



Pigg River Restoration at Power Dam

Year-1 Monitoring Report

As required by VDEQ permit #15-1551 and USFWS biological opinion for the Pigg River Restoration at Power Dam project.

Prepared for:

Friends of the Rivers of Virginia, Inc.
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DECEMBER 2017

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Introduction

Wetland Studies and Solutions, Inc. (WSSI) presents this monitoring report to the Friends of the Rivers of Virginia (FORVA), providing data related to Year-1 Monitoring efforts. The monitoring program has been designed to track changes to the river corridor and adjacent wetlands following the removal of the decommissioned Power Dam on the Pigg River in Rocky Mount, Virginia, and in accordance with the *Virginia Water Protection Permit Joint Permit Application #15-1551* (draft dated 6/30/2016). Monitoring activities were performed as outlined in the *Pigg River Restoration at Power Dam Monitoring RFP* (WSSI#1054, dated July 27, 2016, a.k.a. “RFP”). Results of annual monitoring required by the U.S. Fish and Wildlife Service in their biological opinion dated January 13, 2016 are hereby incorporated by reference.

The majority of necessary field data was collected by WSSI staff during normal baseflow conditions on October 03 - 05, 2017, with additional wetland hydrology information collected November 29, 2017. A total of twelve (12) cross sections were utilized. Cross-sections were established during November 2016 Post-Construction Monitoring and based on locations outlined in the RFP. Cross-sections, as located by GPS, are shown in **Exhibit 1**. Half of the cross-sections were established upstream and half below the relic dam structure. Spacing was adjusted to focus on areas around the dam where the greatest change was anticipated to occur. Cross-sections covered areas far enough upstream to be beyond backwater effects created by the dam and stretched downstream to the point where effects of the dam removal were anticipated to be largely diminished. Cross-section locations were also selected to correspond with previous monitoring efforts (Hitt et al., 2009; Bass, 2015).

Methods

The focus of Year-1 Monitoring efforts was to locate the twelve monitoring stations previously established and document current channel conditions. The results are compared with post-construction monitoring information to show channel evolution throughout the dam removal 5-year post-construction monitoring period. WSSI staff began by accessing upstream cross-sections via canoe. Upstream access was gained through the Town of Rocky Mount’s sanitary sewer pumping station (entrance road located near the intersection of Power Dam Road and Scenic River Drive). Cross-sections 1-5 were accessed exclusively by canoe. Cross-sections 6-12 were accessed via vehicle/foot travel through Town or private property – specifically public land or Town property for sections 6-8, via Hudson Farm Lane (private) for section 9-11, and through private land on Chestnut Hill Road just downstream of the Pigg River bridge for section 12.

At each cross-section, WSSI staff photo-documented local conditions through upstream, downstream and channel bank photos. All photo documentation adhered to VWP guidelines, noting: direction, photographer, date/time, vegetative cover (as applicable), and a brief description. This information is included in **Appendix A**.

In addition to photographs, WSSI staff surveyed cross-section geometry using a laser level and survey tape to record station/elevation information. During Year 1 monitoring, points were surveyed at a maximum of 5-ft intervals along the sections, generally consistent with methodologies used in the *Sediment Capacity and Fate Modeling Report* (Bass, 2015) and Post-

Construction Monitoring. Slight variations in cross section geometry are attributable to differences in individual sampling events and site specific factors (i.e. normal survey error, vegetation, slack in the survey tape, etc.). Major changes seen in cross sections are due to channel evolution and erosion following dam removal. Cross-section geometry is given in **Appendix A**, with sections showing Post-Construction and 1-year channel geometry overlaid.

Physical habitat parameters including particle size, embeddedness, woody debris, and thalweg depth measurements were recorded consistent with previous studies (Hitt et al., 2009). Observations of this information is included in **Appendix A**. The presence and quantification of large woody debris was documented by visual assessment for areas 150 feet upstream and downstream of the measured cross-section. Woody debris counts are also given in **Appendix A**.

Thalweg measurements were taken to document streambed elevation changes in the vicinity of the cross-section. Depth measurements were collected at 5-ft. intervals from the cross-section location in both the upstream and downstream direction for a distance of approximately 50 ft. (each direction), unless obscured by thick vegetation. Thalweg plots are also given in **Appendix A** following site descriptions and photos.

The method of data collection for bed material size varied depending on local conditions. The particle size distribution at the majority of monitored cross-sections was uniformly sandy. Bed material at the two downstream-most cross sections was coarser in nature and warranted formal sampling. A Wolman riffle pebble count was performed at these two sections and particle size distribution data is presented in **Appendix B**.

Year-1 monitoring efforts also included biological stream monitoring at three (3) of the defined cross-sections. Location and sampling methods corresponded to previous monitoring efforts as outlined in *Biomonitoring for the Rocky Mount Power Dam Removal Project: Establishing Baseline Conditions* (Hitt et al., 2009) and WSSI standard operating procedures. Detailed information regarding the biological stream monitoring can be found in **Appendix C**.

Wetland hydrology monitoring activities were conducted at forested wetland sites #2, #3, and #4, as outlined in the Joint Permit Application¹ (two locations within Site #2 and one location each within Site #3 and #4). Locations are shown in **Exhibit 1**. Sampling consisted of photo documentation of site conditions and observations of hydrology and soil characteristics necessary for completion of the hydrology portion of the “Wetland Determination Data Form – Eastern Mountains and Piedmont Region” from the U.S. Army Corps of Engineers Regional Supplement, Version 2 (2012). A 12-18” deep test pit was dug to document the presence of a water table or saturation. Wetland soil indicators were photo documented when observed and are scheduled for more detailed assessment in future years, as required by permit. Field data forms are included in **Appendix D**.

¹ Year 1 wetland hydrology data collection was conducted separate from cross section surveys and benthic sampling. Sampling occurred outside the identified growing season, but all necessary data was still able to be collected.

Also included within this report are the results of the first 9 months (February 02 – November 03, 2017) of groundwater monitoring at Wetland Site #2, (location shown in **Exhibit 1**). Monitoring wells were installed February 02, 2017. All data collected prior to this reports compilation is included. Groundwater monitoring information and results can be found in **Appendix E** with corresponding local weather station data given in **Appendix F**.

Results and Conclusions

Year 1 monitoring cross section surveys indicate slight bed incision at Cross Section 1 (approximately 1-ft of drop in bed elevation), with increased downcutting in Cross Sections 2-4 ranging from 2-ft to nearly 7-ft at Section 4. Changes at Sections 5 and 6 were less dramatic due to the fact that significant evolution occurred during the two-month time between completion of dam removal activities and the 2016 post-construction monitoring when significant high flow events occurred. Where banks are not vertical, surface soils at the cross sections have made moderate gains in stability due to colonization by herbaceous vegetation. However, root depth is shallow and steep bank areas are still exhibiting signs of mass failure. Tension cracking is visible at cross sections where steep banks still exist.

Results of benthic sampling showed a slight decrease in Stream Condition Index scores at two of the three monitoring locations (**Appendix C**). However, the level of variation seen from pre-removal sampling events is not beyond that which may be reasonably expected and attributable to independent factors such as normal climatic variation. Future monitoring events will be necessary to determine the influence of dam removal on benthic communities.

Wetland hydrology monitoring at Sites 2, 3, and 4 found persistent wetland vegetation. Moderate drought conditions were present during sampling. Soils at both Site 3 and 4 locations (adjacent to Cross Section 2 and Cross Section 4, respectively) were a uniform sandy loam texture with no water or saturation observed in test pits. Two sampling locations were established at Wetland Site 2 (river left, just upstream of the dam) and hydric soil indicators were seen in both locations. No water or saturation was seen at Site 2, Point 1. Water was present at approximately 6” below surface elevation at Site 2 Point 2. Qualitative observations made during monthly monitoring well data collection has shown the Site 2 wetland area to be largely dry at the surface since June 2017. These observations of drought conditions are shown by comparing rainfall from *Monthly Climate Normals (1981-2010)* (NOAA) for Roanoke, Virginia to local weather station data (**Appendix E**) for the period of February 2017 through October 2017 (Table 1). While February – March had significantly more than average precipitation totals, June – September experienced a deficit of almost 4.5 inches (Table 1).

Table 1.

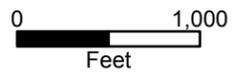
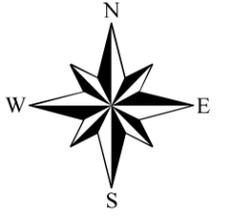
Monthly Rainfall Totals		
	Roanoke (Avg.)¹	KVAROCKY5²
February	2.89	1.17
March	3.46	4.50
April	3.37	6.66
May	4.06	10.49
June	3.83	2.49
July	4.04	3.20
August	3.56	2.98
September	3.89	2.20
October	2.89	3.37
Total	31.99	37.06

¹ NOAA, Roanoke Monthly Rainfall Normals 1981-2010

² Local Weather Station Data - Appendix F



Pigg River Restoration at Power Dam-Monitoring
 Permanent Monitoring Locations
 Original Scale: 1"=1000'



- Survey Locations
- Cross Sections

L:\Proposals\GIS\2016\PiggRiverRestoration_PowerDam\PiggRiverRestoration.mxd

Aerial Imagery Source: Virginia Base Mapping Program (VBMP) - 2015 Natural Color Imagery

Appendix A

Cross Section 1

<u>Location</u>	<u>Latitude</u>	<u>Longitude</u>
Left Bank	36.990985	-79.864618
Right Bank	36.990712	-79.864937

Description: Cross Section 1 is located approximately 600 feet downstream of the existing sanitary pump station, accessible via Scenic River Road. Access was by canoe from the upstream pumping station. Local conditions were noted as forested on the left bank and agricultural fields on the right bank. (*Note:* Left and right bank references will always be made facing downstream.) Bank slopes were steep and reasonably well vegetated with minor bank scour visible along the toe of slope.

The instrument setup for this cross section was at the left bank pin (Height of Instrument, HI = 5.90 ft.). The cross section plot is given on Sheet 1 of Appendix B and the thalweg plot is on Sheet 1 of Appendix C. No pebble count was taken at this location due the uniform fine-grained (sandy) nature of bed sediments.



Photo 1-1

Location, Orientation: XS 1, Looking Upstream

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/16, 10:32 AM

Taken by: *See note below

Description: View looking upstream from the middle of Cross Section 1

Woody Debris: 10

*Note: All Post-construction photographs taken by J. Larkin, unless otherwise noted.



Photo 1-2

Location, Orientation: XS 1, Looking Downstream

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 10:34 AM

Description: View looking downstream from the middle of Cross Section 1

Woody Debris: 30

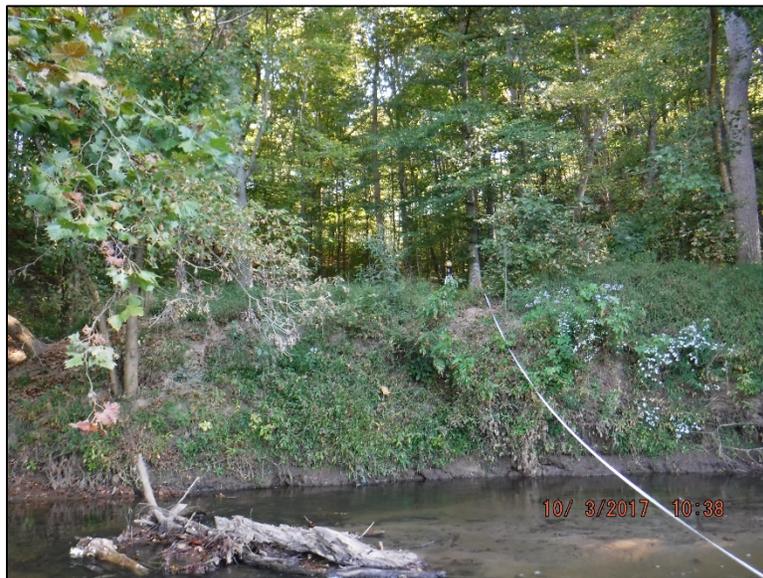


Photo 1-3

Location, Orientation: XS 1, Left Bank

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 10:38 AM

Description: View looking left from the middle of Cross Section 1

Vegetation: 70% herbaceous cover, few trees at top of bank



Photo 1-4

Location, Orientation: XS 1, Right Bank

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 10:54 AM

Description: View looking right from the middle of Cross Section 1

Vegetation: 90% herbaceous cover, no trees

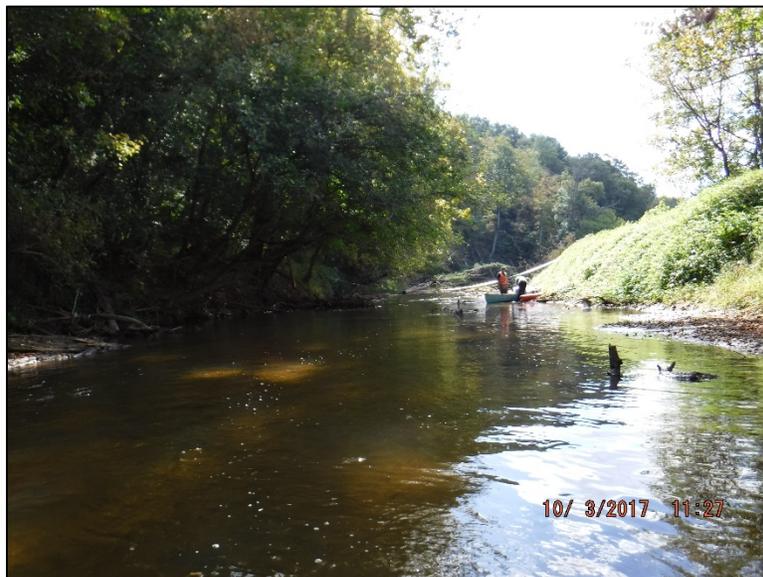


Photo 1-5

Location, Orientation: XS 1, Upstream looking down

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 11:27 AM

Description: View looking downstream at Cross Section 1 from an upstream position



Photo 1-6

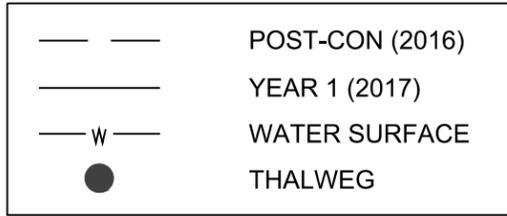
Location, Orientation: XS 1, Downstream looking up

Permit Number: JPA #15-1551

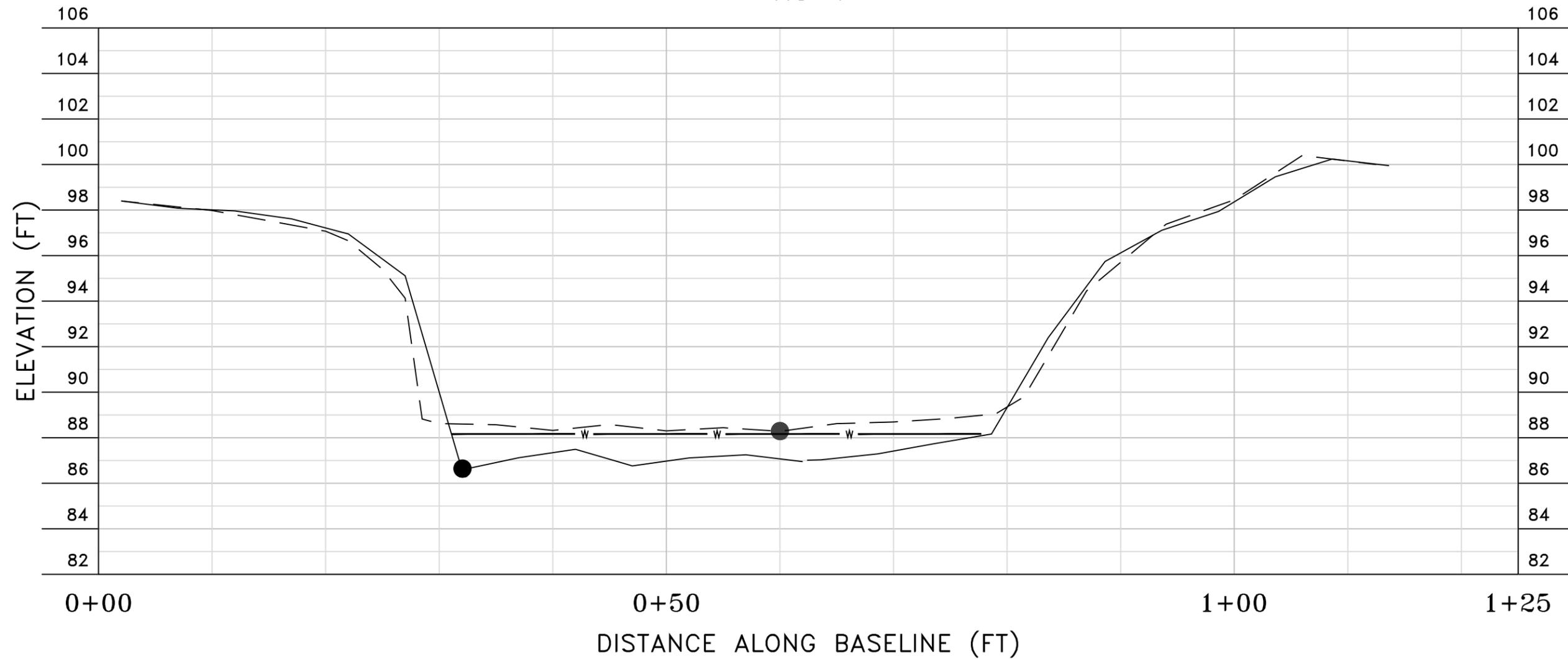
Wetland Data Sheet Reference: n/a

10/03/17, 11:46 AM

Description: View looking upstream at Cross Section 1 from a downstream position



XS 1



PROFILE SCALE:

HORIZ: 1"=10'

VERT: 1"=5'

(ELEV. RELATIVE TO ASSUMED XS END PIN AT 100.)



Pigg River Dam Removal Restoration - Monitoring
Rocky Mount, Virginia

Year 1 - XS 1

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REVISIONS		Rev. No.	App. By	By
No.	Date			

Boundary and Topo Source:
WSSI and Orange Digital Data

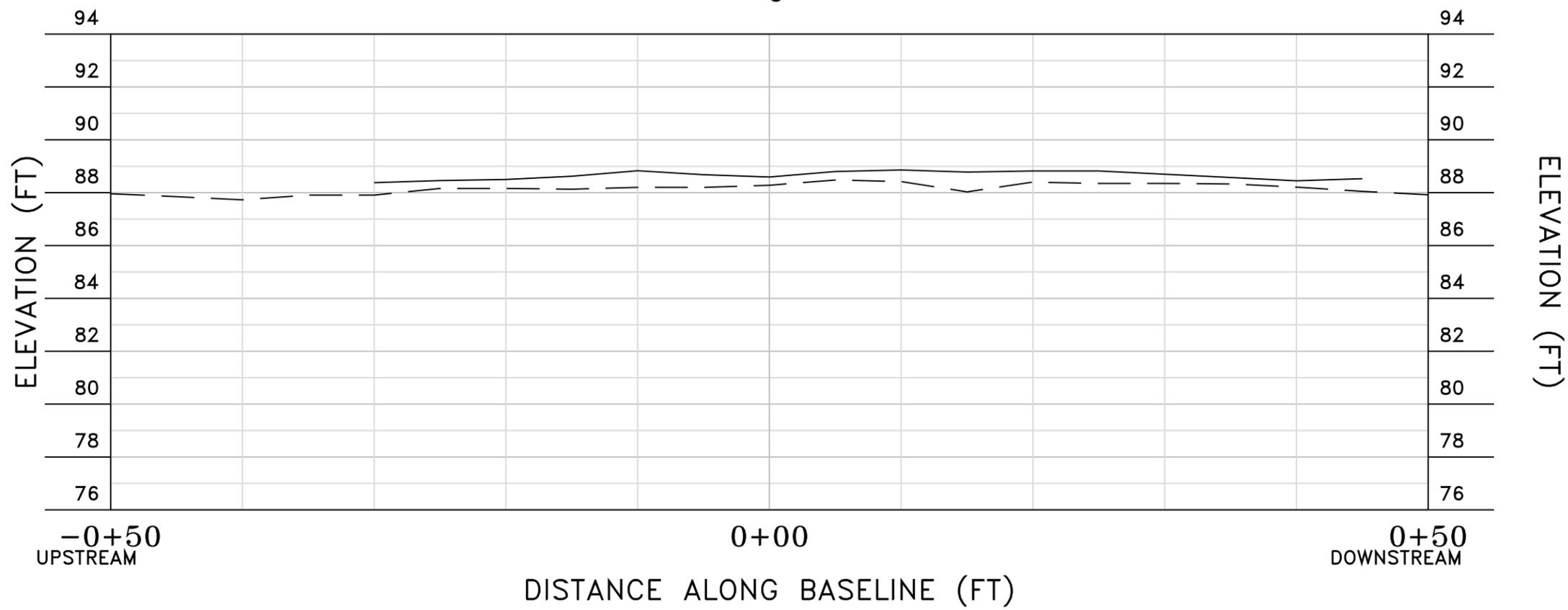
Design	Draft	Approved
NAS	NAS	NAS

Sheet #
5

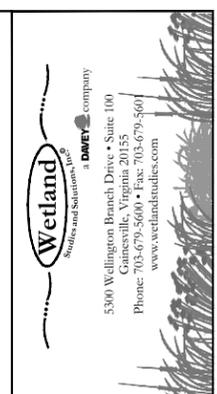
Computer File Name:
C:\2016\2016-2017\06-01\06-01-01.dwg

- - - POST-CON (2016)
 ——— YEAR 1 (2017)

Thalweg XS 1



PROFILE SCALE:
 HORIZ: 1" = 10'
 VERT: 1" = 5'
 (ELEV. RELATIVE TO ASSUMED XS END PIN AT 100.)



Pigg River Dam Removal Restoration - Monitoring
 Rocky Mount, Virginia
 Year 1 - Thalweg Profile XS 1
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No.	Date	Description	Rev. By	App. By

REVISIONS
 DATE: DEC 2017
 SCALE: AS NOTED

Boundary and Topo Source:
WSSI and Orange Digital Data

Design	Draft	Approved
NAS	NAS	NAS

Sheet #
6

Computer File Name:
C:\2016\2260\2260-01C\2260-01C.dwg

Cross Section 2

<i><u>Location</u></i>	<i><u>Latitude</u></i>	<i><u>Longitude</u></i>
Left Bank	36.984705	-79.864096
Right Bank	36.984655	-79.864333

Description: Cross Section 2 is located approximately 2,400 feet downstream (south) of Cross Section 1 and 1,200 feet downstream of the power line crossing. Access was by canoe from the upstream pumping station. Local conditions were noted as forested on both banks. The right bank slope was almost vertical but well stabilized by root structure and herbaceous cover. The left bank was formed by a sandy deposit (bar) and woody debris with little vegetation.

The instrument setup for this cross section was at the left bank pin (HI = 1.38 ft.). The cross section plot is on Sheet 2 of Appendix B, and the thalweg plot is on Sheet 2 of Appendix C. No pebble count was taken at this location due the uniform fine-grained (sandy) nature of bed sediments.

This cross section was located adjacent to the overbank wetland area (left bank) identified in permit documents and previous reports as Wetland Site #4. Wetland hydrology data forms are given in Appendix F.



Photo 2-1

Location, Orientation: XS 2, Looking Upstream

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 1:17 PM

Description: View looking upstream from the center of Cross Section 2

Woody Debris: 20



Photo 2-2

Location, Orientation: XS 2, Looking Downstream

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 1:18 PM

Description: View looking downstream from the middle of Cross Section 2

Woody Debris: 15



Photo 2-3

Location, Orientation: XS 2, Left Bank

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 1:20 PM

Description: View looking left from the middle of Cross Section 2

Vegetation: 40% herbaceous cover, few trees, woody debris



Photo 2-4

Location, Orientation: XS 2, Right Bank

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 1:18 PM

Description: View looking right from the middle of Cross Section 2

Vegetation: 50% herbaceous cover, few trees, woody debris

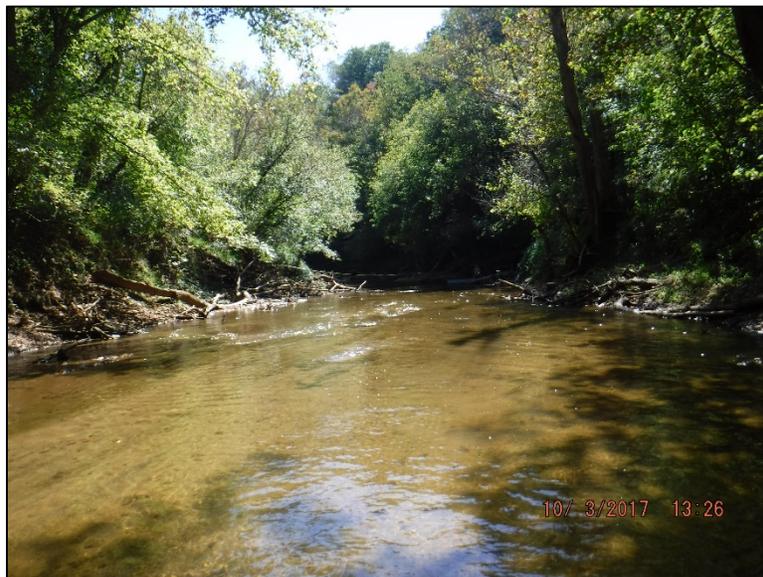


Photo 2-5

Location, Orientation: XS 2, Upstream looking down

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/16, 1:26 PM

Description: View looking downstream at Cross Section 2 from an upstream position



Photo 2-6

Location, Orientation: XS 2, Downstream looking up

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 1:22 PM

Description: View looking upstream at Cross Section 2 from a downstream position



Photo 2-7

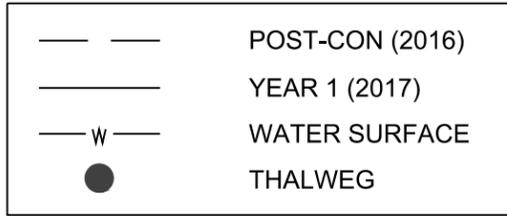
Location, Orientation: XS 2, Bed Material

Permit Number: JPA #15-1551

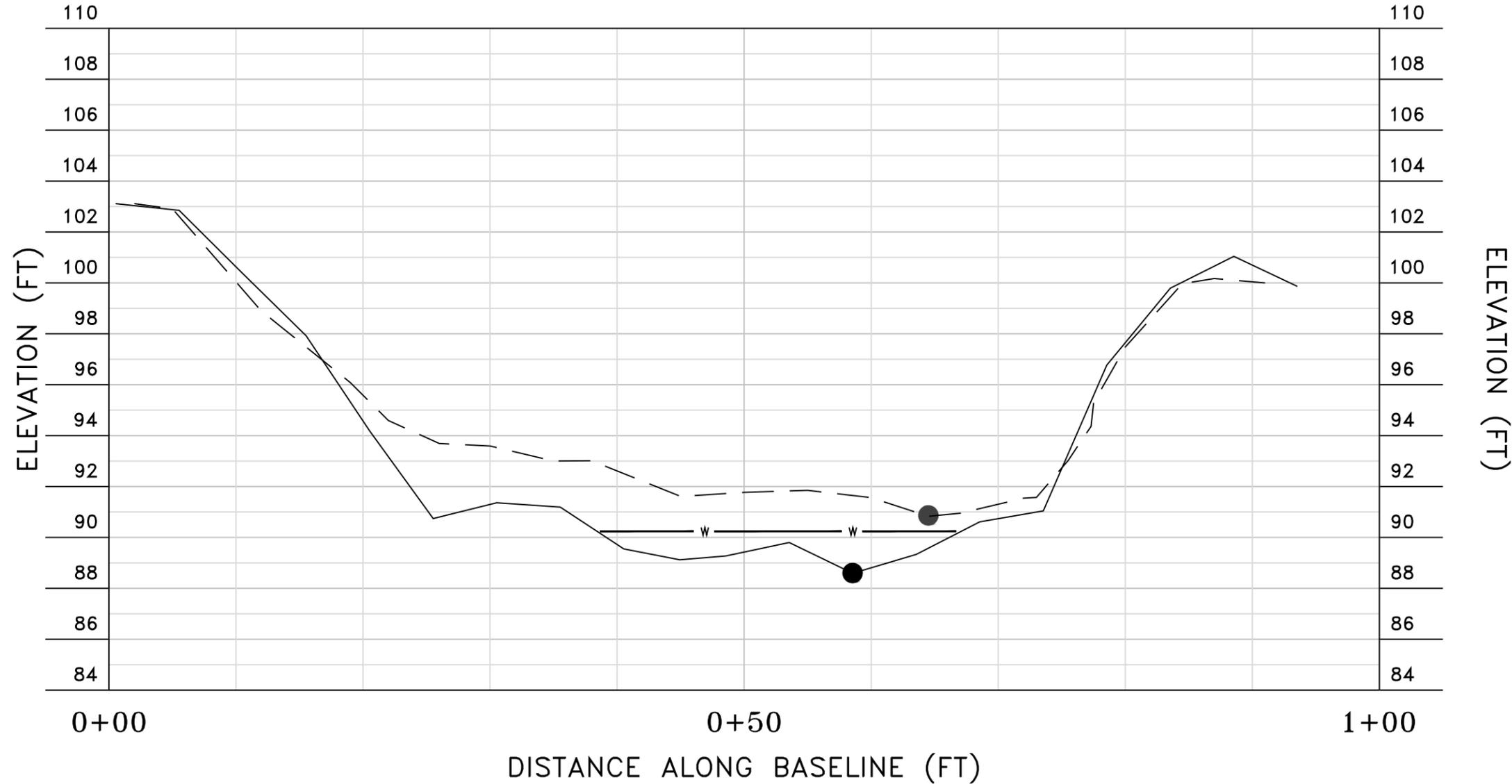
Wetland Data Sheet Reference: n/a

10/03/17, 1:27 PM

Description: Bed material at Cross Section 2 was almost entirely silt/sand



XS 2



PROFILE SCALE:

HORIZ: 1"=10'

VERT: 1"=5'

(ELEV. RELATIVE TO ASSUMED XS END PIN AT 100.)



Pigg River Dam Removal Restoration - Monitoring
Rocky Mount, Virginia

Year 1 - XS 2

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REVISIONS		Rev. No.	App. By	Date

DATE: DEC 2017 SCALE: AS NOTED

Boundary and Topo Source:
WSSI and Orange Digital Data

Design	Draft	Approved
NAS	NAS	NAS

Sheet #
11

Computer File Name:
C:\2016\2016-2017\2016-01-01\2016-01-01.dwg

Cross Section 3

<i>Location</i>	<i>Latitude</i>	<i>Longitude</i>
Left Bank	36.980573	-79.855954
Right Bank	36.980669	-79.855792

Description: Cross Section 3 was located approximately 2,600 feet downstream of Cross Section 2, 500 feet southeast of the south end of Scenic River Road, and just downstream of a large meander bend. Access was by canoe from the upstream pumping station. Local conditions were noted as forested on both banks. Both banks had noticeable scour of fine sediment deposits occurring along the toes of slope. The left bank was composed of 40% vegetative cover and exposed root structures creating a steep vertical upper bank with the lower left bank primarily composed of sediment deposits. The right bank was also steeply sloped on the upper bank and composed of fine-grained sediment deposits towards the toe. Herbaceous cover was 80% on the lower half of the bank with significant woody debris present, while the upper half was exposed and un-vegetated.

The instrument setup for this cross section was at the left bank (HI = 3.55 ft.). The cross section plot is on Sheet 3 of Appendix B, and the thalweg plot is on Sheet 3 of Appendix C. No pebble count was taken at this location due the uniform fine-grained (sandy) nature of bed sediments.



Photo 3-1

Location, Orientation: XS 3, Looking Upstream

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 2:39 PM

Description: View looking upstream from the center of Cross Section 3

Woody Debris: 15



Photo 3-2

Location, Orientation: XS 3, Looking Downstream

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 3:40 PM

Description: View looking downstream from the middle of Cross Section 3

Woody Debris: 50



Photo 3-3

Location, Orientation: XS 3, Left Bank

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 2:45 PM

Description: View looking left from the middle of Cross Section 3

Vegetation: 40% herbaceous plants, few trees



Photo 3-4

Location, Orientation: XS 3, Right Bank

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 2:40 PM

Description: View looking right from the middle of Cross Section 3

Vegetation: 80% herbaceous cover and a few trees at top of bank



Photo 3-5

Location, Orientation: XS 3, Upstream looking down

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 2:46 PM

Description: View looking downstream at Cross Section 3 from an upstream position



Photo 3-6

Location, Orientation: XS 3, Downstream looking up

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 2:43 PM

Description: View looking upstream at Cross Section 3 from a downstream position



Photo 3-7

Location, Orientation: XS 3, Bed Material

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 2:59 PM

Description: Bed material at Cross Section 3 was almost entirely silt

Cross Section 4

<i>Location</i>	<i>Latitude</i>	<i>Longitude</i>
Left Bank	36.985663	-79.856937
Right Bank	36.985403	-79.856873
Thalweg	36.985530	-79.856930

Description: Cross Section 4 is located approximately 1,600 feet downstream of Cross Section 3, east of Scenic River Road, south of the power line easement, and west of Power Dam Road in a short, straight, run between two sharp meander pools. Access was by canoe from the upstream pumping station. The cross section was bounded on both banks by forested conditions. Signs of past inundation and backwater effects from the dam were strongly visible at this cross section. A previously terraced channel cross section post dam removal is now characterized by significant bank failure and channel downcutting with a narrow baseflow channel. The right upper bank face was vertical, approximately 5-ft high, and showed signs of periodic mass failure (Photo 4-4). Upper left bank showed significant signs of bank failure and sluffing up to the top of bank. Lower left bank was composed of fine sediment, terraced and had moderate herbaceous vegetation.

The instrument setup for this cross section was at the left bank (HI = 4.03 ft.). The cross section plot is on Sheet 4 of Appendix B, and the thalweg plot is on Sheet 4 of Appendix C. No pebble count was taken at this location due the uniform fine-grained (sandy/silty) nature of bed sediments.

This cross section was located adjacent to the overbank wetland area (right bank) identified in permit documents and previous reports as Wetland Site #3. Wetland hydrology data forms are given in Appendix F.



Photo 4-1

Location, Orientation: XS 4, Looking Upstream

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 3:50 PM

Description: View looking upstream from the center of Cross Section 4

Woody Debris: 10



Photo 4-2

Location, Orientation: XS 4, Looking Downstream

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 3:50 PM

Description: View looking downstream from the middle of Cross Section 4
Woody Debris: 60



Photo 4-3

Location, Orientation: XS 4, Left Bank

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 3:50 PM

Description: View looking left from the middle of Cross Section 4
Vegetation: 90% herbaceous cover and a few trees at top of bank



Photo 4-4

Location, Orientation: XS 4, Right Bank

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 3:51 PM

Description: View looking right from the middle of Cross Section 4

Vegetation: 80% herbaceous on lower terrace, small shrubs and a few trees at top of bank



Photo 4-5

Location, Orientation: XS 4, Upstream looking down

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 3:53 PM

Description: View looking downstream at Cross Section 4 from an upstream position



Photo 4-6

Location, Orientation: XS 4, Downstream looking up

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 3:55 PM

Description: View looking upstream at Cross Section 4 from a downstream position



Photo 4-7

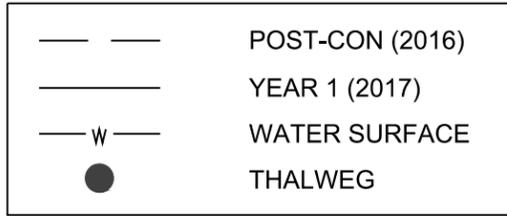
Location, Orientation: XS 4, Bed Material

Permit Number: JPA #15-1551

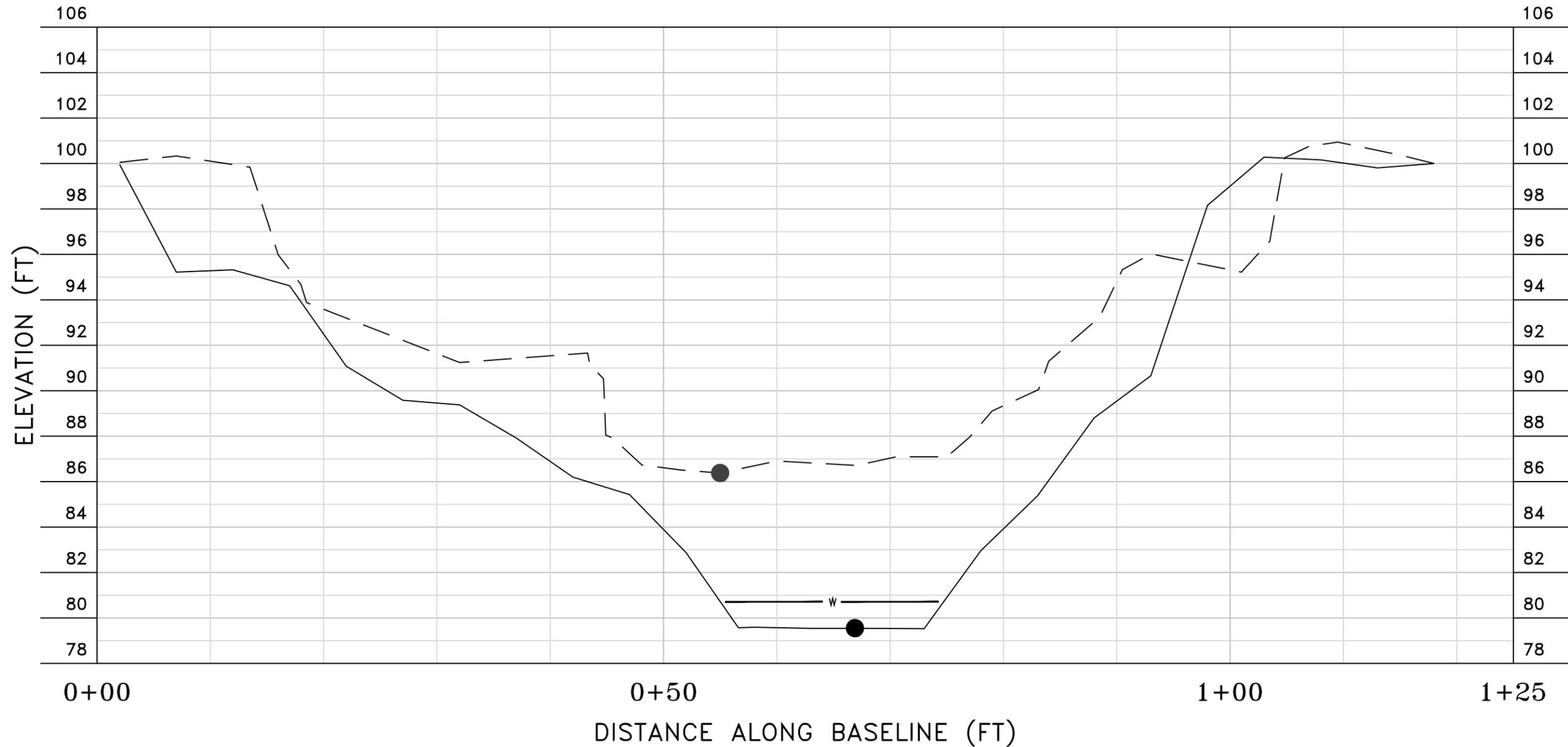
Wetland Data Sheet Reference: n/a

10/03/17, 3:51 PM

Description: Bed material at Cross Section 4 was almost entirely sand/silt



XS 4



PROFILE SCALE:

HORIZ: 1" = 10'

VERT: 1" = 5'

(ELEV. RELATIVE TO ASSUMED XS END PIN AT 100.)

ELEVATION (FT)

REVISIONS		Rev.	Appr.	By
		No.	Date	Description

SCALE: AS NOTED
DATE: DEC 2017

Boundary and Topo Source:
WSSI and Orange Digital Data

Design	Draft	Approved
NAS	NAS	NAS

Sheet #
23

Cross Section 5

<i>Location</i>	<i>Latitude</i>	<i>Longitude</i>
Left Bank	36.991448	-79.857178
Right Bank		

Description: Cross Section 5 is located approximately 2,000 feet downstream of Cross Section 4; approximately 800 feet downstream (north) of the power line easement. Access was by canoe from the upstream pumping station. The cross section is bounded on both banks by forested conditions. Currently the channel is defined by a wide, deep cross section with a confined and down cutting baseflow. The channel is flanked by a wide steep mudflat on the right bank with significant scour (2-4 ft.) of fine sediment occurring at the toe with little to no vegetation present on the lower 1/3. The upper left bank is experiencing significant bank failure with a vertical inner face. Lower left bank is established by herbaceous vegetation with moderate bank scour at the toe.

The instrument setup for this cross section was at the left bank (HI = 2.76 ft.). The cross section plot is on Sheet 5 of Appendix B, and the thalweg plot is on Sheet 5 of Appendix C. No pebble count was taken at this location due the uniform fine-grained (sandy) nature of bed sediments.

This cross section was located adjacent to a narrow band of wetlands (as previously delineated) located on the left bank – the upstream end of the area identified in permit documents and previous reports as Wetland Site #2. Wetland hydrology data forms are given in Appendix F.



Photo 5-1

Location, Orientation: XS 5, Looking Upstream

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 5:01 PM

Description: View looking upstream from the center of Cross Section 5

Woody Debris: 2



Photo 5-2

Location, Orientation: XS 5, Looking Downstream

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 05:01 PM

Description: View looking downstream from the middle of Cross Section 5

Woody Debris: 3



Photo 5-3

Location, Orientation: XS 5, Left Bank

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 5:05 PM

Description: View looking left from the middle of Cross Section 5

Vegetation: Small trees at bankfull, 80% herbaceous cover below top of bank



Photo 5-4

Location, Orientation: XS 5, Right Bank

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 5:01 PM

Description: View looking right from the middle of Cross Section 5
Vegetation: Small trees and grass at bankfull, no vegetation below top of bank



Photo 5-5

Location, Orientation: XS 5, Upstream looking down

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/03/17, 5:09 PM

Description: View looking downstream at Cross Section 5 from an upstream position



Photo 5-6

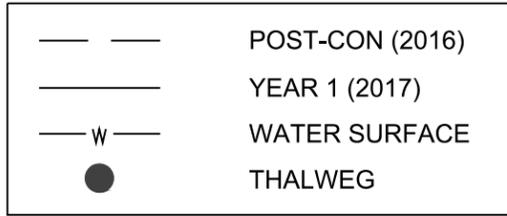
Location, Orientation: XS 5, Downstream looking up

Permit Number: JPA #15-1551

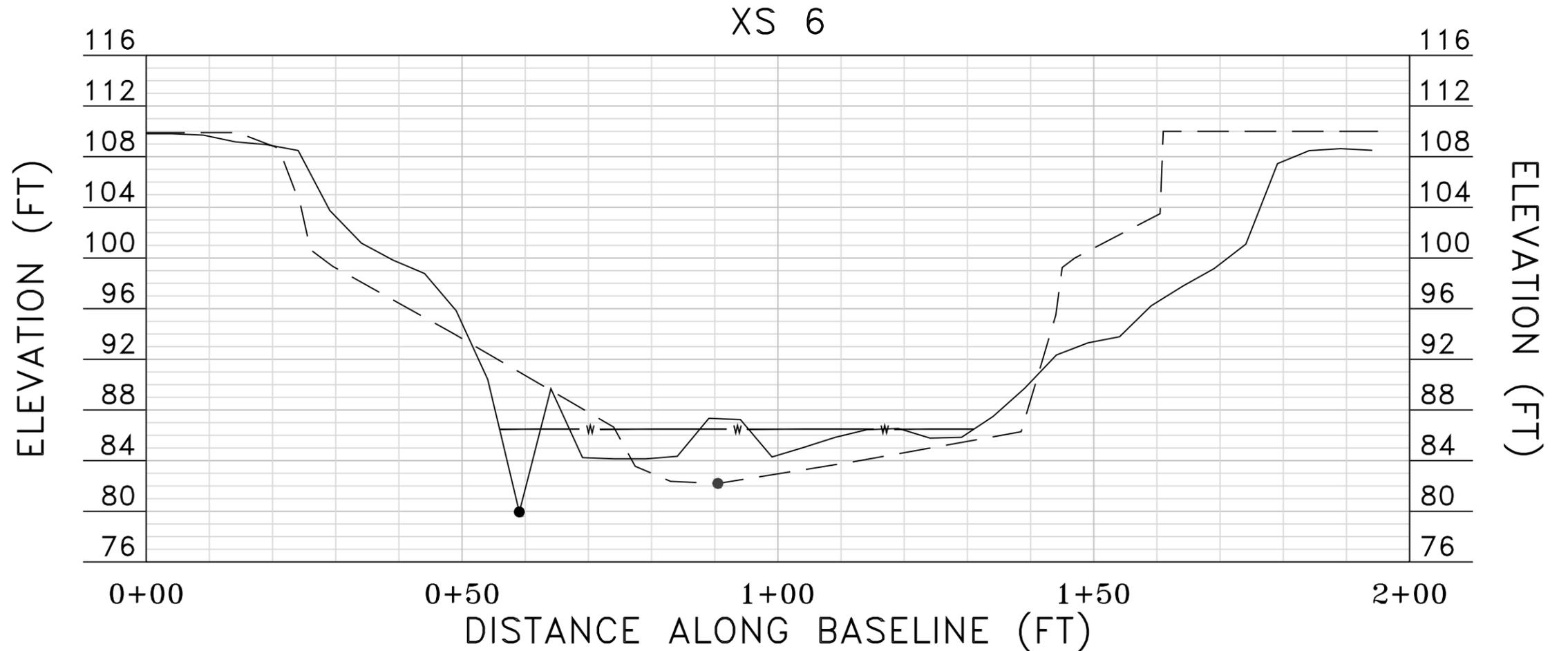
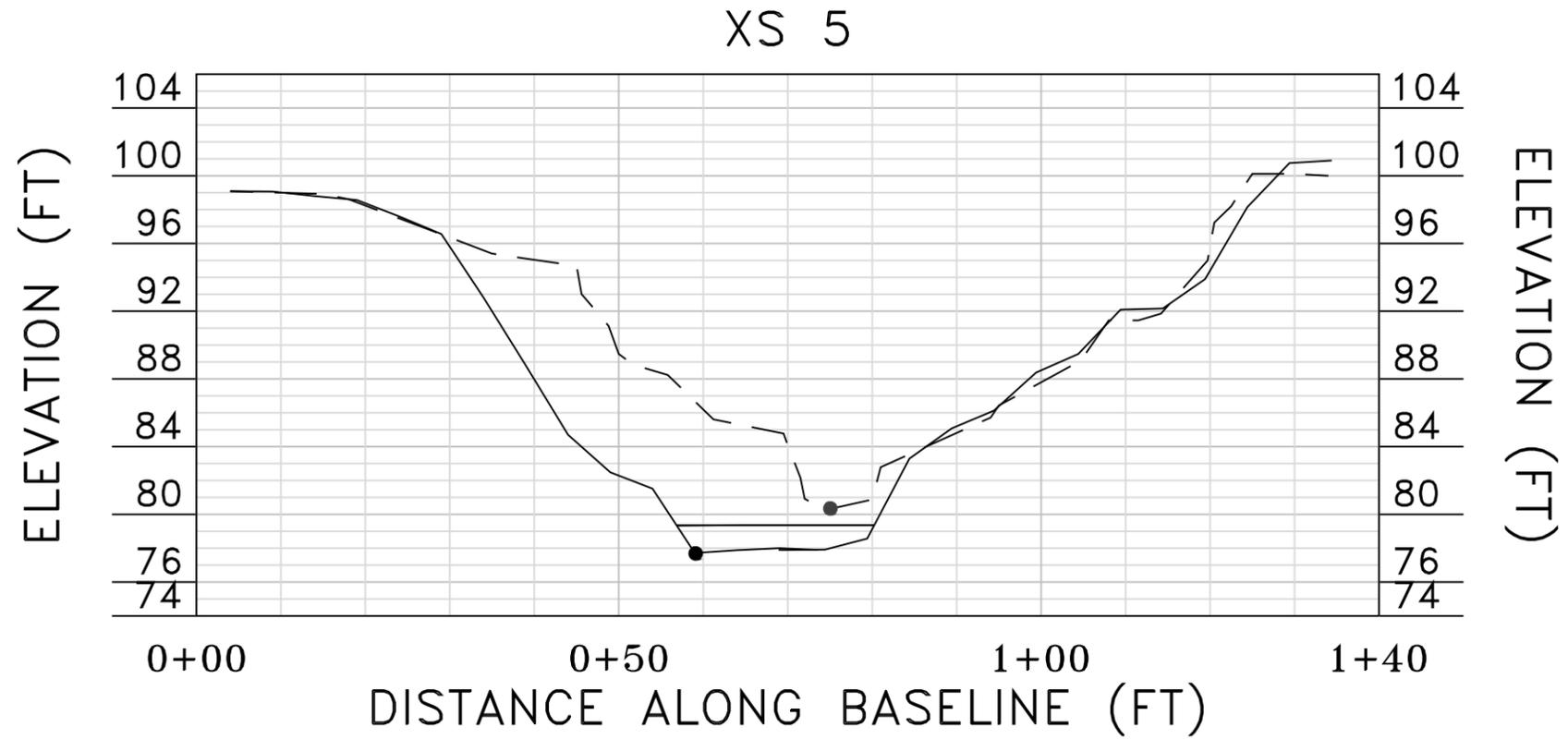
Wetland Data Sheet Reference: n/a

10/03/17, 06:14 PM

Description: View looking upstream at Cross Section 5 from a downstream position



PROFILE SCALE:
 HORIZ: 1"=20'
 VERT: 1"=10'



PROFILE SCALE:
 HORIZ: 1"=20'
 VERT: 1"=10'



Pigg River Dam Removal Restoration - Monitoring
 Rocky Mount, Virginia

Year 1 - XS 5 & 6

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DATE: DEC 2017 SCALE: AS NOTED

Boundary and Topo Source:
 WSSI and Orange Digital Data

Design	Draft	Approved
NAS	NAS	NAS

Sheet #
 29

Computer File Name:
 C:\2016\2260\2260-01C\AS04-DWG

Cross Section 6

<u>Location</u>	<u>Latitude</u>	<u>Longitude</u>
Left Bank		
Right Bank	36.995027	-79.859314

Description: Cross Section 6 is located approximately 300 feet upstream of the Power Dam structure. Access was by foot via the trail paralleling Power Dam Road. The cross section is bounded on both banks by forested conditions. During and following dam removal, flows cut through the deep sediment deposits behind the dam. At the time of Post-Construction monitoring, thalweg elevation at this section appeared to have already approached the elevation at the location of the dam breach. Thus, section depth did not significantly change between Post-Construction Year-1 surveys. This section was approximately 30-ft. deep and characterized by a wide channel cross section with widening of the channel apparent from previously confined cross sections (XS 4, 5, 6). The right bank had a vertical upper bank with evidence of previous bank failures apparent. The mid and lower left bank was composed of mostly sandy material and was established with moderate herbaceous vegetation with minor scour occurring at the toe of slope. The upper left bank showed evidence of mass failure with steep vertical faces. The mid to lower left bank was composed of sediment deposits stabilized by significant herbaceous vegetation. Minor scour was occurring at the toe of slope on the left bank. Large woody debris had mostly been removed in this cross section prior to monitoring efforts.

The instrument setup for this cross section was at the right bank (HI = 1.89 ft.). The cross section plot is on Sheet 6 of Appendix B, and the thalweg plot is on Sheet 6 of Appendix C. No pebble count was taken at this location due the uniform fine-grained (sandy) nature of bed sediments.

This cross section was located adjacent to a wider area of wetlands (as previously delineated) located on the left bank – the lower end of the area identified in permit documents and previous reports as Wetland Site #2. Wetland hydrology data forms are given in Appendix F.



Photo 6-1
 Location, Orientation: XS 6, Looking Upstream
 Permit Number: JPA #15-1551
 Wetland Data Sheet Reference: n/a
 10/04/17, 9:47 AM

Description: View looking upstream from the center of Cross Section 6
Woody Debris: 4



Photo 6-2

Location, Orientation: XS 6, Looking Downstream
Permit Number: JPA #15-1551
Wetland Data Sheet Reference: n/a
10/04/17, 9:38 PM

Description: View looking downstream from the middle of Cross Section 6
Woody Debris: 15



Photo 6-3

Location, Orientation: XS 6, Left Bank
Permit Number: JPA #15-1551
Wetland Data Sheet Reference: n/a

10/04/17, 9:54 AM

Description: View looking left from the middle of Cross Section 6
Vegetation: 90% herbaceous cover, large trees and shrubs at top of bank



Photo 6-4

Location, Orientation: XS 6, Right Bank

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/04/17, 9:54 AM

Description: View looking right from the middle of Cross Section 6
Vegetation: 90% herbaceous cover, large trees and shrubs at top of bank



Photo 6-5

Location, Orientation: XS 6, Upstream looking down

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/04/17, 10:40 PM

Description: View looking downstream at Cross Section 6 from an upstream position



Photo 6-6

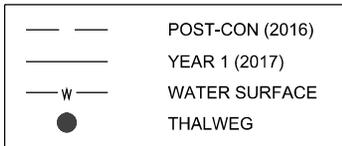
Location, Orientation: XS 6, Downstream looking up

Permit Number: JPA #15-1551

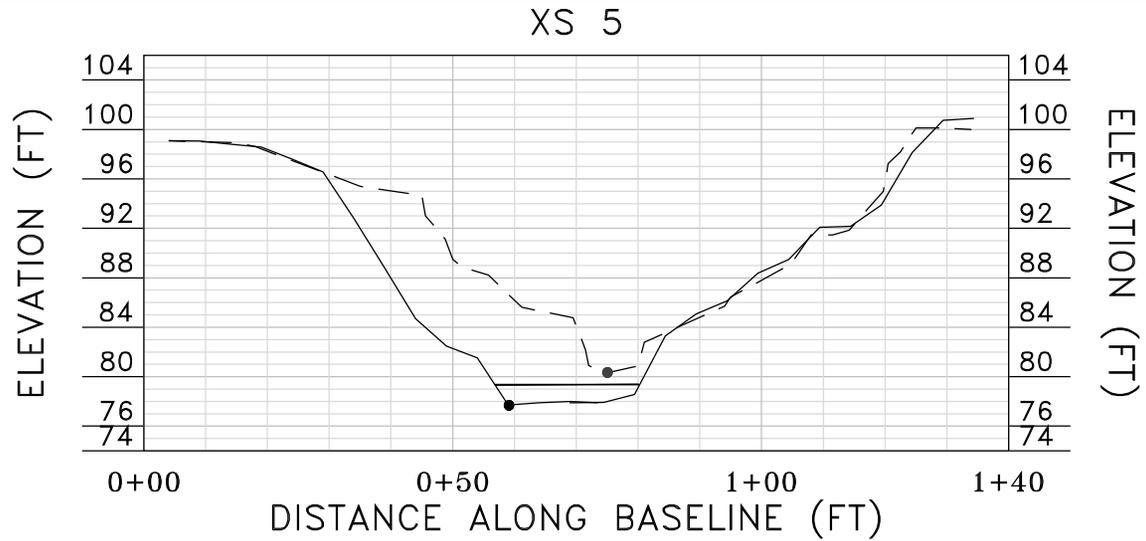
Wetland Data Sheet Reference: n/a

10/04/17, 10:45 AM

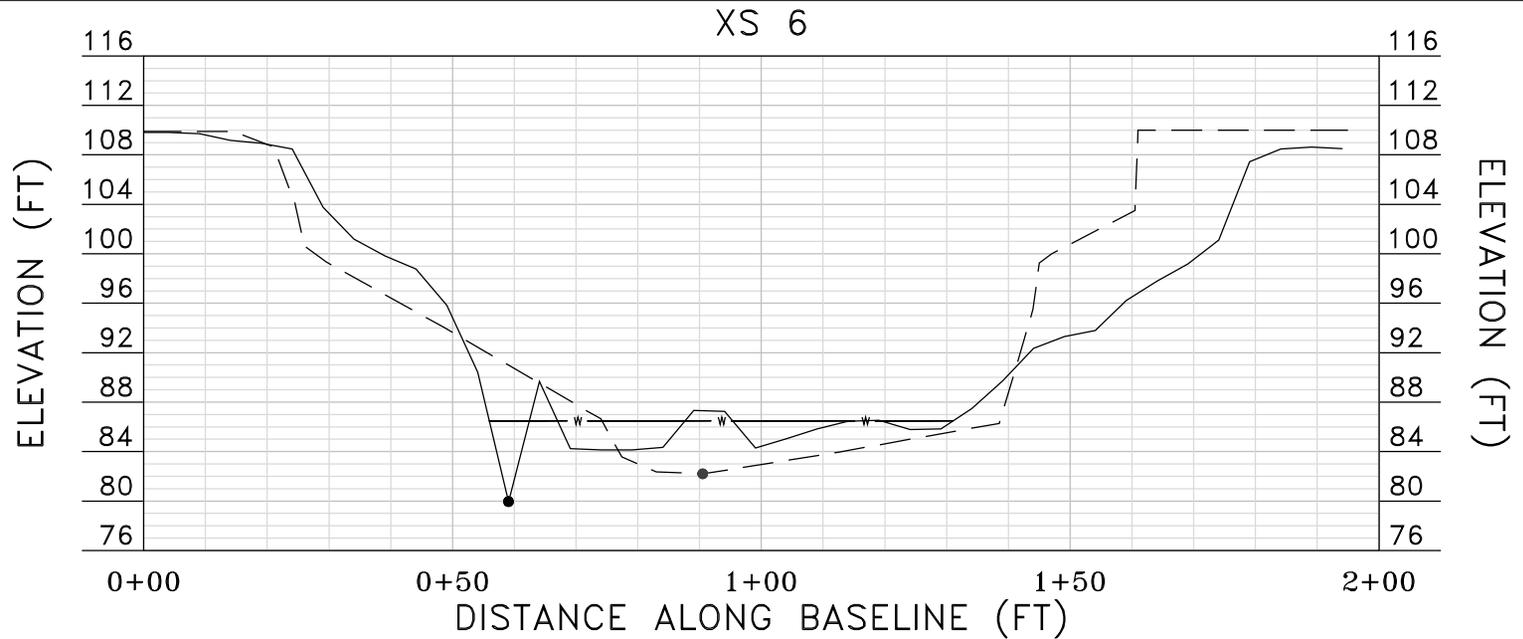
Description: View looking upstream at Cross Section 6 from a downstream position



PROFILE SCALE:
 HORIZ: 1"=20'
 VERT: 1"=10'



PROFILE SCALE:
 HORIZ: 1"=20'
 VERT: 1"=10'



Piggs River Dam Removal Restoration - Monitoring
 Rocky Mount, Virginia

Year 1 - XS 5 & 6

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No.	Description

DATE: DEC 2017 SCALE: AS NOTED

Boundary and Ties Source:
WSS and Orange Digital Data

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NAS	NAS	NAS

Sheet #
35

Computer File Name:
1:\Projects\2017\17-0000\17-0000.dwg

Cross Section 7

<i>Location</i>	<i>Latitude</i>	<i>Longitude</i>
Left Bank	36.997204	-79.860491
Right Bank	36.997218	-79.859878

Description: Cross Section 7 is located approximately 450 feet downstream of the Power Dam Road bridge. Vehicular access was gained via farm field roads on Rocky Mount treatment plant property. The cross section was bounded on the left bank by forest and on the right bank by a narrow band of trees along the top of bank with agricultural fields just beyond. This section had mature woody vegetation to within one to two feet of the baseflow water surface elevation. The water surface width at this section had significantly widened (to more than 50 feet). Banks were relatively stable, with the cut bank located on river left. Fine sediment released from behind the dam had buried bed features and filled the thalweg, resulting in little variation in flow depth across the section. Recent sandy deposits and scour were also visible along the banks. The right bank had a 10-15-ft. wide side channel bar.

The instrument setup for this cross section was at the right bank (HI = 3.58 ft.). The cross section plot is on Sheet 7 of Appendix B, and the thalweg plot is on Sheet 7 of Appendix C. No pebble count was taken at this location due the uniform fine-grained (sandy) nature of bed sediments.



Photo 7-1

Location, Orientation: XS 7, Looking Upstream

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/05/17, 9:29 AM

Description: View looking upstream from the middle of Cross Section 7

Woody Debris: 10



Photo 7-2

Location, Orientation: XS 7, Looking Downstream

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/05/17, 9:30 AM

Description: View looking downstream from the middle of Cross Section 7

Woody Debris: 7



Photo 7-3

Location, Orientation: XS 7, Left Bank

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/05/17, 9:29 AM

Description: View looking left from the middle of Cross Section 7

Vegetation: 30% herbaceous cover, few trees



Photo 7-4

Location, Orientation: XS 7, Right Bank

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/05/17, 9:31 AM

Description: View looking right from the middle of Cross Section 7

Vegetation: 40% herbaceous plants, trees at bankfull



Photo 7-5

Location, Orientation: XS 7, Upstream looking down

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/05/17, 9:32 AM

Description: View looking downstream at Cross Section 7 from an upstream position



Photo 7-6

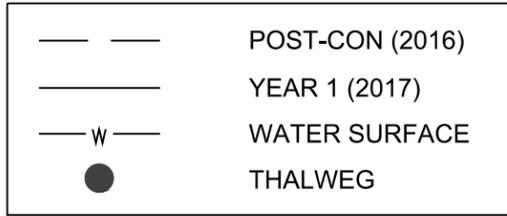
Location, Orientation: XS 7, Downstream looking up

Permit Number: JPA #15-1551

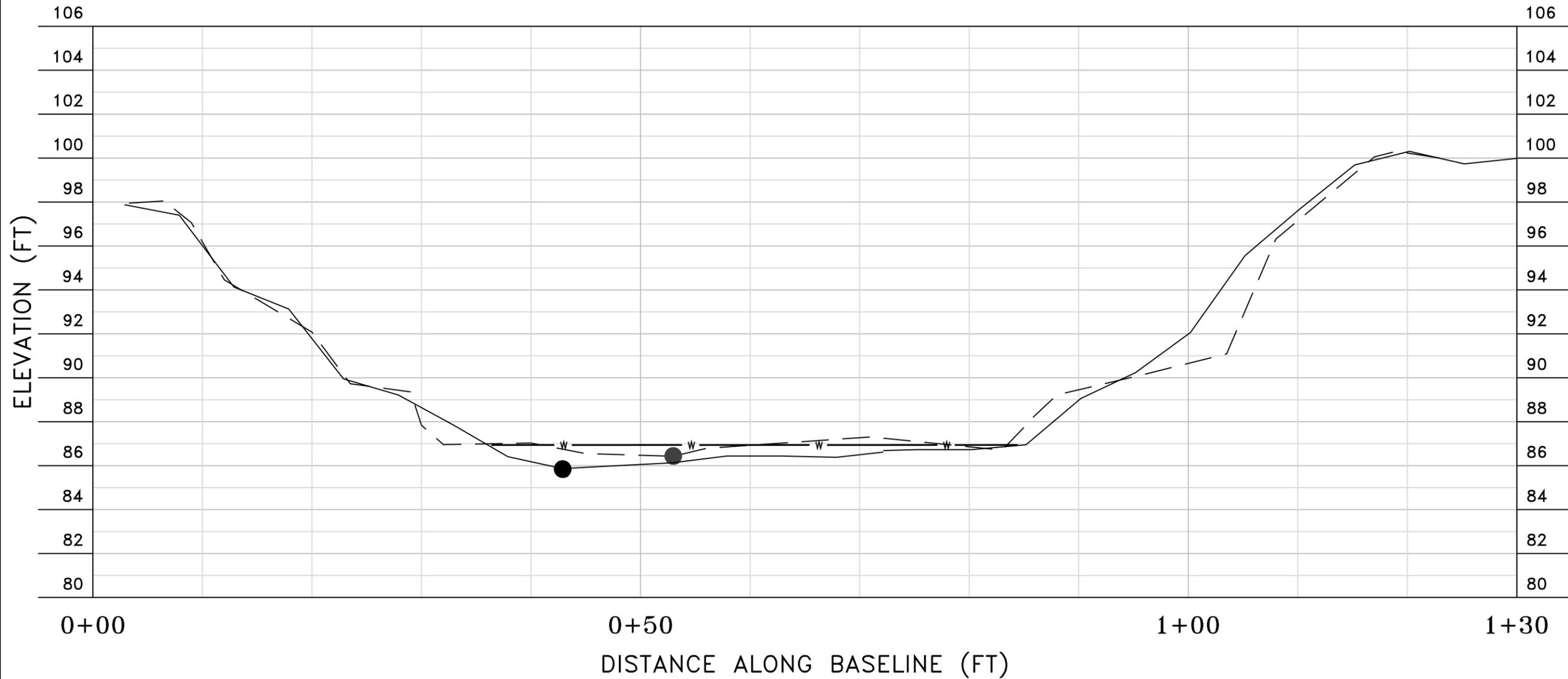
Wetland Data Sheet Reference: n/a

10/05/17, 9:34 AM

Description: View looking upstream at Cross Section 7 from a downstream position



XS 7



PROFILE SCALE:

HORIZ: 1"=10'

VERT: 1"=5'

(ELEV. RELATIVE TO ASSUMED XS END PIN AT 100.)



Pigg River Dam Removal Restoration - Monitoring
Rocky Mount, Virginia

Year 1 - XS 7

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Boundary and Topo Source:
WSSI and Orange Digital Data

Design	Draft	Approved
NAS	NAS	NAS

Sheet #
41

Computer File Name:
C:\2016\2016-2017\2016-2017\2016-2017-ENR

Cross Section 8

<i>Location</i>	<i>Latitude</i>	<i>Longitude</i>
Left Bank	36.998831	-79.856019
Right Bank	36.998555	-79.856062

Description: Cross Section 8 is located approximately 2,000 feet downstream of the dam, or 1,400 feet downstream of Cross Section 7, due north of the existing Town of Rocky Mount Sewage Treatment Plant. Vehicular access was gained via farm field roads on treatment plant property. The cross section is bounded on the left bank by forest and on the right bank by a narrow band of trees along the top of bank with agricultural fields just beyond. This section had mature woody vegetation to within one foot of the baseflow water surface elevation. The water surface width at this section was consistent with that seen at Cross Section 7, but no side channel bars or recent deposits of sediment were visible above the observed water surface elevation. Banks were relatively stable due to good coverage by woody root structure. Fine sediment released from behind the dam buried bed features and filled the thalweg, resulting in little variation in flow depth across the section.

The instrument setup for this cross section was at the right bank (HI = 2.87 ft.). The cross section plot is on Sheet 8 of Appendix B. No thalweg survey was performed at this cross section during Post-Construction monitoring since depth measurements were uniformly flat with the thalweg measurement taken during cross section survey. Thalweg information from the cross section survey was plotted for comparison with longitudinal survey data collected during Year-1 monitoring. Local scour pockets were observed only around isolated pieces of woody debris. No pebble count was taken at this location due the uniform fine-grained (sandy) nature of bed sediments.



Photo 8-1

Location, Orientation: XS 8, Looking Upstream

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/05/17, 11:07 AM

Description: View looking upstream from the middle of Cross Section 8

Woody Debris: 4



Photo 8-2

Location, Orientation: XS 8, Looking Downstream

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/05/17, 11:07 AM

Description: View looking downstream from the middle of Cross Section 8

Woody Debris: 3



Photo 8-3

Location, Orientation: XS 8, Left Bank

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/05/17, 11:07 AM

Description: View looking left from the middle of Cross Section 8

Vegetation: 30% herbaceous cover, saplings, small trees



Photo 8-4

Location, Orientation: XS 8, Right Bank

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/05/17, 11:08 AM

Description: View looking right from the middle of Cross Section 8

Vegetation: 10% herbaceous plants, trees



Photo 8-5

Location, Orientation: XS 8, Upstream looking down

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/05/17, 11:11 AM

Description: View looking downstream at Cross Section 8 from an upstream position



Photo 8-6

Location, Orientation: XS 8, Downstream looking up

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/05/17, 11:09 AM

Description: View looking upstream at Cross Section 8 from a downstream position



Photo 8-7

Location, Orientation: XS 8, Bed Material

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/05/17, 11:08 AM

Description: Bed material at Cross Section 8 was almost entirely silt

Cross Section 9

<i>Location</i>	<i>Latitude</i>	<i>Longitude</i>
Left Bank	36.995239	-79.856860
Right Bank	36.995536	-79.856751

Description: Cross Section 9 is located approximately 1.0 mi downstream of the dam, or 3,300 feet downstream of Cross Section 8. The section was located at the southwest corner of the field at the downstream boundary of sewage treatment plant property, just before a sharp left meander. Vehicular access was gained via Hudson Farm Lane.

The cross section was bounded on both banks by a narrow band of trees along the top of bank with agricultural fields just beyond. Woody root structure made the steep banks relatively stable, despite significant incision (~14-ft bank heights). The water surface width at this section was consistent with that seen at Cross Section 8. Sediment deposition of sand was noted at or just above the observed water surface. Banks were relatively stable due to good coverage by woody root structure. Fine sediment had buried bed features and filled the thalweg, resulting in little variation in flow depth across the section.

The instrument setup for this cross section was at the right bank (HI = 2.82 ft.). The cross section plot is on Sheet 9 of Appendix B. No thalweg survey was performed at this cross section during Post-Construction monitoring since depth measurements were uniformly flat with the thalweg measurement taken during cross section survey. Thalweg information from the cross section survey was plotted for comparison with longitudinal survey data collected during Year-1 monitoring. No pebble count was taken at this location due the uniform fine-grained (sandy) nature of bed sediments.



Photo 9-1

Location, Orientation: XS 9, Looking Upstream

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/04/17, 1:33 PM

Description: View looking upstream from the middle of Cross Section 9
Woody Debris: 4



Photo 9-2

Location, Orientation: XS 9, Looking Downstream

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/04/17, 1:34 PM

Description: View looking downstream from the middle of Cross Section 9

Woody Debris: 5



Photo 9-3

Location, Orientation: XS 9, Left Bank

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/04/17, 1:34 PM

Description: View looking left from the middle of Cross Section 9

Vegetation: 40% herbaceous cover with small trees on top of bank



Photo 9-4

Location, Orientation: XS 9, Right Bank

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/04/17, 1:35 PM

Description: View looking right from the middle of Cross Section 9

Vegetation: 90% herbaceous cover on bank



Photo 9-5

Location, Orientation: XS 9, Upstream looking down

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/04/17, 1:38 PM

Description: View looking downstream at Cross Section 9 from an upstream position



Photo 9-6

Location, Orientation: XS 9, Downstream looking up

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/04/17, 1:36 PM

Description: View looking upstream at Cross Section 9 from a downstream position

Cross Section 10

<i>Location</i>	<i>Latitude</i>	<i>Longitude</i>
Left Bank	36.990961	-79.850516
Right Bank	36.990694	-79.850709

Description: Cross Section 10 is located approximately 1.5 mi. downstream of the dam, or 2,700 feet downstream of Cross Section 9, east of Power Dam Road and north of the power line easement. Accessed via vehicle from Hudson Farm Lane. The section is flanked by fields on both sides, with a narrow band of trees along the tops of bank. Mature trees dotted the banks down to the edge of the observed water surface and root structure afforded good bank stability despite steep slopes and an incised section (~12-ft bank height). The water surface width at this section was consistent with that seen at Cross Section 9. Sediment deposition of sand was noted at or just above the observed water surface. Banks were relatively stable due to good coverage by woody root structure. Fine sediment had buried bed features and filled the thalweg, resulting in little variation in flow depth across the section.

The instrument setup for this cross section was at the left bank (HI = 3.54 ft.). The cross section plot is on Sheet 10 of Appendix B. No pebble count was taken at this location due the uniform fine-grained (sandy) nature of bed sediments. The small gravel (~1-in diameter) area was not representative of the overall bed conditions.



Photo 10-1

Location, Orientation: XS 10, Looking Upstream

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/04/17, 12:23 PM

Description: View looking upstream from the middle of Cross Section 10

Woody Debris: 2



Photo 10-2

Location, Orientation: XS 10, Looking Downstream

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/04/17, 12:23 PM

Description: View looking downstream from the middle of Cross Section 10

Woody Debris: 4



Photo 10-3

Location, Orientation: XS 10, Left Bank

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/04/17, 12:26 PM

Description: View looking left from the middle of Cross Section 10

Vegetation: 30% herbaceous cover, trees



Photo 10-4

Location, Orientation: XS 10, Right Bank

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/04/17, 12:23 PM

Description: View looking right from the middle of Cross Section 10

Vegetation: 60% herbaceous cover, some trees higher on bank



Photo 10-5

Location, Orientation: XS 10, Upstream looking down

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/04/17, 12:28 PM

Description: View looking downstream at Cross Section 10 from an upstream position



Photo 10-6

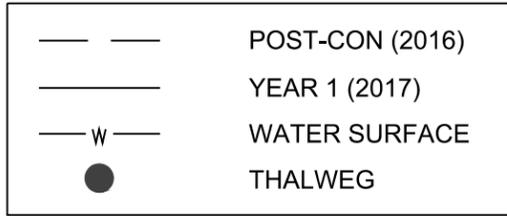
Location, Orientation: XS 10, Downstream looking up

Permit Number: JPA #15-1551

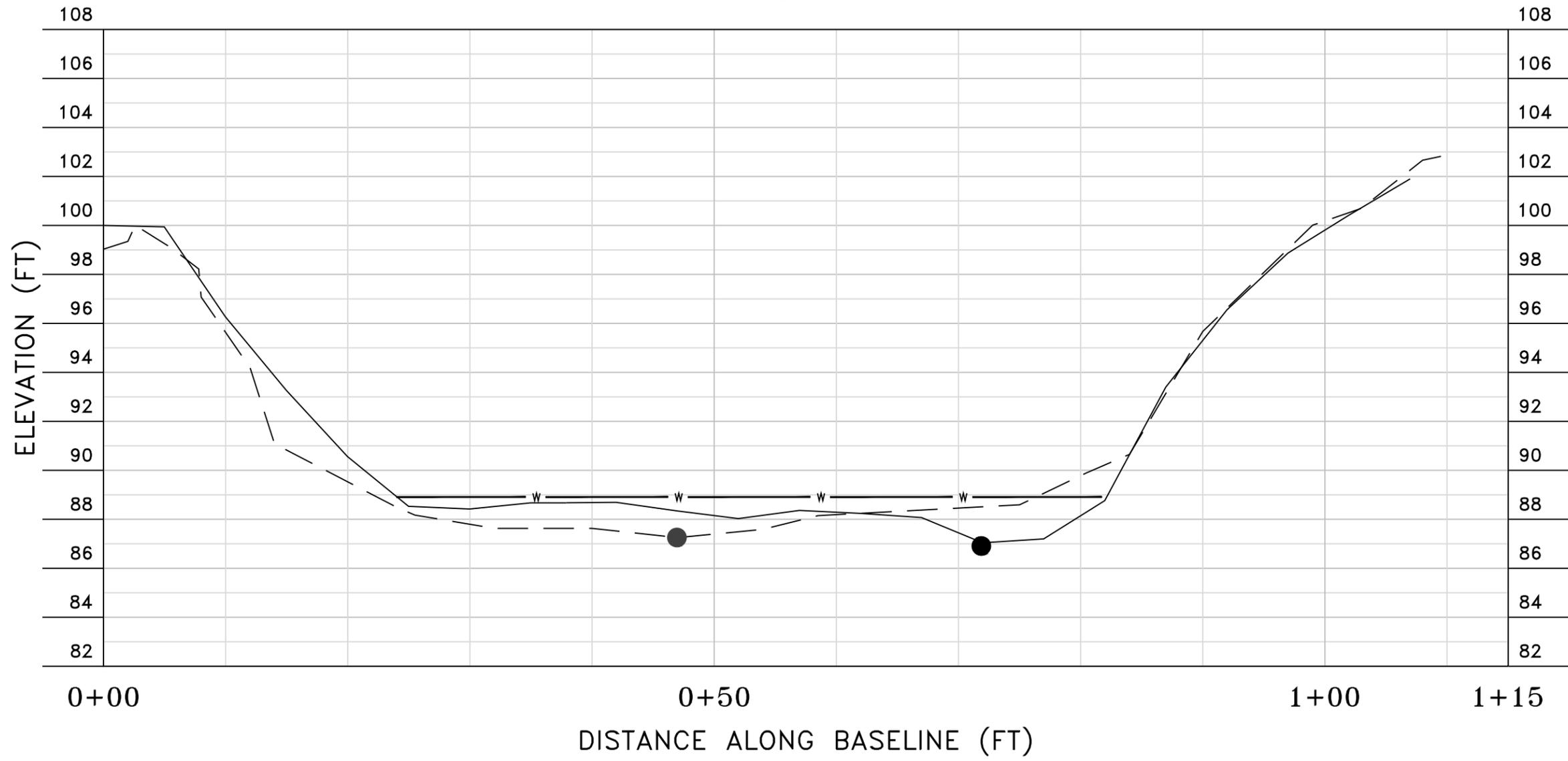
Wetland Data Sheet Reference: n/a

10/04/17, 12:25 PM

Description: View looking upstream at Cross Section 10 from a downstream position



XS 10



PROFILE SCALE:

HORIZ: 1"=10'

VERT: 1"=5'

(ELEV. RELATIVE TO ASSUMED XS END PIN AT 100.)



Pigg River Dam Removal Restoration - Monitoring
Rocky Mount, Virginia

Year 1 - XS 10

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DATE: DEC 2017 SCALE: AS NOTED

Boundary and Topo Source:
WSSI and Orange Digital Data

Design	Draft	Approved
NAS	NAS	NAS

Sheet #
59

Computer File Name:
C:\2016\2016-2017\2016-01-14\2016-01-14.dwg

Cross Section 11

<i>Location</i>	<i>Latitude</i>	<i>Longitude</i>
Left Bank	36.991708	-79.845110
Right Bank	36.991595	-79.845424

Description: Cross Section 11 is located approximately 2.6 miles downstream of the dam, or 1.1 miles downstream of Cross Section 10, north of the power line easement and approximately 1/3rd mile east of Cross Section 10 (as the crow flies). Accessed via vehicle from Hudson Farm Lane. The section was flanked by fields on the left bank and dense forest on the right bank, with a narrow band of trees along the left top of bank. Mature trees grew along the banks to within a few feet of the observed water surface elevation. Banks were stable and slopes much more gradual than other cross sections (generally 2:1 or less). Top of bank height on the right bank was significantly lower than in previous sections (approx. 5 ft). The water surface width at this section was consistent with that seen at Cross Section 10. Minor bank erosion and sand deposits were observed along the edge of water on right bank. Estimated 5% of coarse bed material exposed within cross section. Riffle above cross section embedded by roughly .10 ft. of sandy material.

The instrument setup for this cross section was at the left bank (HI = 3.32 ft.). The cross section plot is on Sheet 11 of Appendix B and the thalweg plot is on Sheet 11 of Appendix C. Pebble count information is summarized on Sheet 1 of Appendix D and indicates a gravel-dominated bed composition.



Photo 11-1

Location, Orientation: XS 11, Looking Upstream

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/04/17, 2:38 PM

Description: View looking upstream from the middle of Cross Section 11

Woody Debris: 2



Photo 11-2

Location, Orientation: XS 11, Looking Downstream

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/04/17, 2:37 PM

Description: View looking downstream from the middle of Cross Section 11

Woody Debris: 3



Photo 11-3

Location, Orientation: XS 11, Left Bank

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/04/17, 2:40 PM

Description: View looking left from the middle of Cross Section 11

Vegetation: 40% herbaceous cover, trees



Photo 11-4

Location, Orientation: XS 11, Right Bank

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/04/17, 2:39 PM

Description: View looking right from the middle of Cross Section 11

Vegetation: 60% herbaceous cover and small trees going up slope, bamboo/forest at bankfull



Photo 11-5

Location, Orientation: XS 11, Upstream looking down

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/04/17, 2:44 PM

Description: View looking downstream at Cross Section 11 from an upstream position



Photo 11-6

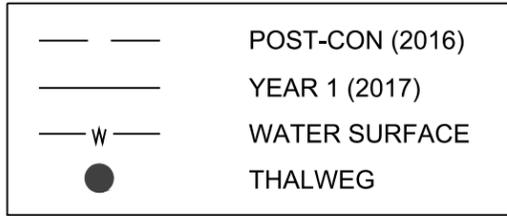
Location, Orientation: XS 11, Downstream looking up

Permit Number: JPA #15-1551

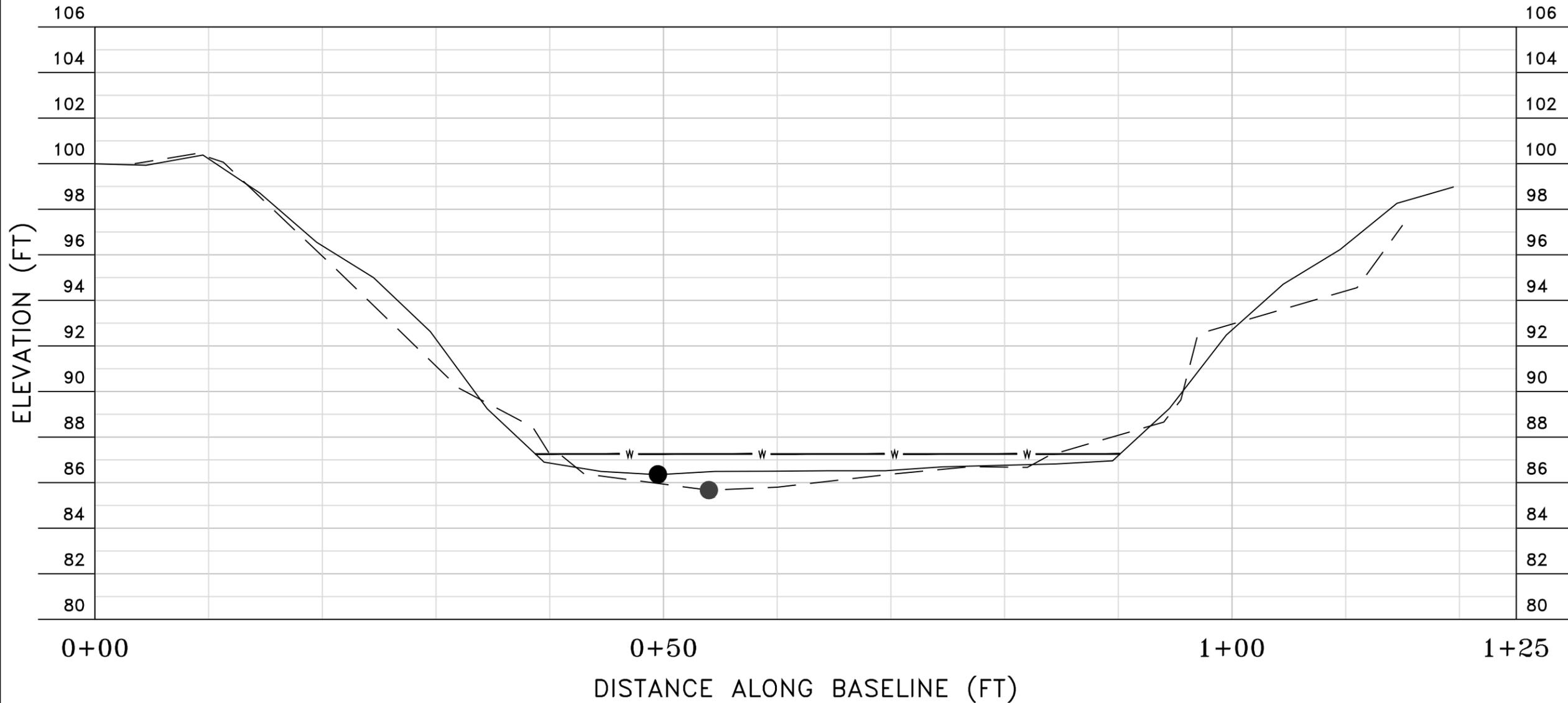
Wetland Data Sheet Reference: n/a

10/04/17, 2:42 PM

Description: View looking upstream at Cross Section 11 from a downstream position



XS 11



PROFILE SCALE:

HORIZ: 1"=10'

VERT: 1"=5'

(ELEV. RELATIVE TO ASSUMED XS END PIN AT 100.)



Pigg River Dam Removal Restoration - Monitoring
 Rocky Mount, Virginia

Year 1 - XS 11

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ELEVATION (FT)

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No.	Date	Description		

DATE: DEC 2017 SCALE: AS NOTED

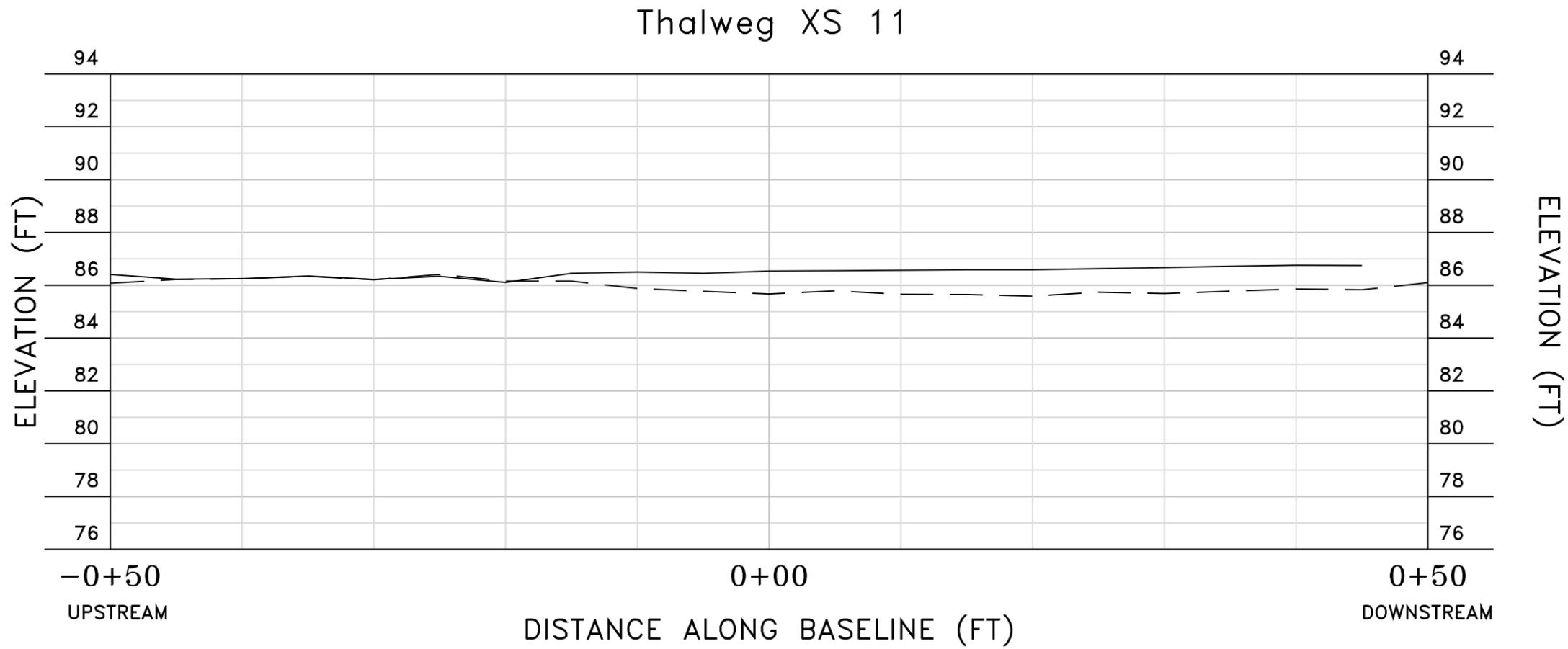
Boundary and Topo Source:
 WSSI and Orange Digital Data

Design	Draft	Approved
NAS	NAS	NAS

Sheet #
 65

Computer File Name:
 C:\2016\2016-2017\2016-01-14\2016-01-14.dwg

- - - POST-CON (2016)
 ——— YEAR 1 (2017)



PROFILE SCALE:
 HORIZ: 1" = 10'
 VERT: 1" = 5'
 (ELEV. RELATIVE TO ASSUMED XS END PIN AT 100.)

Wetland Solutions, Inc.
 5300 Wellington Branch Drive • Suite 100
 Gainesville, Virginia 20155
 Phone: 703-679-5600 • Fax: 703-679-5601
 www.wetlandsolutions.com

Pigg River Dam Removal Restoration - Monitoring
 Rocky Mount, Virginia
 Year 1 - Thalweg Profile XS 11
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DATE: DEC 2017 SCALE: AS NOTED

Boundary and Topo Source:
WSSI and Orange Digital Data

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NAS	NAS	NAS

Sheet #
66

Cross Section 12

<i>Location</i>	<i>Latitude</i>	<i>Longitude</i>
Left Bank	37.002258	-79.825398
Right Bank	37.002247	-79.825677

Description: Cross Section 12 is located approximately 5.2 mi downstream of the dam, or 2.6 mi downstream of Cross Section 11, approximately 300 feet downstream of the Chestnut Hill Road bridge. The section was accessed by parking along the Chestnut Hill Road and walking through the private property on the right bank (with permission). The section is flanked by turf/fields on the right bank (with a narrow band of trees at the top of bank) and forest on the left bank. Banks were steep (~1:1), but stable due to stability afforded by mature woody vegetation and root mass. The section is located at the head of a riffle feature. The top of bank height was greater than the that seen in Cross Section 11, but generally less than other sections downstream of the dam. The water surface width was approximately 50% wider than in previous sections – partially due to the larger watershed area which includes Power Mill Creek. Fine sediment deposition was observed at the cross section with an estimated 50% of coarse bed material exposed.

The instrument setup for this cross section was at the right bank (HI = 3.42 ft.). The cross section plot is on Sheet 11 of Appendix B and the thalweg plot is on Sheet 12 of Appendix C. Pebble count information is summarized on Sheet 2 of Appendix D and indicates a gravel-dominated bed composition.



Photo 12-1

Location, Orientation: XS 12, Looking Upstream

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/05/17, 12:58 PM

Description: View looking upstream from the middle of Cross Section 12

Woody Debris: 2



Photo 12-2

Location, Orientation: XS 12, Looking Downstream

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/05/17, 12:58 PM

Description: View looking downstream from the middle of Cross Section 12

Woody Debris: 2



Photo 12-3

Location, Orientation: XS 12, Left Bank

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/05/17, 1:00 PM

Description: View looking left from the middle of Cross Section 12

Vegetation: 80% herbaceous cover, trees



Photo 12-4

Location, Orientation: XS 12, Right Bank

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/05/17, 12:59 PM

Description: View looking right from the middle of Cross Section 12

Vegetation: 60% herbaceous cover, trees at top of bank

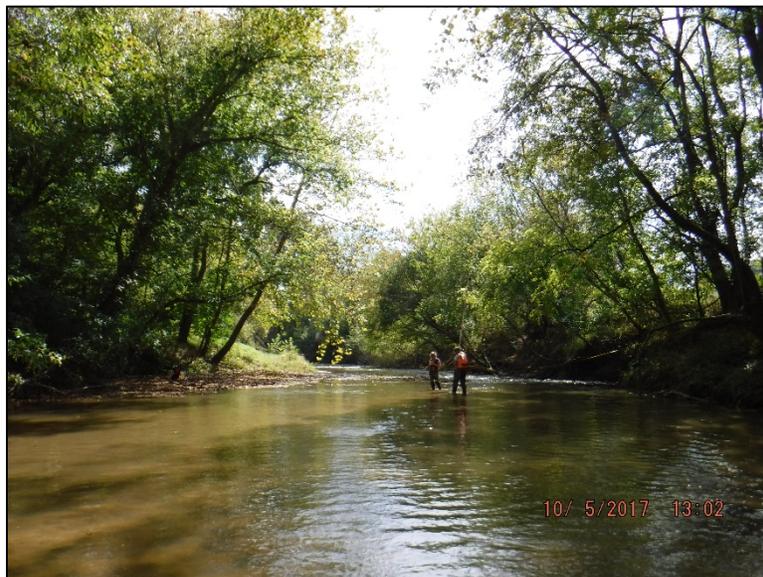


Photo 12-5

Location, Orientation: XS 12, Upstream looking down

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/05/17, 1:02 PM

Description: View looking downstream at Cross Section 12 from an upstream position



Photo 12-6

Location, Orientation: XS 12, Downstream looking up

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: n/a

10/05/17, 1:03 PM

Description: View looking upstream at Cross Section 12 from a downstream position



Photo 12-7

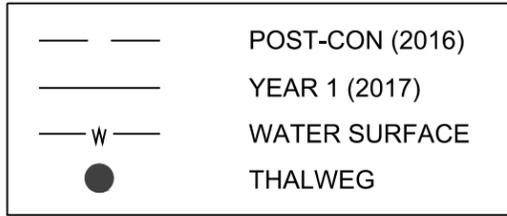
Location, Orientation: XS 12, Bed Material

Permit Number: JPA #15-1551

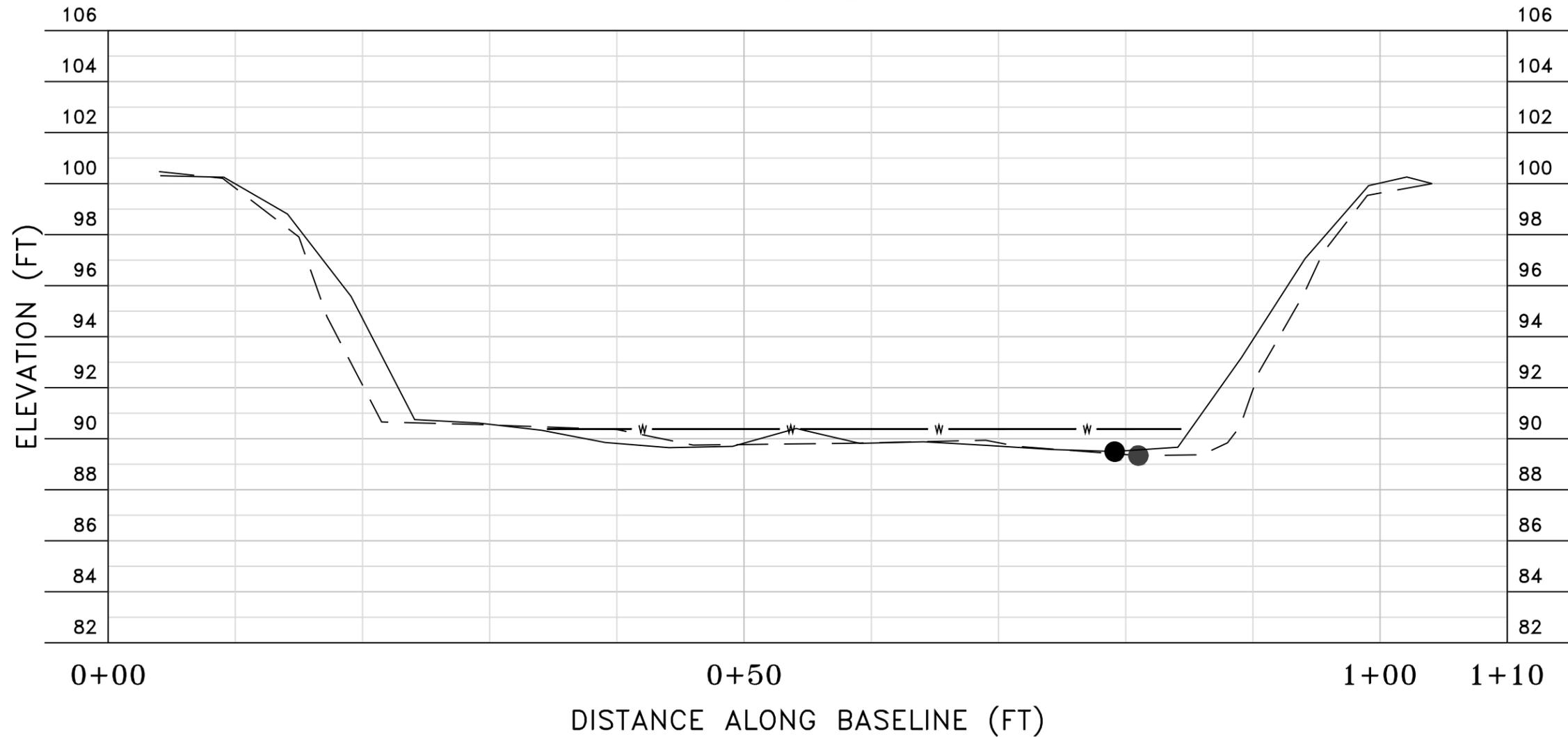
Wetland Data Sheet Reference: n/a

10/05/17, 1:01 PM

Description: Bed material at Cross Section 12 was sand and coarse gravel



XS 12



PROFILE SCALE:

HORIZ: 1"=10'

VERT: 1"=5'

(ELEV. RELATIVE TO ASSUMED XS END PIN AT 100.)



Pigg River Dam Removal Restoration - Monitoring
 Rocky Mount, Virginia

Year 1 - XS 12
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REVISIONS		Rev. No.	App. By
No.	Date	Description	

DATE: DEC 2017 SCALE: AS NOTED

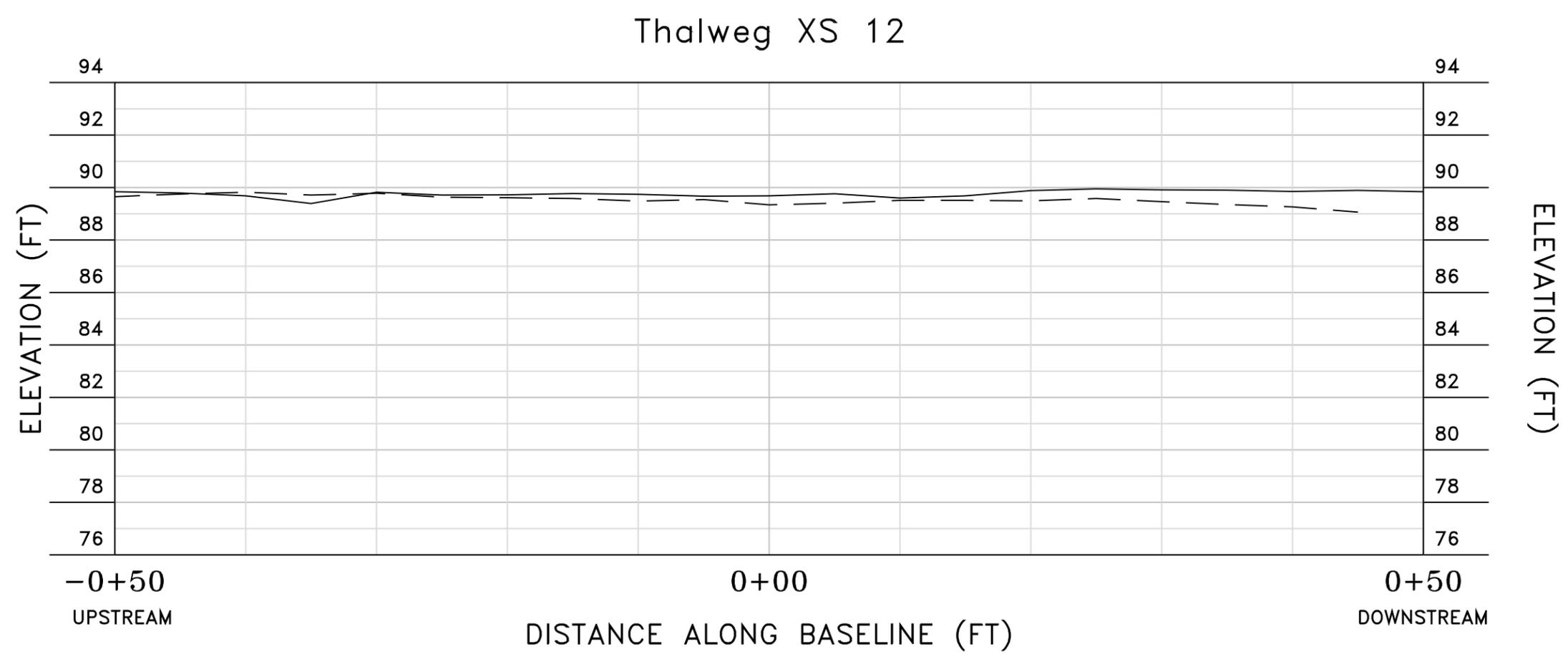
Boundary and Topo Source:
 WSSI and Orange Digital Data

Design	Draft	Approved
NAS	NAS	NAS

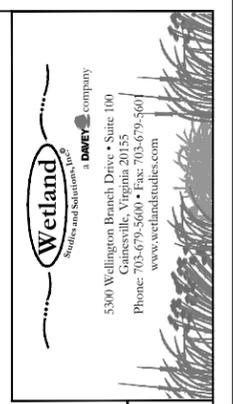
Sheet #
 71

Computer File Name:
 C:\2016\2016-2017\2016-01-01\2016-01-01.dwg

- - - POST-CON (2016)
 ——— YEAR 1 (2017)



PROFILE SCALE:
 HORIZ: 1"=10'
 VERT: 1"=5'
 (ELEV. RELATIVE TO ASSUMED XS END PIN AT 100.)



Pigg River Dam Removal Restoration - Monitoring
 Rocky Mount, Virginia
 Year 1 - Thalweg Profile XS 12
 Copyright © 2017

REVISIONS		Rev. No.	App. By
No.	Date	Description	

DATE: DEC 2017 SCALE: AS NOTED

Boundary and Topo Source:
 WSSI and Orange Digital Data

Design	Draft	Approved
NAS	NAS	NAS

Sheet #

72

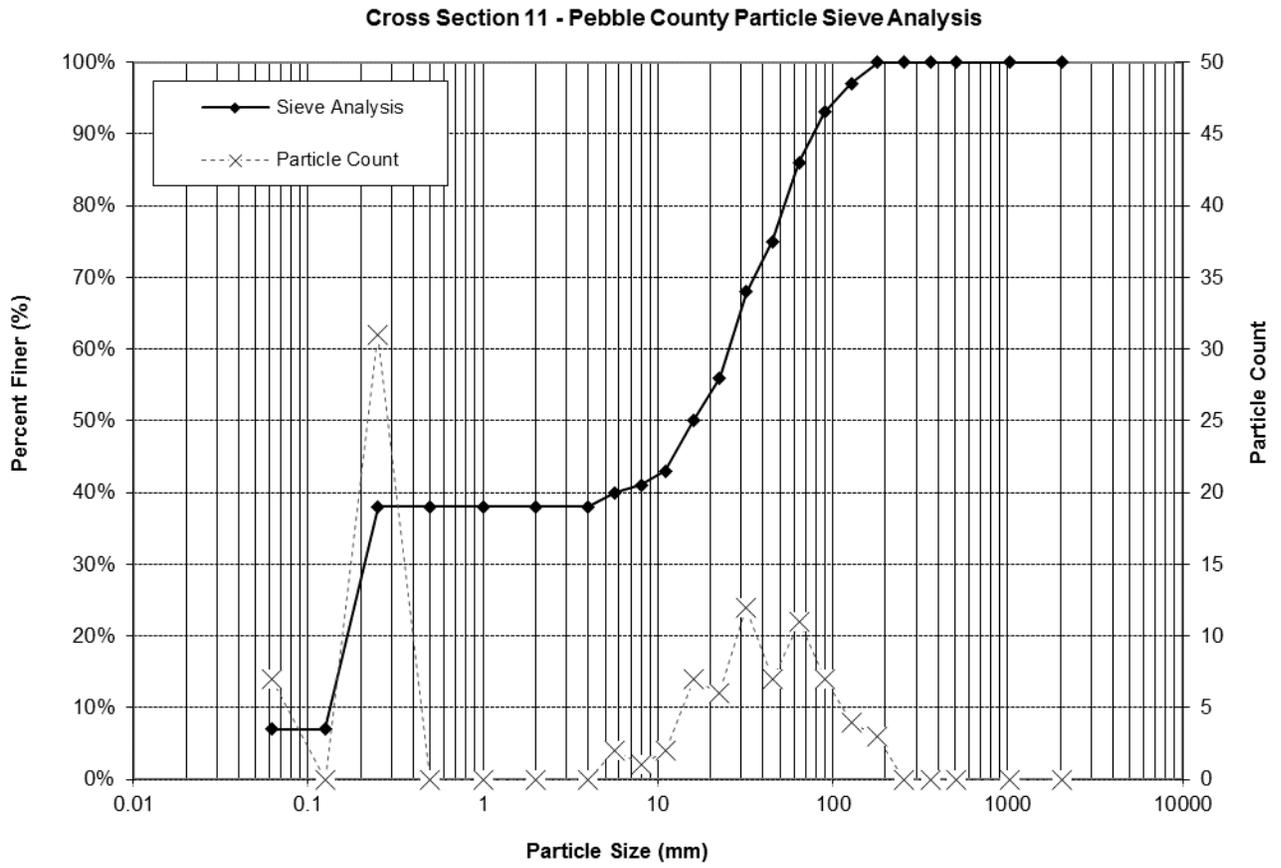
Computer File Name:

Appendix B

Pebble Count Data

RIFFLE CROSS SECTION PEBBLE COUNT DATA WITH PARTICLE SIZE ANALYSIS						
Project Name: Pigg River Monitoring (WSSI# 22906.01)						
Stream ID & XS Station: XS11 (Located 250 ft. upstream in nearest riffle)				Date: Oct. 2017		
Evaluators: MTW, LLC, JHL				FORVA		
Pebble Count Data						
	Particle			Particle Count	ITEM %	CUM %
	Description	Size (mm)		Total		
SAND	Silt/Clay	0	0.062	7	7%	7%
	Very Fine	0.062	0.125	0	0%	7%
	Fine	0.125	0.25	31	31%	38%
	Medium	0.25	0.5	0	0%	38%
	Coarse	0.5	1.0	0	0%	38%
GRAVEL	Very Coarse	1.0	2.0	0	0%	38%
	Very Fine	2.0	4.0	0	0%	38%
	Fine	4.0	5.7	2	2%	40%
	Fine	5.7	8.0	1	1%	41%
	Medium	8.0	11.03	2	2%	43%
	Medium	11.3	16.0	7	7%	50%
	Coarse	16.0	22.6	6	6%	56%
	Coarse	22.6	32.0	12	12%	68%
COBBLE	Very Coarse	32	45	7	7%	75%
	Very Coarse	45	64	11	11%	86%
	Small	64	90	7	7%	93%
	Small	90	128	4	4%	97%
BOULDER	Large	128	180	3	3%	100%
	Large	180	256	0	0%	100%
	Small	256	362	0	0%	100%
	Small	362	512	0	0%	100%
BOULDER	Medium	512	1024	0	0%	100%
	Large - Vry Large	1024	2048	0	0%	100%
	Bedrock	2048		0	0%	100%
Total Particles				100		

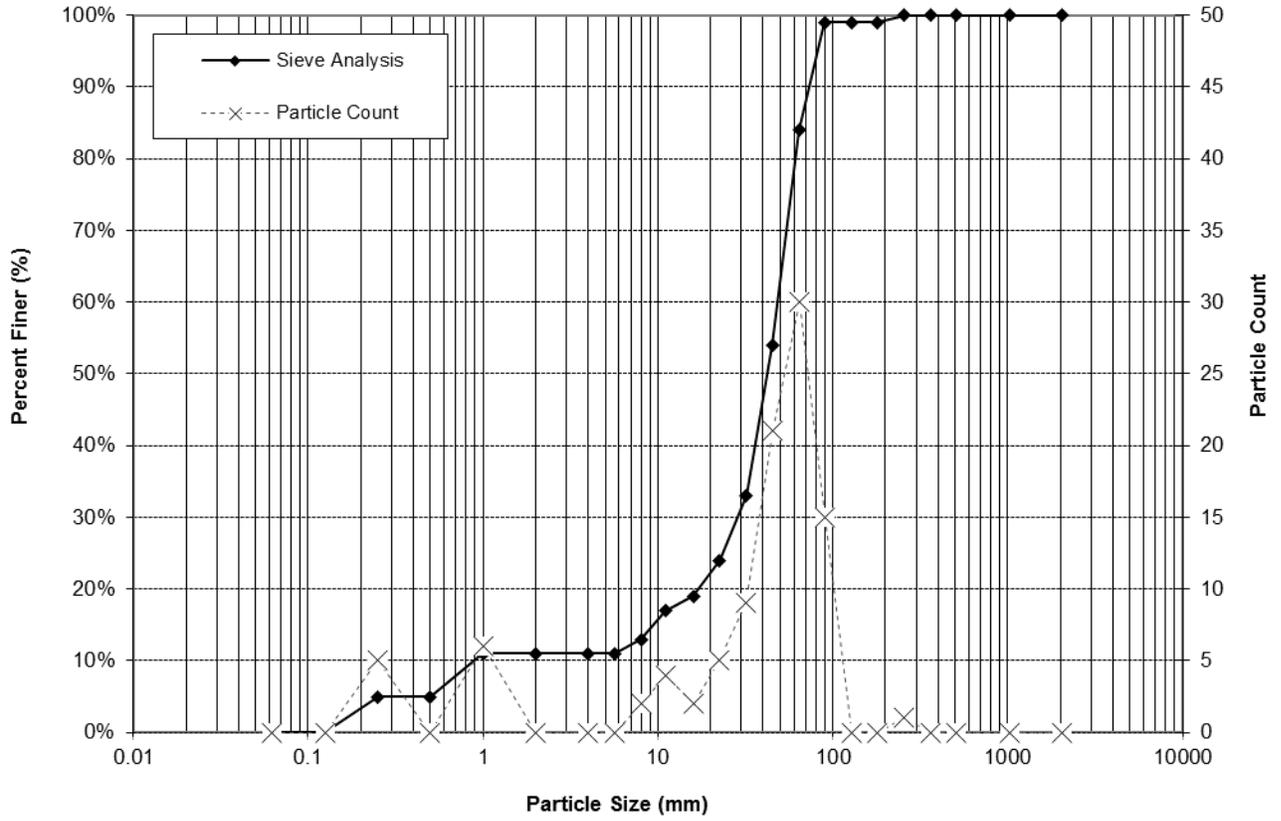
Particle Size Analysis	
Silt/Clay (%)	7%
Sand (%)	31%
Gravel (%)	48%
Cobble (%)	14%
Boulder (%)	0%
Bedrock (%)	0%
D16 (mm)	0.16
D35 (mm)	0.24
D50 (mm)	16.00
D84 (mm)	60.55
D95 (mm)	109.00
D100 (mm)	180.00



RIFFLE CROSS SECTION PEBBLE COUNT DATA WITH PARTICLE SIZE ANALYSIS						
Project Name: Pigg River Monitoring (WSSI# 22906.01)						
Stream ID & XS Station: XS12 (Located 50 ft. downstream in nearest riffle)					Date: Oct. 2017	
Evaluators: MTW, LLC, JHL					FORVA	
Pebble Count Data						
	Particle			Particle Count	ITEM %	CUM %
	Description	Size (mm)				
	Silt/Clay	0	0.062	0	0%	0%
SAND	Very Fine	0.062	0.125	0	0%	0%
	Fine	0.125	0.25	5	5%	5%
	Medium	0.25	0.5	0	0%	5%
	Coarse	0.5	1.0	6	6%	11%
	Very Coarse	1.0	2.0	0	0%	11%
GRAVEL	Very Fine	2.0	4.0	0	0%	11%
	Fine	4.0	5.7	0	0%	11%
	Fine	5.7	8.0	2	2%	13%
	Medium	8.0	11.03	4	4%	17%
	Medium	11.3	16.0	2	2%	19%
	Coarse	16.0	22.6	5	5%	24%
	Coarse	22.6	32.0	9	9%	33%
	Very Coarse	32	45	21	21%	54%
COBBLE	Very Coarse	45	64	30	30%	84%
	Small	64	90	15	15%	99%
	Small	90	128	0	0%	99%
	Large	128	180	0	0%	99%
BOULDER	Large	180	256	1	1%	100%
	Small	256	362	0	0%	100%
	Small	362	512	0	0%	100%
	Medium	512	1024	0	0%	100%
	Large - Vry Large	1024	2048	0	0%	100%
	Bedrock	2048		0	0%	100%
Total Particles				100		

Particle Size Analysis	
Silt/Clay (%)	0%
Sand (%)	11%
Gravel (%)	73%
Cobble (%)	16%
Boulder (%)	0%
Bedrock (%)	0%
D16 (mm)	10.27
D35 (mm)	33.24
D50 (mm)	42.52
D84 (mm)	64.00
D95 (mm)	83.07
D100 (mm)	256.00

Cross Section 12 - Pebble County Particle Sieve Analysis



Appendix C

Biological Monitoring Data

Biological stream monitoring was conducted along three biological monitoring reaches for the Pigg River Restoration at Power Dam project. The baseline conditions for this biomonitoring program were established by the Conservation Management Institute and the U.S. Geological Survey, as described in the October 27, 2009 report titled, “Biomonitoring for the Rocky Mount Power Dam Removal Project: Establishing Baseline Conditions” (Hitt, et al. 2009). Wetland Studies and Solutions, Inc. (WSSI) staff re-established the previously monitored biomonitoring reaches at the time of the 2017 field work. Once re-established, these reaches are to be monitored in post-construction Years 1 and 5. Each reach was collocated with a cross-section: Reach A is at Cross-Section 1, Reach B is at Cross Section 7, and Reach C is at Cross Section 8. The locations of these three sampling reaches relative to the 12 cross-sections are depicted in **Exhibit 1**. Benthic macroinvertebrate sampling and habitat assessment field work was conducted by WSSI staff Lauren Conner PWS, PWD, CT¹, Jamie Larkin WPIT, CT², and Marshall Willis PWS, CE³ on October 3 and 5, 2017.

The stream habitat assessment was conducted using guidance established in the Department of Environmental Quality (DEQ) Standard Operating Procedures (SOPs) for stream habitat assessment (DEQ 2008) and the U.S. Environmental Protection Agency’s Rapid Bioassessment Protocol for habitat (Barbour et al. 1999). Habitat conditions were assessed by qualitatively rating ten habitat parameters, including Epifaunal Substrate/Available Cover, Embeddedness, Velocity/Depth Regime, Sediment Deposition, Channel Flow Status, Channel Alteration, Frequency of Riffles, Bank Stability, Vegetative Protection, and Riparian Vegetative Zone Width. The overall habitat quality of each reach was determined by adding together the individual metric scores to provide a Total Habitat Score at each reach, with a maximum of 200 points possible. Each reach was then assigned a narrative rating according to the total habitat score, where “Optimal” is 200-160, “Sub-Optimal” is 159-107, “Marginal” is 106-54, and “Poor” is 53-0. Stream habitat data was recorded on the WSSI Benthic Macroinvertebrate and Habitat Field Data Sheets which are included in this Appendix and shown below (Table 1 and Figure 1).

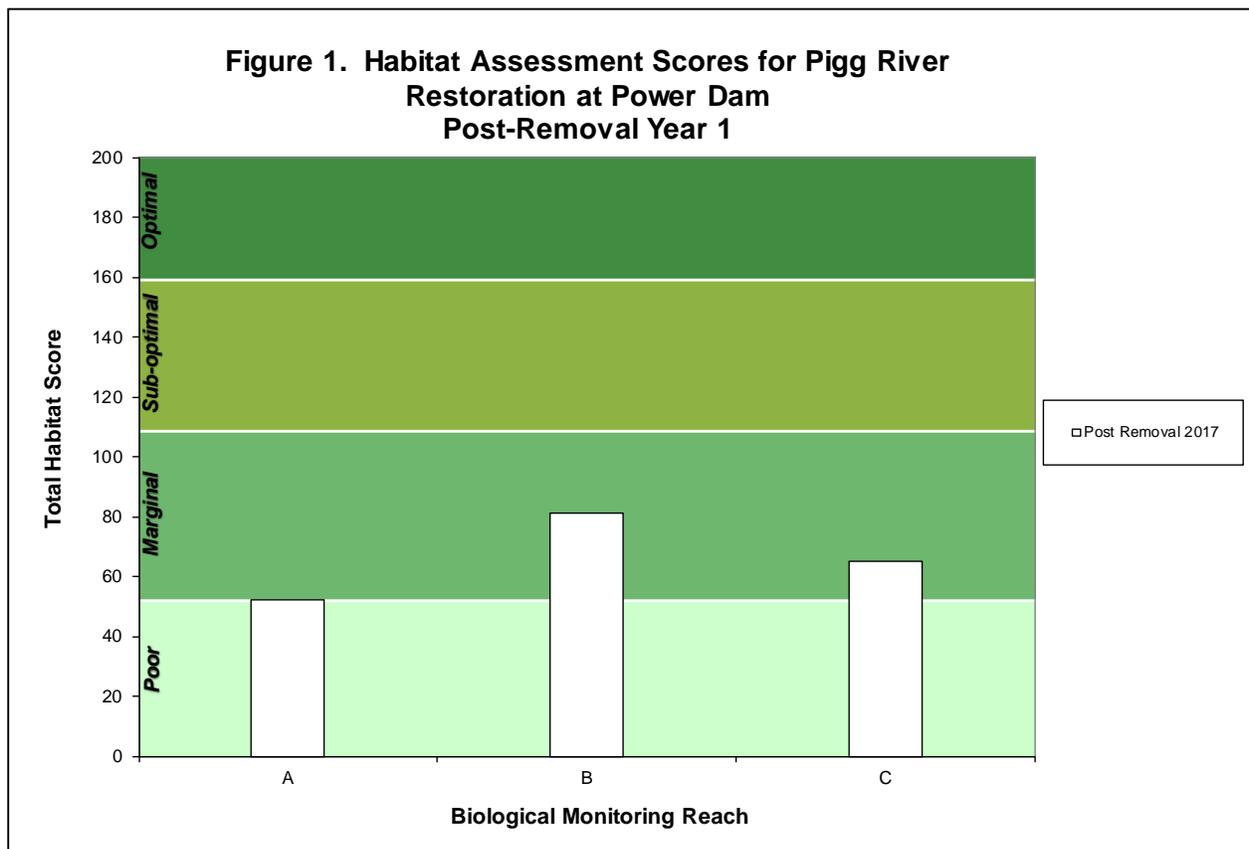
Reach A is in “Poor” condition primarily due to obvious bank erosion with heavy deposits of material into the reach which increased the embeddedness and made the substrate unstable. Reach B is in “Marginal” condition with banks that are moderately unstable with a lack of vegetation protection. Sediment deposition is also present in Reach B but various velocity/depth regimes are present in this reach and the riparian zone is fairly wide. Reach C is in “Marginal” condition with moderately unstable banks and bare soil present with heavy deposits of fine material into the riverbed.

¹ Professional Wetland Scientist #2766, Society of Wetland Scientists Certification Program, Inc.; Virginia Certified Professional Wetland Delineator #3402-000155; Certified Level 1 Taxonomist: All Phyla, Society for Freshwater Science (SFS).

² Wetland Professional in Training, Society of Wetland Scientists Certification Program, Inc.; Certified Level 1 Taxonomist: All Phyla, Society for Freshwater Science (SFS).

³ Professional Wetland Scientist #2796, Society of Wetland Scientists Certification Program, Inc.; Certified Ecologist, Ecological Society of America.

Table 1. 2017 Total Habitat Assessment Scores		
Biomonitoring Reach	Total Habitat Score	Narrative Rating
Reach A	52	Poor
Reach B	81	Marginal
Reach C	65	Marginal
Average	66	Marginal



To assess benthic macroinvertebrate condition, 30 linear feet of best-available habitat was sampled in each reach using a D-Framed Net. A 300-foot linear reach was established at each Sampling Reach location, with the 150-foot marker placed at the corresponding Cross Section location. Within this 300-foot sampling reach, 10 samples were collected at different habitat types within the sampling reach. Each of the 10 samples consisted of a three-foot linear sampling area. Habitat types sampled include cobble/gravel, snags/leafpacks, under-cut banks, root-wads, and loose substrate along the stream bed. A variety of habitat types were sampled at each Sampling Reach, with cobbles and organic materials scrubbed by hand to dislodge attached macroinvertebrates. Organic materials caught in the dip-net were subsequently scrubbed and removed by hand within the sieve bucket to remove invertebrates. Benthic field data was recorded on WSSI’s Benthic Macroinvertebrate and Habitat Field Data Sheets (developed from

the EPA's RBP Benthic Macroinvertebrate Field Data Sheets), which are included in this Appendix.

The benthic macroinvertebrate samples were processed and subsampled by WSSI staff using a fixed-count method, where organisms were randomly picked from a gridded (numbered) tray and the organisms were identified to the family level (if possible) using a dissecting microscope. Each individual (containing a head) found in a sample was recorded and enumerated on a WSSI Benthic Macroinvertebrate Bench Sheet which are included in this Appendix for each reach.

Benthic macroinvertebrate results show that individuals from 24⁴ taxa were collected from all three reaches collectively (Table 2, below) during the 2017 post-removal Year 1 benthic macroinvertebrate monitoring. Of all 24 taxa collected, non-biting midge larvae (Family Chironomidae) and flat-headed mayflies (Family Heptageniidae) comprised the majority of individuals in each reach (Table 2, below).

Table 2. Pigg River Restoration at Power Dam 2017 Raw Data				
TAXA	REACH			
	Reach A	Reach B	Reach C	Total
Aeshenidae	-	-	1	1
Ancyliidae	1	-	1	2
Baetidae	3	6	1	10
Brachycentridae	-	-	3	3
Caenidae	2	1	2	5
Capniidae	1	-	-	1
Chironomidae	52	36	19	107
Corbiculidae	2	1	-	3
Corixidae	1	-	-	1
Elmidae	5	1	9	15
Empididae	1	2	-	3
Ephemerellidae	1	-	-	1
Ephemeroptera	1	-	1	2
Gomphidae	-	-	1	1
Heptageniidae	11	27	40	78
Hydropsychidae	7	21	19	47
Isonychiidae	-	-	5	5
Leptoceridae	2	-	-	2
Perlodidae	-	2	1	3
Philopotamidae	-	-	1	1
Polycentropodidae	1	-	-	1
Psychodidae	1	-	-	1
Simuliidae	1	2	-	3
Sphaeriidae	8	-	-	8
Tipulidae	1	-	-	1
Trichoptera	3	-	-	3
Total	105	99	104	308

⁴ Ephemeroptera and Trichoptera were not included in the taxa count. Orders, are not specific enough to have a recognized tolerance value (according to the DEQ Master Taxa List) and have likely already been represented by another family that was identified. Taxa listed under the Order level are typically too damaged to put in a lower classification.

Benthic macroinvertebrate data were analyzed by calculating the Stream Condition Index for Virginia Non-coastal Streams (VA-SCI), following guidance established in “A Stream Condition Index for Virginia Non-Coastal Streams” (Tetra Tech 2003) and “Using Probabilistic Monitoring Data to Validate the Non-Coastal Virginia Stream Condition Index” (DEQ 2006). The VA-SCI is a multi-metric Index of Biotic Integrity developed for the DEQ to assess Streams of the Commonwealth. The VA-SCI uses seven biotic metrics and one biotic index including Total Taxa, EPT Taxa, Percent Ephemeroptera, Percent Plecoptera + Trichoptera (Excluding Hydropsychidae), Percent Scrapers, Percent Chironomidae, Percent Top Two Dominant Taxa, and Hilsenhoff Biotic Index.

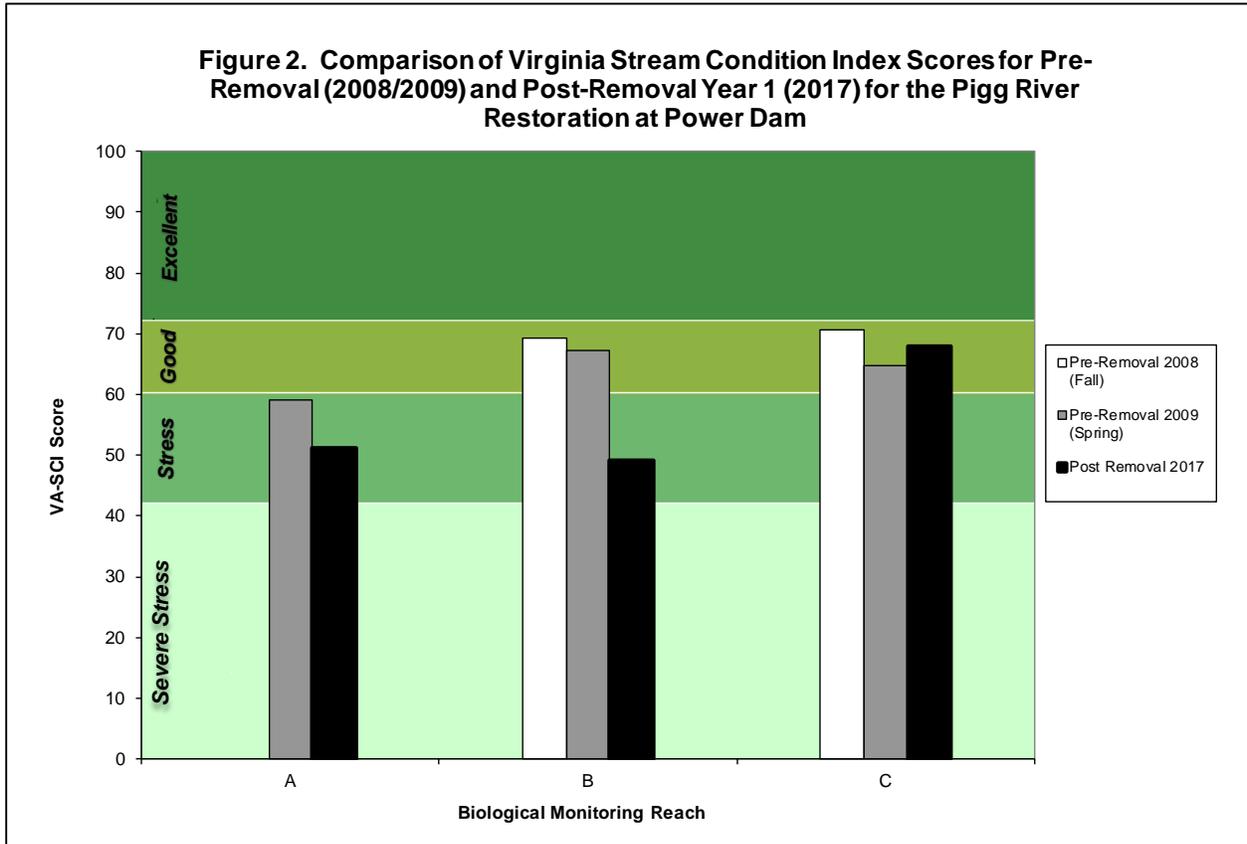
The taxa data collected for each reach were used to calculate the biotic metrics as shown in [Table 3](#), below. The VA-SCI requires that these metrics be weighted to determine the VA-SCI, as shown in [Table 4](#), below.

Reach	Total Taxa	Total EPT Taxa	Percent Ephemeroptera	Percent Plecoptera + Trichoptera (Excluding Hydropsychidae)	Percent Scrapers	Percent Chironomidae	Percent Top Two Dominant	HBI
Reach A	11	8	17.14	6.67	16.19	49.52	60	5.30
Reach B	10	5	34.34	1.01	28.28	36.36	64	5.02
Reach C	13	5	47.12	4.81	48.08	18.27	57	4.28

WEIGHTED METRIC	BIOLOGICAL MONITORING REACH		
	Reach A	Reach B	Reach C
Total Taxa	81.82	45.45	59.09
EPT Taxa	72.73	45.45	72.73
Percent Ephemeroptera	27.97	56.03	76.86
Percent Plecoptera + Trichoptera (Excluding Hydropsychidae)	18.73	2.84	13.50
Percent Scrapers	31.38	54.81	93.17
Percent Chironomidae	50.48	63.64	81.73
Percent Top Two Dominant	57.80	52.55	62.53
HBI	69.19	73.23	84.13
VA-SCI Numerical Score	51.26	49.25	67.97
VA-SCI Narrative Score	Stress	Stress	Good
Average VA-SCI Numerical Score	56.16		
Average VA-SCI Narrative Score	Stress		

[Figure 1](#) depicts the VA-SCI scores from the previous monitoring compared to the post-removal Year 1 data collected this year. Reach A experienced a drop in its VA-SCI score but stayed within the “Stress” category from this year compared to the previous monitoring efforts. Reach B also experienced a drop in its VA-SCI scores from this year to the previous monitoring efforts but went from the “Good” category, to the “Stress” category. Reach C’s VA-SCI has stayed relatively consistent in the “Good” category for each monitoring event.

Due to the natural variability of macroinvertebrate communities and the confounding issues dam placement and removal introduce, it is difficult to determine at this time if the removal of the dam has caused the community assemblages to improve or degrade. It is hoped that with subsequent reporting, trends in the health of the benthic community will be identified.



*Reach A was not monitored during the Pre-Removal 2008 (Fall) fieldwork.

Appendix D

DEQ Wetland Hydrology Monitoring Data Sheets and Photos

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Photo 4-1

Location, Orientation: Wetland Site 4, Looking southwest

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: Site 4, Pt 1

11/29/17, 2:55 PM

Taken by:¹

Description: Taken from wetland facing the main channel (XS2)

¹ All DEQ hydrology monitoring photos taken by N. Staley



Photo 4-2

Location, Orientation: Wetland Site 4, facing southeast

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: Site 4, Pt 1

11/29/17, 2:56 PM

Description: Looking downstream through wetland area



Photo 4-3
Location, Orientation: Wetland Site 4, test pit
Permit Number: JPA #15-1551
Wetland Data Sheet Reference: Site 4, Pt 1
11/29/17, 3:01 PM
Description: Test pit soils



Photo 4-4

Location, Orientation: Wetland Site 4, test pit
Permit Number: JPA #15-1551
Wetland Data Sheet Reference: Site 4, Pt 1
11/29/17, 3:01 PM
Description: Test pit soils



Photo 3-1
Location, Orientation: Wetland Site 3, Looking southwest
Permit Number: JPA #15-1551
Wetland Data Sheet Reference: Site 3, Pt 1
11/29/17, 3:56 PM
Description: Taken from wetland facing the main channel (XS4)



Photo 4-2
Location, Orientation: Wetland Site 4, facing east
Permit Number: JPA #15-1551
Wetland Data Sheet Reference: Site 3, Pt 1
11/29/17, 3:56 PM
Description: Looking downstream through wetland area



Photo 4-3
Location, Orientation: Wetland Site 4, test pit
Permit Number: JPA #15-1551
Wetland Data Sheet Reference: Site 4, Pt 1
11/29/17, 3:01 PM
Description: Test pit soils



Photo 4-4
Location, Orientation: Wetland Site 3, test pit
Permit Number: JPA #15-1551
Wetland Data Sheet Reference: Site 3, Pt 1
11/29/17, 4:01 PM
Description: Test pit soils



Photo 2-1

Location, Orientation: Wetland Site 2, Looking east

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: Site 2, Pt 1

11/29/17, 1:27 PM

Description: Taken from wetland facing the main channel (pink flagging is previous wetland Well #1 location)



Photo 2-2

Location, Orientation: Wetland Site 2, facing north

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: Site 2, Pt 1

11/29/17, 1:27 PM

Description: Looking downstream through wetland area



Photo 2-3

Location, Orientation: Wetland Site 2, test pit

Permit Number: JPA #15-1551 Wetland Data Sheet Reference: Site 2, Pt 1

11/29/17, 1:36 PM

Description: Test pit soils



Photo 2-4

Location, Orientation: Wetland Site 2, test pit
Permit Number: JPA #15-1551
Wetland Data Sheet Reference: Site 2, Pt 1
11/29/17, 1:31 PM
Description: Test pit soils



Photo 2-5

Location, Orientation: Wetland Site 2, Looking east

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: Site 2, Pt 2

11/29/17, 1:51 PM

Description: Taken from wetland facing the main channel



Photo 2-6

Location, Orientation: Wetland Site 2, facing north

Permit Number: JPA #15-1551

Wetland Data Sheet Reference: Site 2, Pt 2

11/29/17, 1:50 PM

Description: Looking downstream through wetland area



Photo 2-7

Location, Orientation: Wetland Site 2, test pit
Permit Number: JPA #15-1551
Wetland Data Sheet Reference: Site 2, Pt 2
11/29/17, 1:54 PM
Description: Test pit soils



Photo 2-8
Location, Orientation: Wetland Site 2, test pit
Permit Number: JPA #15-1551
Wetland Data Sheet Reference: Site 2, Pt 2
11/29/17, 1:54 PM
Description: Test pit soils

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Pigg River - Wetland Site 3 City/County: Franklin Sampling Date: 11/29/2017
 Applicant/Owner: FORVA State: _____ Sampling Point: Pt 1
 Investigator(s): NAS Section, Township, Range: _____
 Landform (hillslope, terrace, etc.): FPL Local relief (concave, convex, none): natural levee Slope (%): 0
 Subregion (LRR or MLRA): _____ Lat: _____ Long: _____ Datum: _____
 Soil Map Unit Name: _____ NWI classification: _____
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No X (If no, explain in Remarks.) Mod. Drought
 Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No _____
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes _____ No _____ Hydric Soil Present? Yes _____ No _____ Wetland Hydrology Present? Yes _____ No _____	Is the Sampled Area within a Wetland? Yes _____ No _____
Remarks:	

HYDROLOGY

Wetland Hydrology Indicators: <u>Primary Indicators (minimum of one is required; check all that apply)</u> ___ Surface Water (A1) ___ True Aquatic Plants (B14) ___ High Water Table (A2) ___ Hydrogen Sulfide Odor (C1) ___ Saturation (A3) ___ Oxidized Rhizospheres on Living Roots (C3) ___ Water Marks (B1) ___ Presence of Reduced Iron (C4) ___ Sediment Deposits (B2) ___ Recent Iron Reduction in Tilled Soils (C6) ___ Drift Deposits (B3) ___ Thin Muck Surface (C7) ___ Algal Mat or Crust (B4) ___ Other (Explain in Remarks) ___ Iron Deposits (B5) ___ ___ Inundation Visible on Aerial Imagery (B7) ___ ___ Water-Stained Leaves (B9) ___ ___ Aquatic Fauna (B13) ___	<u>Secondary Indicators (minimum of two required)</u> ___ Surface Soil Cracks (B6) ___ Sparsely Vegetated Concave Surface (B8) ___ Drainage Patterns (B10) ___ Moss Trim Lines (B16) ___ Dry-Season Water Table (C2) ___ Crayfish Burrows (C8) ___ Saturation Visible on Aerial Imagery (C9) ___ Stunted or Stressed Plants (D1) ___ Geomorphic Position (D2) ___ Shallow Aquitard (D3) ___ Microtopographic Relief (D4) ___ FAC-Neutral Test (D5)
Field Observations: Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____ Saturation Present? Yes _____ No <u>X</u> Depth (inches): _____ (includes capillary fringe)	Wetland Hydrology Present? Yes _____ No _____
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:	
Remarks: <u>40' from Rt bank pin</u> <u>- Soil: even, brown sandy loam</u>	

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Pigg River : Wetland Site 2: Pt 1 City/County: Franklin Co Sampling Date: 12/29/2017
 Applicant/Owner: FORVA State: VA Sampling Point: Site 2: Pt 1
 Investigator(s): NAS Section, Township, Range:
 Landform (hillslope, terrace, etc.): FPL Local relief (concave, convex, none): _____ Slope (%): < 1%
 Subregion (LRR or MLRA): _____ Lat: _____ Long: _____ Datum:
 Soil Map Unit Name: _____ NWI classification:
 Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No X (If no, explain in Remarks.) Mod. Drought
 Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes X No _____
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes _____ No _____ Hydric Soil Present? Yes _____ No _____ Wetland Hydrology Present? Yes _____ No _____	Is the Sampled Area within a Wetland? Yes _____ No _____
Remarks:	

HYDROLOGY

Wetland Hydrology Indicators: <u>Primary Indicators (minimum of one is required; check all that apply)</u> ___ Surface Water (A1) ___ True Aquatic Plants (B14) ___ High Water Table (A2) ___ Hydrogen Sulfide Odor (C1) ___ Saturation (A3) ___ Oxidized Rhizospheres on Living Roots (C3) ___ Water Marks (B1) ___ Presence of Reduced Iron (C4) ___ Sediment Deposits (B2) ___ Recent Iron Reduction in Tilled Soils (C6) ___ Drift Deposits (B3) ___ Thin Muck Surface (C7) ___ Algal Mat or Crust (B4) ___ Other (Explain in Remarks) ___ Iron Deposits (B5) ___ ___ Inundation Visible on Aerial Imagery (B7) ___ Water-Stained Leaves (B9) ___ Aquatic Fauna (B13)	<u>Secondary Indicators (minimum of two required)</u> <input checked="" type="checkbox"/> Surface Soil Cracks (B6) ___ Sparsely Vegetated Concave Surface (B8) ___ Drainage Patterns (B10) ___ Moss Trim Lines (B16) ___ Dry-Season Water Table (C2) ___ Crayfish Burrows (C8) ___ Saturation Visible on Aerial Imagery (C9) ___ Stunted or Stressed Plants (D1) ___ Geomorphic Position (D2) ___ Shallow Aquitard (D3) ___ Microtopographic Relief (D4) ___ FAC-Neutral Test (D5)
Field Observations: Surface Water Present? Yes _____ No <u>X</u> Depth (inches): _____ Water Table Present? Yes _____ No <u>X</u> Depth (inches): _____ Saturation Present? Yes _____ No <u>X</u> Depth (inches): _____ (includes capillary fringe)	Wetland Hydrology Present? Yes _____ No _____
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:	
Remarks: <p style="font-size: 1.2em; margin-left: 20px;"><i>~30' SW of groundwater Well #1 previous location</i></p>	

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Pigg River: Wetland Site 2 City/County: Franklin Sampling Date: 11/29/2017
 Applicant/Owner: FORVA State: VA Sampling Point: Site 2: Pt 2
 Investigator(s): NAS Section, Township, Range:
 Landform (hillslope, terrace, etc.): FPL Local relief (concave, convex, none) Slope (%): 0
 Subregion (LRR or MLRA): _____ Lat: _____ Long: _____ Datum:
 Soil Map Unit Name: _____ NWI classification:

Are climatic / hydrologic conditions on the site typical for this time of year? Yes _____ No X (If no, explain in Remarks.) Mod. Drought
 Are Vegetation _____, Soil _____, or Hydrology _____ significantly disturbed? Are "Normal Circumstances" present? Yes _____ No
 Are Vegetation _____, Soil _____, or Hydrology _____ naturally problematic? (If needed, explain any answers in Remarks.)

SUMMARY OF FINDINGS – Attach site map showing sampling point locations, transects, important features, etc.

Hydrophytic Vegetation Present? Yes _____ No _____ Hydric Soil Present? Yes _____ No _____ Wetland Hydrology Present? Yes _____ No _____	Is the Sampled Area within a Wetland? Yes _____ No _____
Remarks:	

HYDROLOGY

Wetland Hydrology Indicators: <u>Primary Indicators (minimum of one is required; check all that apply)</u> <input checked="" type="checkbox"/> Surface Water (A1) _____ True Aquatic Plants (B14) <input checked="" type="checkbox"/> High Water Table (A2) _____ Hydrogen Sulfide Odor (C1) <input checked="" type="checkbox"/> Saturation (A3) _____ Oxidized Rhizospheres on Living Roots (C3) _____ Water Marks (B1) _____ Presence of Reduced Iron (C4) _____ Sediment Deposits (B2) _____ Recent Iron Reduction in Tilled Soils (C6) _____ Drift Deposits (B3) _____ Thin Muck Surface (C7) _____ Algal Mat or Crust (B4) _____ Other (Explain in Remarks) _____ Iron Deposits (B5) _____ _____ Inundation Visible on Aerial Imagery (B7) _____ Water-Stained Leaves (B9) _____ Aquatic Fauna (B13)	<u>Secondary Indicators (minimum of two required)</u> <input checked="" type="checkbox"/> Surface Soil Cracks (B6) _____ Sparsely Vegetated Concave Surface (B8) _____ Drainage Patterns (B10) _____ Moss Trim Lines (B16) _____ Dry-Season Water Table (C2) _____ Crayfish Burrows (C8) _____ Saturation Visible on Aerial Imagery (C9) _____ Stunted or Stressed Plants (D1) <input checked="" type="checkbox"/> Geomorphic Position (D2) (<u>toe slope</u>) _____ Shallow Aquitard (D3) _____ Microtopographic Relief (D4) _____ FAC-Neutral Test (D5)
Field Observations: Surface Water Present? Yes _____ No <input checked="" type="checkbox"/> Depth (inches): (<u><1" nearby</u>) Water Table Present? Yes <input checked="" type="checkbox"/> No _____ Depth (inches): <u>5"</u> Saturation Present? Yes <input checked="" type="checkbox"/> No _____ Depth (inches): _____ (includes capillary fringe)	Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No _____
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:	
Remarks: <p align="center"><u>n/0 south of surface water monitoring station</u></p>	

Appendix E

Groundwater Monitoring Data

Per the signed additional services proposal with the permittee (FORVA) dated December 28, 2016, on February 02, 2017, WSSI installed three (3) groundwater monitoring wells in and adjacent to Wetland Site #2. Two (2) of the monitoring wells, Wells #1 and #2, were installed within the wetland area to monitor the area's hydroperiod following dam removal. One additional well, Well #3, was installed upslope of the wetland area in order to better understand the source and magnitude of groundwater contribution to the existing wetland area.

Methods

At Wells #1 and #2, Solinst pressure transducers were used in conjunction with an onsite barometer to collect water surface elevation data. These automated wells were programmed to take readings twice daily, recording both water depth and temperature. Manual well data collection occurred monthly, wherein transducer data from Wells #1 and #2 were downloaded and depth-to-water measurements were taken at Well #3.

Note that pressure transducers record absolute pressure (barometric pressure + water pressure). This information was then calibrated using an onsite barometer to give a water height above sensor in ft. Solinst pressure transducers also record groundwater temperature assuming the water level is above the sensor on the transducer. Once the water level falls below the transducer sensor, the water height reads 0 ft. and temperature readings become air temperature at sensor depth. Groundwater results are shown in Figures 1-6.

Daily sum accumulation information for precipitation was taken from weather station KVAROCKY5 accessible through Weather Underground. Significant rainfall event information was compared to the IFLOWS "Rocky Mount/Pigg" (referenced in the applicable permit) to assess the integrity of KVAROCKY5 data. Weather station information from both stations were found to be in good agreement. Information from KVAROCKY5 was used due to completeness and better data availability. This information may be found in **Appendix F**.

Results

Automated groundwater information for Well #1 is shown in Figure 1 and Well #2 in Figure 2. Manual-read data from Well #3 is shown in Figure 3. Well #3 readings were taken using a water-level meter probe. Measurements were taken by lowering a sensor down the well and recording the depth to water level.

In Figures 4 – 6 elevations are given for groundwater levels. These figures also show daily precipitation data as a total accumulation sum in inches. Average ground elevation adjacent to the well and sensor elevation are shown in Figures 4 and 5. Figure 6 shows each of the three (3) wells including daily rainfall accumulation data.

Pigg River Restoration at Power Dam
 Year-1 Monitoring Report
 December 2017
 Appendix E

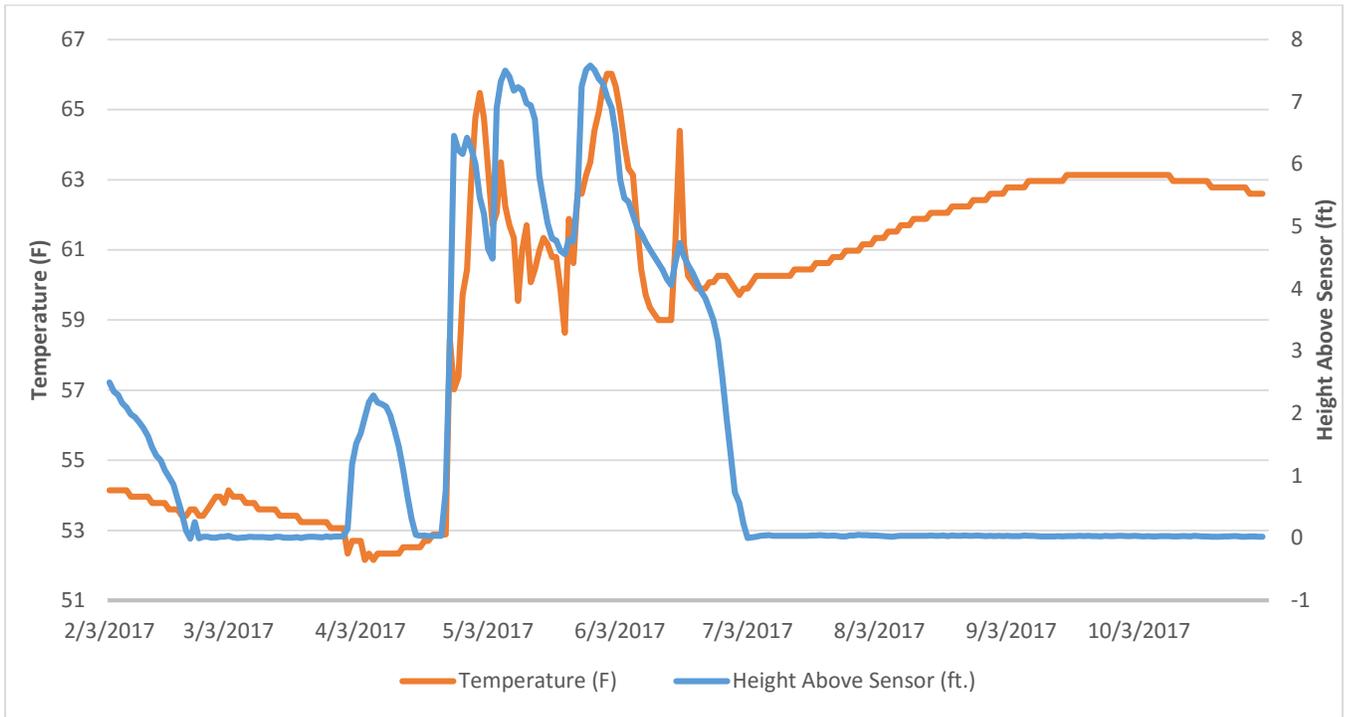


Figure 1: Well #1 - Water Temperature and Height Above Sensor

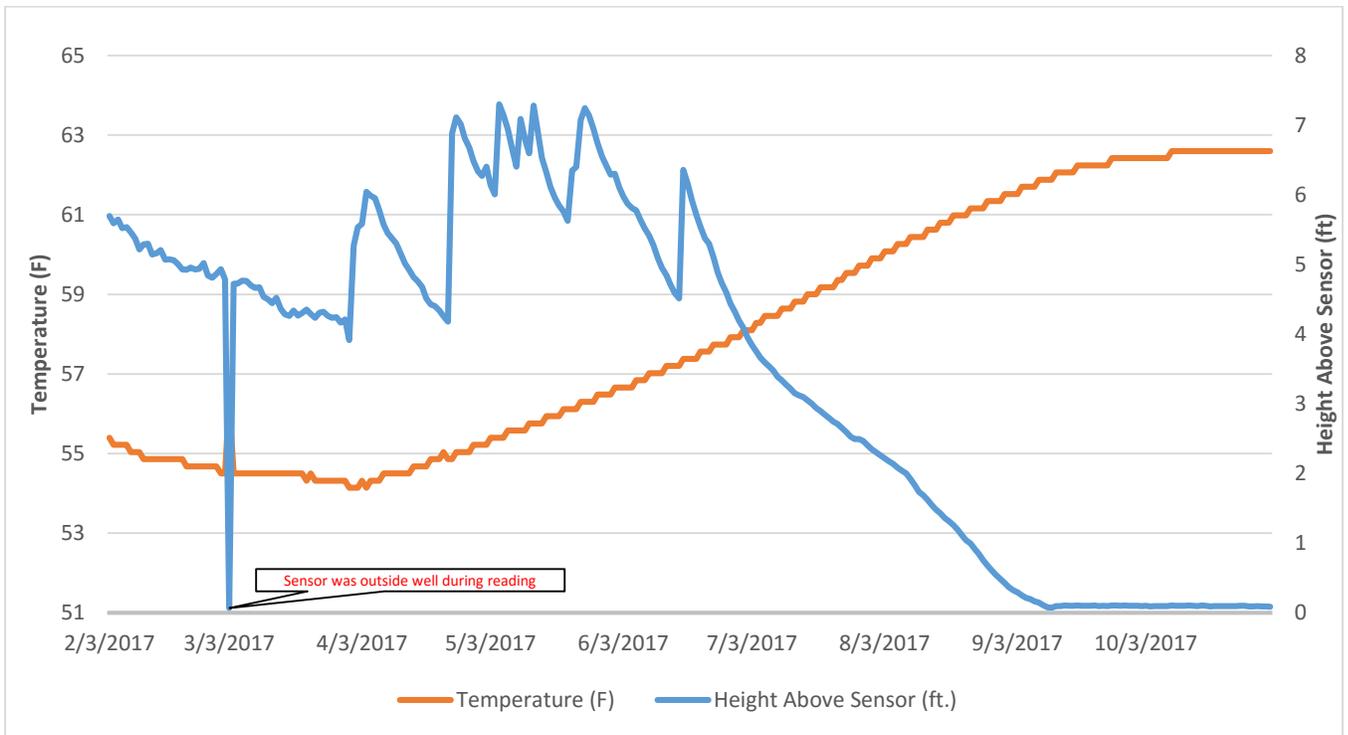


Figure 2: Well #2 - Water Temperature and Height Above Sensor

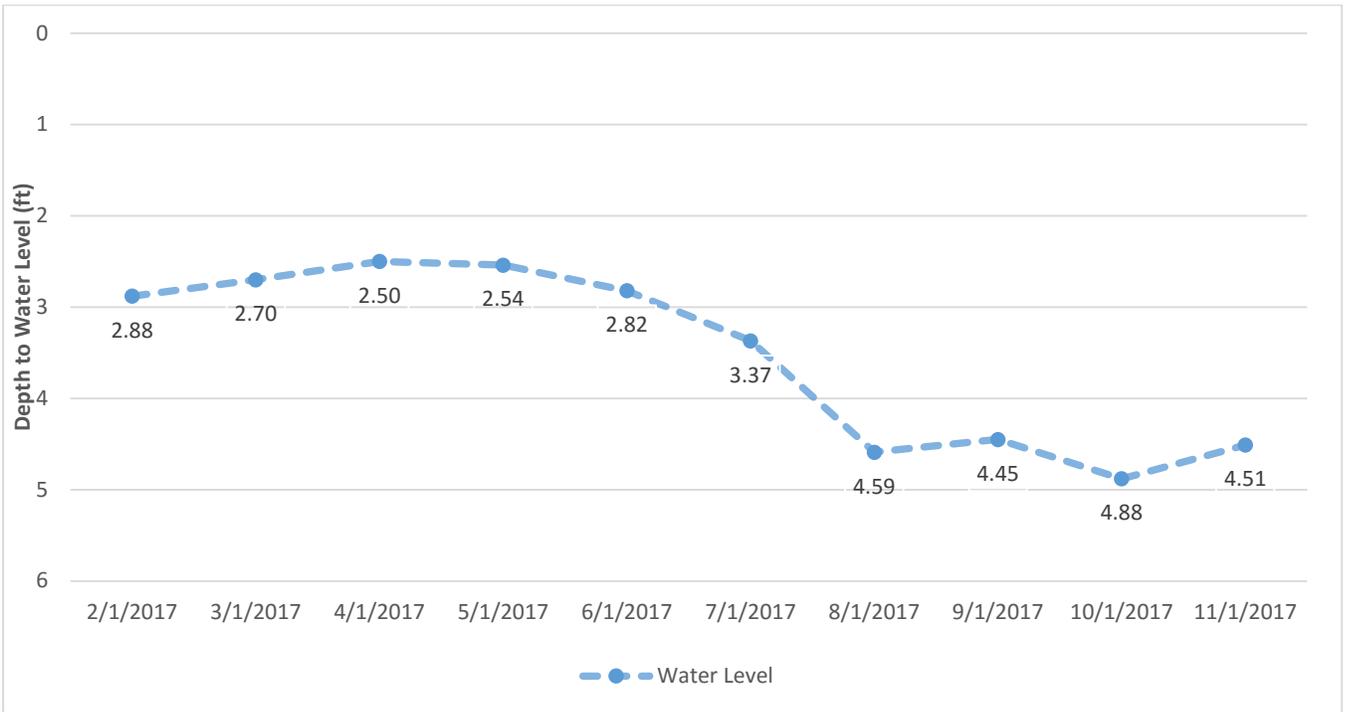


Figure 3: Well #3 - Depth to Water Level (Manual-Read)

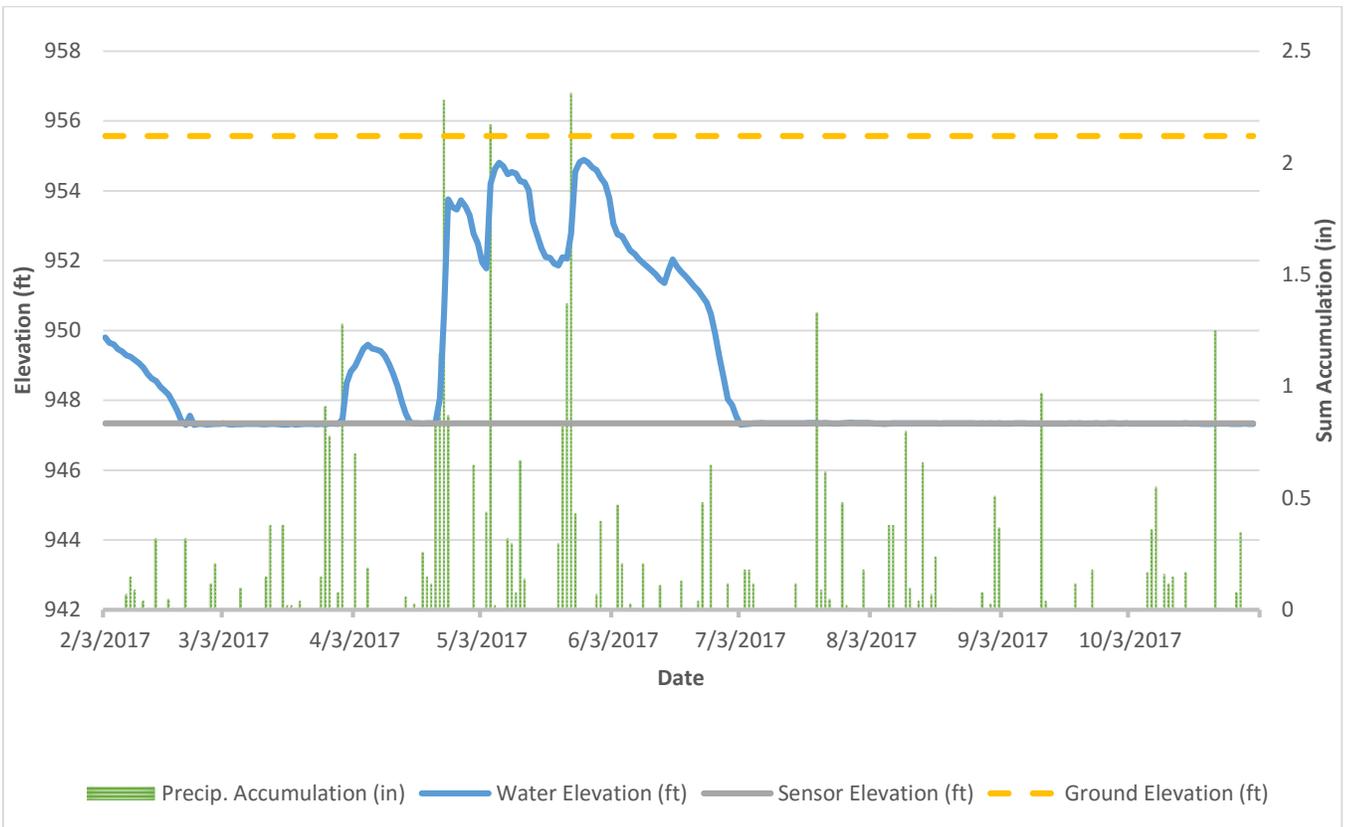


Figure 4: Well #1 – Precipitation and Groundwater Elevation

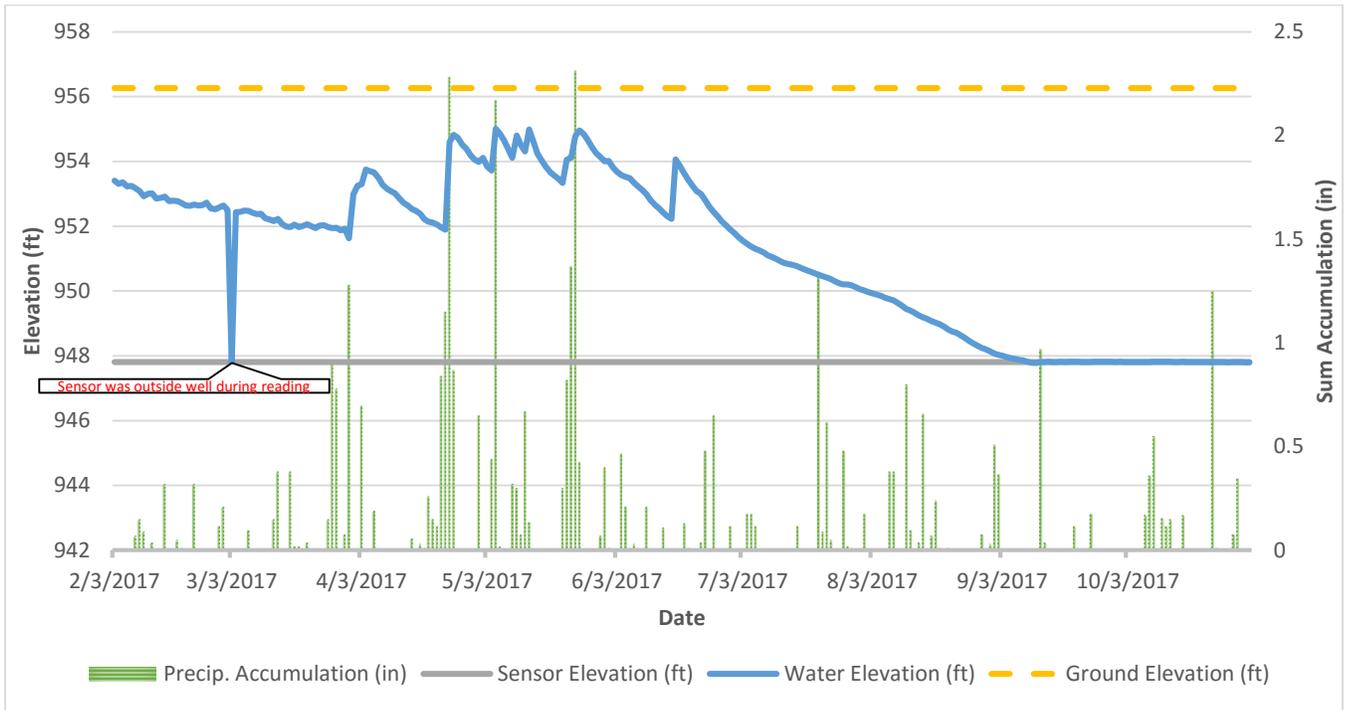


Figure 5: Well #2 - Precipitation and Groundwater Elevation

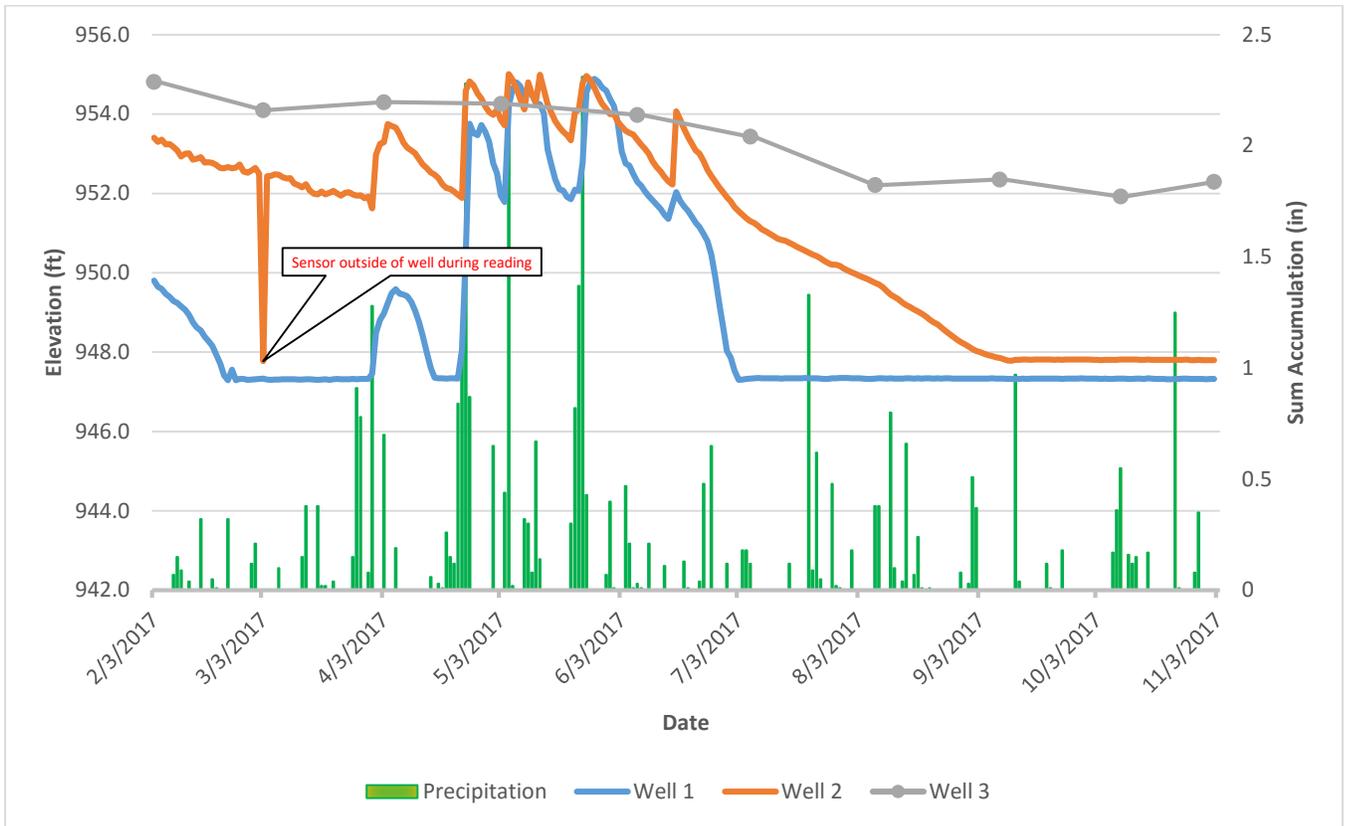
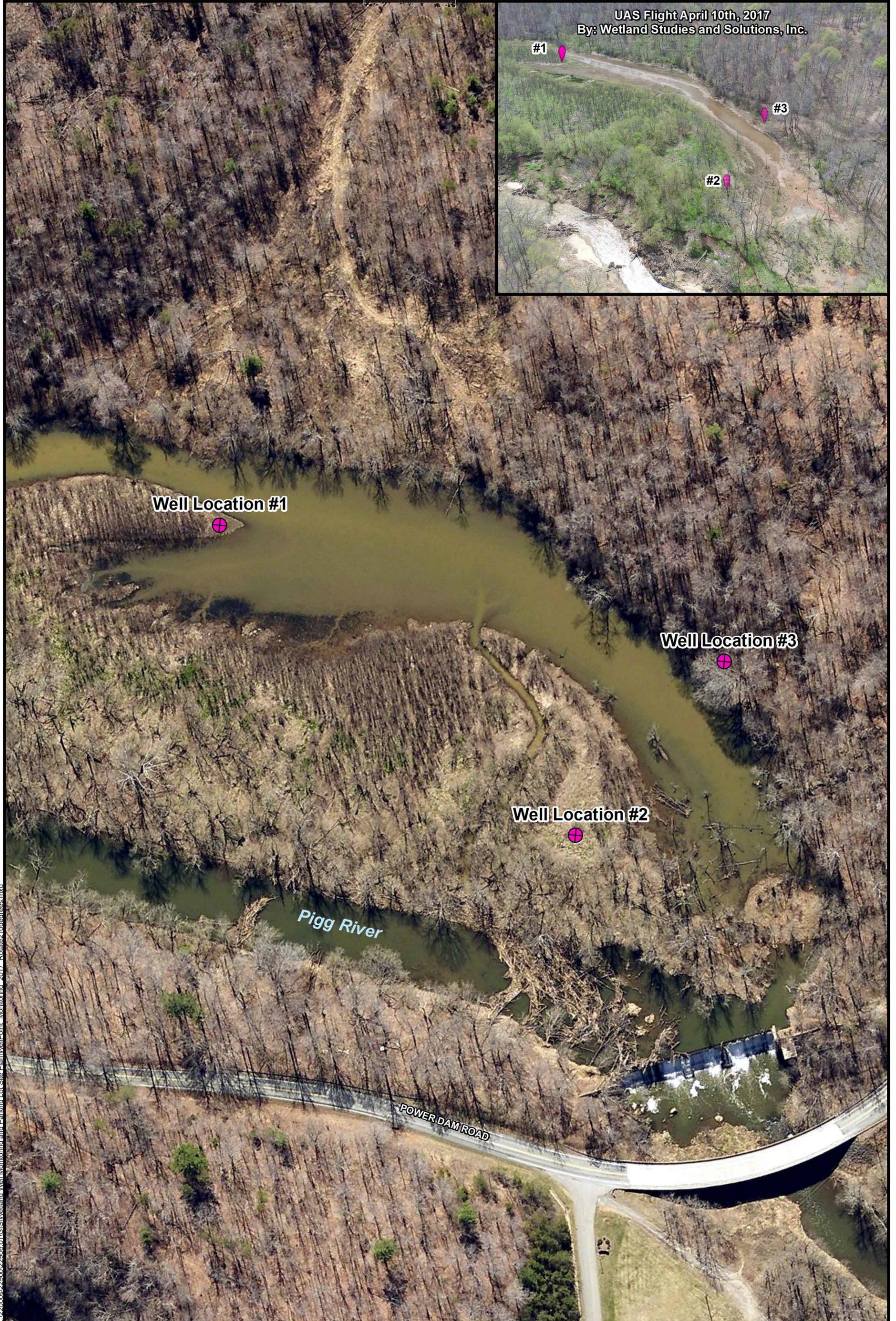


Figure 6: Combined Precipitation and Water Elevation

Pigg River Power Dam Site Appendix E - Wetland Well Locations

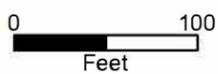
Franklin County, Virginia



L:\220000s\22900\22906_01\GIS\Wetland Well Monitoring and Parkina Lot Site Plan\WellPoint_Monitoring_2017_Rotate210degrees.mxd



Imagery Source: Pictometry®
Spring 2015 Natural Color Imagery



Wetland Studies and Solutions, Inc.
a DAVEY company

Appendix F

(Daily weather data taken from station KVAROCKY5, available online through Weather Underground.)

Doe Run (KVAROCKY5)

(36.971, - 79.846)

Elevation: 1099 ft.

Date	Temperature			Dew Point			Humidity			Speed			Pressure			Precipitation
	High	Avg	Low	High	Avg	Low	High	Avg	Low	High	Avg	Gust	High	Avg	Low	Sum Accumulation (in)
2/1/2017	54.9 °F	45.8 °F	36.7 °F	36.5 °F	28.9 °F	23.3 °F	66%	52%	37%	6 mph	0 mph	6 mph	28.74 in	28.69 in	28.64 in	0
2/2/2017	63.5 °F	49.9 °F	36.5 °F	35.2 °F	28.6 °F	17 °F	82%	53%	28%	9 mph	2 mph	9 mph	28.88 in	28.81 in	28.74 in	0
2/3/2017	43.7 °F	34.3 °F	25 °F	22.7 °F	15.6 °F	7.2 °F	55%	44%	30%	9 mph	2 mph	9 mph	29.02 in	28.92 in	28.81 in	0
2/4/2017	48 °F	32.9 °F	17.8 °F	12.8 °F	7.4 °F	3.3 °F	66%	39%	19%	9 mph	2 mph	9 mph	29.2 in	29.06 in	28.92 in	0
2/5/2017	63.9 °F	46.2 °F	28.8 °F	35.3 °F	23.9 °F	8.3 °F	78%	47%	30%	12 mph	3 mph	12 mph	28.92 in	28.78 in	28.64 in	0
2/6/2017	75.6 °F	55 °F	36.1 °F	40.5 °F	34.8 °F	28.7 °F	92%	52%	21%	12 mph	3 mph	12 mph	28.86 in	28.78 in	28.69 in	0
2/7/2017	74.5 °F	62.8 °F	51.1 °F	53.3 °F	47.5 °F	37.1 °F	76%	62%	47%	18 mph	6 mph	18 mph	28.69 in	28.53 in	28.38 in	0
2/8/2017	79.7 °F	62.5 °F	45.5 °F	53.8 °F	48 °F	43.6 °F	99%	66%	32%	9 mph	2 mph	9 mph	28.44 in	28.36 in	28.28 in	0.07
2/9/2017	51.6 °F	38.2 °F	24.8 °F	50.8 °F	24.9 °F	6.8 °F	99%	58%	33%	16 mph	6 mph	16 mph	28.93 in	28.57 in	28.2 in	0.15
2/10/2017	44.8 °F	31.9 °F	19.4 °F	21.6 °F	11.6 °F	6.1 °F	66%	41%	23%	10 mph	3 mph	10 mph	29.09 in	28.9 in	28.71 in	0.09
2/11/2017	70.2 °F	54.3 °F	38.7 °F	53.5 °F	37.9 °F	11 °F	83%	54%	18%	10 mph	3 mph	10 mph	28.73 in	28.69 in	28.65 in	0
2/12/2017	86 °F	67.9 °F	50.2 °F	61.3 °F	53 °F	31.8 °F	96%	68%	40%	17 mph	5 mph	17 mph	28.7 in	28.56 in	28.42 in	0.04
2/13/2017	66.9 °F	47.8 °F	28.9 °F	31.9 °F	16.9 °F	9.6 °F	54%	32%	15%	12 mph	3 mph	12 mph	28.79 in	28.7 in	28.61 in	0
2/14/2017	57.6 °F	42.4 °F	28 °F	37.4 °F	22.1 °F	14.1 °F	79%	45%	24%	8 mph	1 mph	8 mph	28.77 in	28.58 in	28.39 in	0
2/15/2017	58.8 °F	45.9 °F	33.8 °F	41.9 °F	30.4 °F	14.4 °F	99%	64%	27%	14 mph	3 mph	14 mph	28.42 in	28.31 in	28.21 in	0.32
2/16/2017	55.9 °F	43.2 °F	30.4 °F	21 °F	16.1 °F	10 °F	59%	39%	19%	13 mph	4 mph	13 mph	28.62 in	28.51 in	28.4 in	0
2/17/2017	76.3 °F	52.9 °F	29.8 °F	35.2 °F	27.1 °F	16.5 °F	78%	41%	20%	14 mph	3 mph	14 mph	28.65 in	28.56 in	28.48 in	0
2/18/2017	84.6 °F	62.9 °F	41.2 °F	39.5 °F	32.7 °F	26.1 °F	63%	39%	19%	12 mph	2 mph	12 mph	28.62 in	28.56 in	28.5 in	0.05
2/19/2017	71.8 °F	58.1 °F	44.8 °F	47.1 °F	41.3 °F	34.1 °F	83%	58%	40%	14 mph	2 mph	14 mph	28.79 in	28.67 in	28.54 in	0.01
2/20/2017	81.7 °F	58.7 °F	36.1 °F	47 °F	38.7 °F	31.7 °F	99%	59%	23%	7 mph	1 mph	7 mph	28.92 in	28.85 in	28.79 in	0
2/21/2017	66.6 °F	53.4 °F	40.8 °F	41.7 °F	38.9 °F	35.8 °F	84%	65%	38%	10 mph	2 mph	10 mph	28.96 in	28.86 in	28.77 in	0
2/22/2017	55.2 °F	48.3 °F	41.5 °F	53.8 °F	47.2 °F	38 °F	99%	94%	82%	6 mph	0 mph	6 mph	28.77 in	28.68 in	28.59 in	0.32
2/23/2017	78.8 °F	60.3 °F	43.3 °F	60 °F	52.1 °F	43 °F	99%	80%	47%	13 mph	2 mph	13 mph	28.63 in	28.57 in	28.51 in	0
2/24/2017	81.9 °F	64.8 °F	47.8 °F	59.1 °F	53 °F	47.5 °F	99%	72%	43%	12 mph	2 mph	12 mph	28.62 in	28.53 in	28.45 in	0
2/25/2017	76.8 °F	56.8 °F	37 °F	59.7 °F	44.7 °F	18.7 °F	91%	61%	31%	15 mph	5 mph	15 mph	28.6 in	28.44 in	28.29 in	0
2/26/2017	61.3 °F	43.3 °F	25.3 °F	23.8 °F	19.5 °F	16.1 °F	76%	45%	19%	14 mph	3 mph	14 mph	29.2 in	28.9 in	28.6 in	0
2/27/2017	63.3 °F	44.9 °F	26.8 °F	33.2 °F	26.7 °F	17.4 °F	86%	53%	26%	12 mph	2 mph	12 mph	29.08 in	29.01 in	28.95 in	0
2/28/2017	75 °F	54.5 °F	34.2 °F	56.3 °F	44.4 °F	30.8 °F	99%	70%	36%	15 mph	2 mph	15 mph	29 in	28.86 in	28.73 in	0.12
3/1/2017	76.5 °F	65.6 °F	55.2 °F	61.9 °F	56.4 °F	47.7 °F	99%	88%	56%	18 mph	5 mph	18 mph	28.73 in	28.56 in	28.38 in	0.21
3/2/2017	65.5 °F	50.3 °F	35.8 °F	47.6 °F	25.9 °F	17.7 °F	74%	42%	23%	16 mph	5 mph	16 mph	28.93 in	28.7 in	28.47 in	0
3/3/2017	53.6 °F	38 °F	22.8 °F	26.7 °F	18.4 °F	9.7 °F	80%	49%	22%	16 mph	3 mph	16 mph	29.19 in	29.05 in	28.91 in	0
3/4/2017	61.2 °F	41.4 °F	21.6 °F	25.6 °F	17.5 °F	11.3 °F	72%	45%	17%	10 mph	2 mph	10 mph	29.27 in	29.19 in	29.12 in	0
3/5/2017	54.9 °F	38.8 °F	22.6 °F	23.1 °F	19.8 °F	15.2 °F	81%	51%	27%	9 mph	2 mph	9 mph	29.31 in	29.22 in	29.13 in	0
3/6/2017	66.9 °F	46.6 °F	26.2 °F	46.9 °F	35.8 °F	21.3 °F	91%	68%	37%	12 mph	2 mph	12 mph	29.16 in	29.08 in	29 in	0
3/7/2017	67.5 °F	58.9 °F	50.7 °F	55.4 °F	50.8 °F	45.1 °F	97%	78%	58%	16 mph	5 mph	16 mph	29.01 in	28.89 in	28.77 in	0.1
3/8/2017	74.8 °F	60.6 °F	46.4 °F	54.5 °F	31.3 °F	19.9 °F	90%	41%	14%	13 mph	4 mph	13 mph	28.91 in	28.82 in	28.73 in	0
3/9/2017	82.8 °F	63.2 °F	43.9 °F	29.9 °F	24.5 °F	-17.3 °F	41 %	26%	12%	14 mph	3 mph	14 mph	28.92 in	28.77 in	28.63 in	0
3/10/2017	69.8 °F	51.6 °F	34.3 °F	47.1 °F	28.5 °F	13.9 °F	71%	42%	29%	19 mph	5 mph	19 mph	28.82 in	28.65 in	28.47 in	0
3/11/2017	59.2 °F	43 °F	27.3 °F	16.5 °F	8 °F	-0.6 °F	57 %	29%	11%	9 mph	3 mph	9 mph	28.96 in	28.88 in	28.81 in	0

3/12/2017	59.9 °F	44 °F	28 °F	16.2 °F	11.1 °F	7.2 °F	48%	33%	15%	10 mph	2 mph	10 mph	29.05 in	28.97 in	28.88 in	0
3/13/2017	49.5 °F	36.2 °F	23.5 °F	33.7 °F	23 °F	10.7 °F	99%	68%	37%	10 mph	3 mph	10 mph	29.07 in	28.84 in	28.61 in	0.15
3/14/2017	52.2 °F	37.7 °F	23.7 °F	40.5 °F	27.5 °F	8.3 °F	99%	74%	42%	18 mph	4 mph	18 mph	28.76 in	28.55 in	28.34 in	0.38
3/15/2017	43.3 °F	29.5 °F	16.2 °F	13 °F	6.4 °F	1.3 °F	67%	40%	23%	15 mph	6 mph	15 mph	28.85 in	28.73 in	28.61 in	0
3/16/2017	53.1 °F	37.4 °F	21.7 °F	16.2 °F	11.2 °F	6.2 °F	58%	39%	20%	12 mph	3 mph	12 mph	28.97 in	28.91 in	28.85 in	0
3/17/2017	62.4 °F	42 °F	22.3 °F	37.9 °F	18.3 °F	11.3 °F	99%	48%	18%	12 mph	2 mph	12 mph	29.06 in	28.95 in	28.84 in	0.38
3/18/2017	78.1 °F	57.4 °F	37.2 °F	52.2 °F	42 °F	31.4 °F	99%	72%	24%	14 mph	3 mph	14 mph	28.87 in	28.71 in	28.54 in	0.02
3/19/2017	63.3 °F	48.5 °F	34.5 °F	34.2 °F	30.7 °F	28.3 °F	80%	48%	30%	15 mph	3 mph	15 mph	28.94 in	28.83 in	28.73 in	0.02
3/20/2017	78.1 °F	51.7 °F	26.2 °F	44.5 °F	32.5 °F	25.2 °F	98%	58%	20%	10 mph	2 mph	10 mph	28.94 in	28.8 in	28.66 in	0
3/21/2017	81.5 °F	62.3 °F	43.2 °F	54.5 °F	48.7 °F	38.7 °F	99%	68%	38%	12 mph	2 mph	12 mph	28.69 in	28.64 in	28.59 in	0.04
3/22/2017	64.6 °F	49.9 °F	35.8 °F	40 °F	26.2 °F	13.4 °F	80%	40%	18%	14 mph	3 mph	14 mph	29.09 in	28.87 in	28.65 in	0
3/23/2017	58.5 °F	41 °F	24.1 °F	22 °F	17.2 °F	11.4 °F	68%	40%	20%	10 mph	3 mph	10 mph	29.26 in	29.17 in	29.09 in	0
3/24/2017	74.5 °F	53.8 °F	33.8 °F	48.7 °F	36.8 °F	19.9 °F	68%	54%	37%	15 mph	4 mph	15 mph	29.15 in	29.04 in	28.93 in	0
3/25/2017	82.2 °F	67.6 °F	53.1 °F	54 °F	50.1 °F	46.9 °F	81%	59%	37%	13 mph	3 mph	13 mph	28.96 in	28.9 in	28.83 in	0
3/26/2017	71.4 °F	62.4 °F	53.4 °F	61.3 °F	54.5 °F	48.6 °F	99%	82%	58%	10 mph	2 mph	10 mph	28.91 in	28.85 in	28.8 in	0.15
3/27/2017	78.3 °F	66.9 °F	55.6 °F	63.1 °F	58.7 °F	55.3 °F	99%	79%	54%	13 mph	3 mph	13 mph	28.81 in	28.71 in	28.61 in	0.91
3/28/2017	81 °F	68.7 °F	56.3 °F	64.2 °F	57.1 °F	51.8 °F	99%	80%	41%	11 mph	3 mph	11 mph	28.68 in	28.61 in	28.55 in	0.78
3/29/2017	78.6 °F	55.3 °F	32 °F	99.9 °F	52.3 °F	48.3 °F	99%	62%	42%	9 mph	3 mph	9 mph	28.79 in	28.72 in	28.64 in	0
3/30/2017	61 °F	55.2 °F	49.5 °F	53.1 °F	49.4 °F	46.1 °F	99%	83%	67%	9 mph	4 mph	9 mph	28.84 in	28.74 in	28.63 in	0.08
3/31/2017	71.8 °F	59.4 °F	47.7 °F	62.3 °F	50.5 °F	44.8 °F	99%	88%	44%	13 mph	2 mph	13 mph	28.63 in	28.46 in	28.29 in	1.28
4/1/2017	77.4 °F	61.7 °F	46.2 °F	50.8 °F	45.6 °F	39.9 °F	83%	63%	37%	13 mph	4 mph	13 mph	28.81 in	28.63 in	28.45 in	0
4/2/2017	69.3 °F	52.1 °F	36 °F	46 °F	41 °F	35.7 °F	99%	68%	40%	9 mph	2 mph	9 mph	28.91 in	28.85 in	28.78 in	0
4/3/2017	57.6 °F	49.3 °F	41 °F	54.6 °F	48.7 °F	39.9 °F	99%	93%	78%	9 mph	1 mph	9 mph	28.97 in	28.67 in	28.37 in	0.7
4/4/2017	88.5 °F	71.8 °F	55.2 °F	61.3 °F	53.8 °F	46.6 °F	99%	66%	28%	15 mph	4 mph	15 mph	28.52 in	28.42 in	28.32 in	0
4/5/2017	74.7 °F	61.1 °F	47.7 °F	56.9 °F	51.2 °F	44.9 °F	92%	68%	42%	14 mph	3 mph	14 mph	28.62 in	28.5 in	28.37 in	0
4/6/2017	72.7 °F	58.8 °F	45 °F	60.5 °F	46.6 °F	33 °F	99%	70%	35%	23 mph	6 mph	23 mph	28.37 in	28.23 in	28.09 in	0.19
4/7/2017	56.7 °F	47 °F	37.9 °F	34.6 °F	30.9 °F	27.1 °F	82%	56%	41%	17 mph	6 mph	17 mph	28.62 in	28.46 in	28.3 in	0
4/8/2017	78.1 °F	59.1 °F	40.1 °F	36.2 °F	29 °F	23.6 °F	62%	39%	17%	11 mph	2 mph	11 mph	28.92 in	28.74 in	28.56 in	0
4/9/2017	81.3 °F	56.3 °F	32.4 °F	40.1 °F	32 °F	27.7 °F	89%	45%	17%	12 mph	2 mph	12 mph	28.91 in	28.83 in	28.76 in	0
4/10/2017	87.3 °F	69.4 °F	51.4 °F	49.4 °F	43.4 °F	32.6 °F	63%	42%	24%	13 mph	4 mph	13 mph	28.94 in	28.89 in	28.84 in	0
4/11/2017	92.8 °F	71.4 °F	50.4 °F	57.3 °F	51.4 °F	46.8 °F	90%	53%	29%	13 mph	3 mph	13 mph	28.93 in	28.86 in	28.8 in	0
4/12/2017	89.2 °F	73.2 °F	57.7 °F	59.4 °F	52 °F	41.1 °F	87%	55%	30%	7 mph	2 mph	7 mph	28.97 in	28.9 in	28.83 in	0
4/13/2017	81.9 °F	68.8 °F	55.8 °F	50.9 °F	44.1 °F	37.2 °F	59%	44%	26%	11 mph	3 mph	11 mph	29.04 in	28.97 in	28.89 in	0
4/14/2017	81.5 °F	68.6 °F	55.6 °F	57.1 °F	50.5 °F	45.7 °F	78%	60%	34%	10 mph	3 mph	10 mph	29.03 in	28.96 in	28.89 in	0
4/15/2017	89.1 °F	69.7 °F	51.1 °F	66.3 °F	57.5 °F	50.8 °F	99%	75%	41%	9 mph	1 mph	9 mph	29 in	28.94 in	28.87 in	0.06
4/16/2017	90 °F	73.4 °F	57.7 °F	62.2 °F	56.5 °F	52.7 °F	85%	59%	35%	13 mph	3 mph	13 mph	28.89 in	28.81 in	28.73 in	0
4/17/2017	93.4 °F	74.8 °F	56.3 °F	63 °F	58.4 °F	55.2 °F	99%	75%	32%	9 mph	1 mph	9 mph	28.82 in	28.76 in	28.71 in	0.03
4/18/2017	79 °F	66.8 °F	55.9 °F	59.2 °F	51.4 °F	43.2 °F	99%	66%	35%	12 mph	3 mph	12 mph	29.03 in	28.92 in	28.82 in	0.01
4/19/2017	56.8 °F	52.9 °F	49.1 °F	54.8 °F	50.8 °F	42.9 °F	99%	92%	68%	9 mph	1 mph	9 mph	29.08 in	29 in	28.92 in	0.26
4/20/2017	91.6 °F	59.8 °F	28.4 °F	69.8 °F	61.3 °F	21.2 °F	99%	85%	44%	9 mph	1 mph	9 mph	28.92 in	28.8 in	28.68 in	0.15
4/21/2017	92.7 °F	74.9 °F	57.7 °F	68.1 °F	62.7 °F	57.4 °F	99%	78%	42%	10 mph	2 mph	10 mph	31.78 in	30.15 in	28.52 in	0.12
4/22/2017	77.4 °F	63.8 °F	50.9 °F	68.8 °F	60.8 °F	50.6 °F	99%	96%	75%	9 mph	2 mph	9 mph	28.7 in	28.6 in	28.5 in	0.84
4/23/2017	51.1 °F	48.8 °F	46.4 °F	50.8 °F	47.2 °F	46.1 °F	99%	98%	91%	11 mph	4 mph	11 mph	28.76 in	28.71 in	28.66 in	1.15
4/24/2017	51.4 °F	48.9 °F	46.4 °F	51.1 °F	48.6 °F	46.1 °F	99%	99%	99%	12 mph	5 mph	12 mph	28.71 in	28.61 in	28.51 in	2.28

4/25/2017	63 °F	56.1 °F	49.6 °F	60.7 °F	54.9 °F	49.3 °F	99%	98%	89%	13 mph	4 mph	13 mph	28.51 in	28.44 in	28.38 in	0.87
4/26/2017	87.3 °F	68.7 °F	50 °F	66.3 °F	59.4 °F	49.7 °F	99%	79%	45%	12 mph	2 mph	12 mph	28.5 in	28.46 in	28.42 in	0
4/27/2017	82.8 °F	69.1 °F	55.6 °F	65 °F	60 °F	55.3 °F	99%	80%	48%	12 mph	2 mph	12 mph	28.59 in	28.53 in	28.48 in	0
4/28/2017	87.3 °F	71 °F	54.7 °F	69.1 °F	62.9 °F	54.4 °F	99%	77%	47%	14 mph	3 mph	14 mph	28.74 in	28.66 in	28.58 in	0
4/29/2017	91.6 °F	77.7 °F	63.9 °F	73.9 °F	69.4 °F	63.5 °F	99%	78%	54%	13 mph	3 mph	13 mph	28.85 in	28.79 in	28.73 in	0
4/30/2017	87.8 °F	77.4 °F	67.1 °F	70.2 °F	67.2 °F	63.5 °F	99%	78%	50%	12 mph	4 mph	12 mph	28.84 in	28.78 in	28.72 in	0
5/1/2017	77.5 °F	69.9 °F	62.4 °F	72.6 °F	67.1 °F	61.2 °F	99%	93%	83%	15 mph	6 mph	15 mph	28.72 in	28.55 in	28.38 in	0.65
5/2/2017	85.5 °F	68.9 °F	53.6 °F	61 °F	48 °F	41.4 °F	99%	57%	24%	13 mph	3 mph	13 mph	28.69 in	28.56 in	28.42 in	0
5/3/2017	85.1 °F	66.8 °F	48.9 °F	49.6 °F	44.1 °F	33.3 °F	81%	51%	21%	10 mph	2 mph	10 mph	28.81 in	28.7 in	28.6 in	0
5/4/2017	67.8 °F	57.7 °F	47.7 °F	62.7 °F	51.3 °F	36.3 °F	99%	79%	62%	12 mph	4 mph	12 mph	28.85 in	28.62 in	28.4 in	0.44
5/5/2017	77 °F	64.9 °F	53.4 °F	67.9 °F	57.2 °F	45.2 °F	99%	79%	46%	21 mph	5 mph	21 mph	28.4 in	28.25 in	28.1 in	2.17
5/6/2017	68.2 °F	56.5 °F	45 °F	51.3 °F	44.1 °F	37.7 °F	95%	71%	36%	15 mph	3 mph	15 mph	28.42 in	28.26 in	28.1 in	0.02
5/7/2017	76.3 °F	58.3 °F	40.3 °F	49.1 °F	39.7 °F	30.3 °F	99%	62%	24%	9 mph	2 mph	9 mph	28.6 in	28.51 in	28.41 in	0
5/8/2017	77.7 °F	58.9 °F	40.3 °F	39.5 °F	33.1 °F	25.2 °F	92%	49%	17%	10 mph	2 mph	10 mph	28.71 in	28.64 in	28.57 in	0
5/9/2017	64.8 °F	50.9 °F	37.6 °F	56.1 °F	47.3 °F	31.9 °F	99%	85%	68%	10 mph	0 mph	10 mph	28.72 in	28.67 in	28.62 in	0.32
5/10/2017	84 °F	69.4 °F	55.2 °F	71.2 °F	63.6 °F	54.9 °F	99%	88%	65%	9 mph	2 mph	9 mph	28.67 in	28.61 in	28.56 in	0.3
5/11/2017	93.6 °F	74.7 °F	55.8 °F	71.1 °F	64.2 °F	55.5 °F	99%	86%	41%	10 mph	2 mph	10 mph	28.62 in	28.53 in	28.44 in	0.08
5/12/2017	55.8 °F	52.8 °F	49.8 °F	55.5 °F	51.3 °F	49.5 °F	99%	99%	99%	10 mph	3 mph	10 mph	28.66 in	28.6 in	28.54 in	0.67
5/13/2017	80.6 °F	63.2 °F	47.7 °F	62.5 °F	52 °F	46.9 °F	99%	82%	43%	7 mph	1 mph	7 mph	28.57 in	28.51 in	28.44 in	0.14
5/14/2017	91.4 °F	67.8 °F	44.2 °F	60.7 °F	53.4 °F	43.9 °F	99%	66%	33%	10 mph	2 mph	10 mph	28.58 in	28.54 in	28.5 in	0
5/15/2017	91.8 °F	74.2 °F	57 °F	65.1 °F	56.1 °F	47.7 °F	95%	62%	30%	9 mph	2 mph	9 mph	28.72 in	28.63 in	28.54 in	0
5/16/2017	87.3 °F	67.7 °F	48.7 °F	62.6 °F	55 °F	47.6 °F	99%	66%	31%	9 mph	2 mph	9 mph	28.81 in	28.72 in	28.64 in	0
5/17/2017	97.7 °F	77.8 °F	57.9 °F	71.6 °F	62.7 °F	57.6 °F	99%	67%	34%	12 mph	2 mph	12 mph	28.92 in	28.81 in	28.7 in	0
5/18/2017	92.1 °F	77.2 °F	62.4 °F	72.3 °F	65.1 °F	58.2 °F	89%	72%	48%	9 mph	2 mph	9 mph	28.8 in	28.75 in	28.7 in	0
5/19/2017	99.3 °F	81.2 °F	63.9 °F	74.8 °F	66.8 °F	62.2 °F	99%	78%	43%	9 mph	1 mph	9 mph	28.78 in	28.74 in	28.69 in	0
5/20/2017	95.7 °F	78.4 °F	62.4 °F	74.2 °F	66.9 °F	61.8 °F	99%	77%	41%	9 mph	2 mph	9 mph	28.92 in	28.83 in	28.73 in	0
5/21/2017	68.5 °F	63.4 °F	58.3 °F	65.1 °F	59.2 °F	56.1 °F	99%	93%	83%	9 mph	2 mph	9 mph	28.94 in	28.88 in	28.82 in	0.3
5/22/2017	88.7 °F	73.6 °F	58.8 °F	73.1 °F	62.4 °F	58.2 °F	99%	85%	46%	6 mph	1 mph	6 mph	28.83 in	28.74 in	28.64 in	0.82
5/23/2017	60.8 °F	59.1 °F	57.4 °F	60.5 °F	58.3 °F	57.1 °F	99%	99%	94%	6 mph	1 mph	6 mph	28.65 in	28.52 in	28.4 in	1.37
5/24/2017	63.3 °F	60.2 °F	57.2 °F	62.8 °F	59 °F	56.9 °F	99%	99%	99%	8 mph	3 mph	8 mph	28.41 in	28.3 in	28.19 in	2.31
5/25/2017	80.4 °F	68.2 °F	56.1 °F	65.9 °F	57.1 °F	50.4 °F	99%	83%	45%	9 mph	2 mph	9 mph	28.37 in	28.25 in	28.13 in	0.43
5/26/2017	88.3 °F	72.9 °F	57.7 °F	59.9 °F	56.3 °F	51.8 °F	92%	64%	36%	13 mph	3 mph	13 mph	28.82 in	28.6 in	28.37 in	0
5/27/2017	98.6 °F	76.8 °F	55.4 °F	73.2 °F	64.6 °F	54.8 °F	99%	73%	40%	7 mph	1 mph	7 mph	28.65 in	28.59 in	28.53 in	0
5/28/2017	82.9 °F	72.6 °F	62.2 °F	72.5 °F	66.6 °F	60.9 °F	99%	86%	64%	12 mph	2 mph	12 mph	28.58 in	28.53 in	28.49 in	0
5/29/2017	95.4 °F	77 °F	59.2 °F	69.1 °F	63.9 °F	58.9 °F	99%	73%	36%	7 mph	1 mph	7 mph	28.73 in	28.63 in	28.53 in	0
5/30/2017	93.6 °F	77.1 °F	60.8 °F	70.5 °F	64.9 °F	60.5 °F	99%	78%	40%	7 mph	1 mph	7 mph	28.75 in	28.71 in	28.67 in	0.07
5/31/2017	95 °F	76.3 °F	58.1 °F	68.4 °F	61.7 °F	54.8 °F	99%	80%	30%	7 mph	1 mph	7 mph	29.01 in	28.85 in	28.69 in	0.4
6/1/2017	94.8 °F	76.2 °F	57.7 °F	68.3 °F	59.2 °F	51.6 °F	99%	65%	30%	9 mph	1 mph	9 mph	28.77 in	28.72 in	28.67 in	0.01
6/2/2017	94.5 °F	75.6 °F	56.7 °F	62 °F	54.3 °F	48.2 °F	90%	57%	25%	7 mph	1 mph	7 mph	28.78 in	28.74 in	28.69 in	0
6/3/2017	99.9 °F	74.8 °F	50 °F	62.2 °F	54.1 °F	48.5 °F	99%	60%	20%	6 mph	1 mph	6 mph	28.8 in	28.74 in	28.68 in	0
6/4/2017	94.1 °F	72.8 °F	52.7 °F	74 °F	61.7 °F	51.2 °F	99%	76%	38%	10 mph	2 mph	10 mph	28.74 in	28.65 in	28.55 in	0.47
6/5/2017	72.1 °F	66.9 °F	61.7 °F	70.2 °F	66.7 °F	61.2 °F	99%	96%	84%	7 mph	1 mph	7 mph	28.58 in	28.49 in	28.4 in	0.21
6/6/2017	84 °F	71.2 °F	59 °F	67.3 °F	58.3 °F	50.2 °F	99%	70%	38%	7 mph	1 mph	7 mph	28.54 in	28.48 in	28.42 in	0.01
6/7/2017	77 °F	63.4 °F	50.7 °F	59.3 °F	54.2 °F	49.6 °F	97%	72%	48%	10 mph	3 mph	10 mph	28.67 in	28.6 in	28.52 in	0.03

6/8/2017	76.5 °F	65.4 °F	55.2 °F	60.3 °F	56.8 °F	48.2 °F	99%	83%	53%	9 mph	2 mph	9 mph	28.68 in	28.6 in	28.53 in	0.01
6/9/2017	90 °F	69.6 °F	50.2 °F	62.9 °F	56.3 °F	49.9 °F	99%	71%	35%	11 mph	1 mph	11 mph	28.71 in	28.62 in	28.54 in	0
6/10/2017	97 °F	75.6 °F	54.7 °F	68.9 °F	61.1 °F	54.4 °F	99%	69%	35%	9 mph	1 mph	9 mph	28.83 in	28.76 in	28.69 in	0.21
6/11/2017	100.4 °F	79.6 °F	60.6 °F	72.3 °F	65 °F	60.2 °F	99%	68%	38%	9 mph	1 mph	9 mph	28.89 in	28.85 in	28.81 in	0
6/12/2017	96.6 °F	78.8 °F	61.2 °F	72.7 °F	66.9 °F	60.6 °F	99%	72%	42%	6 mph	1 mph	6 mph	28.88 in	28.81 in	28.75 in	0
6/13/2017	100.4 °F	82.8 °F	66.2 °F	75.5 °F	69.9 °F	65.9 °F	99%	79%	40%	8 mph	1 mph	8 mph	30.06 in	29.37 in	28.68 in	0
6/14/2017	98.8 °F	82.5 °F	66.6 °F	75 °F	68.4 °F	63.1 °F	99%	81%	44%	7 mph	0 mph	7 mph	30.08 in	30.03 in	29.99 in	0.11
6/15/2017	92.8 °F	78.3 °F	63.9 °F	76.6 °F	69.8 °F	63.6 °F	99%	81%	51%	8 mph	2 mph	8 mph	30.07 in	29.99 in	29.92 in	0
6/16/2017	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
6/17/2017	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
6/18/2017	93.9 °F	82.1 °F	70.5 °F	77.4 °F	72.4 °F	66.8 °F	88%	67%	55%	13 mph	5 mph	13 mph	29.98 in	29.93 in	29.89 in	0
6/19/2017	91.8 °F	79.4 °F	67.5 °F	75.9 °F	71 °F	67 °F	99%	84%	57%	12 mph	4 mph	12 mph	30.3 in	30.1 in	29.9 in	0.13
6/20/2017	91.2 °F	76.3 °F	62.1 °F	71 °F	66.7 °F	61.8 °F	99%	79%	42%	8 mph	2 mph	8 mph	30.12 in	29.44 in	28.76 in	0.01
6/21/2017	96.8 °F	79.9 °F	63.5 °F	73.8 °F	68.4 °F	63.2 °F	99%	79%	41%	10 mph	2 mph	10 mph	28.76 in	28.73 in	28.7 in	0
6/22/2017	90.9 °F	77.6 °F	64.4 °F	74.8 °F	70.2 °F	64.1 °F	99%	84%	55%	6 mph	1 mph	6 mph	28.78 in	28.74 in	28.7 in	0
6/23/2017	90.7 °F	80.2 °F	70.5 °F	78.6 °F	72.3 °F	69.3 °F	99%	84%	62%	12 mph	5 mph	12 mph	28.74 in	28.6 in	28.45 in	0.04
6/24/2017	97.3 °F	80.2 °F	65.3 °F	75.7 °F	68.3 °F	61.7 °F	89%	69%	45%	13 mph	2 mph	13 mph	28.72 in	28.58 in	28.43 in	0.48
6/25/2017	93 °F	74.8 °F	56.8 °F	67.4 °F	60.3 °F	53.1 °F	98%	70%	34%	7 mph	1 mph	7 mph	28.82 in	28.76 in	28.71 in	0
6/26/2017	91.4 °F	71.8 °F	52.2 °F	63.3 °F	56 °F	50.3 °F	96%	64%	28%	8 mph	1 mph	8 mph	28.83 in	28.76 in	28.7 in	0.65
6/27/2017	87.3 °F	71.1 °F	55.6 °F	60.9 °F	55.8 °F	51.2 °F	96%	66%	36%	7 mph	1 mph	7 mph	28.81 in	28.76 in	28.71 in	0
6/28/2017	88.5 °F	67.4 °F	48 °F	61.6 °F	55 °F	47.2 °F	99%	69%	37%	7 mph	2 mph	7 mph	28.92 in	28.86 in	28.81 in	0
6/29/2017	90.1 °F	73 °F	55.9 °F	69.1 °F	63.3 °F	55.6 °F	99%	73%	48%	12 mph	2 mph	12 mph	28.87 in	28.83 in	28.79 in	0
6/30/2017	90.3 °F	76.6 °F	63.7 °F	77.2 °F	69.2 °F	61.9 °F	99%	85%	58%	13 mph	3 mph	13 mph	28.82 in	28.75 in	28.68 in	0.12
7/1/2017	95 °F	82.6 °F	70.5 °F	77.8 °F	73.5 °F	70.2 °F	99%	82%	58%	8 mph	2 mph	8 mph	28.73 in	28.68 in	28.64 in	0
7/2/2017	101.5 °F	83.6 °F	66.6 °F	75.3 °F	70.7 °F	63.7 °F	99%	74%	40%	8 mph	0 mph	8 mph	28.8 in	28.75 in	28.7 in	0
7/3/2017	99.9 °F	81.2 °F	62.8 °F	72.1 °F	66.5 °F	62.1 °F	99%	71%	34%	8 mph	1 mph	8 mph	28.79 in	28.75 in	28.71 in	0
7/4/2017	96.1 °F	81.4 °F	67.3 °F	77.9 °F	70.8 °F	67 °F	99%	83%	47%	6 mph	1 mph	6 mph	28.78 in	28.74 in	28.69 in	0.18
7/5/2017	88.9 °F	77.9 °F	67.6 °F	76.5 °F	71.6 °F	67.3 °F	99%	92%	64%	6 mph	1 mph	6 mph	28.82 in	28.78 in	28.75 in	0.18
7/6/2017	98.2 °F	83.3 °F	69.6 °F	77.2 °F	72.3 °F	69.3 °F	99%	78%	46%	7 mph	1 mph	7 mph	28.8 in	28.72 in	28.63 in	0.12
7/7/2017	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
7/8/2017	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
7/9/2017	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
7/10/2017	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
7/11/2017	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
7/12/2017	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
7/13/2017	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
7/14/2017	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
7/15/2017	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
7/16/2017	81 °F	73.1 °F	65.3 °F	74.9 °F	62.9 °F	60.3 °F	94%	79%	58%	0 mph	0 mph	0 mph	28.68 in	28.67 in	28.65 in	0.12
7/17/2017	100.8 °F	80.2 °F	59.5 °F	74 °F	67 °F	59.1 °F	99%	72%	36%	7 mph	1 mph	7 mph	28.75 in	28.7 in	28.65 in	0
7/18/2017	103.3 °F	84.3 °F	65.3 °F	75.9 °F	69.3 °F	64 °F	99%	75%	35%	6 mph	1 mph	6 mph	28.82 in	28.78 in	28.74 in	0
7/19/2017	103.3 °F	82.8 °F	62.6 °F	72.6 °F	67.3 °F	62.1 °F	99%	67%	33%	7 mph	1 mph	7 mph	28.82 in	28.77 in	28.72 in	0
7/20/2017	108.3 °F	87.1 °F	66 °F	74.2 °F	70.2 °F	65.7 °F	99%	68%	28%	8 mph	1 mph	8 mph	28.78 in	28.72 in	28.65 in	0
7/21/2017	101.8 °F	84.8 °F	69.1 °F	76.7 °F	72.1 °F	66.9 °F	99%	78%	42%	8 mph	1 mph	8 mph	28.72 in	28.68 in	28.64 in	1.33

7/22/2017	105.3 °F	87.4 °F	70.5 °F	82.3 °F	75 °F	70.2 °F	99%	78%	44%	7 mph	1 mph	7 mph	28.68 in	28.6 in	28.52 in	0.09
7/23/2017	106 °F	88.1 °F	71.2 °F	78.1 °F	72.3 °F	67 °F	99%	71%	37%	13 mph	2 mph	13 mph	28.58 in	28.53 in	28.48 in	0.62
7/24/2017	105.1 °F	86.9 °F	68.7 °F	74.6 °F	69.5 °F	62.9 °F	99%	67%	29%	8 mph	2 mph	8 mph	28.66 in	28.57 in	28.48 in	0.05
7/25/2017	103.5 °F	84.2 °F	65.3 °F	71.9 °F	65.7 °F	57.6 °F	99%	60%	24%	8 mph	2 mph	8 mph	28.8 in	28.73 in	28.66 in	0
7/26/2017	96.1 °F	81.9 °F	68 °F	70.6 °F	67.2 °F	61.8 °F	98%	65%	42%	9 mph	2 mph	9 mph	28.92 in	28.85 in	28.77 in	0
7/27/2017	100.6 °F	82.8 °F	65.7 °F	77.2 °F	71.2 °F	65.4 °F	99%	86%	47%	8 mph	1 mph	8 mph	28.8 in	28.69 in	28.59 in	0.48
7/28/2017	90 °F	79.7 °F	69.6 °F	78.5 °F	73.5 °F	69.3 °F	99%	90%	61%	6 mph	0 mph	6 mph	28.6 in	28.48 in	28.36 in	0.02
7/29/2017	85.3 °F	73.3 °F	61.7 °F	70.9 °F	66.3 °F	61.2 °F	99%	81%	54%	12 mph	3 mph	12 mph	28.67 in	28.51 in	28.35 in	0.01
7/30/2017	90.9 °F	73.3 °F	55.9 °F	62.1 °F	57.2 °F	52.4 °F	99%	66%	31%	9 mph	2 mph	9 mph	28.81 in	28.74 in	28.66 in	0
7/31/2017	95.5 °F	74.4 °F	54 °F	64.3 °F	59.8 °F	53.7 °F	99%	67%	34%	8 mph	2 mph	8 mph	28.85 in	28.81 in	28.76 in	0
8/1/2017	88.5 °F	76.7 °F	65.1 °F	68.4 °F	65.8 °F	62.9 °F	99%	77%	45%	7 mph	0 mph	7 mph	28.82 in	28.78 in	28.75 in	0.18
8/2/2017	99.7 °F	80.9 °F	62.6 °F	72.7 °F	67.5 °F	62.3 °F	99%	77%	38%	6 mph	1 mph	6 mph	28.81 in	28.76 in	28.72 in	0
8/3/2017	100 °F	80.3 °F	60.6 °F	72.6 °F	65.2 °F	60.3 °F	99%	68%	34%	9 mph	1 mph	9 mph	28.83 in	28.78 in	28.73 in	0
8/4/2017	103.3 °F	82.2 °F	61.9 °F	70.8 °F	65.3 °F	61.6 °F	99%	65%	30%	12 mph	2 mph	12 mph	28.76 in	28.67 in	28.59 in	0
8/5/2017	93.2 °F	76.6 °F	60.3 °F	64.9 °F	59 °F	53.3 °F	94%	59%	32%	12 mph	2 mph	12 mph	28.78 in	28.69 in	28.61 in	0
8/6/2017	99 °F	75.8 °F	52.7 °F	65.9 °F	60.1 °F	52.4 °F	99%	66%	33%	7 mph	1 mph	7 mph	28.84 in	28.79 in	28.74 in	0
8/7/2017	90 °F	77.6 °F	65.1 °F	75 °F	69.9 °F	63.9 °F	99%	90%	60%	8 mph	1 mph	8 mph	28.78 in	28.69 in	28.59 in	0.38
8/8/2017	90.3 °F	76.4 °F	62.8 °F	72.3 °F	68.2 °F	62.5 °F	99%	87%	47%	8 mph	1 mph	8 mph	28.83 in	28.72 in	28.61 in	0.38
8/9/2017	93.6 °F	75.8 °F	57.9 °F	69.6 °F	61.7 °F	57.6 °F	99%	73%	37%	6 mph	2 mph	6 mph	28.92 in	28.88 in	28.83 in	0
8/10/2017	91.8 °F	73.8 °F	56.3 °F	69.2 °F	63.2 °F	56 °F	99%	77%	42%	7 mph	1 mph	7 mph	28.94 in	28.89 in	28.83 in	0
8/11/2017	96.3 °F	79.5 °F	63.5 °F	74 °F	68.7 °F	63.2 °F	99%	86%	46%	8 mph	1 mph	8 mph	28.85 in	28.78 in	28.7 in	0.8
8/12/2017	98.4 °F	82.9 °F	68.4 °F	77.4 °F	71.7 °F	23.2 °F	99%	83%	46%	7 mph	1 mph	7 mph	28.97 in	28.77 in	28.58 in	0.1
8/13/2017	93.9 °F	81.3 °F	68.7 °F	73.6 °F	70.8 °F	68.4 °F	99%	84%	48%	8 mph	1 mph	8 mph	28.74 in	28.68 in	28.62 in	0
8/14/2017	85.3 °F	76.2 °F	67.6 °F	73.3 °F	70.3 °F	67.3 °F	99%	90%	67%	6 mph	1 mph	6 mph	28.74 in	28.68 in	28.62 in	0.04
8/15/2017	97.3 °F	82.9 °F	68.7 °F	80 °F	73 °F	68.4 °F	99%	89%	53%	13 mph	0 mph	13 mph	28.66 in	28.61 in	28.56 in	0.66
8/16/2017	102.6 °F	84.5 °F	66.4 °F	77.4 °F	71.5 °F	66.1 °F	99%	76%	38%	7 mph	1 mph	7 mph	28.75 in	28.7 in	28.65 in	0
8/17/2017	105.6 °F	87.1 °F	69.6 °F	78.6 °F	73.7 °F	69.3 °F	99%	77%	41%	8 mph	1 mph	8 mph	28.75 in	28.69 in	28.62 in	0.07
8/18/2017	105.4 °F	87.7 °F	70.3 °F	80 °F	74.5 °F	69.9 °F	99%	81%	40%	8 mph	1 mph	8 mph	28.65 in	28.58 in	28.52 in	0.24
8/19/2017	102.4 °F	83.4 °F	65.1 °F	74.9 °F	68.8 °F	64.8 °F	99%	74%	32%	6 mph	1 mph	6 mph	28.7 in	28.66 in	28.62 in	0.01
8/20/2017	104.2 °F	83.8 °F	63.3 °F	73.5 °F	68.7 °F	63 °F	99%	73%	33%	8 mph	1 mph	8 mph	28.87 in	28.78 in	28.7 in	0
8/21/2017	106 °F	85.5 °F	65.7 °F	79 °F	71.5 °F	65.4 °F	99%	80%	37%	6 mph	1 mph	6 mph	28.91 in	28.86 in	28.82 in	0.01
8/22/2017	104.7 °F	84.9 °F	65.8 °F	77.1 °F	71.7 °F	65.5 °F	99%	73%	40%	9 mph	1 mph	9 mph	28.86 in	28.73 in	28.59 in	0
8/23/2017	100.4 °F	83.7 °F	67.3 °F	74.7 °F	68.8 °F	59.7 °F	99%	72%	38%	8 mph	1 mph	8 mph	28.63 in	28.58 in	28.52 in	0
8/24/2017	90.9 °F	75.9 °F	61 °F	65 °F	62 °F	59.8 °F	99%	73%	38%	7 mph	1 mph	7 mph	28.72 in	28.67 in	28.61 in	0
8/25/2017	94.1 °F	74.3 °F	55 °F	62 °F	58.4 °F	54.7 °F	99%	71%	30%	7 mph	1 mph	7 mph	28.87 in	28.8 in	28.72 in	0
8/26/2017	92.7 °F	76.4 °F	60.3 °F	67.5 °F	62.1 °F	58.7 °F	97%	74%	41%	7 mph	2 mph	7 mph	28.91 in	28.87 in	28.83 in	0
8/27/2017	91.6 °F	76.6 °F	62.1 °F	66.5 °F	62.1 °F	58.7 °F	99%	75%	38%	8 mph	1 mph	8 mph	28.91 in	28.85 in	28.8 in	0
8/28/2017	82.2 °F	69.7 °F	57.2 °F	60.8 °F	58.2 °F	54.8 °F	94%	70%	47%	11 mph	3 mph	11 mph	28.88 in	28.83 in	28.78 in	0
8/29/2017	72.3 °F	64.8 °F	57.6 °F	64.8 °F	60.7 °F	57.3 °F	99%	91%	74%	9 mph	3 mph	9 mph	28.79 in	28.74 in	28.68 in	0.08
8/30/2017	94.3 °F	75.4 °F	56.8 °F	69.9 °F	64.6 °F	56.5 °F	99%	80%	43%	7 mph	1 mph	7 mph	28.76 in	28.72 in	28.67 in	0
8/31/2017	91.6 °F	76.9 °F	62.6 °F	72.8 °F	67.2 °F	-33.4 °F	99 %	86%	48%	6 mph	1 mph	6 mph	28.75 in	28.7 in	28.66 in	0.03
9/1/2017	65.5 °F	59.9 °F	54.3 °F	65.2 °F	60.2 °F	53.8 °F	99%	99%	91%	10 mph	3 mph	10 mph	28.78 in	28.73 in	28.67 in	0.51
9/2/2017	65.7 °F	58.9 °F	52.2 °F	62.4 °F	57.2 °F	51.9 °F	99%	97%	89%	6 mph	2 mph	6 mph	28.77 in	28.73 in	28.68 in	0.37
9/3/2017	92.5 °F	72.6 °F	52.9 °F	66 °F	59.7 °F	52.6 °F	99%	75%	35%	13 mph	2 mph	13 mph	28.75 in	28.72 in	28.69 in	0

9/4/2017	61.7 °F	61.7 °F	61.7 °F	60 °F	60 °F	60 °F	94%	94%	94%	0 mph	0 mph	0 mph	28.75 in	28.75 in	28.75 in	0
9/5/2017	61.7 °F	61.7 °F	61.7 °F	60 °F	60 °F	60 °F	94%	94%	94%	0 mph	0 mph	0 mph	28.75 in	28.75 in	28.75 in	0
9/6/2017	61.7 °F	61.7 °F	61.7 °F	60 °F	60 °F	60 °F	94%	94%	94%	0 mph	0 mph	0 mph	30.13 in	29.44 in	28.75 in	0
9/7/2017	61.7 °F	61.7 °F	61.7 °F	60 °F	60 °F	60 °F	94%	94%	94%	0 mph	0 mph	0 mph	30.13 in	29.44 in	28.75 in	0
9/8/2017	61.7 °F	61.7 °F	61.7 °F	60 °F	60 °F	60 °F	94%	94%	94%	0 mph	0 mph	0 mph	30.13 in	29.44 in	28.75 in	0
9/9/2017	61.7 °F	61.7 °F	61.7 °F	60 °F	60 °F	60 °F	94%	94%	94%	0 mph	0 mph	0 mph	30.13 in	30.13 in	30.13 in	0
9/10/2017	75.2 °F	64.4 °F	53.6 °F	60 °F	56.9 °F	50.5 °F	95%	85%	43%	9 mph	1 mph	9 mph	30.41 in	29.7 in	29 in	0
9/11/2017	63.9 °F	57.2 °F	50.5 °F	57.5 °F	54.2 °F	50.2 °F	99%	90%	72%	9 mph	3 mph	9 mph	30.38 in	30.26 in	30.14 in	0
9/12/2017	65.8 °F	60.9 °F	55.9 °F	65.5 °F	60.5 °F	55.6 °F	99%	98%	90%	9 mph	3 mph	9 mph	30.14 in	29.35 in	28.57 in	0.97
9/13/2017	90.3 °F	75.8 °F	62.1 °F	70 °F	64.8 °F	61.8 °F	99%	82%	43%	9 mph	1 mph	9 mph	29.96 in	29.25 in	28.54 in	0.04
9/14/2017	87.6 °F	73.1 °F	59 °F	68.3 °F	63.9 °F	58.7 °F	99%	84%	48%	6 mph	1 mph	6 mph	28.7 in	28.64 in	28.57 in	0
9/15/2017	90 °F	71.6 °F	56.1 °F	68 °F	58.2 °F	55.6 °F	99%	97%	49%	7 mph	0 mph	7 mph	28.81 in	28.75 in	28.69 in	0
9/16/2017	95.5 °F	72 °F	59.4 °F	68.7 °F	64.1 °F	58.3 °F	99%	93%	59%	6 mph	0 mph	6 mph	28.85 in	28.82 in	28.79 in	0
9/17/2017	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
9/18/2017	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
9/19/2017	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
9/20/2017	97.7 °F	70 °F	67.3 °F	70.9 °F	68.2 °F	59.8 °F	99%	98%	94%	6 mph	0 mph	6 mph	28.72 in	28.68 in	28.65 in	0.12
9/21/2017	96.3 °F	78.9 °F	62.2 °F	71.7 °F	66.6 °F	61.9 °F	99%	79%	39%	8 mph	1 mph	8 mph	28.78 in	28.74 in	28.69 in	0.01
9/22/2017	96.8 °F	79.2 °F	62.1 °F	73.2 °F	66.7 °F	61.8 °F	99%	79%	40%	8 mph	1 mph	8 mph	28.8 in	28.75 in	28.7 in	0
9/23/2017	95.7 °F	77.2 °F	58.8 °F	70.9 °F	62.3 °F	56.4 °F	99%	74%	30%	7 mph	1 mph	7 mph	29.05 in	28.89 in	28.73 in	0
9/24/2017	95.9 °F	76.8 °F	57.7 °F	68.2 °F	61.6 °F	57.4 °F	99%	72%	32%	7 mph	2 mph	7 mph	28.82 in	28.76 in	28.71 in	0.18
9/25/2017	91.2 °F	75.5 °F	60.3 °F	69.8 °F	65.3 °F	60 °F	99%	79%	48%	9 mph	2 mph	9 mph	28.76 in	28.7 in	28.65 in	0
9/26/2017	97.2 °F	80.4 °F	63.9 °F	70.6 °F	66.1 °F	63.2 °F	99%	75%	40%	9 mph	2 mph	9 mph	28.7 in	28.65 in	28.59 in	0
9/27/2017	97.7 °F	79.8 °F	62.2 °F	68.9 °F	63.7 °F	57.6 °F	99%	69%	31%	9 mph	2 mph	9 mph	28.64 in	28.58 in	28.52 in	0
9/28/2017	97.7 °F	78.6 °F	59.7 °F	70.6 °F	62.8 °F	54.7 °F	97%	68%	36%	10 mph	2 mph	10 mph	28.71 in	28.63 in	28.55 in	0
9/29/2017	88.7 °F	69.2 °F	50.7 °F	58.6 °F	54.9 °F	50.4 °F	99%	73%	36%	8 mph	1 mph	8 mph	28.82 in	28.76 in	28.7 in	0
9/30/2017	81.5 °F	64.9 °F	48.4 °F	53.3 °F	45.8 °F	36.3 °F	99%	62%	24%	12 mph	3 mph	12 mph	29 in	28.9 in	28.8 in	0
10/1/2017	78.3 °F	59.3 °F	40.6 °F	47.9 °F	44.1 °F	40.2 °F	99%	69%	32%	9 mph	2 mph	9 mph	29.08 in	29.01 in	28.95 in	0
10/2/2017	84 °F	61.9 °F	39.9 °F	56.7 °F	48.5 °F	39.6 °F	99%	77%	37%	7 mph	1 mph	7 mph	29.12 in	29.06 in	29 in	0
10/3/2017	84 °F	63.6 °F	43.2 °F	57.8 °F	50.4 °F	42.9 °F	99%	77%	38%	8 mph	1 mph	8 mph	29.25 in	29.19 in	29.12 in	0
10/4/2017	91.4 °F	66.8 °F	42.8 °F	60.2 °F	51.8 °F	42.5 °F	99%	75%	31%	6 mph	1 mph	6 mph	29.19 in	29.08 in	28.98 in	0
10/5/2017	95 °F	69.8 °F	45.1 °F	62.8 °F	53.8 °F	44.8 °F	99%	73%	30%	7 mph	1 mph	7 mph	29 in	28.91 in	28.82 in	0
10/6/2017	96.3 °F	72.7 °F	49.5 °F	62.4 °F	56 °F	49.2 °F	99%	72%	31%	7 mph	1 mph	7 mph	28.85 in	28.79 in	28.73 in	0
10/7/2017	92.7 °F	72.3 °F	52 °F	67.9 °F	61.7 °F	51.7 °F	99%	85%	40%	8 mph	1 mph	8 mph	28.81 in	28.75 in	28.69 in	0.17
10/8/2017	84.7 °F	75.8 °F	66.9 °F	75.6 °F	71.1 °F	66.6 °F	99%	94%	71%	9 mph	1 mph	9 mph	28.72 in	28.65 in	28.58 in	0.36
10/9/2017	94.8 °F	83.2 °F	71.6 °F	77.3 °F	73.1 °F	71.2 °F	99%	87%	50%	16 mph	3 mph	16 mph	28.73 in	28.62 in	28.51 in	0.55
10/10/2017	88.9 °F	79.2 °F	70 °F	74.8 °F	72 °F	69.7 °F	99%	90%	62%	6 mph	0 mph	6 mph	28.79 in	28.76 in	28.72 in	0
10/11/2017	90.7 °F	78.2 °F	67.3 °F	78.1 °F	72.4 °F	67 °F	99%	92%	65%	5 mph	0 mph	5 mph	28.74 in	28.7 in	28.66 in	0.16
10/12/2017	72.9 °F	66.8 °F	61 °F	70.5 °F	64.8 °F	60.7 °F	99%	96%	83%	8 mph	0 mph	8 mph	28.93 in	28.81 in	28.68 in	0.12
10/13/2017	64.6 °F	61.3 °F	58.1 °F	62.2 °F	59.7 °F	57.8 °F	99%	98%	89%	0 mph	0 mph	0 mph	29.01 in	28.97 in	28.93 in	0.15
10/14/2017	85.5 °F	71.4 °F	57.7 °F	67.5 °F	61.9 °F	57.4 °F	99%	88%	53%	6 mph	0 mph	6 mph	28.96 in	28.89 in	28.82 in	0
10/15/2017	93.9 °F	74.1 °F	55.4 °F	69.5 °F	63.7 °F	55.1 °F	99%	83%	45%	7 mph	1 mph	7 mph	28.85 in	28.74 in	28.64 in	0
10/16/2017	69.3 °F	55.4 °F	41.5 °F	67.5 °F	50.1 °F	40.1 °F	99%	75%	44%	3 mph	0 mph	3 mph	28.95 in	28.78 in	28.62 in	0.17
10/17/2017	73.8 °F	55.5 °F	37.8 °F	51.1 °F	41 °F	37.5 °F	99%	76%	32%	0 mph	0 mph	0 mph	29.06 in	28.99 in	28.93 in	0

10/18/2017	78.3 °F	56.1 °F	34.2 °F	48.4 °F	41.7 °F	33.9 °F	99%	76%	31%	0 mph	0 mph	0 mph	29.08 in	29.02 in	28.97 in	0
10/19/2017	86.9 °F	60.8 °F	35.2 °F	54.7 °F	45.2 °F	34.9 °F	99%	74%	28%	0 mph	0 mph	0 mph	28.99 in	28.92 in	28.85 in	0
10/20/2017	85.8 °F	65 °F	44.4 °F	55.4 °F	50.5 °F	44.1 °F	99%	74%	33%	1 mph	0 mph	1 mph	28.98 in	28.92 in	28.86 in	0
10/21/2017	87.1 °F	65.9 °F	45.1 °F	58.1 °F	52.4 °F	44.8 °F	99%	78%	36%	2 mph	0 mph	2 mph	29.03 in	28.98 in	28.93 in	0
10/22/2017	85.1 °F	65.6 °F	46.4 °F	59.7 °F	53.2 °F	46.1 °F	99%	79%	40%	5 mph	0 mph	5 mph	29.05 in	28.99 in	28.93 in	0
10/23/2017	67.3 °F	59.3 °F	51.3 °F	66.4 °F	59.8 °F	50.8 °F	99%	98%	91%	12 mph	0 mph	12 mph	28.93 in	28.68 in	28.43 in	1.25
10/24/2017	78.6 °F	61.2 °F	44.2 °F	58.8 °F	48.3 °F	37.4 °F	99%	73%	38%	8 mph	1 mph	8 mph	28.53 in	28.49 in	28.44 in	0.01
10/25/2017	68.7 °F	53.3 °F	38.5 °F	44.2 °F	38 °F	34.8 °F	94%	62%	35%	9 mph	0 mph	9 mph	28.54 in	28.5 in	28.45 in	0
10/26/2017	68.5 °F	51.7 °F	35.4 °F	43.2 °F	36.1 °F	27.7 °F	99%	70%	23%	0 mph	0 mph	0 mph	28.7 in	28.6 in	28.5 in	0
10/27/2017	79.9 °F	56.8 °F	34.2 °F	51.4 °F	43.4 °F	33.9 °F	99%	74%	36%	7 mph	0 mph	7 mph	28.92 in	28.79 in	28.66 in	0
10/28/2017	74.5 °F	60.3 °F	46.2 °F	58.7 °F	52.1 °F	45.2 °F	99%	80%	52%	8 mph	1 mph	8 mph	28.68 in	28.54 in	28.4 in	0.08
10/29/2017	58.5 °F	49.3 °F	40.1 °F	58.2 °F	45.4 °F	31.4 °F	99%	87%	70%	16 mph	2 mph	16 mph	28.4 in	28.26 in	28.13 in	0.35
10/30/2017	67.3 °F	51.5 °F	35.6 °F	38.1 °F	32.7 °F	27.1 °F	94%	61%	26%	12 mph	1 mph	12 mph	28.66 in	28.44 in	28.22 in	0
10/31/2017	72.9 °F	54.7 °F	36.9 °F	44.7 °F	39.6 °F	35.6 °F	99%	72%	31%	8 mph	1 mph	8 mph	28.88 in	28.77 in	28.66 in	0
11/1/2017	73.4 °F	55.3 °F	37.6 °F	52.6 °F	45.5 °F	37.3 °F	99%	80%	44%	5 mph	0 mph	5 mph	28.91 in	28.86 in	28.82 in	0
11/2/2017	84.6 °F	65.7 °F	47.3 °F	60.1 °F	53.5 °F	47 °F	99%	79%	42%	8 mph	1 mph	8 mph	28.93 in	28.88 in	28.82 in	0
11/3/2017	89.6 °F	69.2 °F	48.9 °F	65.5 °F	57.9 °F	48.6 °F	99%	81%	40%	10 mph	1 mph	10 mph	28.86 in	28.8 in	28.73 in	0.01

* Data station offline. No data was collected from the weather station.

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