000544	13	
WB RM1.8	1.8										12	17	15	16	16	13	16	16	no change	0.082406	0.490591	8
SC025											15	16	17	17	15	15	15					