Heath Dairy Road Stream Restoration Site
Randolph County, North Carolina

DMS Project #170
USACE Action Item # SAW 2008 02860

MY – 05 Fall Monitoring Report

Data Collected: October/November 2018
Final Report Submitted: January 2019

Prepared for:
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Environmental Quality

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APPENDICES

1.0 Project Summary

1.1 Goals & Objectives

The Heath Dairy Road Stream Restoration Site (Heath Dairy Site, DMS # 170) lies along Back Creek and unnamed tributaries in Randolph County NC, within the Yadkin-Pee Dee watershed (HUC #03040103-050050). This project includes restoration, enhancement and preservation of approximately 8,344 linear feet of degraded channels, and wetland enhancement and preservation including soil restoration (scarification of compacted soil) and planting of wetland vegetation.
Specific **goals** for the Heath Dairy project include:

- Improve local water quality within the restored channel reaches as well as the downstream watercourses through:
  - Reduction of current channel and off-site sediment loads by restoring appropriately sized channels with stable beds and banks.
  - Reduction of nutrient loads from adjacent agricultural fields by restoring the riparian buffer.
  - Reduction of water temperatures provided through shading of the channel by canopy species along with the resultant increase in oxygen content.
- Improve local aquatic and terrestrial habitat and diversity within the restored channels and their vicinity through:
  - Restoration of appropriate bed form to provide habitat for fish, amphibian, and benthic species.
  - Enhancement of riparian wetlands along the stream corridor to provide additional landscape and habitat diversity.
  - Restoration of a suitable riparian buffer corridor in order to provide both vertical and horizontal structure and connectivity with adjacent upland areas.
  - Restoration of understory and canopy species in order to provide forage, cover, and nesting for a variety of mammals, reptiles, and avian species.

To meet these goals, the following **objectives** have been established for the Heath Dairy project:

- Restore natural stable channel morphology and proper sediment transport capacity;
- Create and/or improve bed form diversity and improve aquatic habitat;
- Construct a floodplain (or local bankfull bench) that is accessible at the proposed bankfull channel elevation;
- Improve channel and stream bank stabilization by integrating in-stream structures and native bank vegetation;
- Restore 7,791 linear feet of stream through Priority I and II restoration from the existing 6,748 linear feet of stream;
- Enhance 960 linear feet of stream from the existing 960 linear feet of stream;
- Preserve 636 linear feet of stream;
- Enhance 0.60 acres of wetlands from the existing 0.60 acres of wetlands (all are riparian non-riverine wetlands);
- Preserve 1.18 acres of wetlands (all are riparian non-riverine wetlands, except Wetland J

which is a riparian riverine wetland consisting of 0.090 acres of preservation); and,
- Restore approximately 30 acres of riparian buffer by establishing a native forested and herbaceous riparian buffer plant community.

1.2 Project Success Criteria

1.2.1 Streams

Post-restoration monitoring of channel stability will include dimension (cross-sections), pattern and profile (longitudinal profile), and photo documentation of the project. Success criteria for the stream restoration also include substrate analysis (Wolmann Pebble Counts) and the frequency of bankfull events. The success criteria are described below for each parameter.

- ***Dimension***

Riffle cross-sections on the restoration reaches should remain relatively stable; however, due to the sand/silt nature of the substrate throughout the project reaches, fluctuations of the riffle bed elevation over time are expected. These fluctuations should be temporary and will likely correspond to storm events. Riffle cross-sectional ratios (width-to-depth, depth ratio, and bank height ratio) should fall within the parameters defined for channels of the appropriate Natural Channel Design stream type. If persistent changes are observed, these changes will be evaluated to assess whether the stream channel is showing signs of long term instability. Indicators of instability include, but are not limited to, a vertically incising thalweg or eroding channel banks. Changes in the channel that indicate a movement toward stability or enhanced habitat include a decrease in the width-to-depth ratio in meandering channels or an increase in pool depth. Remedial action should not be taken if channel changes indicate a movement toward stability.

- ***Pattern and Profile***

Longitudinal profile data for the stream restoration reaches should show that the bedform features are remaining stable. The riffles should be steeper and shallower than the pools, while the pools should be deep with flat water surface slopes. The relative percentage of riffles and pools should not change significantly from the design parameters. Adjustments in length and slope of run and glide features are expected and will not be considered a sign of instability. The longitudinal profile should show that the bank height ratio remains very near to 1.0 for the majority of the restoration reaches.

- ***Photo Documentation***

Photographs illustrate the site's vegetation and morphological stability on an annual basis. Cross-section photos should demonstrate no excessive erosion or degradation of the banks. Longitudinal photos should indicate the absence of persistent bars within the channel or vertical incision. Grade control structures should remain stable. Deposition of sediment on the bank side of vane arms is preferable. Maintenance of scour pools on the channel side of vane arms is expected. Reference photos will also be taken for each of the vegetation plots.

- ***Substrate***

Substrate materials in the restoration reaches should indicate a progression towards or the presence of coarser materials in the riffle features and smaller particles in the pool features.

- ***Bankfull Events***

Two bankfull flow events in separate years must be documented on the project within the five- year monitoring period. Bankfull events will be documented using a crest gage, photographs, and visual assessments such as debris lines.

1.2.2 Wetland Hydrology

As per the mitigation plan, wetland hydrology success criteria will be satisfied in restored wetlands when saturated soil conditions occur within 12 inches of the ground's surface for a minimum of 12.5% of the 239-day growing season (30 days) during average climatic conditions, OR if the restored area is within 20% of the reference wetland's hydroperiod during drought conditions.

1.2.3 Vegetation

Success will be determined by survival of target species within the sample plots. A minimum of 260 stems/acre must survive for at least five years after initial planting. If the vegetative success criteria are not met, the cause of failure will be determined and an appropriate corrective action will be taken. The criteria for vegetative success will be as follows:

- A minimum survival rate of 320 trees per acre in the riparian buffer at the end of 3 years.
- A minimum survival rate of 260 trees per acre in the conservation easement at the end of 5 years.

These values include both planted and native volunteer species in riparian wetlands and non-wetland riparian areas, as per the mitigation plan.

1.3 Project Setting & Pre-Restoration Conditions

The Heath Dairy Site is located in Randolph County, North Carolina, northwest of Asheboro and southwest of the Town of Randleman (Figure 1). The site is located in the Back Creek watershed of the Yadkin-Pee Dee River Basin, United States Geological Survey (USGS) Hydrologic Unit Code 03040103-050050, and within the North Carolina Division of Water Resources (NCDWR) sub-basin 03-07-09. Back Creek drains into the Back Creek (Lucas) Lake and then into the Uwharrie River approximately eleven miles downstream of the site. This HUC is identified as a Targeted Local Watershed (TLW) in EEP's 2003 and 2009 Yadkin River Basin Restoration Priority (RBRP) Plan. Prior to restoration, the site was utilized for agricultural purposes, including cattle grazing pasture. The surrounding land uses consist of pastureland, woodland, and rural residential lots.

1.4 Project Components and Mitigation Assets

The project components are summarized in Table 1 of Appendix A and depicted in Figures 2.0 through 2.9.

1.5 Project Design Approach

The Heath Dairy Site restored and/or enhanced approximately 7,708 linear feet of degraded channels and preserved 636 linear feet of channels. Table 1 and Figure 2 in the Appendix present the project assets.

With the exception of the lower portion of Back Creek, the channel was designed as a Type B4c stream. This channel configuration provided the most stable form in moderately sloping colluvial valleys. Not only does it effectively convey bankfull discharge and sediment load but also conforms to the natural conveyance of flood flows. Along the lower reach of Back Creek where the topography opens into a broad flat alluvial floodplain the channel was designed as a Type E4 stream. The proposed channel dimensions, patterns, and profiles were based on hydraulic relationships and morphological dimensionless ratios of reference reaches.

Restoration consisted of Priority I and II activities which involved reconstruction of the channels along new and existing alignments. Bed material from the existing channel was mined and used in the riffles of the channels. Bed material was augmented with additional stone where necessary.

At the request of the DMS the upper portion of Back Creek was redesigned as an enhancement reach to facilitate a paired watershed study to be conducted by North Carolina State University (NCSU). Enhancement efforts entailed raising the profile in place to reconnect the stream to the relic floodplain, construction of in-stream structures, and stabilization of the banks. Degraded riparian buffers used as cattle pasture were re-planted with native trees, with restored widths ranging from 50 to 200 feet from the stream banks.

Nine separate wetland areas totaling 1.78 acres were identified on the Heath Dairy Site, including 1.18 acres of preserved Non-Riverine Riparian Wetland and 0.60 acres of enhanced Non-Riverine Riparian Wetland (Table 1a). Enhancement activities included removal of grazing activity and planting of native wetland vegetation.

1.6. Current Conditions and Performance Summary

1.6.1. Stream Assessment

During the fall stream survey, flow was present along the entire extent of Back Creek and North Branch with water levels sufficient to cover all riffles. West Branch and East Branch had little or no base flow in riffles, but retained water in most of the pools.

Minor stream stability issues that were noted in previous years (i.e. center bars, loose geotech fabric, piping, etc.) have largely resolved themselves due to the increasing size and root density of stream bank trees and shrubs, and natural fluvial processes. The "stream problem areas" designated in previous years (Figure 2 and Table 5) have been removed, and no new problem areas were identified this year on the CCPV figures. Cross-sections and longitudinal profile survey data (Appendix D) show negligible change from 2017 and no noteworthy instability or geomorphic problems. Pebble counts show that all reaches have particle size distributions appropriate for their bedforms, and that sand and gravel transport is occurring normally.

1.6.2. Wetlands Assessment

Standing water and saturated soils were observed in most areas of the enhanced and preserved wetlands on site (Figure 2.1 through 2.9) during the spring and fall 2018 site visits. All wetland areas appear to be meeting vegetation criteria; no "low woody stem density" areas were designated in the wetlands. Please refer to section 1.6.4. below for details regarding wetland hydrology.

1.6.3. Vegetation Assessment

MMI staff monitored the 26 permanent CVS vegetation plots (.0247 acre / plot) and evaluated the surrounding planted area (32 acres) within the conservation easement. Planted stem counts in the CVS plots ranged from 0 to 14 per plot and total native hardwood stems (planted plus volunteers) ranged from 4 to 29 per plot. Nineteen plots (73%) exceed the 260 stems/acre success criteria based on planted and volunteer stems combined (at MY5). The failing plots (4, 6, 7, 12, 15, 20, 21) all have dense herbaceous cover (*Aster*, *Solidago*, *Eupatorium*, grasses) and blackberry (Rubus) that overtopped and apparently out-competed the planted trees, and has impeded the recruitment of native volunteer trees.

Four areas of "low woody stem density" totaling 0.79 acre remain on the current CCPV figures; other areas have achieved success due to growth of planted and volunteer stems. The majority of the 0.79 acres of low woody stem density areas exist beyond the required 50 ft stream buffer zones. Numerous invasive plant areas (mostly multiflora rose and Chinese privet) mapped in April 2018 at scattered locations throughout the site do not appear to have been treated recently, and remain the same as shown in the spring 2018 report. Other invasives noted at scattered sites include Japanese honeysuckle, porcelainberry, ailanthus, and callery pear. The NC DMS is currently contracting additional invasive species treatment to address invasives on the entire 58-acre site.

No signs of cattle or other livestock or human encroachment damage within the easement were observed, and the fence line integrity was intact in areas that have a perimeter fence. Beaver activity noted in previous years appears to have subsided, probably due to the active trapping program during the past couple years.

1.6.4. Hydrology Assessment

Multiple bankfull or over-bank flood events occurred during 2018 based on crest gauge data and observations of recently deposited wrack on the floodplains (Table 12). The peak stage readings for the two cork crest gauges on Back Creek were 0.5 ft (upstream gauge) and 0.3 ft (downstream gauge) above

bankfull as recorded during the spring 2018 visit. The fall 2018 visit was after Hurricane Michael; both crest gauges had apparently been overtopped and wrack deposits were evident on the floodplains 3 feet or more above the creek banks. MMI is no longer monitoring the HOBO gauges at their request; DMS took over that task as of fall 2017.

All four RDS Gages were most recently downloaded in January 2019 and recorded complete data for the 2018 growing season. Gages #3 and #4 did meet hydrological success criteria (Gage 3 = 34% of growing season, Gage 4 = 14% of growing season) with the latter being located in a reference wetland (Table 12; Appendix E). Gauges #1 and #2, which are located in the southeastern portion of the restored wetland "M" did not meet criteria (Gage 1 = 6% of growing season, Gage 2 = 5% of growing season).

2.0. Monitoring Methods

2.1. Vegetation Methodologies

Twenty six (26) permanent vegetation plots were monitored for native woody species according to the CVS Level 2 Vegetation Monitoring Protocol Version 4.2 (Lee *et al.* 2008). Beginning in MY4, non-native woody volunteers have been listed with the plot data but they are not included towards the total stem density calculation and success criteria evaluation.

2.2. Wetland Methodologies

All four (4) RDS groundwater monitoring gauges and two (2) HOBO gauges were downloaded most recently in January 2019. Both Crest Stage Gauges on Back creek were visually inspected and cork replaced. The growing season extends from March 21 through November 14 (239 days) based on the 30-year climate records at Asheboro, NC.

2.3. Stream Methodologies

Longitudinal Profiles were conducted using a Trimble RDK survey-grade GPS unit along the entire length of West Branch, East Branch North Branch, and three 1,000-foot reaches on Back Creek (Stations: 14+15 to 24+15, 26+80 to 40+28, and51+42 to 62+22). All twenty eight (28) of the permanent stream cross sections established on the site were surveyed using a rod and level. Wolman pebble counts were conducted at 20 of the 28 permanent cross-sections and used to calculate the sediment distributions.

3.0. References

Lee, Michael T., Peet, Robert K., Roberts, Steven D., Wentworth, Thomas R. (2008). *CVS-EEP Protocol for Recording Vegetation version 4.2, October 2008*. Retrieved September 2011, from: http://cvs.bio.unc.edu/methods.htm

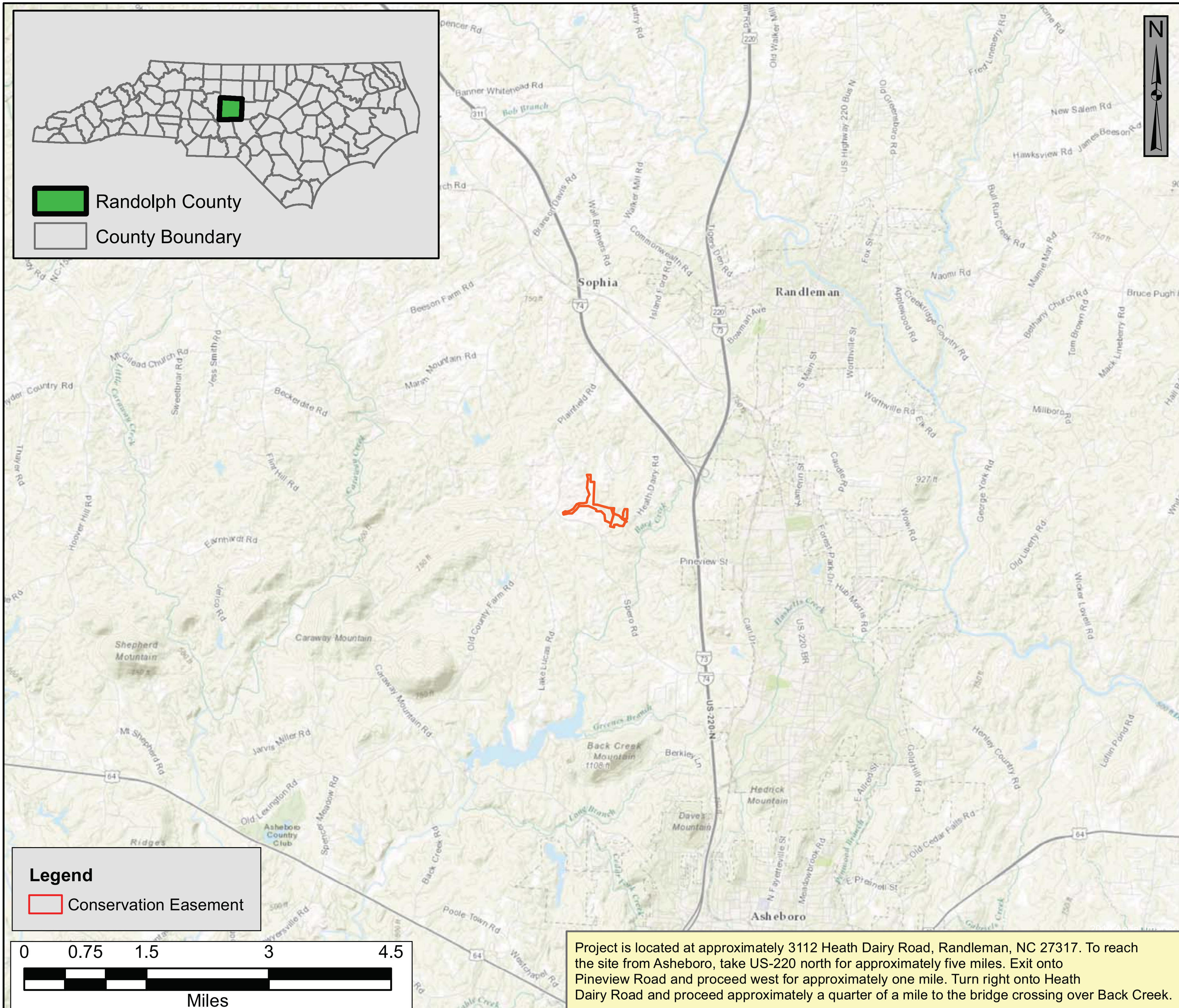
AECOM. 2014. Baseline Monitoring Document and As-built Baseline Report -- Heath Dairy Road Stream Restoration Site, Randolph County. NC-DENR Ecosystem Enhancement Program, July 2014.

Rosgen, D. L. 1996 *Applied River Morphology*. Wildlands Hydrology Books, Pagosa Springs, CO.

Weakley, A.S. (2011) *Flora of the Carolinas, Virginia, Georgia and the Surrounding Areas* University of North Carolina at Chapel Hill

Wolman, M. G. 1954. *A Method of Sampling Coarse River-Bed Material*, Transactions of American Geophysical Union 35:951-956

Appendix A: Project Background Data



Project is located at approximately 3112 Heath Dairy Road, Randleman, NC 27317. To reach the site from Asheboro, take US-220 north for approximately five miles. Exit onto Pineview Road and proceed west for approximately one mile. Turn right onto Heath Dairy Road and proceed approximately a quarter of a mile to the bridge crossing over Back Creek.

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2018

HEATH DAIRY MONITORING YEAR 5
VICINITY MAP
DMS #170

Randolph County, North Carolina

FIGURE 1

Table 1. Project Components & Mitigation Credits

Table 1. Project Components and Mitigation Credits
Heath Dairy Road Stream Restoration/ DMS No. 170

Mitigation Credits

	Stream		Riparian Wetland		Non-riparian Wetland		Buffer	Nitrogen Offset	Phosphorous Offset
Type	R	RE	R	RE	R	RE			
Totals	8431	127		0.54					

Project Components

Project Component	Stationing/Location	Existing Footage or Acreage	Approach	Restoration or Restoration Equivalent	Restoration Footage or	Mitigation Ratio
Back Creek 1	10+00 – 11+55	149 LF	Restoration	Restoration	155 LF	1:1
Back Creek 2	11+55 – 16+25	470 LF	Enhancement I	Restoration	470 LF	1.5:1
Back Creek 3	16+25 – 17+00	75 LF	Restoration	Restoration	75 LF	1:1
Back Creek 4	17+00 – 20+90	390 LF	Enhancement I	Restoration	390 LF	1.5:1
Back Creek 5	20+90 – 24+60	374 LF	Restoration	Restoration	370 LF	1:1
Back Creek 6	24+60 – 25+60	100 LF	Enhancement I	Restoration	100 LF	1.5:1
Back Creek 7	25+60 – 63+45	3450 LF	Restoration	Restoration	3785 LF	1:1
West Preserve	14+58 - 18+75	417 LF	Preservation	Restoration Equivalent	417 LF	5:1
West Branch 1	10+00 – 26+12	1523 LF	Restoration	Restoration	1590 LF*	1:1
North Branch 1	10+30 – 21+97	495 LF	Restoration	Restoration	1167 LF	1:1
East Preserve	5+01 - 7+20	219 LF	Preservation	Restoration Equivalent	219 LF	5:1
East Branch 1	9+96 – 15+93	580 LF	Restoration	Restoration	547 LF*	1:1
UT to West Br.	10+36 – 11+38	102 LF	Restoration	Restoration	102 LF	1:1
Wetland A1	*NA*	1.075 AC	Preservation	Restoration Equivalent	1.075 AC	5:1
Wetland A2	*NA*	0.136AC	Enhancement	Restoration Equivalent	0.136 AC	2:1
Wetland B	*NA*	0.307 AC	Enhancement	Restoration Equivalent	0.307 AC	2:1
Wetland C	*NA*	0.104 AC	Enhancement	Restoration Equivalent	0.104 AC	2:1
Wetland E	*NA*	0.010 AC	Enhancement	Restoration Equivalent	0.010 AC	2:1
Wetland F	*NA*	0.036 AC	Enhancement	Restoration Equivalent	0.036 AC	2:1
Wetland I	*NA*	0.007 AC	Preservation	Restoration Equivalent	0.007 AC	5:1
Wetland J	*NA*	0.090 AC	Preservation	Restoration Equivalent	0.090 AC	5:1
Wetland K	*NA*	0.010 AC	Enhancement	Restoration Equivalent	0.010 AC	2:1
Wetland L	*NA*	0.007 AC	Preservation	Restoration Equivalent	0.007 AC	5:1
Wetland M	*NA*	1.4 AC	Restoration	Restoration	1.4 AC	1:01

Component Summation

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-Riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration	7791					30
Enhancement			0.6			
Enhancement I	960					
Enhancement II						
Creation						
Preservation	636		1.18			
High Quality Preservation						

Table 2. Project Activity & Reporting History

Table 2. Project Activity and Reporting History Heath Dairy Road Stream Restoration/ DMS No. 170		
Activity or Report	**Data Collection Complete**	**Completion or Delivery**
Restoration Plan	Apr-09	May-09
CLOMR	Jun-10	Mar-11
LOMR	Apr-14	Oct-15
Final Design – Construction Plans	*NA*	Jun-11
Construction	*NA*	Aug-13
Permanent seed applied to entire site	*NA*	Aug-13
Plantings for entire site	*NA*	Feb-14
Mitigation Plan (Year 0 Monitoring – baseline)	Apr-14	May-14
Year 1 Fall Monitoring	Nov-14	Mar-15
Year 2 Fall Monitoring	Sep-15	Jan-16
Supplemental Planting	*NA*	Apr-16
Year 3 Spring Monitoring	Mar-16	Apr-16
Invasive Species Management	*NA*	As needed, MY0-MY3
Year 3 Fall Monitoring	Sep/Oct-16	Nov-16
Beaver Management	Observed Summer 2017	Treated Summer 2017
Year 4 Spring Monitoring	Apr-17	Apr-17
Year 4 Fall Monitoring	Sep-17	Dec-17
Year 5 Fall Monitoring	Oct-18	Nov-18

Table 3. Project Contacts

Table 3. Project Contact Table Heath Dairy Road Stream Restoration/ DMS No. 170	
Owner NCDEQ Division of Mitigation Services	Melonie Allen 217 W. Jones Street Suite 300A Raleigh, NC 27603 919-368-9352
Designer AECOM of North Carolina, Inc.	Tammie Tucker 701 Corporate Center Drive, Suite 475 Raleigh, NC 27607 919-760-4025
Landowner Mr. Phillip Ridge Dr. Edward Shackleford	 3562 Plainfield Road Sophia, NC 27350 336-861-4555 203 Shannon Road Asheboro, NC 27203 336-625-6222
Construction Contractor	Backwater Environmental 515 S. Kennedy Avenue Eden, NC 27288
Planting Contractor & Invasives Management	Carolina Silvics, Inc. 908 Indian Trail Road Edenton, NC 27932
Seeding Contractor	Backwater Environmental 515 S. Kennedy Avenue Eden, NC 27288
Monitoring Performer Mogensen Mitigation, Inc.	Richard K. Mogensen P.O. Box 690429 Charlotte, NC, 28227 704-576-1111

Table 4. Project Attributes

Table 4. Project Baseline Information and Attributes Heath Dairy Road Stream Restoration / DMS Project #170					
Project Information					
Project Name	Heath Dairy Farm Road Stream Restoration				
Project County	Randolph				
Project Area (acres)	56.8				
Project Coordinates (lat/long)	35°46'47.85"N / 79°50'51.50"W				
Project Watershed Summary					
Physiographic Province	Piedmont				
Project River Basin	Yadkin				
USGS HUC for Project	3.0401E+12				
NCDWQ Sub-basin for Project	3/7/2009				
Project Drainage Area (acres)	1722				
Project Drainage Area Percentage of Impervious Area	< 2%				
CGIA Land Use Classification	Agricultural Land – Cropland and Pasture				
Reach Summary Information (Pre-restoration)					
Parameters	**Back Creek**	**West Branch**	**North Branch**	**East Branch**	**UT to West Branch**
Length of Reach (feet)	5008	1940	495	799	102
Valley Classification	VIII	II	II	II	II
Drainage area (acres)	1722	90	730	160	32
NCDWQ Stream ID Score	NA	NA	NA	NA	NA
NCDWQ Water Quality Classification	WS-II, HQW	WS-II, HQW	WS-II, HQW	WS-II, HQW	WS-II, HQW
Morphological Description	G4, E4	G4	E4	G4	G4
Evolutionary Trend	NA	NA	NA	NA	NA
Underlying Mapped Soils	(DoB) Dogue and (BtC2) Badin-Tarrus Complex				
Drainage Class	Well Drained to Moderately Well Drained				
Soil Hydric Status	Non-hydric	Non-hydric	Non-hydric	Non-hydric	Non-hydric
Slope					
FEMA Classification	Detail Study	None	Detail Study	None	None
Native Vegetation	Mesic Mixed Hardwood Forest (Piedmont Subtype)				
Percent Composition of Exotic Invasive Vegetation	20%	20%	20%	20%	20%
Wetland Summary Information					
Parameters	**Wetland A**	**Wetland B**	**Wetland C**	**Wetland D - L**	
Size of Wetland)acres)	1.21	0.31	0.1	0.26	
Wetland Type	Riparian	Riparian	Riparian	Riparian	
Mapped Soil Series	(BtC2) Badin-Tarrus Complex				
Drainage Class	Moderately Well Drained				
Soil Hydric Series	Soil series not hydric but soils exhibited low-chroma colors and mottling				
Source of Hydrology	Surface drainage	Surface drainage	Toe of Slope Seepage	Toe of Slope Seepage	
Hydrologic Impairment	No	No	No	No	
Native Vegetation	Piedmont Bottomland Forest / Piedmont Alluvial Forest				
Percent Composition of Exotic Invasive Vegetation	20%	20%	20%	20%	
Regulatory Considerations					
Regulation	**Applicable**	**Resolved**	**Supporting Documentation**		
Waters of the US – Section 404	Yes	Yes			
Waters of the US – Section 401	Yes	Yes			
Endangered Species Act	Yes	Yes			
Historic Preservation Act	Yes	Yes	2/1/2007 SHPO Concurrance Letter		
CZMA/CAMA	No	NA			
FEMA Floodplain Compliance	Yes	Yes			
Essential Fisheries Habitat	No	NA			

Appendix B: Visual Assessment Data

FIGURE 2

HEATH DAIRY MONITORING YEAR 5
CURRENT CONDITIONS PLAN VIEW OVERWIEW
DMS #170

Randolph County, North Carolina

January 2019

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Figure 2.1

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HEATH DAIRY MONITORING YEAR 5
CURRENT CONDITIONS PLAN VIEW
DMS #170 - WEST BRANCH

Randolph County, North Carolina

January 2019

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Figure 2.2

Environmental Quality

HEATH DAIRY MONITORING YEAR 5
CURRENT CONDITIONS PLAN VIEW
DMS #170 - WEST BRANCH

Randolph County, North Carolina

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HEATH DAIRY MONITORING YEAR 5
CURRENT CONDITIONS PLAN VIEW
DMS #170 - BACK CREEK

Randolph County, North Carolina

Figure 2.3

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Figure 2.4

Environmental Quality

HEATH DAIRY MONITORING YEAR 5
CURRENT CONDITIONS PLAN VIEW
DMS #170 - BACK CREEK

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Figure 2.5

HEATH DAIRY MONITORING YEAR 5
CURRENT CONDITIONS PLAN VIEW
DMS #170 - BACK CREEK

Randolph County, North Carolina

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Figure 2.6	HEATH DAIRY MONITORING YEAR 5 CURRENT CONDITIONS PLAN VIEW DMS #170 - NORTH BRANCH Randolph County, North Carolina	January 2019	Mogensen Mitigation, Inc. P.O. Box 690429 Charlotte, NC 28227 (704) 576-1111

Figure 2.7

HEATH DAIRY MONITORING YEAR 5
CURRENT CONDITIONS PLAN VIEW
DMS #170 - BACK CREEK

Randolph County, North Carolina

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Figure 2.8

HEATH DAIRY MONITORING YEAR 5
CURRENT CONDITIONS PLAN VIEW
DMS #170 - EAST BRANCH

Randolph County, North Carolina

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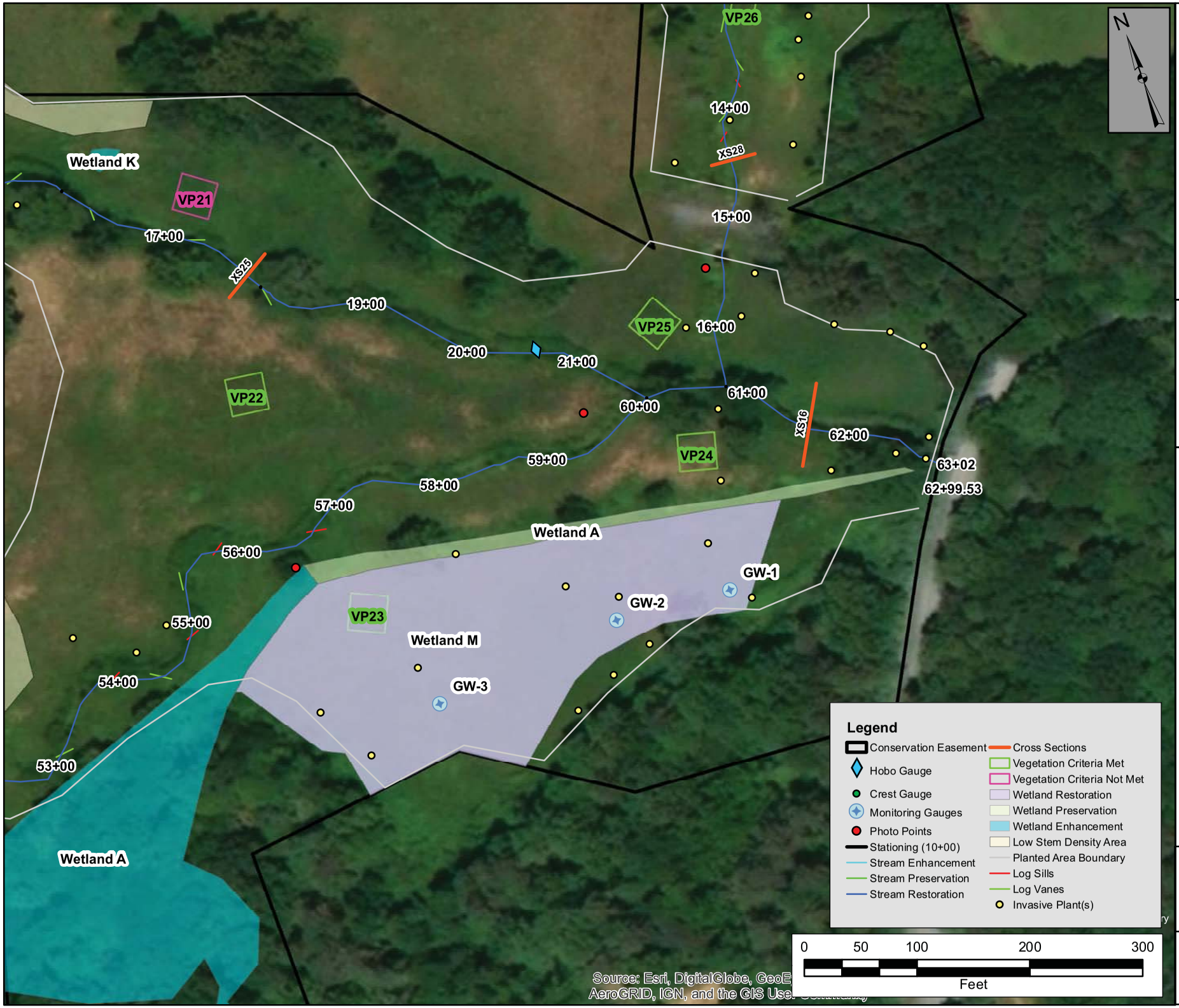

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HEATH DAIRY MONITORING YEAR 5
CURRENT CONDITIONS PLAN VIEW
DMS #170 - BACK CREEK

Randolph County, North Carolina

Figure 2.9

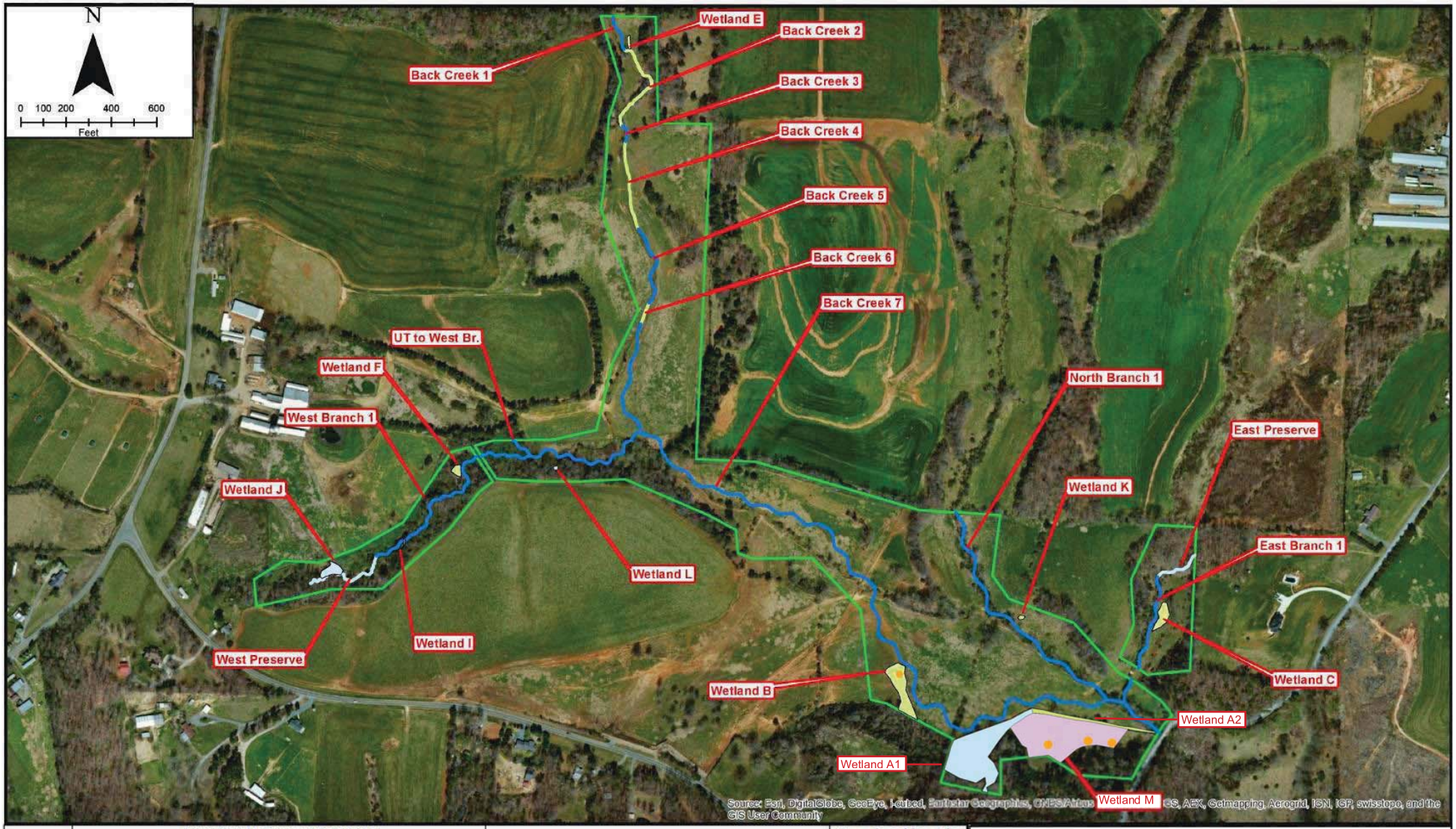

Fig 2.10

COMPONENT ASSESSMENT MAP
HEATH DAIRY ROAD
STREAM RESTORATION SITE
RANDOLPH COUNTY, NORTH CAROLINA
MONITORING YEAR 5
DMS # 170

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Reproduced from the HDR As-built report; Figure 2, July 2014

2018

Legend

- Stream Restoration
- Stream Enhancement I
- Stream Preservation
- Easement Boundary
- GW Gauges

Wetland Type

- Wetland Enhancement
- Wetland Preservation
- Wetland Restoration

Table 5.1. Visual Stream Assessment

Visual Stream Assement - Back Creek							
Major Channel Category	**Channel Sub-Category**	**Metric**	**# Stable, Performing as Intended**	**Total Number in As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	76	76			100%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	76	76			100%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	76	76			100%
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	76	76			100%
		2. Thalweg centering at downstream of meander (Glide)	76	76			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	104	104			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	43	43			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	42	43			98%
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	43	43			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	104	104			100%

Table 5.2. Visual Stream Assessment

Visual Stream Assement - West Branch to Back Creek							
Major Channel Category	**Channel Sub-Category**	**Metric**	**# Stable, Performing as Intended**	**Total Number in As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	52	52			100%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	52	52			100%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	52	52			100%
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	52	52			100%
		2. Thalweg centering at downstream of meander (Glide)	52	52			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	84	84			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	84	84			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	84	84			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	84	84			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	84	84			100%

Table 5.3. Visual Stream Assessment

Visual Stream Assement - North Branch to Back Creek							
Major Channel Category	**Channel Sub-Category**	**Metric**	**# Stable, Performing as Intended**	**Total Number in As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	14	14			100%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	14	14			100%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	14	14			100%
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	14	14			100%
		2. Thalweg centering at downstream of meander (Glide)	14	14			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	15	15			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	15	15			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	15	15			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	15	15			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	15	15			100%

Table 5.4. Visual Stream Assessment

Visual Stream Assement - East Branch to Back Creek							
Major Channel Category	**Channel Sub-Category**	**Metric**	**# Stable, Performing as Intended**	**Total Number in As-built**	**Number of Unstable Segments**	**Amount of Unstable Footage**	**% Stable, Performing as Intended**
1. Bed	1. **Vertical Stability** (Riffle and Run units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	14	14			100%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	14	14			100%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	14	14			100%
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	14	14			100%
		2. Thalweg centering at downstream of meander (Glide)	14	14			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	17	17			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	17	17			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	17	17			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	17	17			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	17	17			100%

Table 6. Vegetation Condition Assessment

Planted Acreage **32**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	N/A	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY5 criteria.	0.1 acres	yellow polygon	4	0.79	2.5%
			Total	0	0.79	2.5%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	N/A	0	0.00	0.0%
			Cumulative Total	4	0.79	2.5%

Easement Acreage **56.8**

Vegetation Category	Definitions	Mapping Threshold (SF)	CCPV Depiction	Number of points	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	0	yellow points	126	NA	NA
5. Easement Encroachment Areas	Areas or points (if too small to render as polygons at map scale).	0	N/A	0	0.00	0.0%

Heath Dairy Stream Restoration/DMS Project No. 170 Photo Points - MY5 (2018)

Heath Dairy Stream Restoration Photo Point 1 Spring 2014

Heath Dairy Stream Restoration Photo Point 1 Fall 2018

Heath Dairy Stream Restoration Photo Point 2 Spring 2014

Heath Dairy Stream Restoration Photo Point 2 Fall 2018

Heath Dairy Stream Restoration/DMS Project No. 170 Photo Points - MY5 (2018)

Heath Dairy Stream Restoration Photo Point 3 Spring 2014

Heath Dairy Stream Restoration Photo Point 3 Fall 2018

Heath Dairy Stream Restoration Photo Point 4 Spring 2014

Heath Dairy Stream Restoration Photo Point 4 Fall 2018

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY5 (2018)

Heath Dairy Stream Restoration Veg Plot 1 Fall 2014

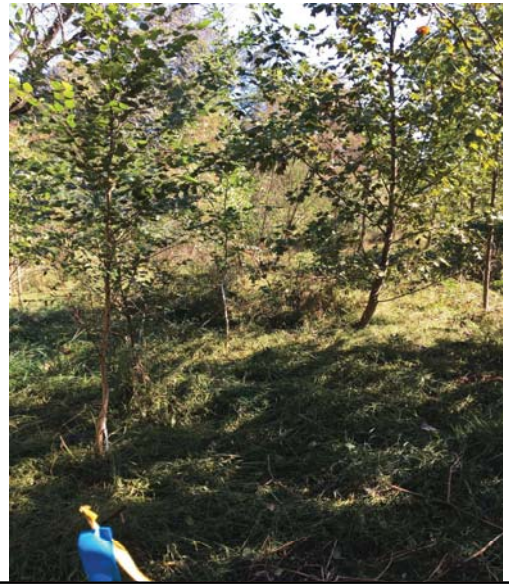
Heath Dairy Stream Restoration Veg Plot 1 Fall 2018

Heath Dairy Stream Restoration Veg Plot 2 Fall 2014

Heath Dairy Stream Restoration Veg Plot 2 Fall 2018

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY5 (2018)

Heath Dairy Stream Restoration Veg Plot 3 Fall 2014



Heath Dairy Stream Restoration Veg Plot 3 Fall 2018

Heath Dairy Stream Restoration Veg Plot 4 Fall 2014

Heath Dairy Stream Restoration Veg Plot 4 Fall 2018

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY5 (2018)

Heath Dairy Stream Restoration Veg Plot 5 Fall 2014

Heath Dairy Stream Restoration Veg Plot 5 Fall 2018

Heath Dairy Stream Restoration Veg Plot 6 Fall 2014

Heath Dairy Stream Restoration Veg Plot 6 Fall 2018

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY5 (2018)

Heath Dairy Stream Restoration Veg Plot 7 Fall 2014

Heath Dairy Stream Restoration Veg Plot 7 Fall 2018

Heath Dairy Stream Restoration Veg Plot 8 Fall 2014

Heath Dairy Stream Restoration Veg Plot 8 Fall 2018

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY5 (2018)

Heath Dairy Stream Restoration Veg Plot 9 Fall 2014

Heath Dairy Stream Restoration Veg Plot 9 Fall 2018

Heath Dairy Stream Restoration Veg Plot 10 Fall 2014

Heath Dairy Stream Restoration Veg Plot 10 Fall 2018

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY5 (2018)

Heath Dairy Stream Restoration Veg Plot 11 Fall 2014

Heath Dairy Stream Restoration Veg Plot 11 Fall 2018

Heath Dairy Stream Restoration Veg Plot 12 Fall 2014

Heath Dairy Stream Restoration Veg Plot 12 Fall 2018

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY5 (2018)

Heath Dairy Stream Restoration Veg Plot 13 Fall 2014

Heath Dairy Stream Restoration Veg Plot 13 Fall 2018

Heath Dairy Stream Restoration Veg Plot 14 Fall 2014

Heath Dairy Stream Restoration Veg Plot 14 Fall 2018

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY5 (2018)

Heath Dairy Stream Restoration Veg Plot 15 Fall 2014

Heath Dairy Stream Restoration Veg Plot 15 Fall 2018

Heath Dairy Stream Restoration Veg Plot 16 Fall 2014

Heath Dairy Stream Restoration Veg Plot 16 Fall 2018

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY5 (2018)

Heath Dairy Stream Restoration Veg Plot 17 Fall 2014

Heath Dairy Stream Restoration Veg Plot 17 Fall 2018

Heath Dairy Stream Restoration Veg Plot 18 Fall 2014

Heath Dairy Stream Restoration Veg Plot 18 Fall 2018

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY5 (2018)

Heath Dairy Stream Restoration Veg Plot 19 Fall 2014

Heath Dairy Stream Restoration Veg Plot 19 Fall 2018

Heath Dairy Stream Restoration Veg Plot 20 Fall 2014

Heath Dairy Stream Restoration Veg Plot 20 Fall 2018

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY5 (2018)

Heath Dairy Stream Restoration Veg Plot 21 Fall 2014

Heath Dairy Stream Restoration Veg Plot 21 Fall 2018

Heath Dairy Stream Restoration Veg Plot 22 Fall 2014

Heath Dairy Stream Restoration Veg Plot 22 Fall 2018

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY5 (2018)

Heath Dairy Stream Restoration Veg Plot 23 Fall 2014

Heath Dairy Stream Restoration Veg Plot 23 Fall 2018

Heath Dairy Stream Restoration Veg Plot 24 Fall 2014

Heath Dairy Stream Restoration Veg Plot 24 Fall 2018

Heath Dairy Stream Restoration/DMS Project No. 170 Vegetation Plot Photos - MY5 (2018)

Heath Dairy Stream Restoration Veg Plot 25 Fall 2014

Heath Dairy Stream Restoration Veg Plot 25 Fall 2018

Heath Dairy Stream Restoration Veg Plot 26 Fall 2014

Heath Dairy Stream Restoration Veg Plot 26 Fall 2018

Appendix C: Vegetation Plot Data

Table 7. Vegetation Plot Success Criteria Attainment Summary

Plot #	Stream/ Wetland Stems[2]	Volunteers[3]	Total[4]	Success Criteria Met?
1	405	81	486	YES
2	405	323	728	YES
3	486	161	647	YES
4	162	40	202	NO
5	283	41	324	YES
6	243	0	243	NO
7	162	40	202	NO
8	405	769	1174	YES
9	0	728	728	YES
10	324	81	405	YES
11	243	202	445	YES
12	121	81	202	NO
13	243	162	405	YES
14	283	243	526	YES
15	162	40	202	NO
16	445	122	567	YES
17	526	364	890	YES
18	486	40	526	YES
19	567	202	769	YES
20	162	40	202	NO
21	121	41	162	NO
22	324	364	688	YES
23	526	202	728	YES
24	243	404	647	YES
25	81	445	526	YES
26	202	203	405	YES
Project Avg	**293**	**208**	**501**	YES

Stem Class	Characteristics
[1]Buffer Stems	Native planted hardwood trees. Does NOT include shrubs. No pines. No vines.
[2]Stream/ Wetland Stems	Native planted woody stems. Includes shrubs, does NOT include live stakes. No vines
[3]Volunteers	Native woody stems. Not planted. No vines.
[4]Total	Planted + volunteer native woody stems. Includes live stakes. Excl. exotics. Excl. vines.

Table 8.1. Vegetation Plot Summary

Scientific Name	Common Name	Species Type	Veg Plot 01			Veg Plot 02			Veg Plot 03			Veg Plot 04			Veg Plot 05		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree															
Baccharis	baccharis	Shrub															
Betula nigra	river birch	Tree	1	1	1				2	2	2				2	2	2
Carpinus	hornbeam	Tree															
Carya	hickory	Tree															
Carya glabra	pignut hickory	Tree			1				1	1	1						
Celtis	hackberry	Tree									1						
Celtis laevigata	sugarberry	Tree						2									1
Celtis occidentalis	common hackberry	Tree															
Diospyros virginiana	common persimmon	Tree	6	6	6	1	1	1	1	1	1						
Fraxinus pennsylvanica	green ash	Tree						1	3	3	5						
Juglans nigra	black walnut	Tree						3			1						
Liquidambar styraciflua	sweetgum	Tree			1			1									
Liriodendron tulipifera	tuliptree	Tree	2	2	2	1	1	2	1	1	1						
Nyssa sylvatica	blackgum	Tree				2	2	2									
Platanus occidentalis	American sycamore	Tree										3	3	4	1	1	1
Quercus	oak	Tree															
Quercus falcata	southern red oak	Tree															
Quercus michauxii	swamp chestnut oak	Tree				1	1	1									
Quercus nigra	water oak	Tree															
Quercus palustris	pin oak	Tree															
Quercus phellos	willow oak	Tree				4	4	4							2	2	2
Quercus rubra	northern red oak	Tree	1	1	1				4	4	4	1	1	1	1	1	1
Quercus velutina	black oak	Tree				1	1	1							1	1	1
Salix nigra	black willow	Tree															
Sambucus nigra	European black elderberry	Shrub															
Ulmus alata	winged elm	Tree															
Ulmus americana	American elm	Tree															
Ligustrum sinense	Chinese privet	Shrub															
Rosa multiflora	multiflora rose	Shrub															
	Stem count		10	10	12	10	10	18	12	12	16	4	4	5	7	7	8
	size (ares)		1			1			1			1			1		
	size (ACRES)		0.02			0.02			0.02			0.02			0.02		
	Species count		4	4	6	6	6	10	6	6	8	2	2	2	5	5	6
	Stems per ACRE		404.7	404.7	486	404.7	404.7	728	485.6	485.6	647	161.9	161.9	202	283.3	283.3	324

Color Codes for Total Stem Density
Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

Table 8.2. Vegetation Plot Summary

Scientific Name	Common Name	Species Type	Veg Plot 06			Veg Plot 07			Veg Plot 08			Veg Plot 09			Veg Plot 10		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree									1						
Baccharis	baccharis	Shrub															
Betula nigra	river birch	Tree	1	1	1						3				1	1	1
Carpinus	hornbeam	Tree													1	1	1
Carya	hickory	Tree												1			1
Carya glabra	pignut hickory	Tree															
Celtis	hackberry	Tree															
Celtis laevigata	sugarberry	Tree															
Celtis occidentalis	common hackberry	Tree															
Diospyros virginiana	common persimmon	Tree	1	1	1										2	2	2
Fraxinus pennsylvanica	green ash	Tree	2	2	2	2	2	2	3	3	4						1
Juglans nigra	black walnut	Tree												17			
Liquidambar styraciflua	sweetgum	Tree									1						
Liriodendron tulipifera	tuliptree	Tree							3	3	9				1	1	1
Nyssa sylvatica	blackgum	Tree															
Platanus occidentalis	American sycamore	Tree	1	1	1			1	1	1	1						
Quercus	oak	Tree															
Quercus falcata	southern red oak	Tree													1	1	1
Quercus michauxii	swamp chestnut oak	Tree															
Quercus nigra	water oak	Tree															
Quercus palustris	pin oak	Tree															
Quercus phellos	willow oak	Tree	1	1	1	1	1	1	3	3	3				1	1	1
Quercus rubra	northern red oak	Tree				1	1	1							1	1	1
Quercus velutina	black oak	Tree															
Salix nigra	black willow	Tree									4						
Sambucus nigra	European black elderberry	Shrub															
Ulmus alata	winged elm	Tree									3						
Ulmus americana	American elm	Tree															
Ligustrum sinense	Chinese privet	Shrub															
Rosa multiflora	multiflora rose	Shrub															
	Stem count		6	6	6	4	4	5	10	10	29	0	0	18	8	8	10
	size (ares)		1			1			1			1			1		
	size (ACRES)		0.02			0.02			0.02			0.02			0.02		
	Species count		5	5	5	3	3	4	4	4	9	0	0	2	7	7	9
	Stems per ACRE		242.8	242.8	243	161.9	161.9	202	404.7	404.7	1174	0	0	728	323.7	323.7	405

Color Codes for Total Stem Density
Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

Table 8.3. Vegetation Plot Summary

Scientific Name	Common Name	Species Type	Veg Plot 11			Veg Plot 12			Veg Plot 13			Veg Plot 14			Veg Plot 15		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree						1									
Baccharis	baccharis	Shrub															
Betula nigra	river birch	Tree															
Carpinus	hornbeam	Tree															
Carya	hickory	Tree															
Carya glabra	pignut hickory	Tree	2	2	2										1	1	1
Celtis	hackberry	Tree	1	1	1						1						
Celtis laevigata	sugarberry	Tree															
Celtis occidentalis	common hackberry	Tree															
Diospyros virginiana	common persimmon	Tree										2	2	2	1	1	1
Fraxinus pennsylvanica	green ash	Tree			2	3	3	3	1	1	1						
Juglans nigra	black walnut	Tree			1			1						2			
Liquidambar styraciflua	sweetgum	Tree												2			1
Liriodendron tulipifera	tuliptree	Tree	2	2	2				2	2	2						
Nyssa sylvatica	blackgum	Tree															
Platanus occidentalis	American sycamore	Tree							1	1	1						
Quercus	oak	Tree															
Quercus falcata	southern red oak	Tree															
Quercus michauxii	swamp chestnut oak	Tree										3	3	3			
Quercus nigra	water oak	Tree															
Quercus palustris	pin oak	Tree															
Quercus phellos	willow oak	Tree										1	1	1			
Quercus rubra	northern red oak	Tree	1	1	1				1	1	1				2	2	2
Quercus velutina	black oak	Tree															
Salix nigra	black willow	Tree			2						1			2			
Sambucus nigra	European black elderberry	Shrub							1	1	3						
Ulmus alata	winged elm	Tree															
Ulmus americana	American elm	Tree										1	1	1			
Ligustrum sinense	Chinese privet	Shrub															
Rosa multiflora	multiflora rose	Shrub															
	Stem count		6	6	11	3	3	5	6	6	10	7	7	13	4	4	5
	size (ares)		1			1			1			1			1		
	size (ACRES)		0.02			0.02			0.02			0.02			0.02		
	Species count		4	4	7	1	1	3	5	5	7	4	4	7	3	3	4
	Stems per ACRE		242.8	242.8	445	121.4	121.4	202	242.8	242.8	405	283.3	283.3	526	161.9	161.9	202

Color Codes for Total Stem Density
Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

Table 8.4. Vegetation Plot Summary

Scientific Name	Common Name	Species Type	Veg Plot 16			Veg Plot 17			Veg Plot 18			Veg Plot 19			Veg Plot 20		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree						1									
Baccharis	baccharis	Shrub															
Betula nigra	river birch	Tree							1	1	1			4	2	2	3
Carpinus	hornbeam	Tree															
Carya	hickory	Tree															
Carya glabra	pignut hickory	Tree															
Celtis	hackberry	Tree	1	1	1												
Celtis laevigata	sugarberry	Tree															
Celtis occidentalis	common hackberry	Tree															
Diospyros virginiana	common persimmon	Tree	2	2	5	5	5	5				1	1	1			
Fraxinus pennsylvanica	green ash	Tree	2	2	2				9	9	9	1	1	1	1	1	1
Juglans nigra	black walnut	Tree												1			
Liquidambar styraciflua	sweetgum	Tree						1									
Liriodendron tulipifera	tuliptree	Tree				2	2	4				1	1	1			
Nyssa sylvatica	blackgum	Tree				1	1	3			1						
Platanus occidentalis	American sycamore	Tree						1							1	1	1
Quercus	oak	Tree															
Quercus falcata	southern red oak	Tree										3	3	3			
Quercus michauxii	swamp chestnut oak	Tree	3	3	3	1	1	1	1	1	1	2	2	2			
Quercus nigra	water oak	Tree															
Quercus palustris	pin oak	Tree															
Quercus phellos	willow oak	Tree	1	1	1	2	2	2				2	2	2			
Quercus rubra	northern red oak	Tree	1	1	1	2	2	2	1	1	1	3	3	3			
Quercus velutina	black oak	Tree	1	1	1												
Salix nigra	black willow	Tree						2									
Sambucus nigra	European black elderberry	Shrub															
Ulmus alata	winged elm	Tree															
Ulmus americana	American elm	Tree										1	1	1			
Ligustrum sinense	Chinese privet	Shrub															
Rosa multiflora	multiflora rose	Shrub															
	Stem count		11	11	14	13	13	22	12	12	13	14	14	19	4	4	5
	size (ares)		1			1			1			1			1		
	size (ACRES)		0.02			0.02			0.02			0.02			0.02		
	Species count		7	7	7	6	6	10	4	4	5	8	8	10	3	3	3
	Stems per ACRE		445.2	445.2	567	526.1	526.1	890	485.6	485.6	526	566.6	566.6	769	161.9	161.9	202

Color Codes for Total Stem Density
Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

Table 8.5. Vegetation Plot Summary

Scientific Name	Common Name	Species Type	Veg Plot 21			Veg Plot 22			Veg Plot 23			Veg Plot 24			Veg Plot 25		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree															
Baccharis	baccharis	Shrub															
Betula nigra	river birch	Tree				2	2	2	1	1	1						
Carpinus	hornbeam	Tree															
Carya	hickory	Tree															
Carya glabra	pignut hickory	Tree															
Celtis	hackberry	Tree															
Celtis laevigata	sugarberry	Tree				1	1	1									
Celtis occidentalis	common hackberry	Tree															
Diospyros virginiana	common persimmon	Tree				1	1	1	4	4	4			1			1
Fraxinus pennsylvanica	green ash	Tree	2	2	2	2	2	10	1	1	6	1	1	8	1	1	3
Juglans nigra	black walnut	Tree			1									1			
Liquidambar styraciflua	sweetgum	Tree															
Liriodendron tulipifera	tuliptree	Tree															1
Nyssa sylvatica	blackgum	Tree							1	1	1	1	1	2			
Platanus occidentalis	American sycamore	Tree						1	1	1	1						5
Quercus	oak	Tree															
Quercus falcata	southern red oak	Tree													1	1	1
Quercus michauxii	swamp chestnut oak	Tree				1	1	1	1	1	1						
Quercus nigra	water oak	Tree				1	1	1				2	2	2			
Quercus palustris	pin oak	Tree															
Quercus phellos	willow oak	Tree							1	1	1	2	2	2			
Quercus rubra	northern red oak	Tree	1	1	1				1	1	1						
Quercus velutina	black oak	Tree							2	2	2						
Salix nigra	black willow	Tree															
Sambucus nigra	European black elderberry	Shrub															
Ulmus alata	winged elm	Tree															
Ulmus americana	American elm	Tree															2
Ligustrum sinense	Chinese privet	Shrub															
Rosa multiflora	multiflora rose	Shrub															
	Stem count		3	3	4	8	8	17	13	13	18	6	6	16	2	2	13
	size (ares)		1			1			1			1			1		
	size (ACRES)		0.02			0.02			0.02			0.02			0.02		
	Species count		2	2	3	6	6	7	9	9	9	4	4	6	2	2	6
	Stems per ACRE		121.4	121.4	162	323.7	323.7	688	526.1	526.1	728	242.8	242.8	647	80.94	80.94	526

Color Codes for Total Stem Density
Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

Table 8.6. Vegetation Plot Summary

Scientific Name	Common Name	Species Type	Veg Plot 26		
			PnoLS	P-all	T
Acer negundo	boxelder	Tree			
Baccharis	baccharis	Shrub			
Betula nigra	river birch	Tree			
Carpinus	hornbeam	Tree			
Carya	hickory	Tree			
Carya glabra	pignut hickory	Tree			
Celtis	hackberry	Tree			
Celtis laevigata	sugarberry	Tree			
Celtis occidentalis	common hackberry	Tree			
Diospyros virginiana	common persimmon	Tree			
Fraxinus pennsylvanica	green ash	Tree	3	3	3
Juglans nigra	black walnut	Tree			
Liquidambar styraciflua	sweetgum	Tree			
Liriodendron tulipifera	tuliptree	Tree			
Nyssa sylvatica	blackgum	Tree			
Platanus occidentalis	American sycamore	Tree			1
Quercus	oak	Tree			
Quercus falcata	southern red oak	Tree	1	1	1
Quercus michauxii	swamp chestnut oak	Tree	1	1	1
Quercus nigra	water oak	Tree			
Quercus palustris	pin oak	Tree			
Quercus phellos	willow oak	Tree			
Quercus rubra	northern red oak	Tree			
Quercus velutina	black oak	Tree			
Salix nigra	black willow	Tree			4
Sambucus nigra	European black elderberry	Shrub			
Ulmus alata	winged elm	Tree			
Ulmus americana	American elm	Tree			
Ligustrum sinense	Chinese privet	Shrub			
Rosa multiflora	multiflora rose	Shrub			
	Stem count		5	5	10
	size (ares)		1		
	size (ACRES)		0.02		
	Species count		3	3	5
	Stems per ACRE		202.3	202.3	405

Color Codes for Total Stem Density
Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

Table 8.7 Vegetation Plot Summary

Scientific Name	Common Name	Species Type	MY5 (2018)			MY4 (2017)			MY3 (2016)			MY2 (2015)			MY1 (2014)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree			3						2						
Baccharis	baccharis	Shrub									9						
Betula nigra	river birch	Tree	13	13	21	11	11	20	11	11	12	3	3	3	2	2	2
Carpinus	hornbeam	Tree	1	1	1	1	1	1	1	1	1						
Carya	hickory	Tree			2						1						
Carya glabra	pignut hickory	Tree	4	4	5	3	3	3	3	3	3	4	4	4	6	6	6
Celtis	hackberry	Tree	2	2	4	1	1	1	1	1	1						
Celtis laevigata	sugarberry	Tree	1	1	4									1			
Celtis occidentalis	common hackberry	Tree						1									
Diospyros virginiana	common persimmon	Tree	27	27	32	24	24	27	24	24	24	18	18	20	12	12	12
Fraxinus pennsylvanica	green ash	Tree	37	37	66	34	34	45	35	35	42	28	28	34	19	19	19
Juglans nigra	black walnut	Tree			28			26			34			25			
Liquidambar styraciflua	sweetgum	Tree			7			5			13	1	1	6			
Liriodendron tulipifera	tuliptree	Tree	15	15	25	16	16	19	16	16	24	17	17	23	7	7	7
Nyssa sylvatica	blackgum	Tree	5	5	9	7	7	8	7	7	8	3	3	4			
Platanus occidentalis	American sycamore	Tree	9	9	19	9	9	20	10	10	12	10	10	10	3	3	3
Quercus	oak	Tree				2	2	2	2	2	2	7	7	7	18	18	18
Quercus falcata	southern red oak	Tree	6	6	6	6	6	6	5	5	5	9	9	9	3	3	3
Quercus michauxii	swamp chestnut oak	Tree	14	14	14	5	5	5	2	2	2				1	1	1
Quercus nigra	water oak	Tree	3	3	3	4	4	4	3	3	3	4	4	4	3	3	3
Quercus palustris	pin oak	Tree							1	1	1						
Quercus phellos	willow oak	Tree	21	21	21	18	18	19	20	20	20	12	12	12	15	15	15
Quercus rubra	northern red oak	Tree	22	22	22	22	22	25	26	26	26	16	16	16	1	1	1
Quercus velutina	black oak	Tree	5	5	5	4	4	4	4	4	5						
Salix nigra	black willow	Tree			15			12			11			9			
Sambucus nigra	European black elderberry	Shrub	1	1	3	1	1	2	1	1	1						
Ulmus alata	winged elm	Tree			3						1			3			
Ulmus americana	American elm	Tree	2	2	4	2	2	9	2	2	7			3			
Ligustrum sinense	Chinese privet	Shrub						24									
Rosa multiflora	multiflora rose	Shrub						11									
	Stem count		188	188	322	171	171	264	174	174	270	132	132	193	90	90	90
	size (ares)		26			26			26			26			26		
	size (ACRES)		0.64			0.64			0.64			0.64			0.64		
	Species count		18	18	24	18	18	22	19	19	26	13	13	18	12	12	12
	Stems per ACRE		292.6	292.6	501	266.2	266.2	410	270.8	270.8	420	205.5	205.5	300	140	140	140

Color Codes for Total Stem Density
Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

Appendix D: Stream Survey Data

Figure 3.1 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	**Heath Dairy**
DMS Project Number	**170**
Cross-Section ID	**XS-1, Pool**
Survey Date	**10/2018**
SUMMARY DATA	
MY5 Bankfull Elevation (ft)	613.88
MY0 Bankfull X-sec Area (ft^2)	32.0
Bankfull Width (ft)	22.2
Flood Prone Area Elevation (ft)	616.42
Flood Prone Width (ft)	32.00
Bankfull Mean Depth (ft)	1.44
Bankfull Max Depth (ft)	2.54
W/D Ratio	15.40
Entrenchment Ratio	1.44
Low Top of Bank	613.46
Bank Height Ratio	0.83

XS-1: Upstream

XS-1: Downstream

Station	Elevation	Notes
0.0	616.21	TLP
0.0	616.06	BLP
2.0	615.76	
4.0	615.44	
6.0	614.90	
9.0	614.40	
11.0	614.09	
14.0	613.68	
15.5	613.46	
16.4	613.08	
16.9	612.46	WS
16.9	612.28	LEW
17.4	611.97	
19.2	611.53	
21.0	611.41	
23.2	611.34	THW
25.5	611.34	
27.5	611.42	
28.8	611.9	REW
28.8	612.5	WS
29.5	613.2	
30.5	613.5	
32.0	613.8	
34.0	613.8	
37.0	614.1	
39.0	614.2	
42.0	614.7	
44.5	615.1	
46.0	615.6	
48.0	615.9	
49.4	616.0	BRP
49.4	616.3	TLP

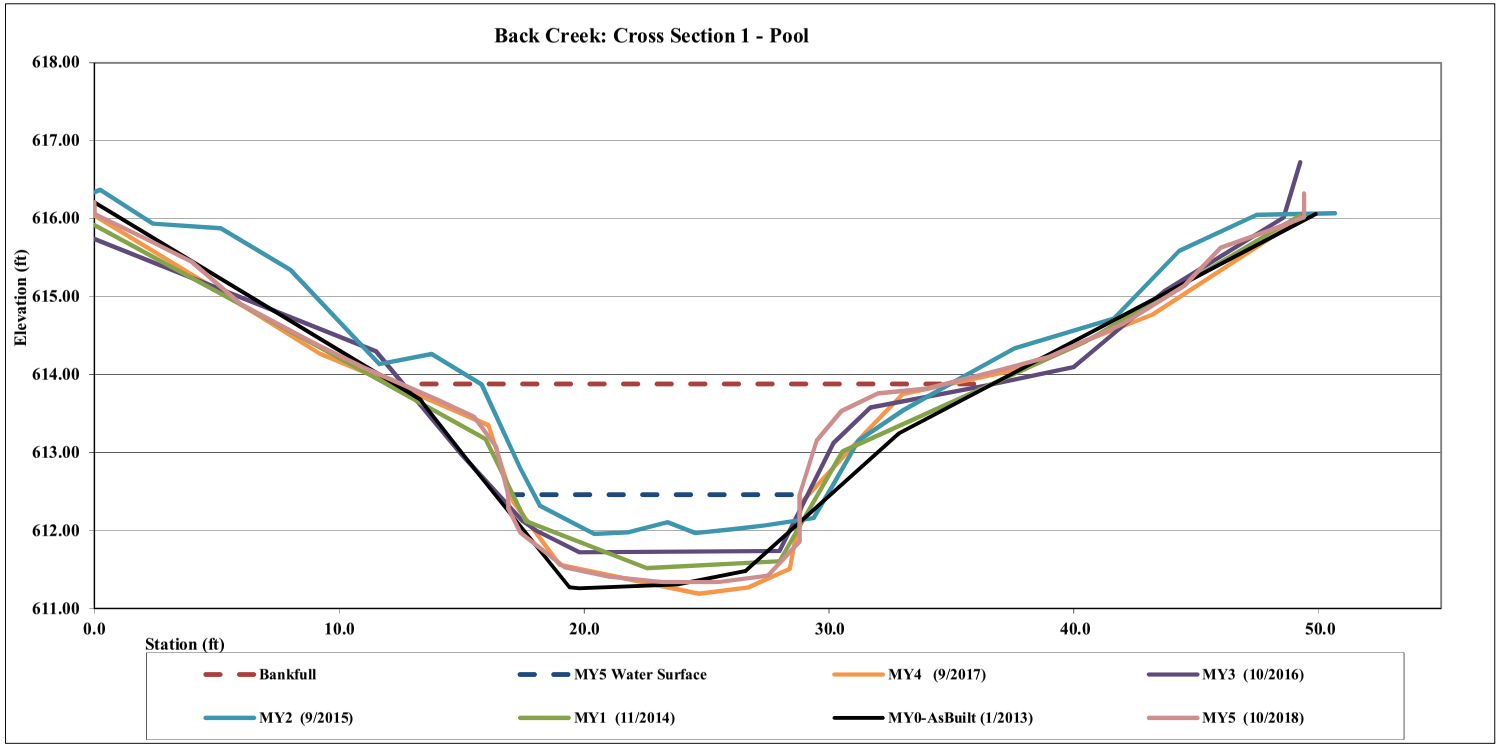


Figure 3.2 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	**Heath Dairy**
DMS Project Number	**170**
Cross-Section ID	**XS-2, Riffle**
Survey Date	**10/2018**
SUMMARY DATA	
MY5 Bankfull Elevation (ft)	613.63
MY0 Bankfull X-sec Area (ft^2)	17.0
Bankfull Width (ft)	17.6
Flood Prone Area Elevation (ft)	615.14
Flood Prone Width (ft)	26.00
Bankfull Mean Depth (ft)	0.97
Bankfull Max Depth (ft)	1.51
W/D Ratio	18.22
Entrenchment Ratio	1.48
Low Top of Bank	613.55
Bank Height Ratio	0.95

XS-2: Upstream

XS-2: Downstream

Station	Elevation	Notes
0.0	615.13	TLP
0.0	615.05	BLP
3.0	614.86	
6.0	614.65	
9.0	614.41	
11.0	614.26	
13.0	613.86	
15.0	613.55	
16.0	613.27	
16.8	613.04	
17.5	612.73	
17.9	612.43	
18.6	612.37	LEW
20.5	612.21	
22.1	612.13	
23.0	612.12	THW
25.0	612.13	
25.8	612.37	REW
27.3	612.46	
28.5	612.90	
30.2	613.23	
31.8	613.55	
33.0	613.95	
35.0	614.11	
38.0	614.57	
41.0	615.12	
44.0	615.56	
47.0	616.07	
49.8	616.44	BRP
49.8	616.82	TRP

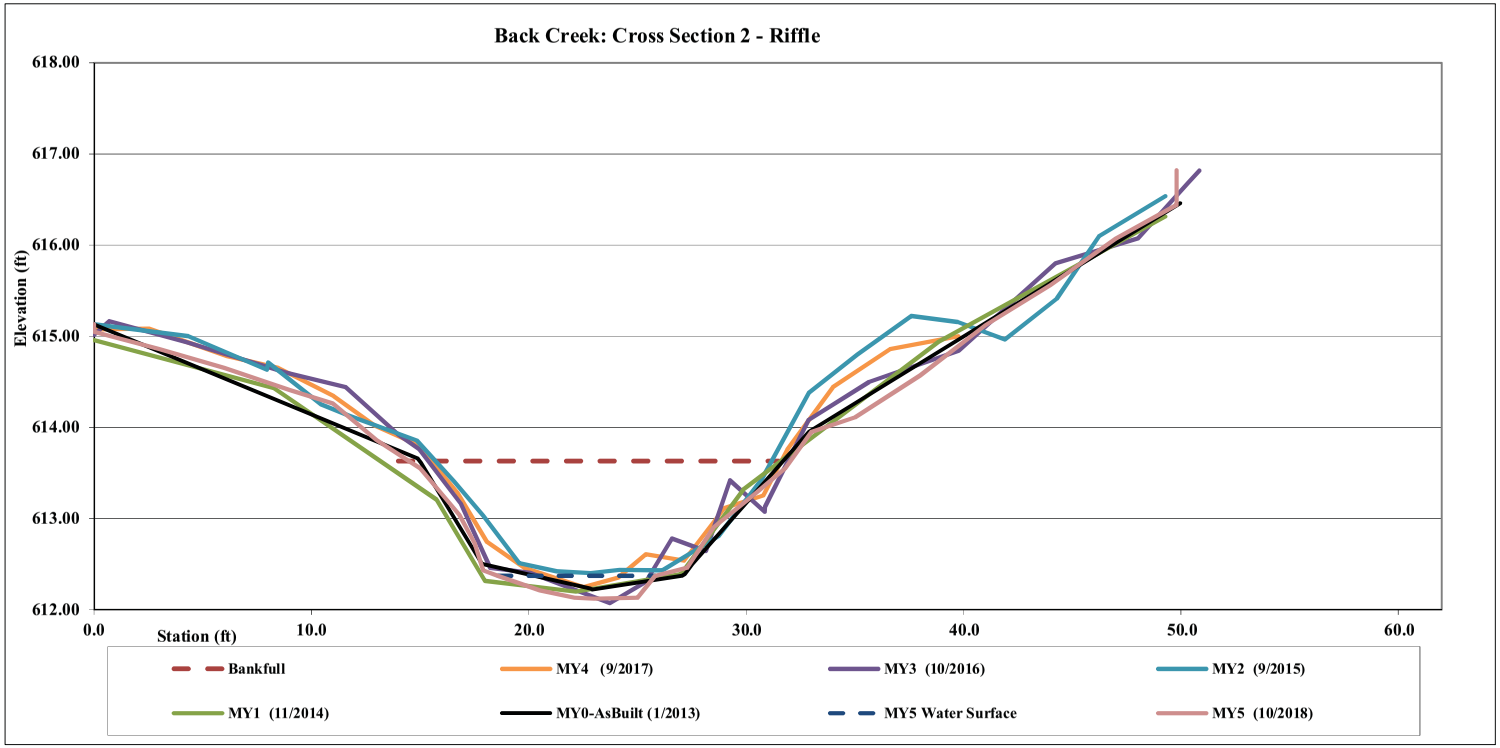


Figure 3.3 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	**Heath Dairy**
DMS Project Number	**170**
Cross-Section ID	**XS-3, Riffle**
Survey Date	**10/2018**
SUMMARY DATA	
MY5 Bankfull Elevation (ft)	611.06
MY0 Bankfull X-sec Area (ft^2)	24.6
Bankfull Width (ft)	13.6
Flood Prone Area Elevation (ft)	613.92
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.81
Bankfull Max Depth (ft)	2.86
W/D Ratio	7.52
Entrenchment Ratio	7.35
Low Top of Bank	611.14
Bank Height Ratio	1.03

XS-3: Upstream

XS-3: Downstream

Station	Elevation	Notes
0.0	611.38	TLP
0.0	611.02	BLP
1.0	611.06	
4.0	611.14	
7.0	611.28	
10.0	611.42	
13.0	611.47	
16.0	611.53	
19.0	611.41	
20.0	611.15	
21.0	610.52	
21.6	609.91	
21.8	609.09	WS
21.8	608.76	LEW
23.0	608.25	
24.5	608.20	THW
26.0	608.24	
27.8	608.39	
28.8	608.48	
29.8	608.72	REW
29.8	609.09	WS
30.0	609.53	
30.8	610.30	
31.6	610.67	
33.0	611.14	
35.0	611.36	
37.0	611.52	
40.0	611.97	
42.0	612.39	
45.0	612.58	
49.0	612.69	BRP
49.0	613.11	TRP

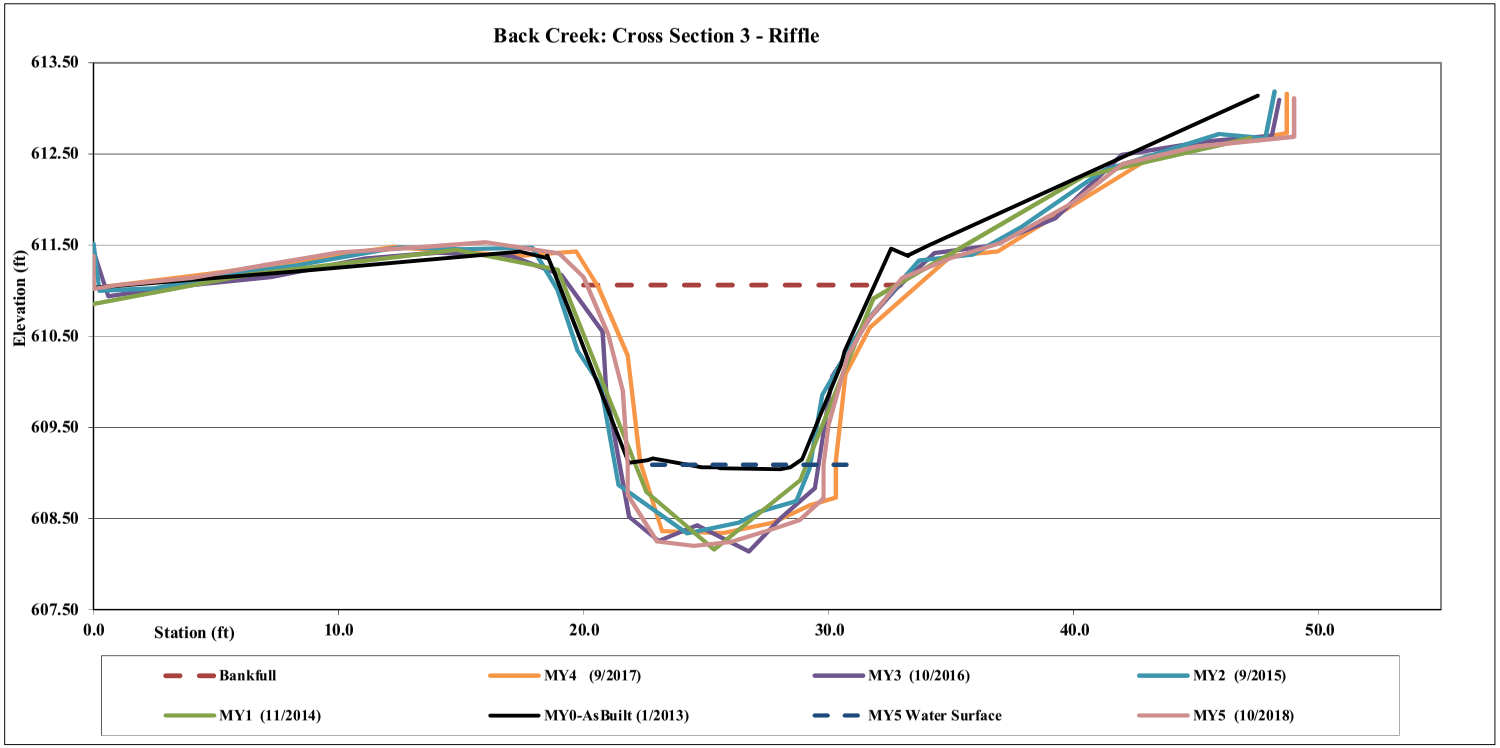


Figure 3.4 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	**Heath Dairy**
DMS Project Number	**170**
Cross-Section ID	**XS-4, Pool**
Survey Date	**10/2018**
SUMMARY DATA	
MY5 Bankfull Elevation (ft)	610.39
MY0 Bankfull X-sec Area (ft^2)	25.3
Bankfull Width (ft)	16.2
Flood Prone Area Elevation (ft)	613.12
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.56
Bankfull Max Depth (ft)	2.73
W/D Ratio	10.37
Entrenchment Ratio	6.17
Low Top of Bank	610.24
Bank Height Ratio	0.95

XS-4: Upstream

XS-4: Downstream

Station	Elevation	Notes
0.0	610.89	TLP
0.0	610.70	BLP
2.0	610.71	
5.0	610.65	
8.0	610.79	
11.0	610.88	
14.0	610.80	
16.0	610.50	
18.0	610.24	
19.0	609.89	
20.0	609.43	
20.3	608.88	WS
20.3	608.24	LEW
21.5	607.83	
23.0	607.99	
24.7	608.05	
26.2	608.02	
28.0	607.66	THW
29.2	607.85	REW
29.2	608.88	WS
29.7	609.50	
30.8	609.87	
32.0	610.14	
34.0	610.63	
36.0	610.91	
39.0	611.40	
42.0	611.75	
45.0	612.02	
47.5	612.28	
49.5	612.09	BRP
49.5	612.42	TRP

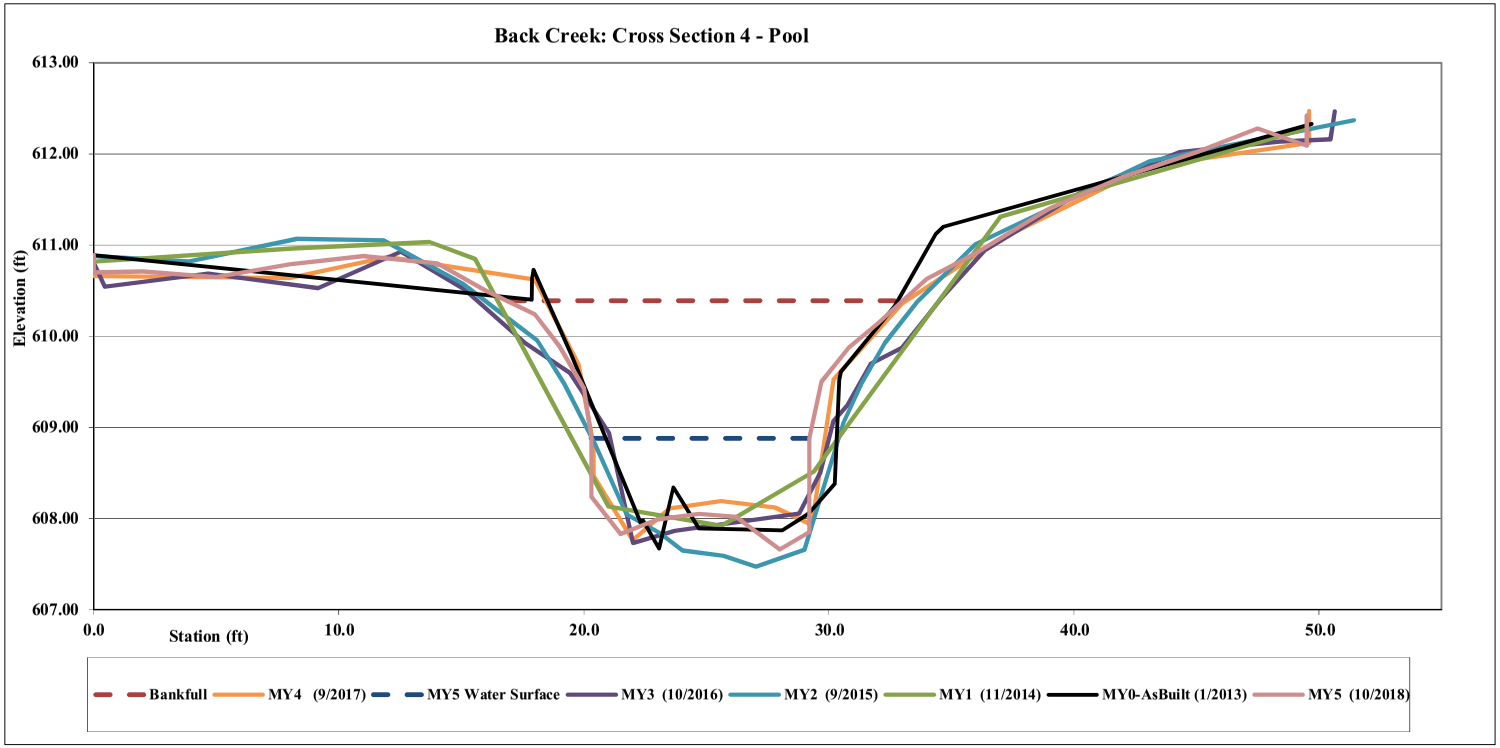


Figure 3.5 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	**Heath Dairy**
DMS Project Number	**170**
Cross-Section ID	**XS-5, Pool**
Survey Date	**10/2018**
SUMMARY DATA	
MY5 Bankfull Elevation (ft)	608.59
MY0 Bankfull X-sec Area (ft^2)	29.3
Bankfull Width (ft)	12.3
Flood Prone Area Elevation (ft)	611.70
Flood Prone Width (ft)	50.00
Bankfull Mean Depth (ft)	2.38
Bankfull Max Depth (ft)	3.11
W/D Ratio	5.16
Entrenchment Ratio	4.07
Low Top of Bank	609.14
Bank Height Ratio	1.18

XS-5: Upstream

XS-5: Downstream

Station	Elevation	Notes
0.0	610.10	TLP
0.0	609.79	BLP
2.0	609.87	
4.0	609.79	
7.0	609.70	
10.0	609.53	
12.5	609.34	
14.5	609.36	
15.5	609.48	
16.4	609.20	
17.0	608.50	
17.3	607.66	WS
17.3	606.94	LEW
19.0	606.22	
21.4	605.81	
23.0	605.48	THW
24.8	605.51	
26.2	606.02	
28.0	607.00	
29.0	607.36	REW
29.0	607.66	WS
29.2	608.58	
30.3	609.14	
31.5	609.18	
33.0	609.29	
36.0	609.21	
38.5	609.31	
40.0	609.57	
41.8	609.89	
43.5	610.12	
46.0	610.16	
49.7	610.08	BRP
49.7	610.49	TRP

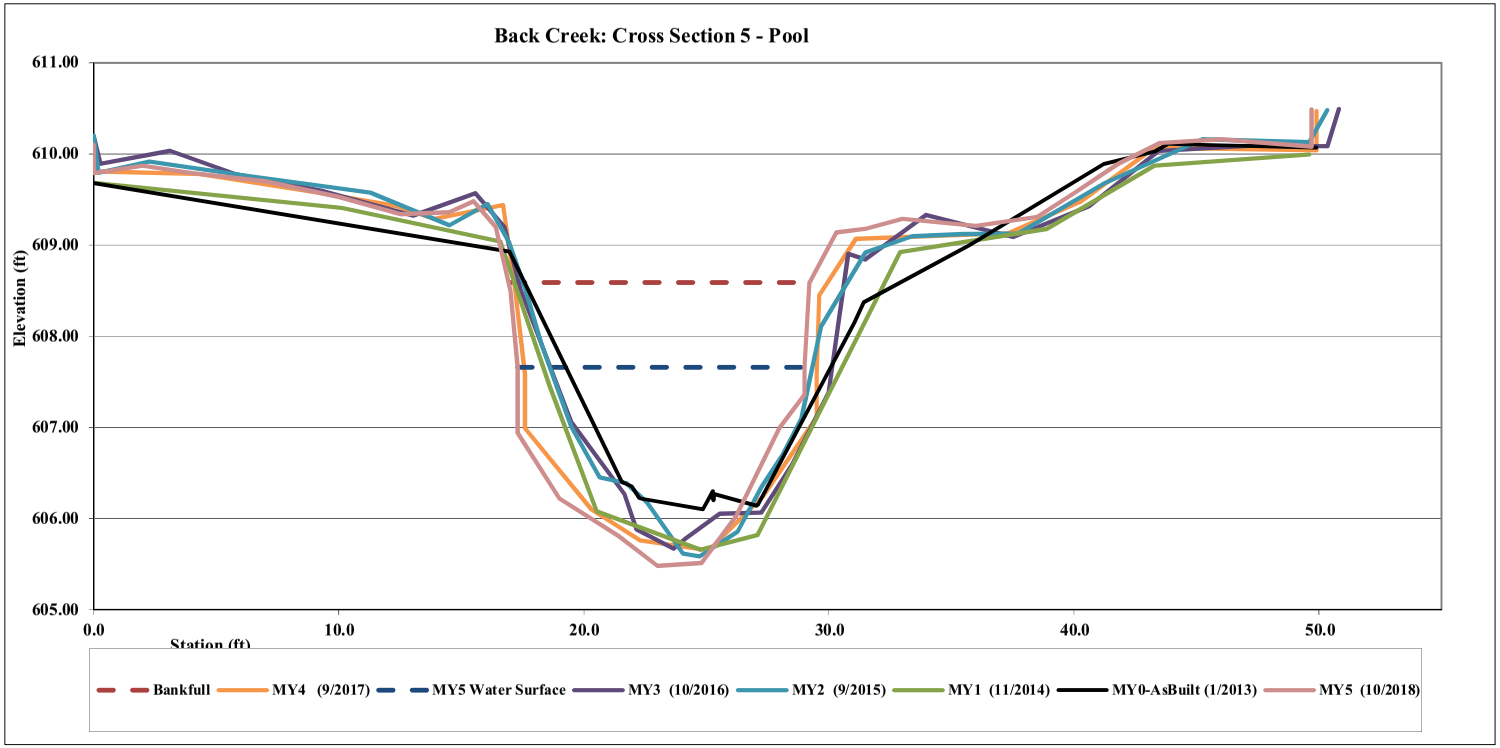


Figure 3.6 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-6, Riffle	
Survey Date	10/2018	
SUMMARY DATA		
MY5 Bankfull Elevation (ft)		606.55
MY0 Bankfull X-sec Area (ft^2)		12.4
Bankfull Width (ft)		13.0
Flood Prone Area Elevation (ft)		608.29
Flood Prone Width (ft)		75.00
Bankfull Mean Depth (ft)		0.95
Bankfull Max Depth (ft)		1.74
W/D Ratio		13.63
Entrenchment Ratio		5.77
Low Top of Bank		606.49
Bank Height Ratio		0.97

XS-6: Upstream

XS-6: Downstream

Station	Elevation	Notes
0.0	608.40	TLP
0.0	608.01	BLP
2.0	607.94	
5.0	607.89	
7.2	607.55	
10.0	607.31	
12.5	606.86	
14.0	606.91	
16.0	606.93	
18.0	606.79	
19.5	606.67	
20.4	606.49	
21.5	605.99	
22.5	605.51	
23.5	605.37	
24.6	605.17	WS
24.6	605.17	LEW
25.2	604.99	
26.0	604.85	
26.6	604.81	THW
27.4	604.90	
28.2	605.17	REW
28.2	605.17	WS
28.9	605.65	
30.0	605.95	
32.0	606.13	
33.5	606.68	
35.0	606.84	
37.0	606.83	
39.0	606.78	
42.0	606.87	
44.0	607.17	
45.5	607.27	
47.5	607.50	
49.9	607.56	BRP
49.9	607.91	TRP

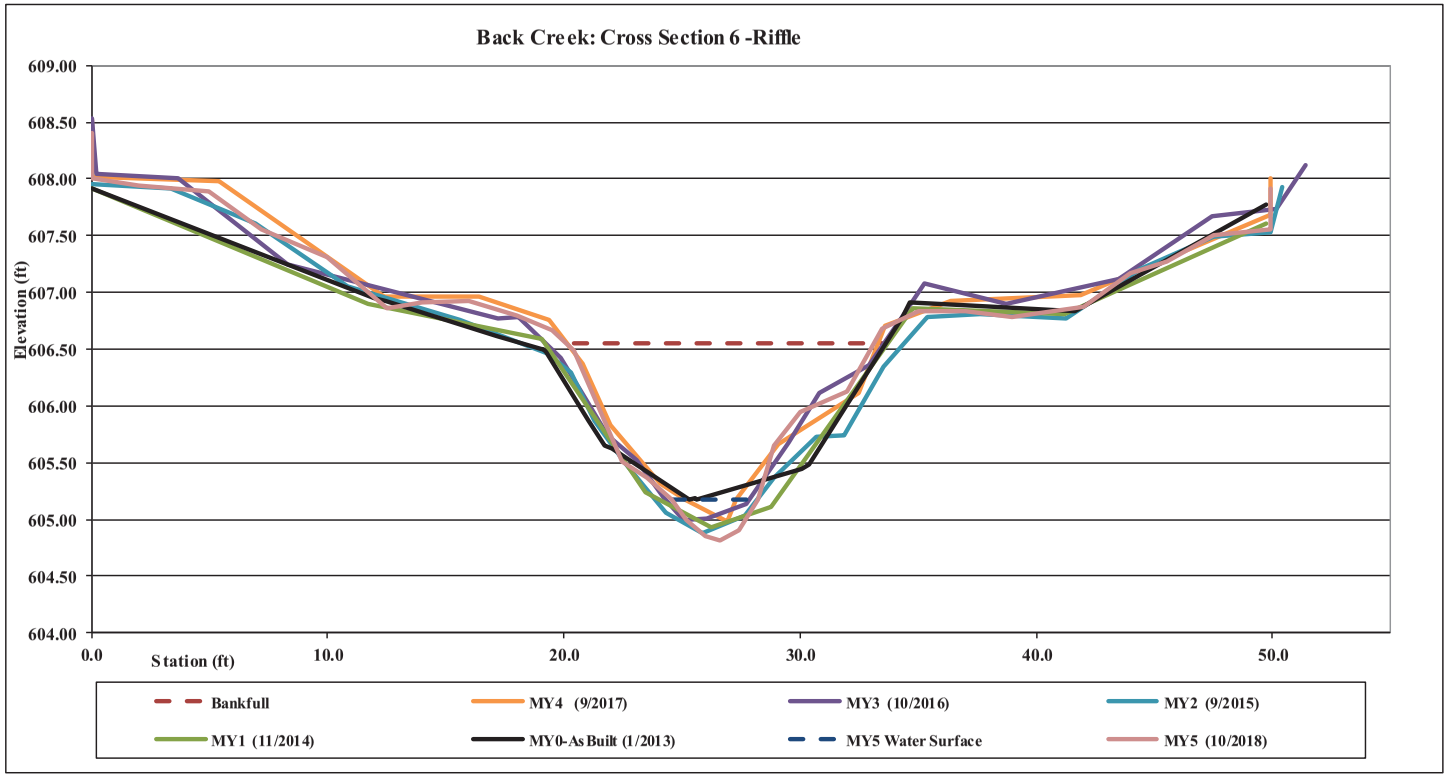


Figure 3.7 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-7, Pool
Survey Date	10/2018
SUMMARY DATA	
MY5 Bankfull Elevation (ft)	605.79
MY0 Bankfull X-sec Area (ft^2)	29.9
Bankfull Width (ft)	15.5
Flood Prone Area Elevation (ft)	608.83
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.93
Bankfull Max Depth (ft)	3.04
W/D Ratio	8.04
Entrenchment Ratio	6.45
Low Top of Bank	605.60
Bank Height Ratio	0.94

XS-7: Upstream

XS-7: Downstream

Station	Elevation	Notes
0.0	608.19	TLP
0.0	607.82	BLP
2.0	607.57	
4.0	607.71	
7.0	607.11	
9.0	606.81	
11.5	606.61	
13.0	606.22	
15.0	605.93	
16.0	605.59	
17.5	605.60	
18.2	605.29	
18.5	604.83	WS
18.5	604.00	LEW
19.0	603.41	
20.5	602.96	
22.0	602.78	
23.5	602.75	THW
25.5	602.90	
27.0	603.41	
28.6	604.07	
29.6	604.47	REW
29.6	604.8	WS
30.2	605.5	
31.4	606.1	
32.0	606.1	
34.0	606.1	
36.0	606.0	
39.3	606.3	
41.0	606.8	
44.0	607.0	
47.0	607.2	
49.6	607.3	BRP
49.6	607.6	TRP

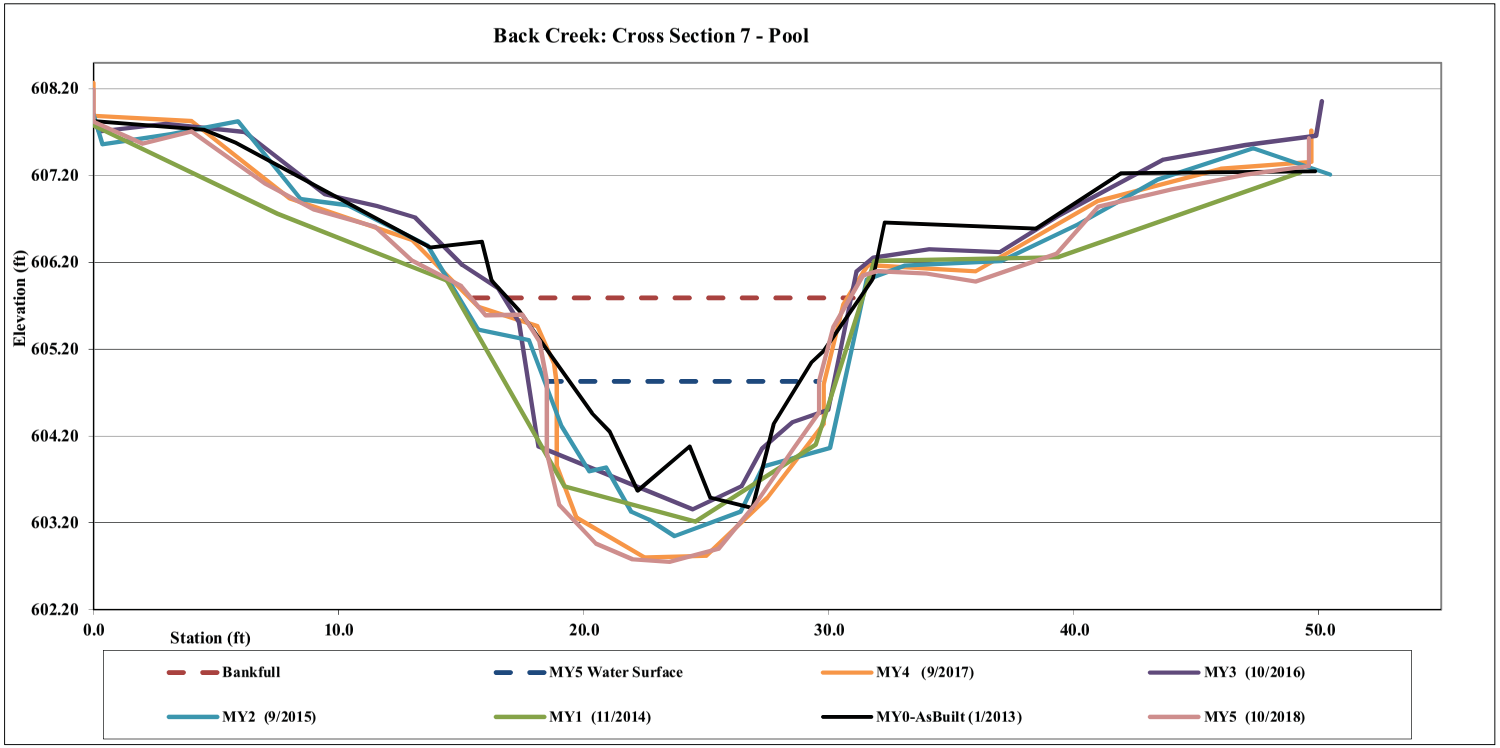


Figure 3.8 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	**Heath Dairy**
DMS Project Number	**170**
Cross-Section ID	**XS-8 - Riffle**
Survey Date	**10/2018**
SUMMARY DATA	
MY5 Bankfull Elevation (ft)	602.33
MY0 Bankfull X-sec Area (ft^2)	25.6
Bankfull Width (ft)	20.1
Flood Prone Area Elevation (ft)	604.42
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.27
Bankfull Max Depth (ft)	2.09
W/D Ratio	15.78
Entrenchment Ratio	4.98
Low Top of Bank	602.56
Bank Height Ratio	1.11

XS-8: Upstream

XS-8: Downstream

Station	Elevation	Notes
0.0	602.45	TLP
0.0	602.45	BLP
3.0	602.42	
6.0	602.56	
9.0	602.48	
12.0	602.43	
15.0	602.53	
18.0	602.52	
21.0	602.58	
22.5	602.30	
24.0	601.76	
25.5	601.15	
26.6	600.70	
27.4	600.54	
27.8	600.50	WS
27.8	600.50	LEW
28.8	600.30	
30.0	600.24	
30.9	600.24	THW
32.4	600.34	
34.0	600.44	
35.2	600.52	
36.2	600.68	REW
36.2	600.68	WS
37.0	601.10	
38.6	601.66	
40.0	602.08	
42.0	602.26	
44.0	602.56	
46.5	602.64	
49.0	602.62	
52.0	602.55	
54.0	602.54	
55.8	602.58	BRP
55.8	602.78	TRP

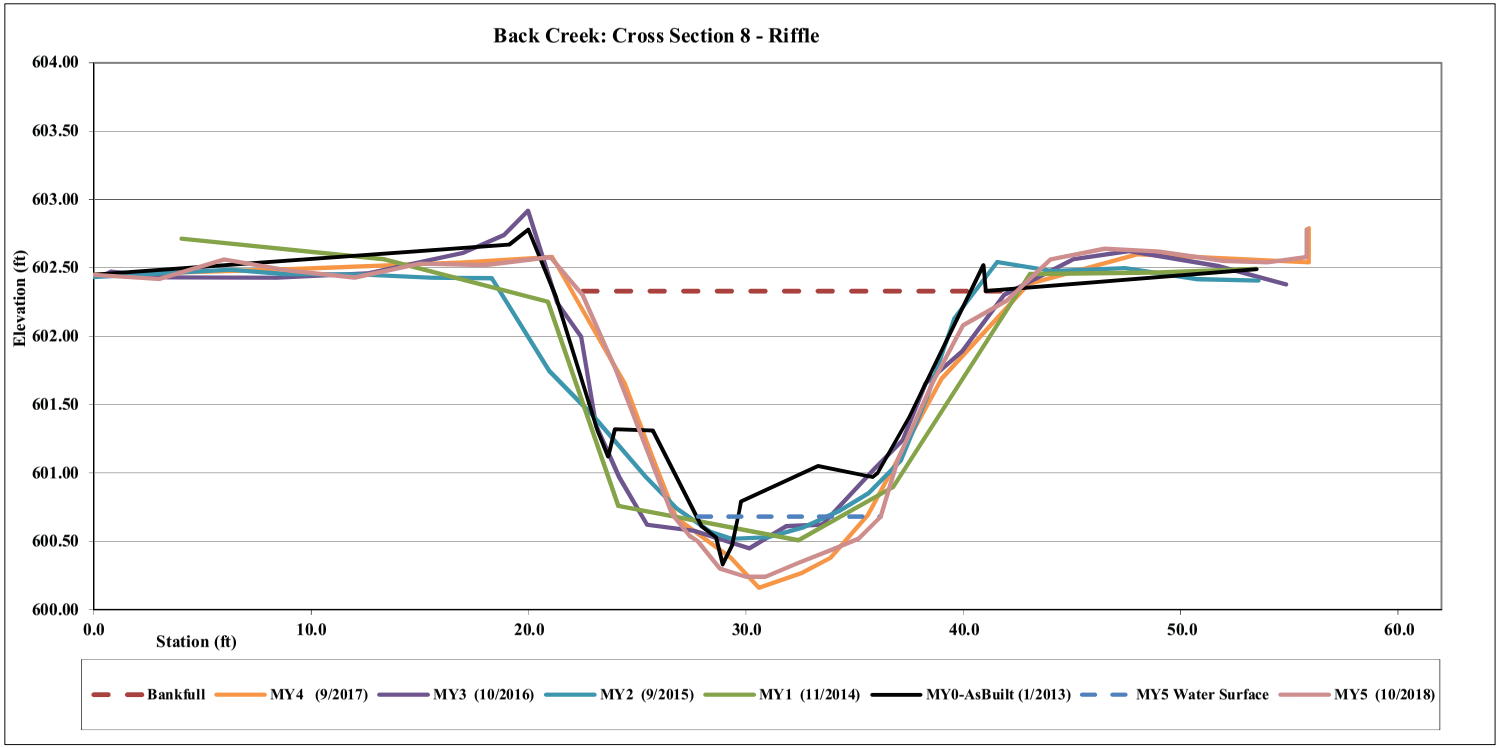


Figure 3.9 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-9, Pool
Survey Date	10/2018
SUMMARY DATA	
MY5 Bankfull Elevation (ft)	602.13
MY0 Bankfull X-sec Area (ft^2)	37.4
Bankfull Width (ft)	18.0
Flood Prone Area Elevation (ft)	605.34
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	2.08
Bankfull Max Depth (ft)	3.21
W/D Ratio	8.66
Entrenchment Ratio	5.56
Low Top of Bank	601.81
Bank Height Ratio	0.90

XS-9: Upstream

XS-9: Downstream

Station	Elevation	Notes
0.0	603.24	TLP
0.0	602.93	BLP
2.0	602.97	
5.0	602.90	
8.0	602.79	
11.0	602.75	
12.7	602.61	
14.0	602.00	
15.4	601.81	
16.2	601.59	
16.6	600.98	WS
16.6	600.53	LEW
17.8	599.92	
19.5	599.42	
21.0	599.14	
23.0	598.92	THW
25.0	598.99	
27.0	599.28	
28.4	599.60	
29.8	600.98	REW
29.8	600.98	WS
30.5	601.68	
31.2	602.04	
32.5	602.27	
34.0	602.73	
36.0	603.06	
38.5	602.95	
41.0	602.90	
44.0	602.90	
47.0	602.88	
49.9	602.74	BRP
49.9	603.10	TLP

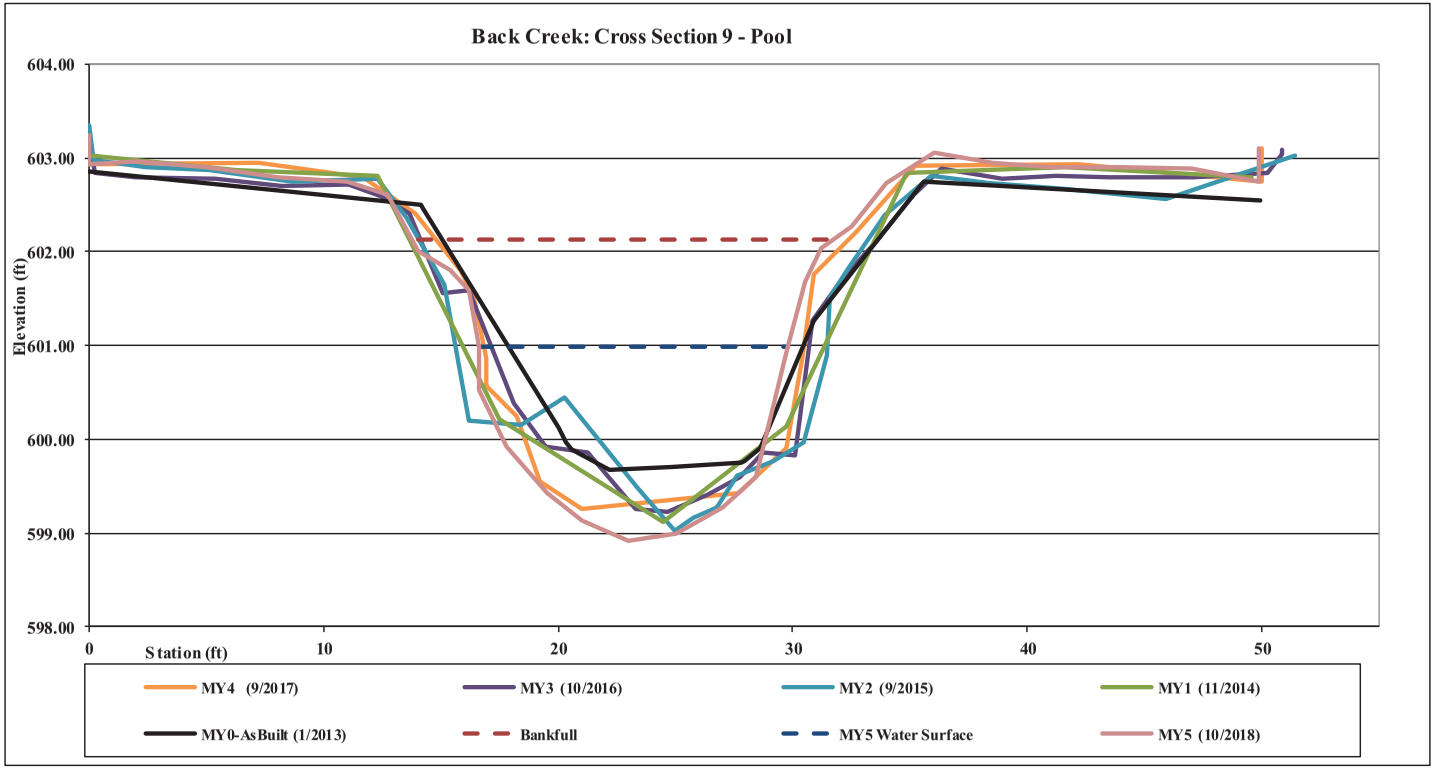


Figure 3.10 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	**Heath Dairy**
DMS Project Number	**170**
Cross-Section ID	**XS-10, Riffle**
Survey Date	**10/2018**
SUMMARY DATA	
MY5 Bankfull Elevation (ft)	600.11
MY0 Bankfull X-sec Area (ft^2)	25.1
Bankfull Width (ft)	22.0
Flood Prone Area Elevation (ft)	602.10
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.14
Bankfull Max Depth (ft)	1.99
W/D Ratio	19.28
Entrenchment Ratio	4.55
Low Top of Bank	599.90
Bank Height Ratio	0.89

Station	Elevation	Notes
0.0	600.12	TLP
0.0	599.87	BLP
2.9	599.93	
6.9	600.05	
10.9	600.13	
14.9	600.17	
16.9	599.96	
18.9	599.65	
20.9	598.72	
21.9	598.27	
22.7	598.19	LEW
23.7	598.12	THW
25.7	598.19	REW
28.9	598.32	
30.9	598.45	
31.9	599.03	
32.9	599.49	
33.9	599.90	
38.9	600.31	
43.9	600.22	
49.7	600.08	BRP
49.7	600.72	TRP

XS-10: Upstream

XS-10: Downstream

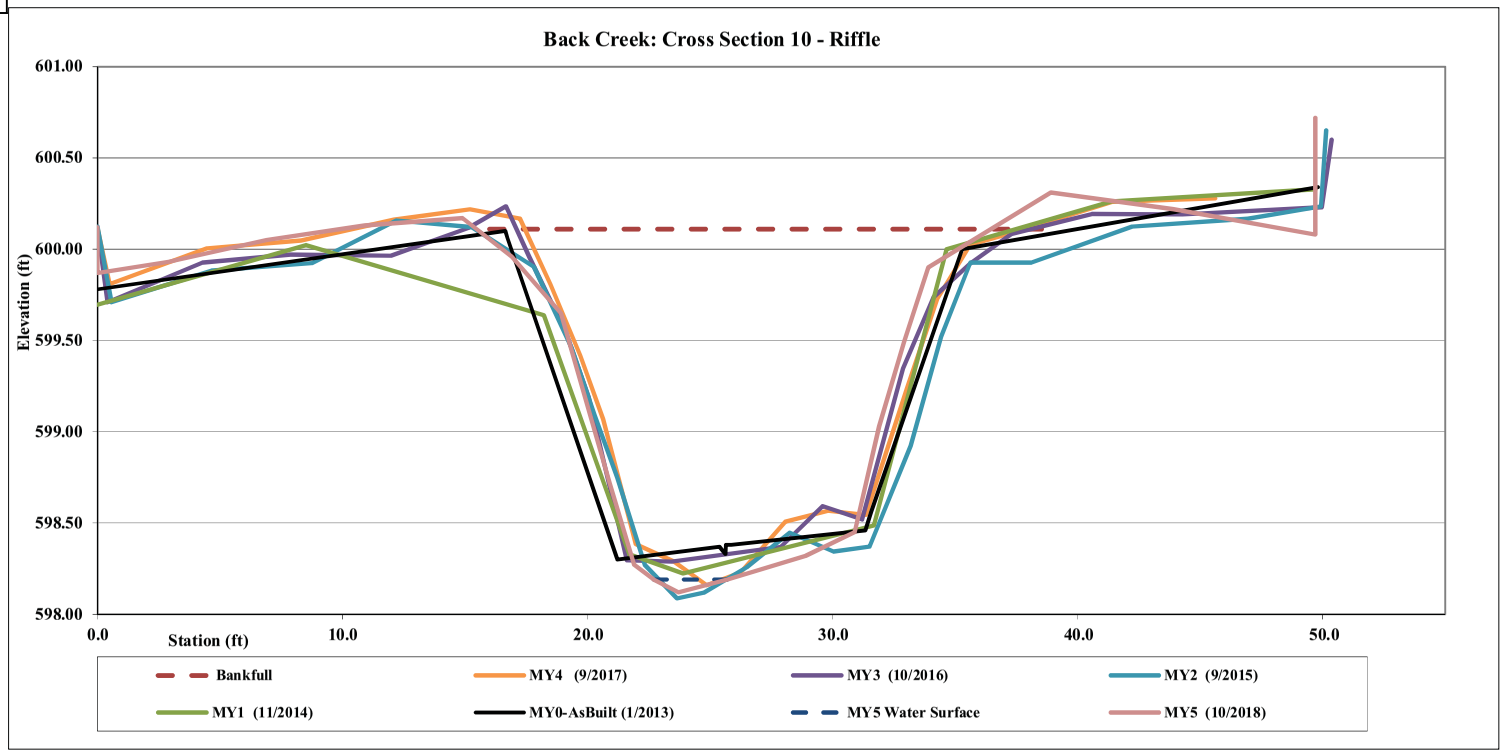


Figure 3.11 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	**Heath Dairy**
DMS Project Number	**170**
Cross-Section ID	**XS-11, Pool**
Survey Date	**10/2018**
SUMMARY DATA	
MY5 Bankfull Elevation (ft)	599.95
MY0 Bankfull X-sec Area (ft^2)	34.1
Bankfull Width (ft)	21.8
Flood Prone Area Elevation (ft)	603.13
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.56
Bankfull Max Depth (ft)	3.18
W/D Ratio	13.94
Entrenchment Ratio	4.59
Low Top of Bank	599.89
Bank Height Ratio	0.98

XS-11: Upstream

XS-11: Downstream

Station	Elevation	Notes
0.0	600.00	TLP
0.0	600.00	BLP
8.0	600.05	
11.0	599.98	
14.0	599.87	
16.0	599.49	
17.8	599.18	
18.4	598.24	LEW
18.5	597.35	
20.6	596.98	
23.0	596.77	THW
25.0	596.89	
27.0	597.07	
28.0	597.84	
28.1	598.24	REW
29.0	598.78	
30.0	599.24	
31.0	599.63	
33.0	599.87	
35.0	600.11	
39.0	600.22	
44.0	600.33	
49.8	600.36	BRP
49.8	601.20	TRP

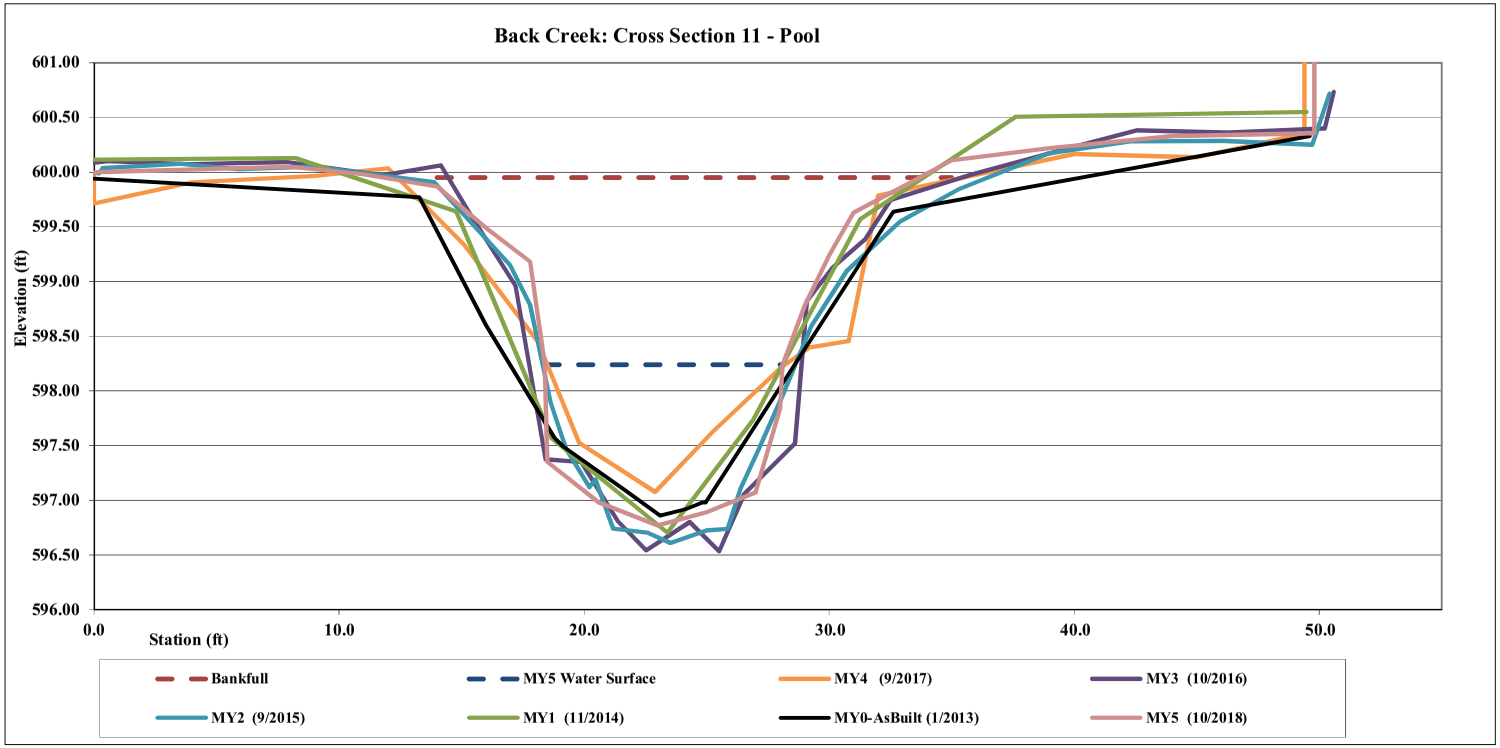


Figure 3.12 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-12, Riffle	
Survey Date	10/2018	
SUMMARY DATA		
MY5 Bankfull Elevation (ft)		596.29
MY0 Bankfull X-sec Area (ft^2)		23.6
Bankfull Width (ft)		19.1
Flood Prone Area Elevation (ft)		598.31
Flood Prone Width (ft)		100.00
Bankfull Mean Depth (ft)		1.24
Bankfull Max Depth (ft)		2.02
W/D Ratio		15.46
Entrenchment Ratio		5.24
Low Top of Bank		596.08
Bank Height Ratio		0.90

XS-12: Upstream

XS-12: Downstream

Station	Elevation	Notes
0.0	596.62	TLP
0.0	596.58	BLP
3.2	596.60	
7.2	596.66	
10.2	596.48	
12.2	596.52	
14.2	596.38	
16.2	596.08	
17.2	595.19	
18.2	594.52	LEW
19.2	594.27	THW
20.3	594.52	REW
20.9	594.75	
22.2	594.82	
24.2	594.94	
25.0	594.88	
25.9	594.52	LEW
26.7	594.34	
28.5	594.52	REW
29.2	594.63	
30.2	595.00	
31.2	595.57	
32.2	596.11	
37.2	596.63	
43.2	597.00	
49.3	597.43	BRP
49.3	597.84	TRP

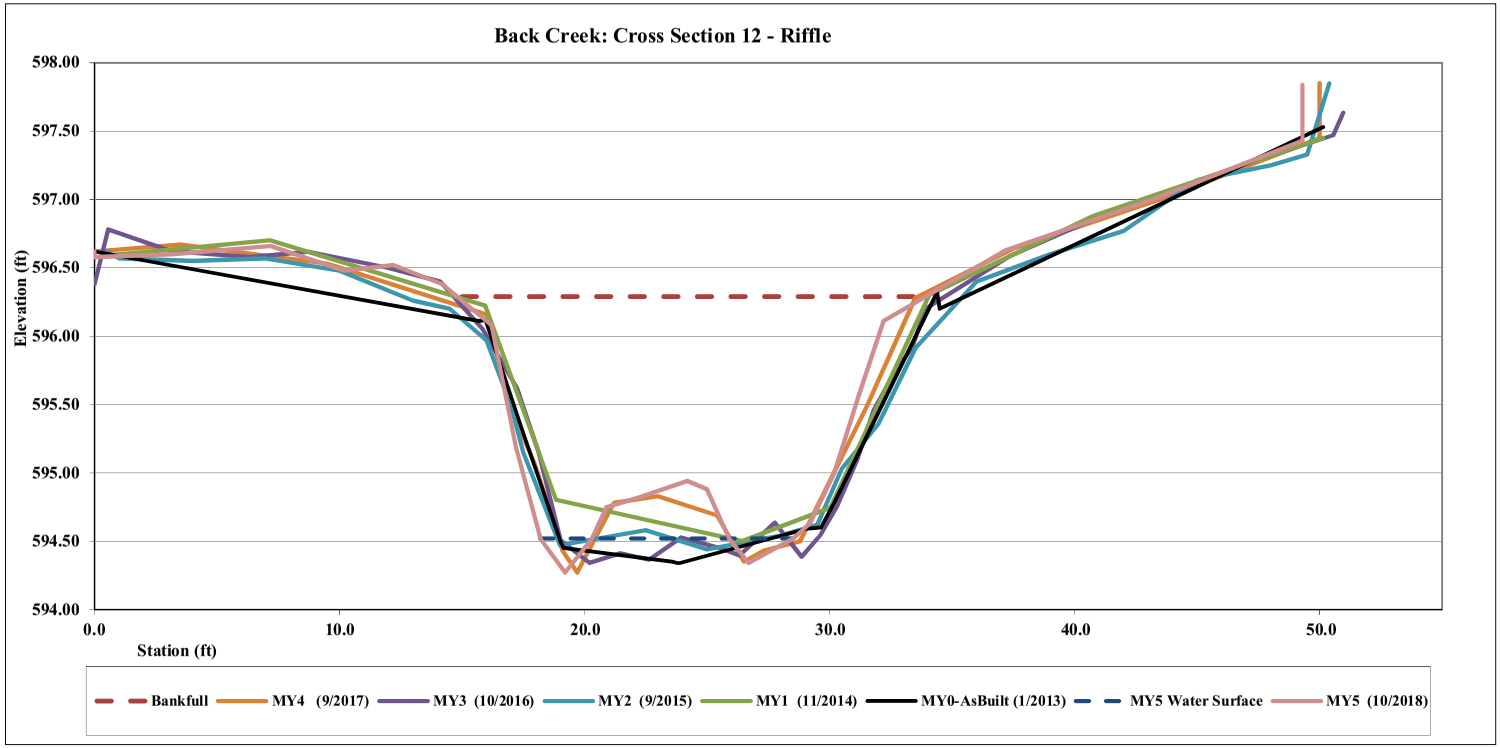
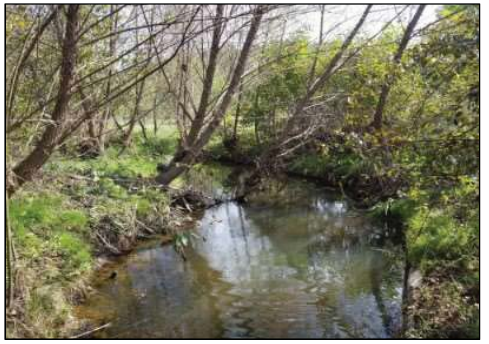


Figure 3.13 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	**Heath Dairy**
DMS Project Number	**170**
Cross-Section ID	**XS-13, Pool**
Survey Date	**10/2018**
SUMMARY DATA	
MY5 Bankfull Elevation (ft)	595.71
MY0 Bankfull X-sec Area (ft^2)	28.6
Bankfull Width (ft)	13.7
Flood Prone Area Elevation (ft)	598.62
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	2.09
Bankfull Max Depth (ft)	2.91
W/D Ratio	6.56
Entrenchment Ratio	7.30
Low Top of Bank	595.86
Bank Height Ratio	1.05

XS-13: Upstream



XS-13: Downstream

Station	Elevation	Notes
0.0	596.78	TLP
0.0	596.57	BLP
2.9	596.53	
6.9	596.55	
9.9	596.59	
12.9	596.53	
15.9	596.33	
17.9	596.31	
19.9	596.02	
21.4	595.29	
21.9	595.06	
22.9	594.08	LEW
23.9	593.67	
25.4	592.90	
26.9	592.80	THW
29.0	592.87	
31.0	593.02	
32.9	593.66	
32.9	594.08	REW
33.6	594.86	
34.3	595.86	
34.9	596.04	
36.9	596.35	
40.9	596.37	
46.4	596.86	
50.7	597.18	BRP
50.7	597.39	TRP

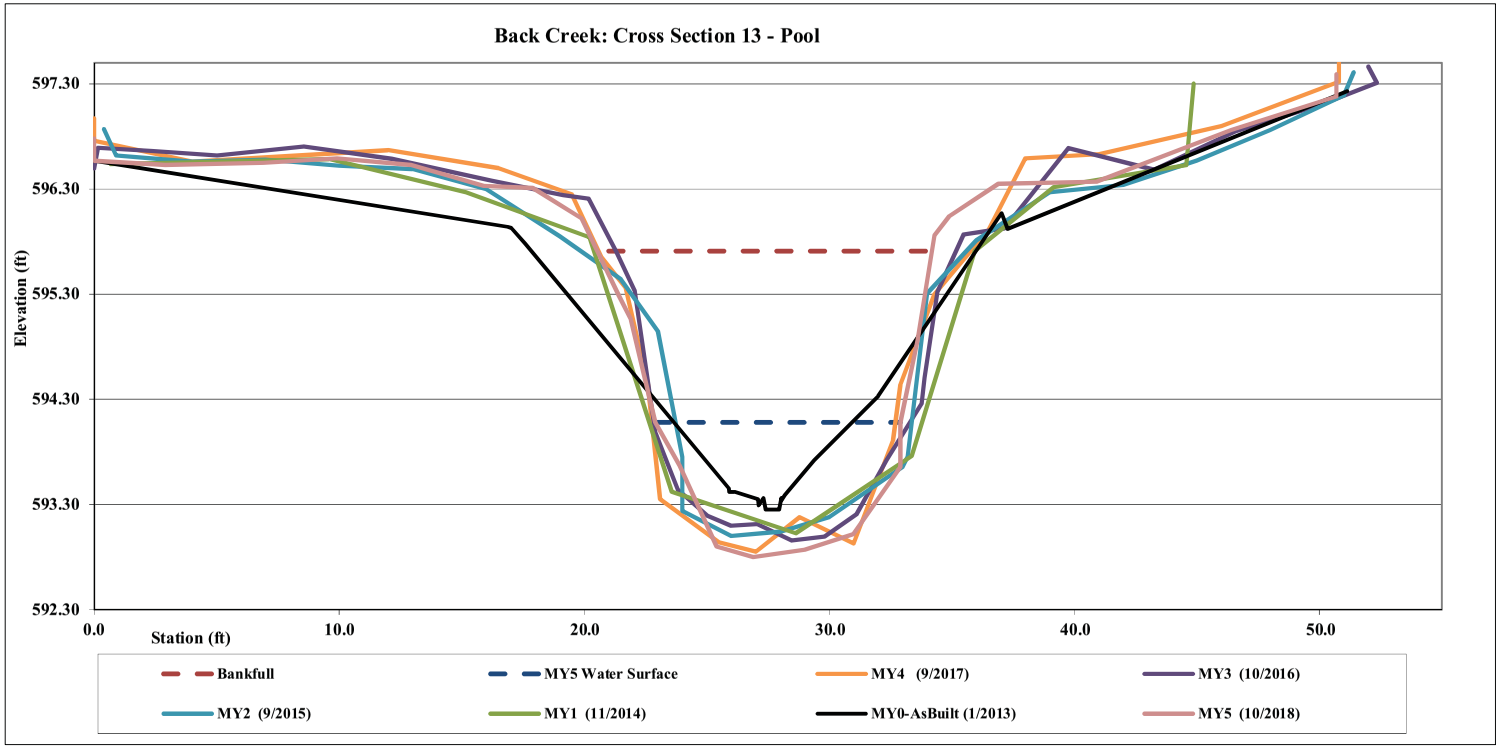


Figure 3.14 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-14, Riffle	
Survey Date	10/2018	
SUMMARY DATA		
MY5 Bankfull Elevation (ft)		594.73
MY0 Bankfull X-sec Area (ft^2)		26.6
Bankfull Width (ft)		21.1
Flood Prone Area Elevation (ft)		596.98
Flood Prone Width (ft)		70.00
Bankfull Mean Depth (ft)		1.26
Bankfull Max Depth (ft)		2.25
W/D Ratio		16.74
Entrenchment Ratio		3.32
Low Top of Bank		594.76
Bank Height Ratio		1.01

XS-14: Upstream

XS-14: Downstream

Station	Elevation	Notes
0.0	596.09	TLP
0.0	595.83	BLP
2.7	594.94	
5.7	594.60	
8.7	594.49	
11.7	594.80	
15.7	594.63	
19.7	594.76	
21.7	594.55	
23.7	594.04	
25.7	593.46	LEW
27.7	592.97	
30.3	592.69	
32.7	592.48	THW
35.7	593.46	REW
37.5	594.16	
38.1	594.36	
39.3	594.58	
40.7	594.78	
42.7	594.66	
47.7	594.58	
51.7	594.51	
53.7	594.70	
57.8	595.55	BRP
57.8	595.83	TRP

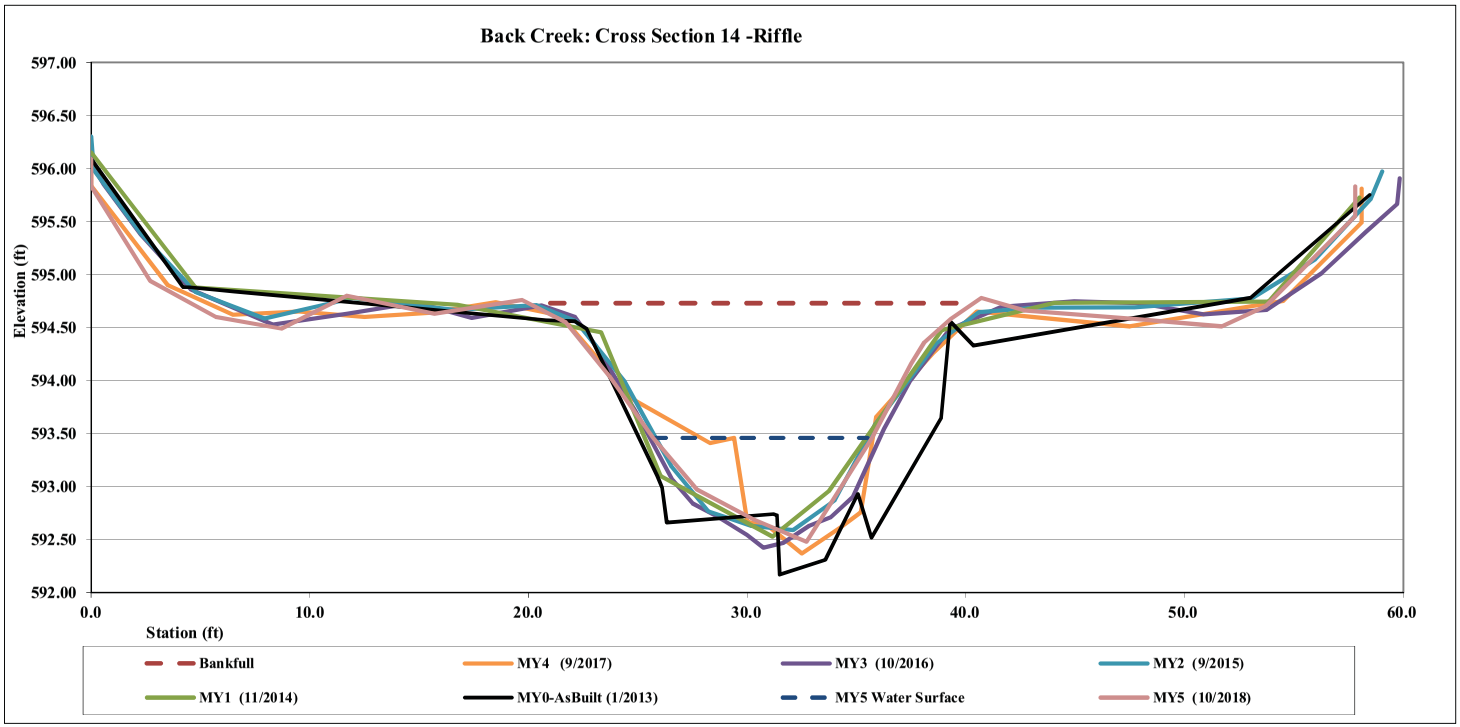


Figure 3.15 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	**Heath Dairy**
DMS Project Number	**170**
Cross-Section ID	**XS-15, Pool**
Survey Date	**10/2018**
SUMMARY DATA	
MY5 Bankfull Elevation (ft)	593.93
MY0 Bankfull X-sec Area (ft^2)	29.1
Bankfull Width (ft)	12.6
Flood Prone Area Elevation (ft)	597.36
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	2.31
Bankfull Max Depth (ft)	3.43
W/D Ratio	5.46
Entrenchment Ratio	7.94
Low Top of Bank	593.92
Bank Height Ratio	1.00

XS-15: Upstream

XS-15: Downstream

Station	Elevation	Notes
0.0	595.54	TLP
0.0	595.30	BLP
2.7	594.98	
6.7	594.42	
11.7	594.50	
15.7	594.55	
18.7	594.38	
20.7	594.17	
21.1	594.06	
22.1	593.66	
22.5	593.16	LEW
23.1	592.40	
25.7	591.13	
27.0	590.50	THW
30.7	590.53	
32.7	592.68	
33.7	593.16	REW
33.9	593.92	
36.0	594.43	
36.9	594.50	
38.7	594.34	
42.7	594.28	
47.7	594.54	
51.8	595.19	BRP
51.8	594.90	TRP

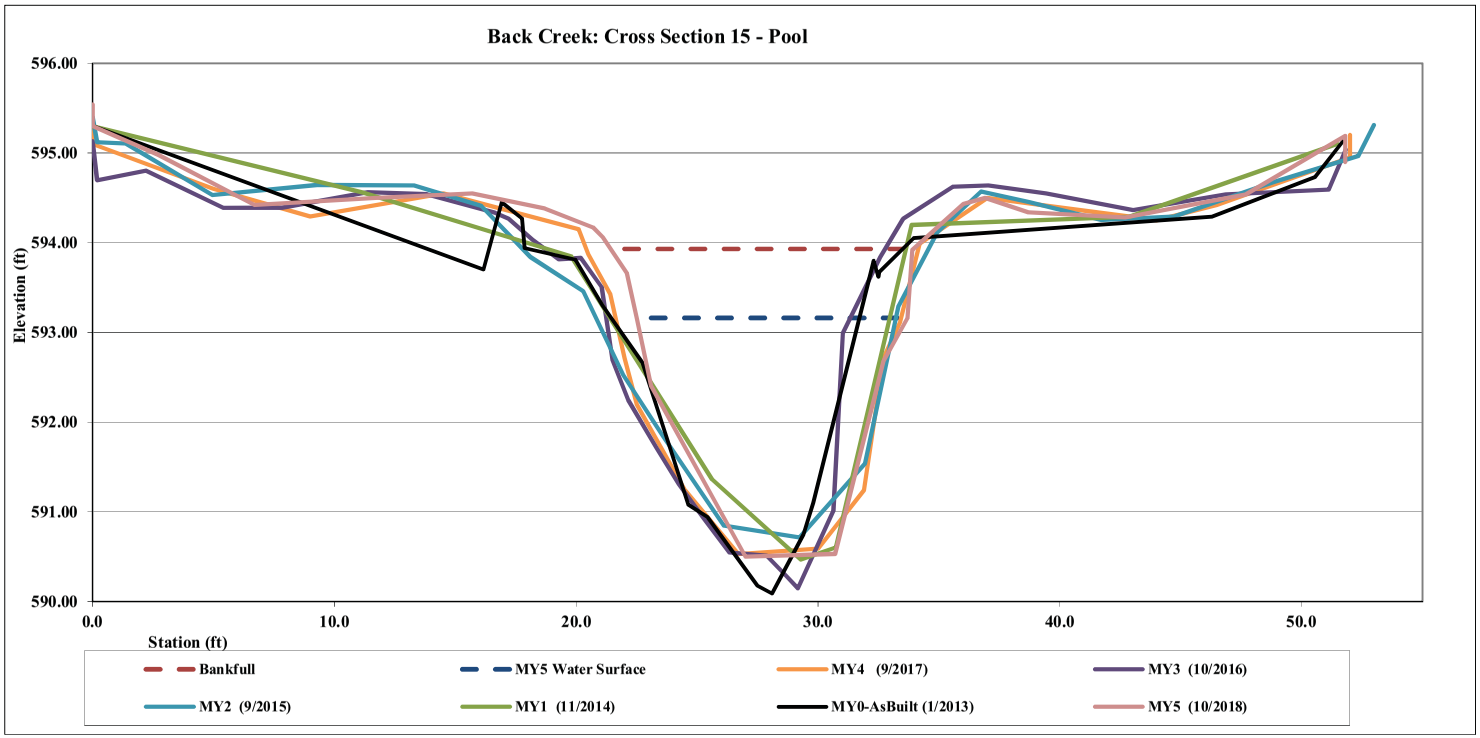


Figure 3.16 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-16, Pool	
Survey Date	10/2018	
SUMMARY DATA		
MY5 Bankfull Elevation (ft)		587.81
MY0 Bankfull X-sec Area (ft^2)		42.7
Bankfull Width (ft)		16.2
Flood Prone Area Elevation (ft)		590.89
Flood Prone Width (ft)		57.00
Bankfull Mean Depth (ft)		2.64
Bankfull Max Depth (ft)		3.08
W/D Ratio		6.15
Entrenchment Ratio		3.52
Low Top of Bank		588.30
Bank Height Ratio		1.16

XS-16: Upstream

XS-16: Downstream

Station	Elevation	Notes
0.0	592.00	TLP
0.0	591.77	BLP
6.6	591.85	
12.6	591.01	
18.0	589.38	
21.8	589.28	
27.4	588.90	
32.3	588.30	
33.3	587.28	
33.6	586.30	LEW
33.6	586.01	
37.1	584.73	THW
46.1	584.74	
48.3	585.91	
48.3	586.30	REW
48.7	587.03	
49.1	588.36	
51.1	588.69	
58.1	589.30	
64.1	589.92	
70.1	591.42	
74.3	592.01	BRP
74.3	592.21	TRP

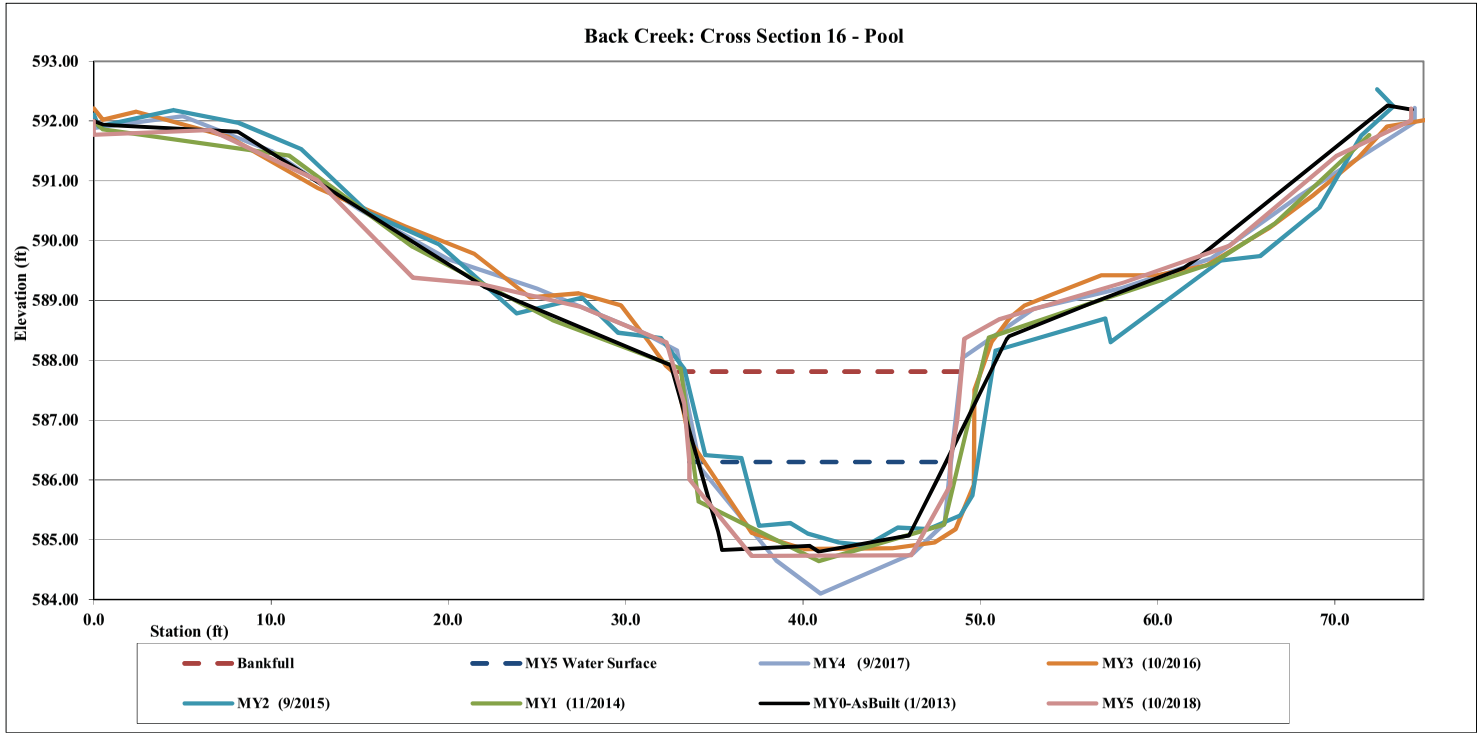


Figure 3.17 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-17, Pool	
Survey Date	10/2018	
SUMMARY DATA		
MY5 Bankfull Elevation (ft)		626.07
MY0 Bankfull X-sec Area (ft^2)		4.1
Bankfull Width (ft)		5.1
Flood Prone Area Elevation (ft)		627.08
Flood Prone Width (ft)		20.00
Bankfull Mean Depth (ft)		0.81
Bankfull Max Depth (ft)		1.01
W/D Ratio		6.20
Entrenchment Ratio		3.96
Low Top of Bank		626.39
Bank Height Ratio		1.32

XS-17: Upstream

XS-17: Downstream

Station	Elevation	Notes
0.0	629.06	TLP
0.0	628.59	BLP
2.0	628.31	
4.0	627.93	
6.0	627.52	
8.5	627.38	
10.0	626.96	
11.3	626.64	
11.6	625.64	
11.9	625.49	WS
11.9	625.49	LEW
12.9	625.13	
14.0	625.06	THW
15.0	625.19	
16.4	625.32	REW
16.4	625.49	WS
16.6	626.39	
17.2	626.73	
18.3	627.06	
19.5	627.38	
21.0	627.65	
23.0	627.71	
26.0	627.90	
28.0	628.00	
30.0	628.00	BRP
30.0	628.48	TRP

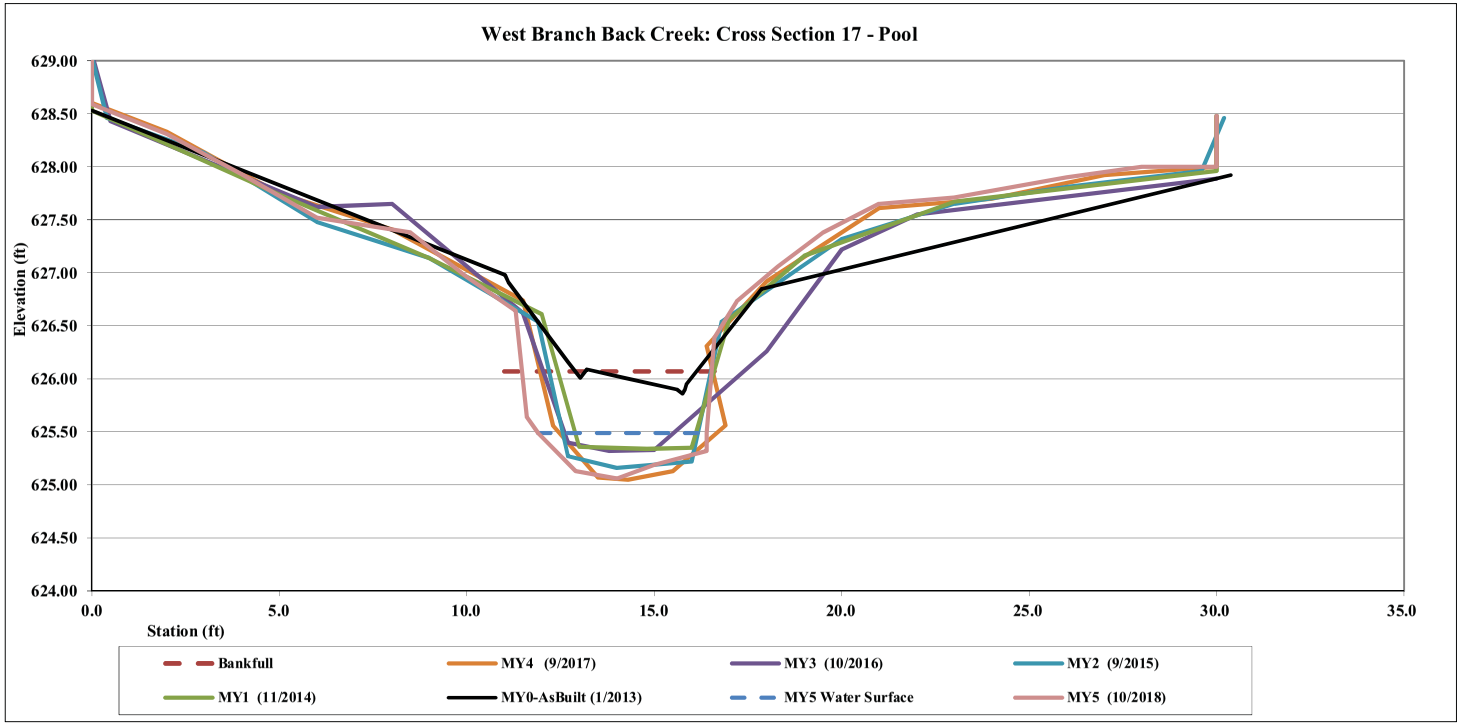


Figure 3.18 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-18, Riffle	
Survey Date	10/2018	
SUMMARY DATA		
MY5 Bankfull Elevation (ft)		626.55
MY0 Bankfull X-sec Area (ft^2)		4.0
Bankfull Width (ft)		6.9
Flood Prone Area Elevation (ft)		627.40
Flood Prone Width (ft)		26.00
Bankfull Mean Depth (ft)		0.58
Bankfull Max Depth (ft)		0.85
W/D Ratio		11.85
Entrenchment Ratio		3.79
Low Top of Bank		626.60
Bank Height Ratio		1.06

XS-18: Upstream

XS-18: Downstream

Station	Elevation	Notes
0.0	628.48	TLP
0.0	628.12	BLP
2.0	627.77	
4.5	627.42	
6.5	627.01	
8.5	626.74	
10.5	626.64	
11.2	626.46	
11.8	625.88	
13.0	625.70	THW
14.0	625.78	
15.0	625.87	
16.5	625.88	
17.0	626.43	
18.0	626.6	
20.0	626.7	
22.0	626.91	
24.0	627	
26.5	627.04	
29.3	627.11	BRP
29.3	627.44	TRP

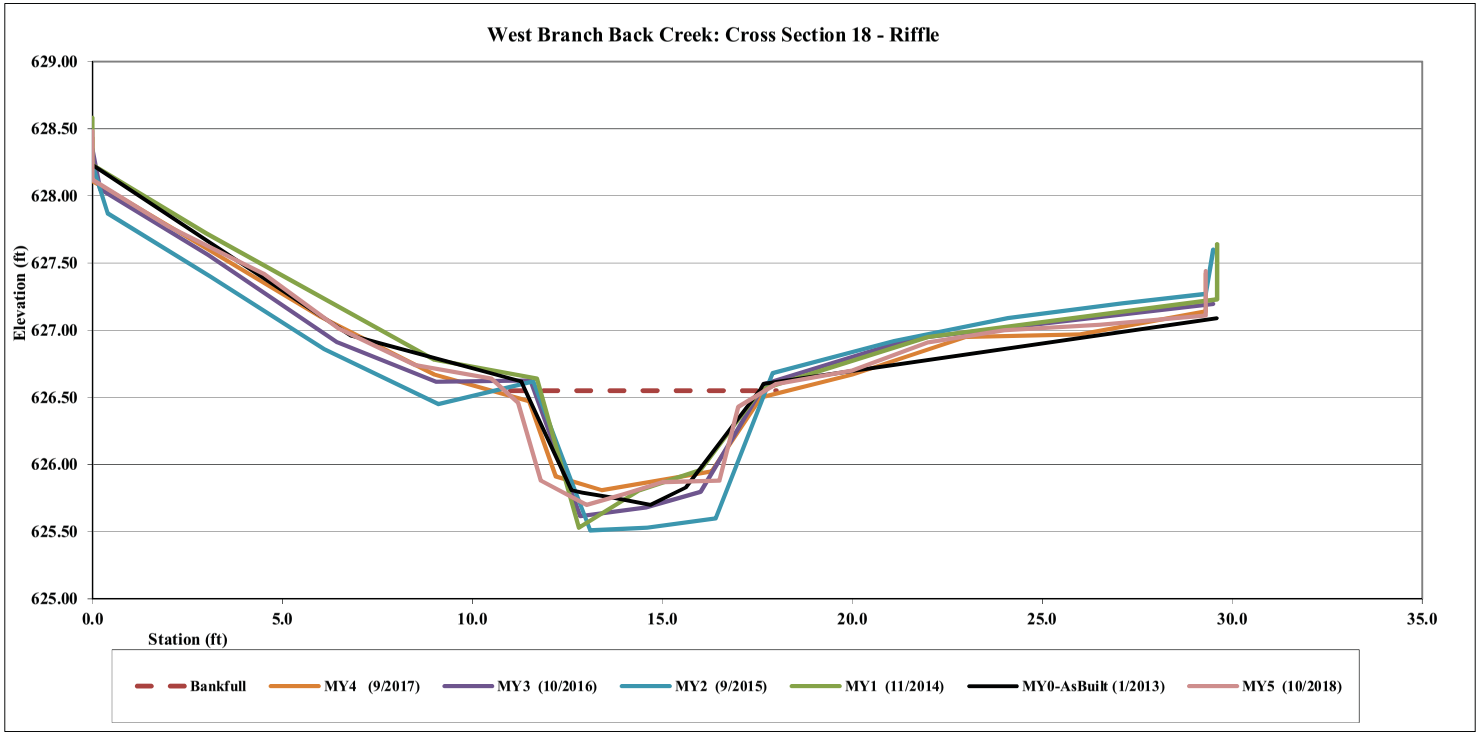


Figure 3.19 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	**Heath Dairy**
DMS Project Number	**170**
Cross-Section ID	**XS-19, Riffle**
Survey Date	**10/2018**
SUMMARY DATA	
MY5 Bankfull Elevation (ft)	616.08
MY0 Bankfull X-sec Area (ft^2)	4.0
Bankfull Width (ft)	9.8
Flood Prone Area Elevation (ft)	616.80
Flood Prone Width (ft)	27.70
Bankfull Mean Depth (ft)	0.41
Bankfull Max Depth (ft)	0.72
W/D Ratio	24.13
Entrenchment Ratio	2.83
Low Top of Bank	616.01
Bank Height Ratio	0.90

XS-19: Upstream

XS-19: Downstream

Station	Elevation	Notes
0.0	617.25	TLP
0.0	616.79	BLP
2.0	616.99	
4.0	616.91	
7.0	616.94	
10.0	616.89	
13.0	616.83	
15.0	616.61	
17.0	616.33	
18.7	616.20	
19.2	615.92	
19.8	615.5	
21.0	615.49	
22.6	615.36	THW
23.7	615.46	
24.9	615.53	
25.6	615.67	
25.9	615.99	
27.0	616.01	
29.0	616.09	
31.0	616.21	
34.0	616.25	
36.5	616.42	
38.5	616.64	
40.1	616.72	BRP
40.1	617.12	TRP

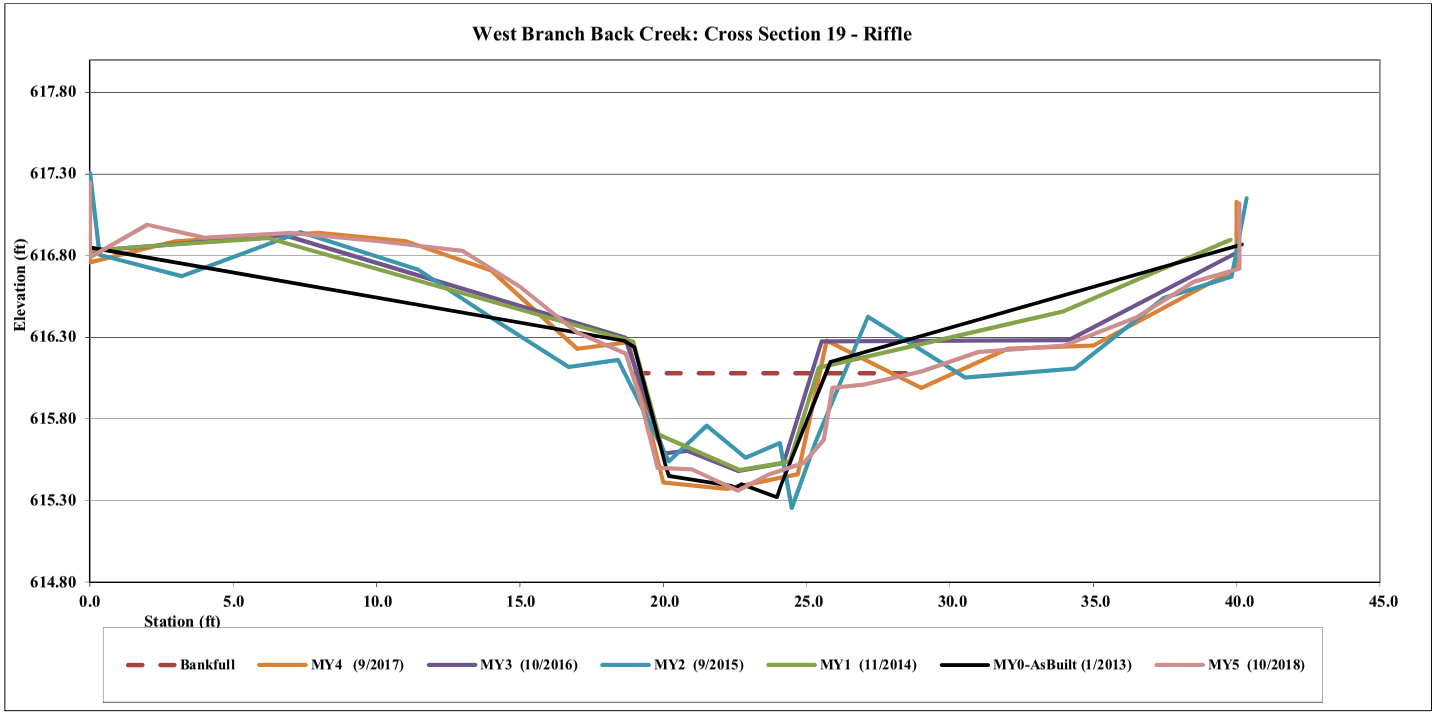


Figure 3.20 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-20, Riffle	
Survey Date	10/2018	
SUMMARY DATA		
MY5 Bankfull Elevation (ft)		608.98
MY0 Bankfull X-sec Area (ft^2)		6.8
Bankfull Width (ft)		9.6
Flood Prone Area Elevation (ft)		610.12
Flood Prone Width (ft)		29.00
Bankfull Mean Depth (ft)		0.71
Bankfull Max Depth (ft)		1.14
W/D Ratio		13.49
Entrenchment Ratio		3.02
Low Top of Bank		608.84
Bank Height Ratio		0.88

Station	Elevation	Notes
0.0	610.04	TLP
0.0	609.74	BLP
2.0	609.72	
5.0	609.76	
8.0	609.72	
11.0	609.65	
12.5	609.27	
14.0	609.25	
15.3	609.07	
16.0	608.42	
16.2	608.16	WS
16.2	607.98	LEW
17.4	607.92	
18.7	607.88	
19.8	607.84	THW
21.0	607.9	
21.7	607.91	REW
21.7	608.16	WS
22.0	608.54	
22.5	608.84	
24.0	608.88	
26.0	609.08	
29.0	609.15	
32.0	609.02	
35.0	609.14	
37.5	609.43	
39.7	609.64	BRP
39.7	610.17	TRP

XS-20: Upstream

XS-20: Downstream

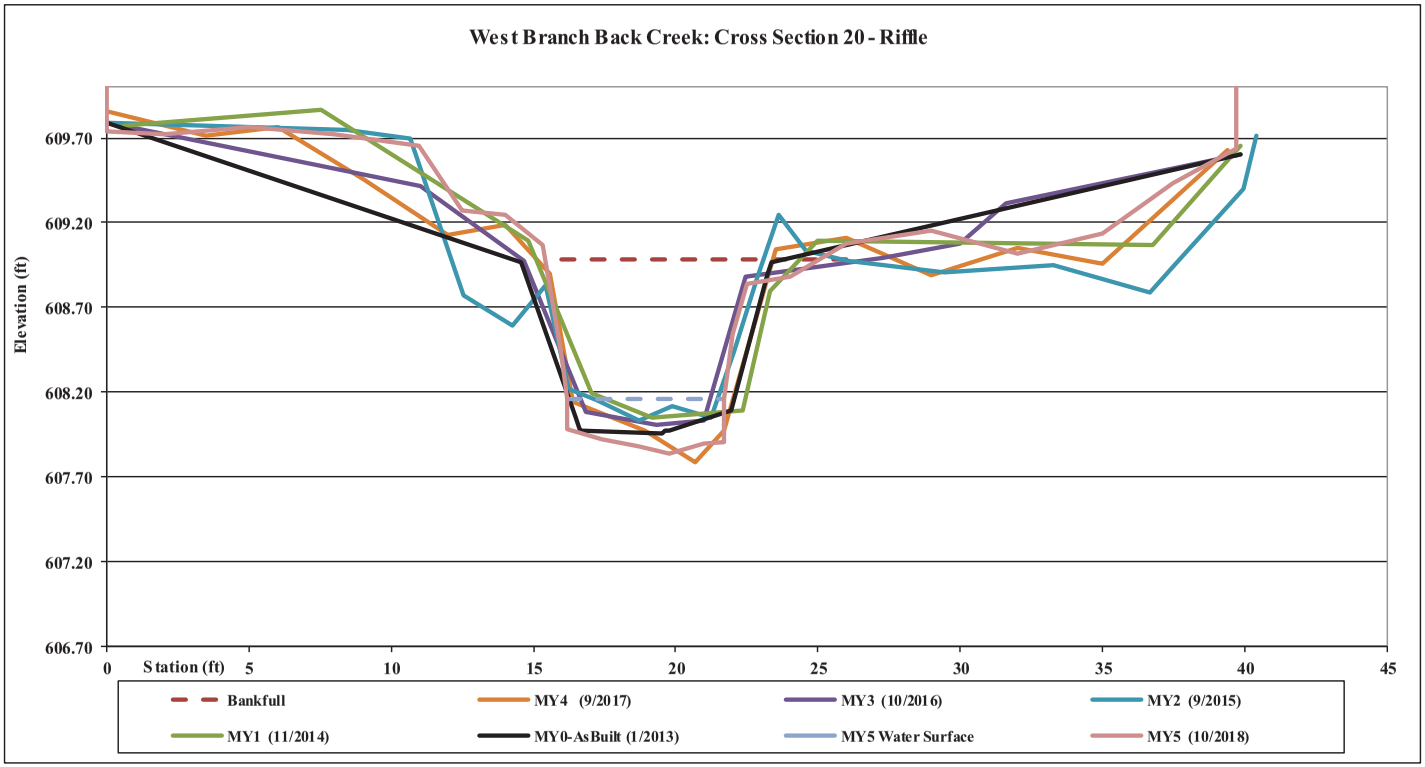


Figure 3.21 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	**Heath Dairy**
DMS Project Number	**170**
Cross-Section ID	**XS-21, Pool**
Survey Date	**10/2018**
SUMMARY DATA	
MY5 Bankfull Elevation (ft)	607.85
MY0 Bankfull X-sec Area (ft^2)	6.4
Bankfull Width (ft)	6.6
Flood Prone Area Elevation (ft)	609.22
Flood Prone Width (ft)	40.00
Bankfull Mean Depth (ft)	0.97
Bankfull Max Depth (ft)	1.37
W/D Ratio	6.78
Entrenchment Ratio	6.05
Low Top of Bank	607.90
Bank Height Ratio	1.04

XS-21: Upstream

XS-21: Downstream

Station	Elevation	Notes
0.0	609.37	TLP
0.0	609.08	BLP
2.0	609.04	
5.0	609.02	
7.5	608.88	
10.0	608.60	
12.5	608.37	
14.4	608.50	
15.2	608.24	
15.7	607.80	
16.0	607.41	WS
16.0	607.41	LEW
17.3	606.67	
18.7	606.48	THW
20.0	606.62	
21.0	606.79	
21.8	607.41	REW
21.8	607.41	WS
22.3	607.9	
23.2	608.29	
25.0	608.31	
27.0	608.37	
29.0	608.47	
31.0	608.37	
34.0	608.43	
36.5	608.43	
38.0	608.74	
39.5	608.9	BRP
39.5	609.44	TRP

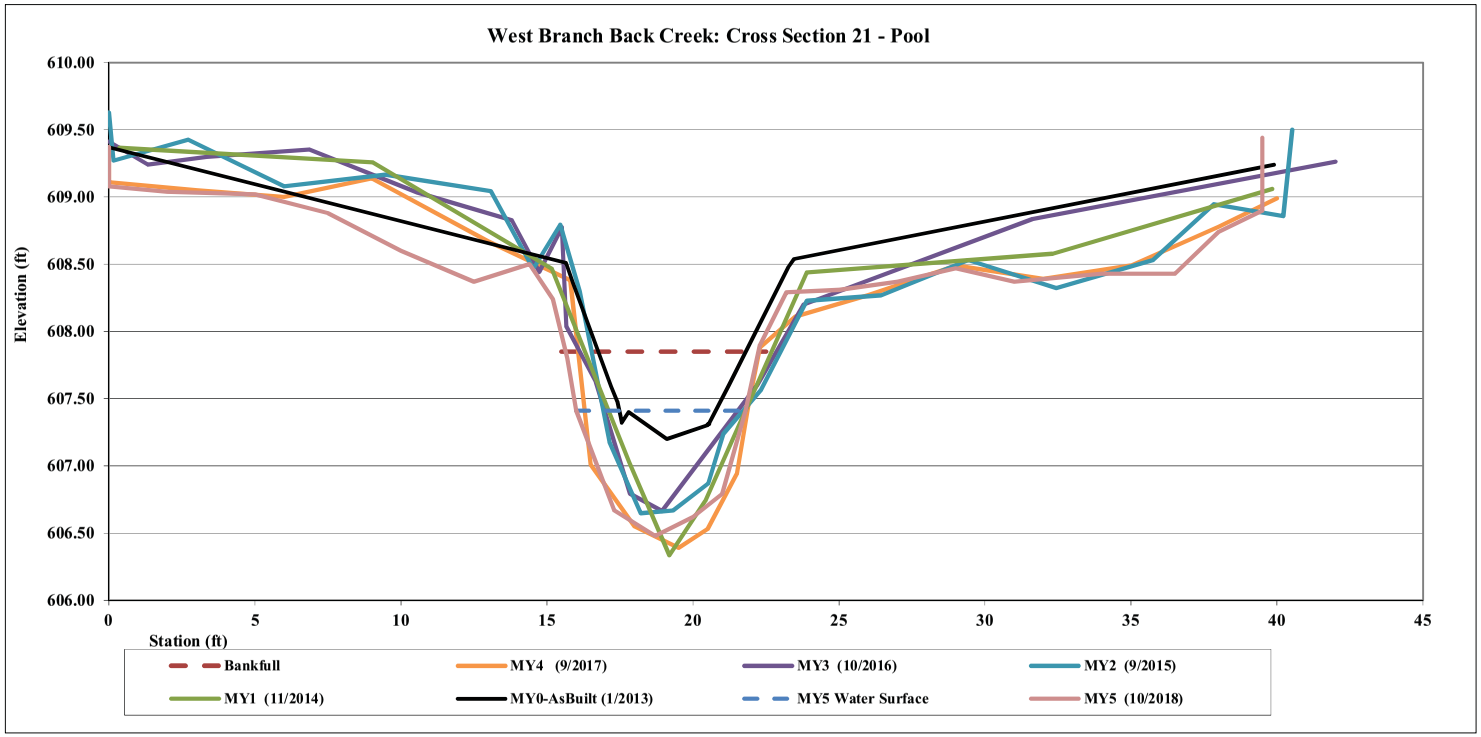


Figure 3.22 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-22, Riffle	
Survey Date	10/2018	
SUMMARY DATA		
MY5 Bankfull Elevation (ft)		613.63
MY0 Bankfull X-sec Area (ft^2)		4.5
Bankfull Width (ft)		7.5
Flood Prone Area Elevation (ft)		614.18
Flood Prone Width (ft)		75.00
Bankfull Mean Depth (ft)		0.59
Bankfull Max Depth (ft)		0.55
W/D Ratio		12.61
Entrenchment Ratio		10.00
Low Top of Bank		613.69
Bank Height Ratio		1.11

Station	Elevation	Notes
0.0	614.70	TLP
0.0	614.34	BLP
1.0	614.27	
4.0	614.20	
7.0	614.11	
10.0	614.00	
13.0	613.98	
15.0	613.83	
16.5	613.69	
17.3	613.32	
17.8	613.00	WS
17.8	613.00	LEW
19.4	612.99	
21.3	613.08	
22.3	612.92	
22.8	613.00	REW
22.8	613.00	WS
23.2	613.56	
24.0	613.85	
25.5	613.81	
27.0	613.78	
29.0	613.64	
32.0	613.59	
34.5	613.43	
38.2	613.55	BRP
38.2	613.55	TRP

XS-22: Upstream

XS-22: Downstream

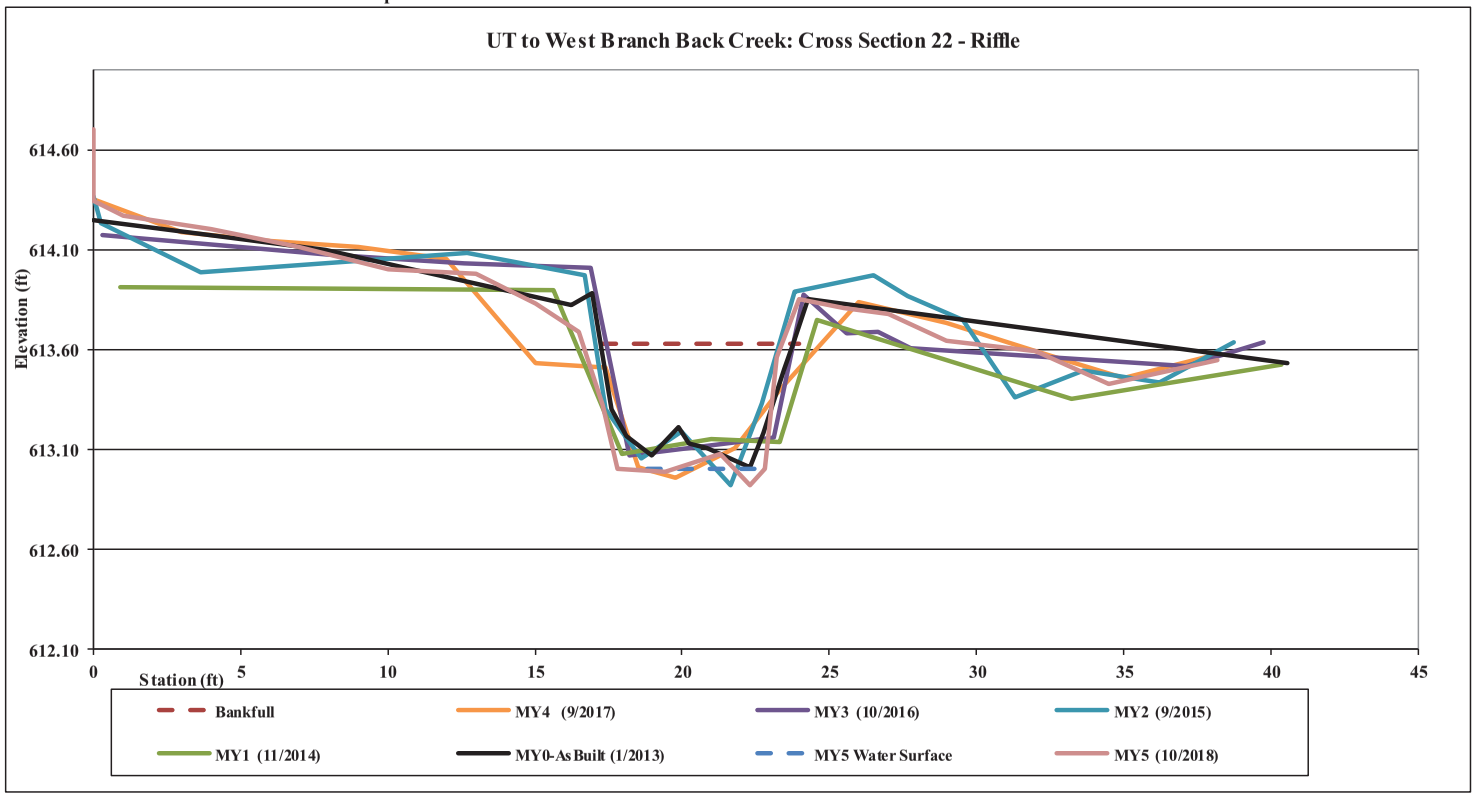


Figure 3.23 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-23, Pool
Survey Date	10/2018
SUMMARY DATA	
MY5 Bankfull Elevation (ft)	595.03
MY0 Bankfull X-sec Area (ft^2)	51.4
Bankfull Width (ft)	15.6
Flood Prone Area Elevation (ft)	600.30
Flood Prone Width (ft)	200.00
Bankfull Mean Depth (ft)	3.29
Bankfull Max Depth (ft)	5.27
W/D Ratio	4.74
Entrenchment Ratio	12.82
Low Top of Bank	595.15
Bank Height Ratio	1.02

Station	Elevation	Notes
0.0	596.02	TLP
0.0	595.80	BLP
3.8	595.49	
9.8	595.40	
14.6	595.27	
18.1	595.08	
19.0	595.15	
19.8	593.61	
20.7	592.84	LEW
22.1	591.65	
23.7	590.59	
27.6	589.76	THW
29.5	590.08	
31.7	592.84	REW
33.1	594.30	
35.1	595.26	
39.1	595.51	
44.1	595.92	
49.1	595.83	
53.9	595.66	BLP
53.9	595.72	TLP

XS-23: Upstream

XS-23: Downstream

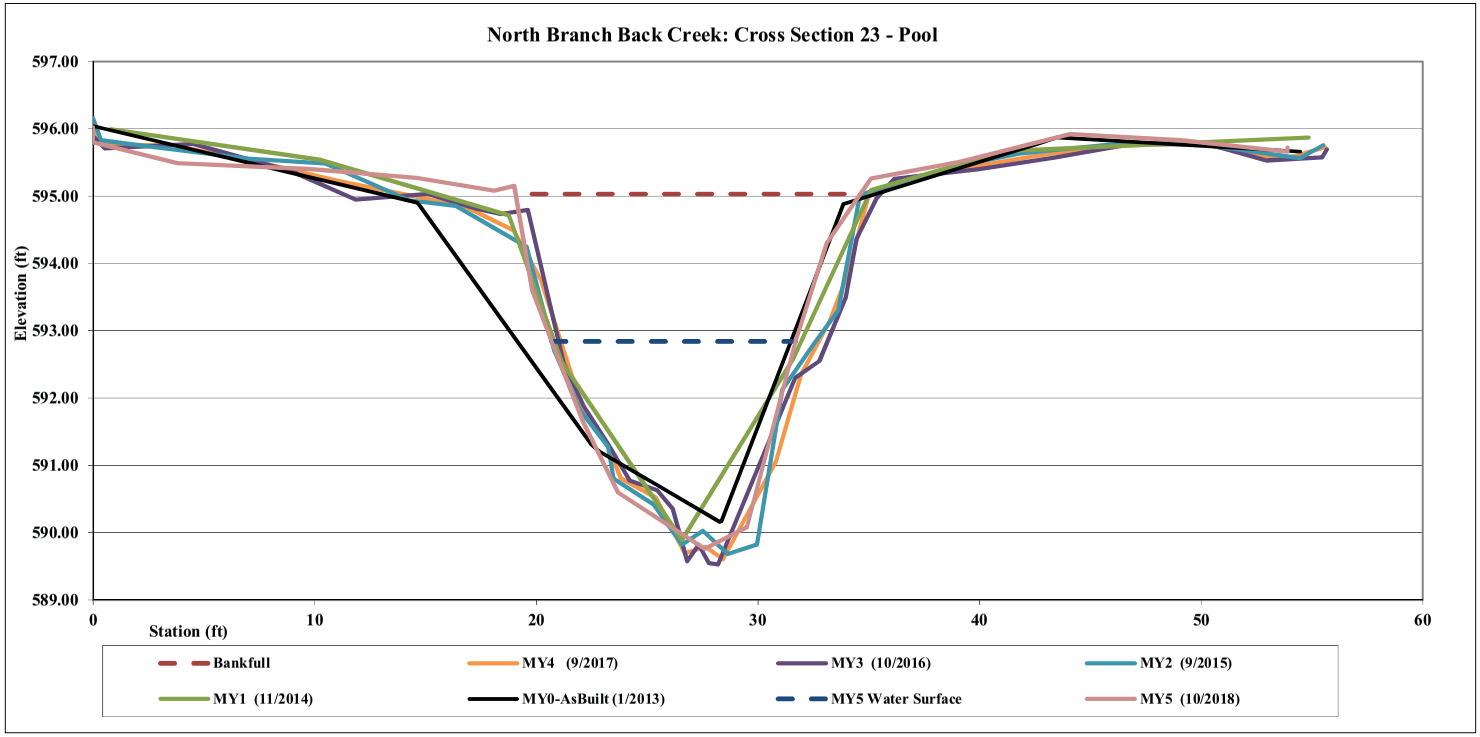


Figure 3.24 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-24, Riffle	
Survey Date	10/2018	
SUMMARY DATA		
MY5 Bankfull Elevation (ft)		594.96
MY0 Bankfull X-sec Area (ft^2)		24.4
Bankfull Width (ft)		20.6
Flood Prone Area Elevation (ft)		597.33
Flood Prone Width (ft)		200.00
Bankfull Mean Depth (ft)		1.19
Bankfull Max Depth (ft)		2.37
W/D Ratio		17.37
Entrenchment Ratio		9.71
Low Top of Bank		595.02
Bank Height Ratio		1.03

XS-24: Upstream

XS-24: Downstream

Station	Elevation	Notes
0.0	596.00	TLP
0.0	595.86	BLP
3.3	595.81	
7.3	595.37	
10.3	595.19	
13.3	595.02	
15.3	594.66	
17.3	594.34	
18.3	593.90	
19.3	593.40	
22.3	593.45	
23.3	593.37	
24.8	593.14	
25.6	592.85	LEW
26.8	592.59	THW
29.2	592.85	REW
29.2	592.85	
29.3	593.59	
30.3	594.07	
31.3	594.46	
33.3	594.83	
36.3	595.23	
40.3	595.40	
44.3	595.79	
49.4	596.02	BLP
49.4	596.29	TLP

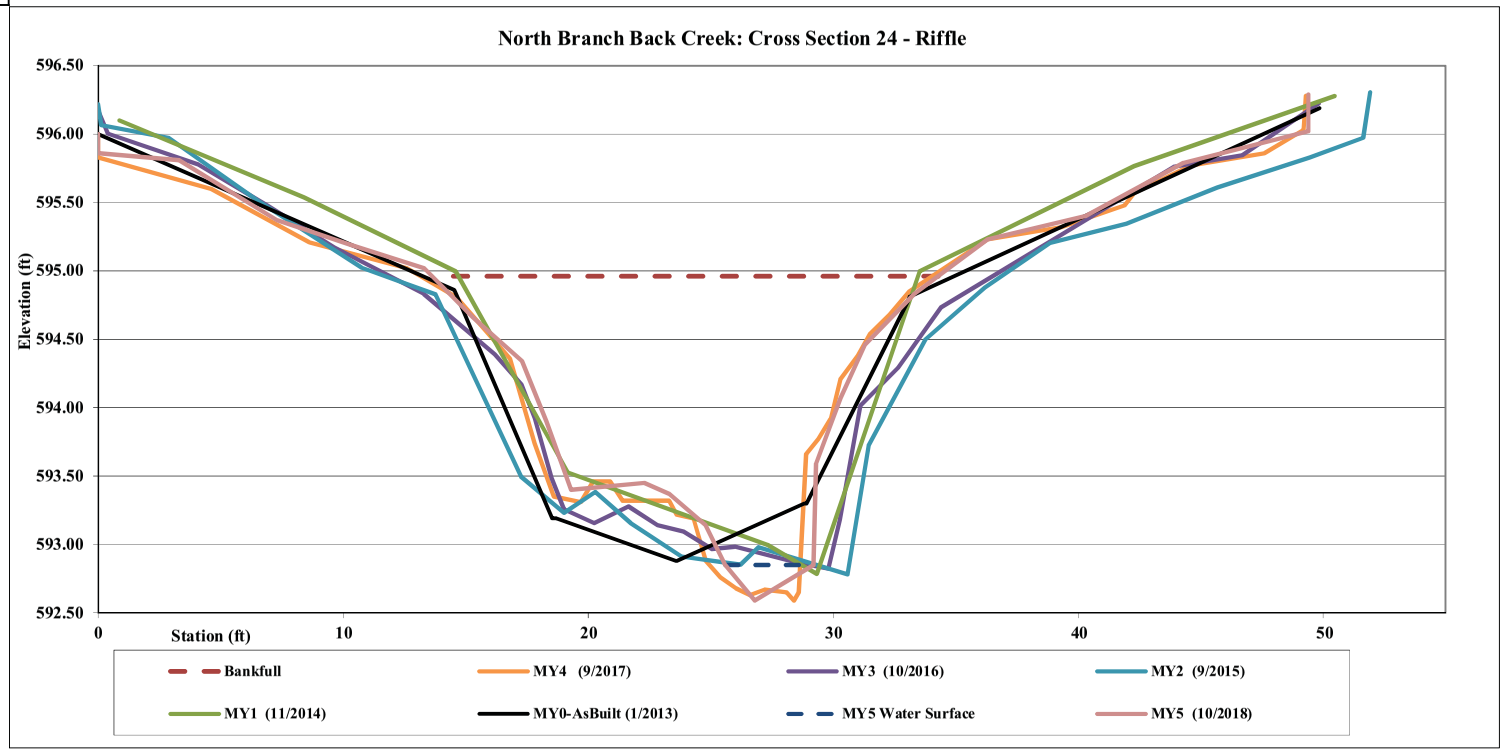


Figure 3.25 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-25, Riffle
Survey Date	10/2018
SUMMARY DATA	
MY5 Bankfull Elevation (ft)	593.25
MY0 Bankfull X-sec Area (ft^2)	25.7
Bankfull Width (ft)	18.8
Flood Prone Area Elevation (ft)	595.28
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.37
Bankfull Max Depth (ft)	2.03
W/D Ratio	13.76
Entrenchment Ratio	5.32
Low Top of Bank	593.10
Bank Height Ratio	0.93

Station	Elevation	Notes
0.0	594.60	TLP
0.0	594.54	BLP
3.1	594.41	
7.1	594.10	
11.1	593.70	
14.1	593.47	
15.1	593.30	
16.1	593.10	
17.1	592.67	
18.1	592.29	
19.1	591.40	LEW
21.1	591.25	
23.1	591.22	THW
28.1	591.23	
29.2	591.40	REW
31.1	592.76	
33.1	593.10	
36.1	593.51	
40.1	593.74	
45.1	593.91	
50.2	594.09	BLP
50.2	594.38	TLP

XS-25: Upstream

XS-25: Downstream

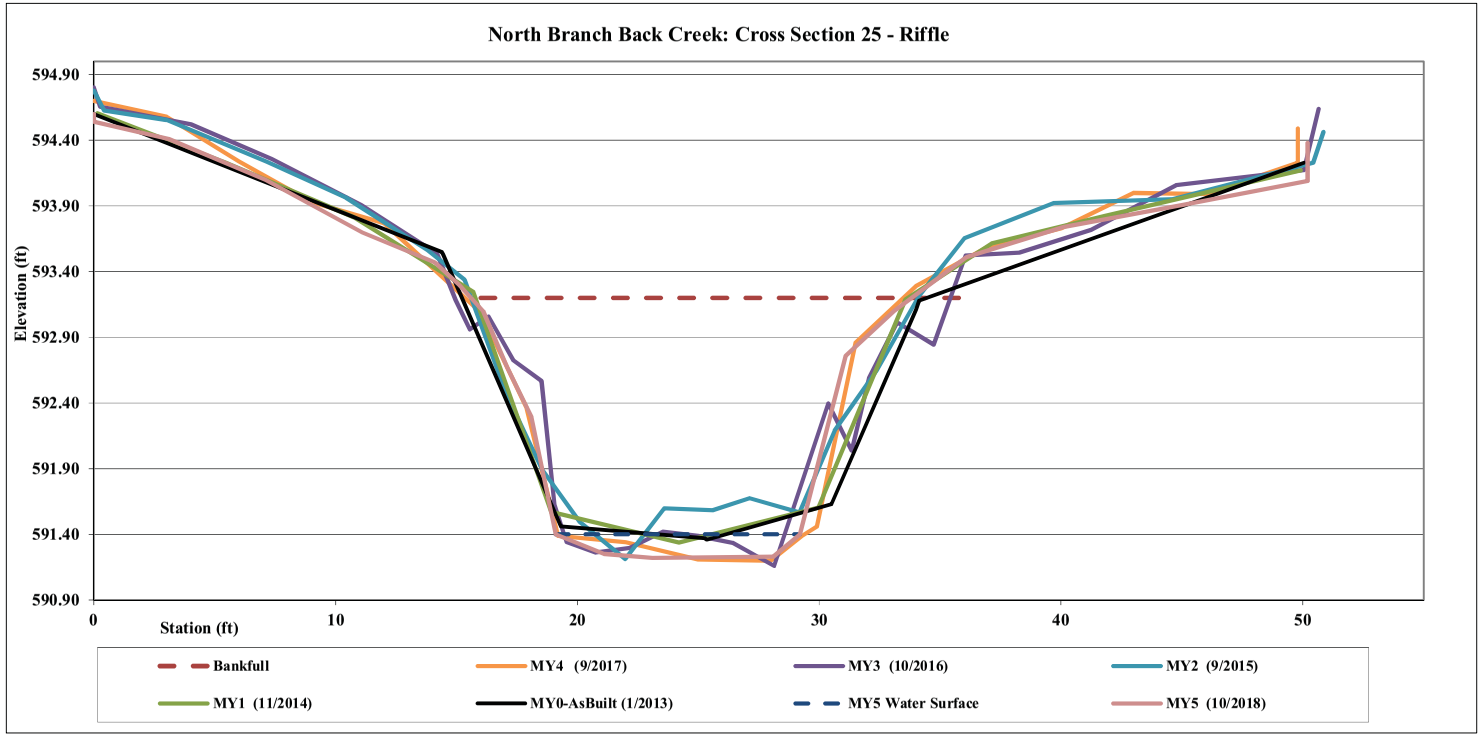


Figure 3.26 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-26, Pool	
Survey Date	10/2018	
SUMMARY DATA		
MY5 Bankfull Elevation (ft)		596.35
MY0 Bankfull X-sec Area (ft^2)		8.1
Bankfull Width (ft)		10.1
Flood Prone Area Elevation (ft)		597.94
Flood Prone Width (ft)		50.00
Bankfull Mean Depth (ft)		0.80
Bankfull Max Depth (ft)		1.59
W/D Ratio		12.59
Entrenchment Ratio		4.95
Low Top of Bank		596.20
Bank Height Ratio		0.91

XS-26: Upstream

XS-26: Downstream

Station	Elevation	Notes
0.0	596.45	TLP
0.0	596.29	BLP
4.8	596.36	
7.8	596.60	
10.3	596.55	
11.8	596.42	
13.8	596.20	
14.8	595.96	
15.8	595.77	
16.8	595.60	
17.3	595.26	LEW
18.8	594.76	THW
19.8	594.85	
21.2	595.26	REW
21.8	595.86	
22.8	596.41	
23.8	596.42	
26.8	596.62	
29.8	597.08	
32.8	597.35	
36.8	597.60	
39.5	597.70	BRP
39.5	598.06	TRP

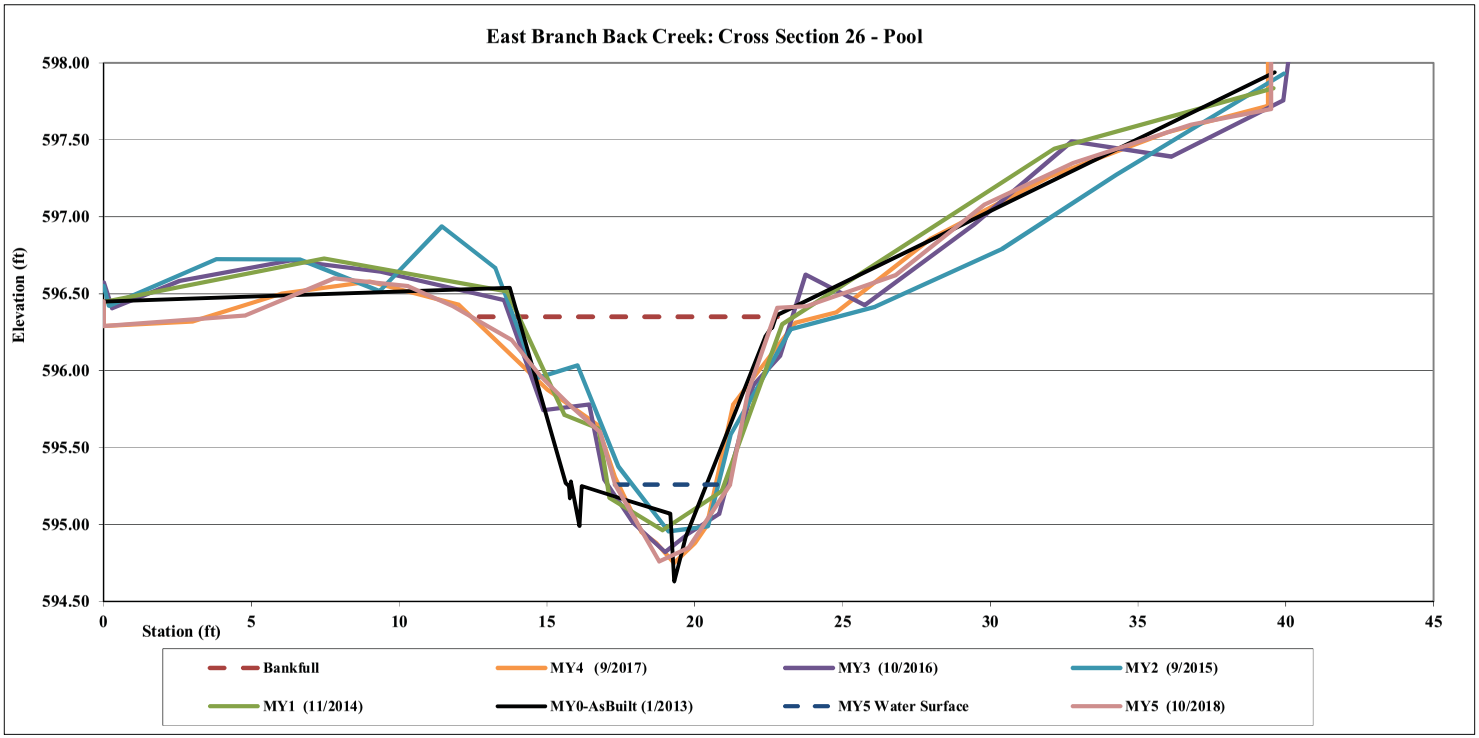


Figure 3.27 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-27, Riffle	
Survey Date	10/2018	
SUMMARY DATA		
MY5 Bankfull Elevation (ft)		596.24
MY0 Bankfull X-sec Area (ft^2)		6.3
Bankfull Width (ft)		13.0
Flood Prone Area Elevation (ft)		597.40
Flood Prone Width (ft)		50.00
Bankfull Mean Depth (ft)		0.49
Bankfull Max Depth (ft)		1.16
W/D Ratio		26.78
Entrenchment Ratio		3.85
Low Top of Bank		596.20
Bank Height Ratio		0.97

XS-27: Upstream

XS-27: Downstream

Station	Elevation	Notes
0.0	595.77	TLP
0.0	596.13	BLP
3.1	596.16	
6.1	596.37	
9.1	596.26	
11.1	596.35	
12.1	596.27	
13.1	596.01	
14.1	595.64	
15.1	595.45	
15.9	595.22	LEW
16.6	595.08	THW
17.6	595.22	REW
18.1	595.40	
19.1	595.67	
20.1	595.83	
22.1	596.20	
25.1	596.41	
29.1	596.52	
33.1	596.96	
37.1	596.90	
39.8	597.22	BRP
39.8	597.53	TRP

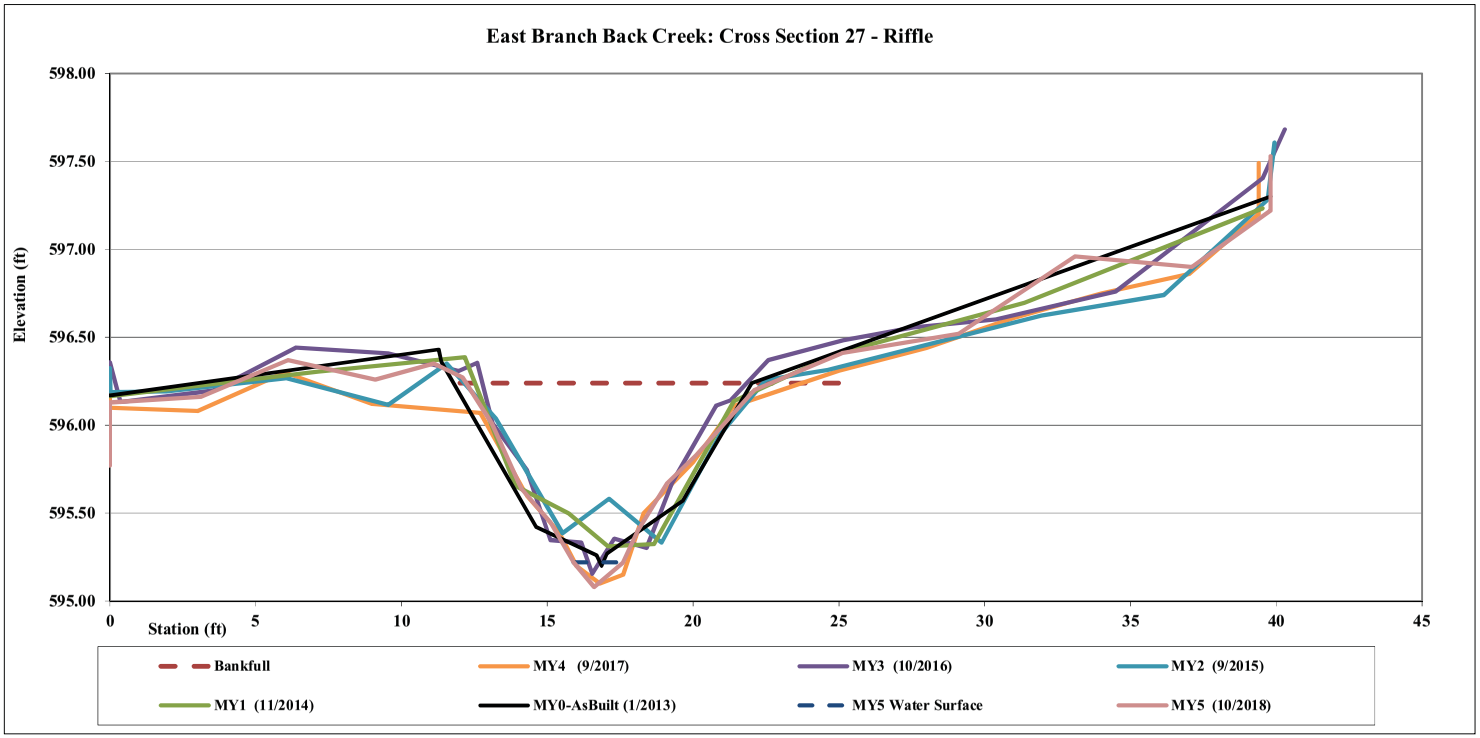


Figure 3.28 Cross-sectional Profile with Annual Overlays
Heath Dairy Road Stream Restoration Site
Monitoring Year 5 of 5, 2018

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-28,Riffle
Survey Date	10/2018
SUMMARY DATA	
MY5 Bankfull Elevation (ft)	594.20
MY0 Bankfull X-sec Area (ft^2)	6.8
Bankfull Width (ft)	9.0
Flood Prone Area Elevation (ft)	595.39
Flood Prone Width (ft)	50.00
Bankfull Mean Depth (ft)	0.76
Bankfull Max Depth (ft)	1.19
W/D Ratio	11.86
Entrenchment Ratio	5.56
Low Top of Bank	594.21
Bank Height Ratio	1.01

XS-28: Upstream

XS-28: Downstream

Station	Elevation	Notes
0.0	595.73	TLP
0.0	595.73	BLP
3.1	595.30	
7.1	594.99	
10.1	594.73	
13.1	594.49	
16.1	594.48	
18.1	594.27	
19.1	593.95	
20.1	593.70	
21.1	593.25	
21.8	593.11	LEW
22.9	593.01	THW
24.1	593.05	REW
25.1	593.55	
26.1	593.76	
27.1	594.21	
29.1	594.14	
32.1	594.18	
36.1	594.09	
39.8	594.33	BRP
39.8	594.63	TRP

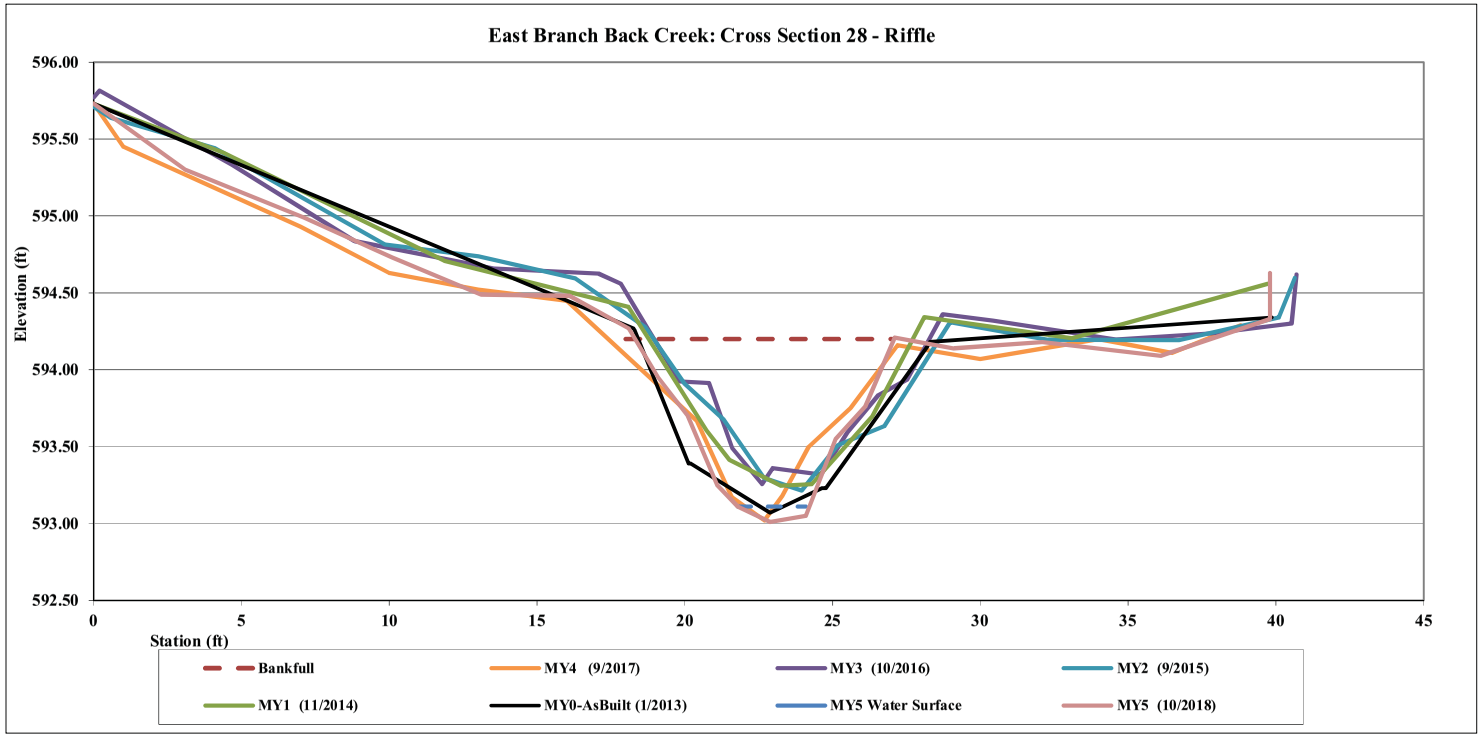
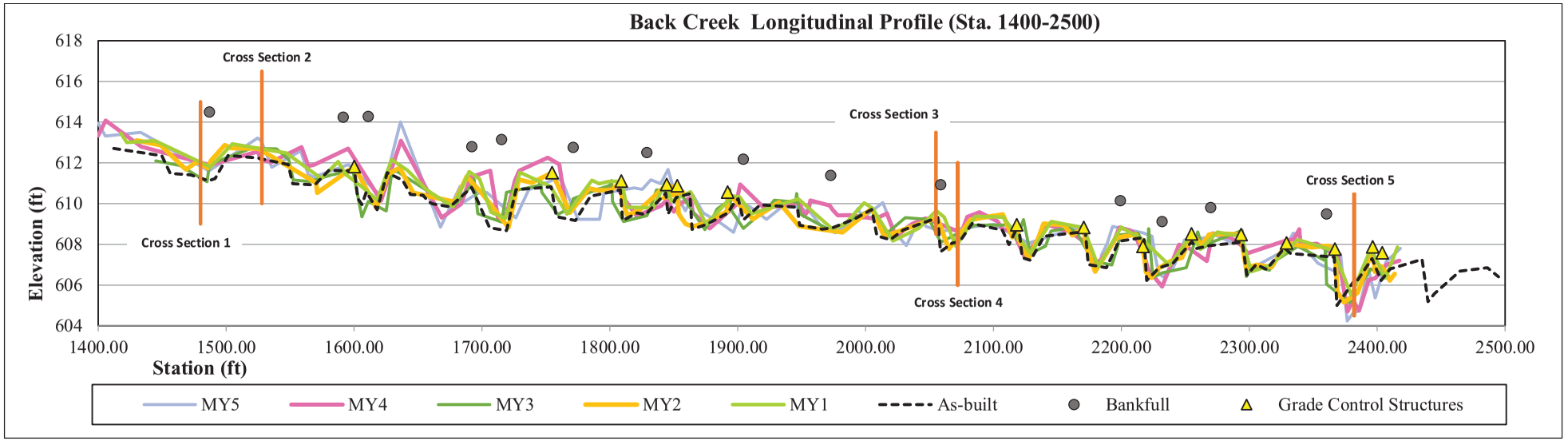
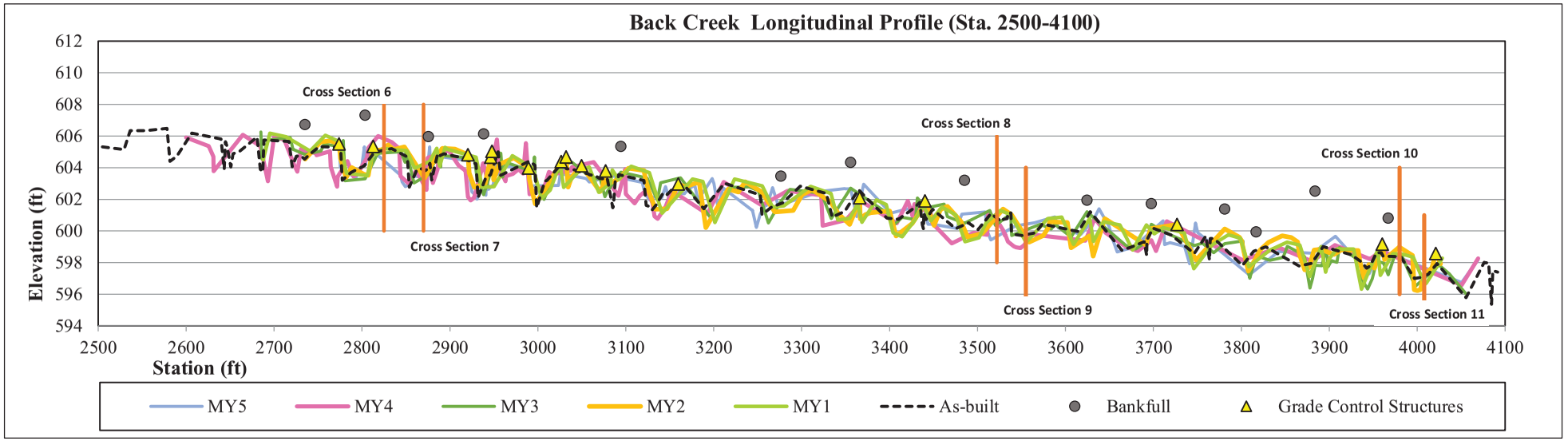


Figure 4.1. Longitudinal Profile – Back Creek





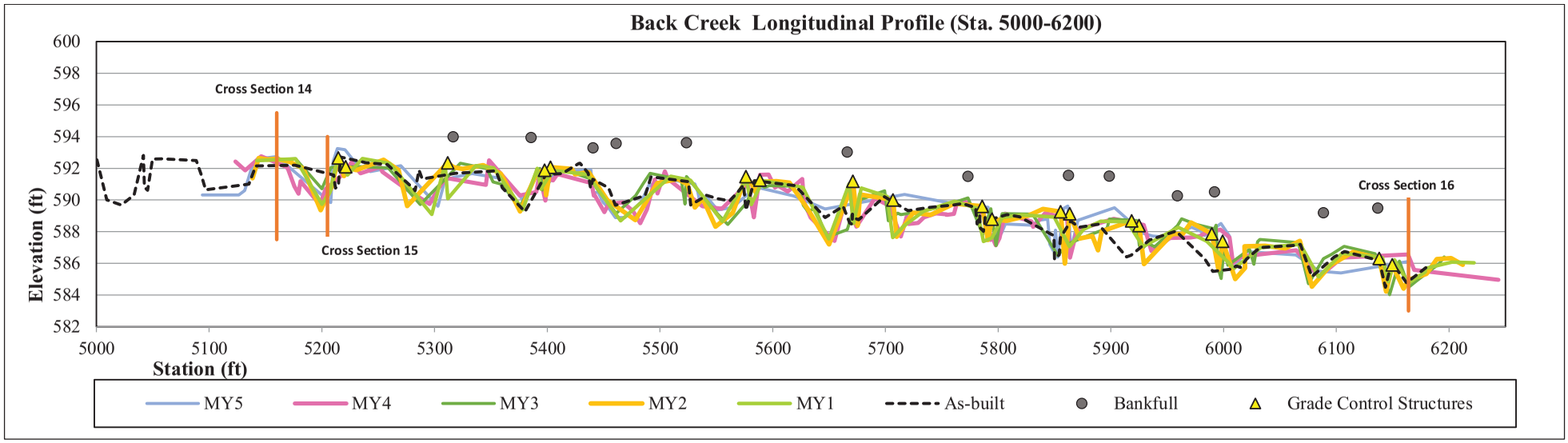
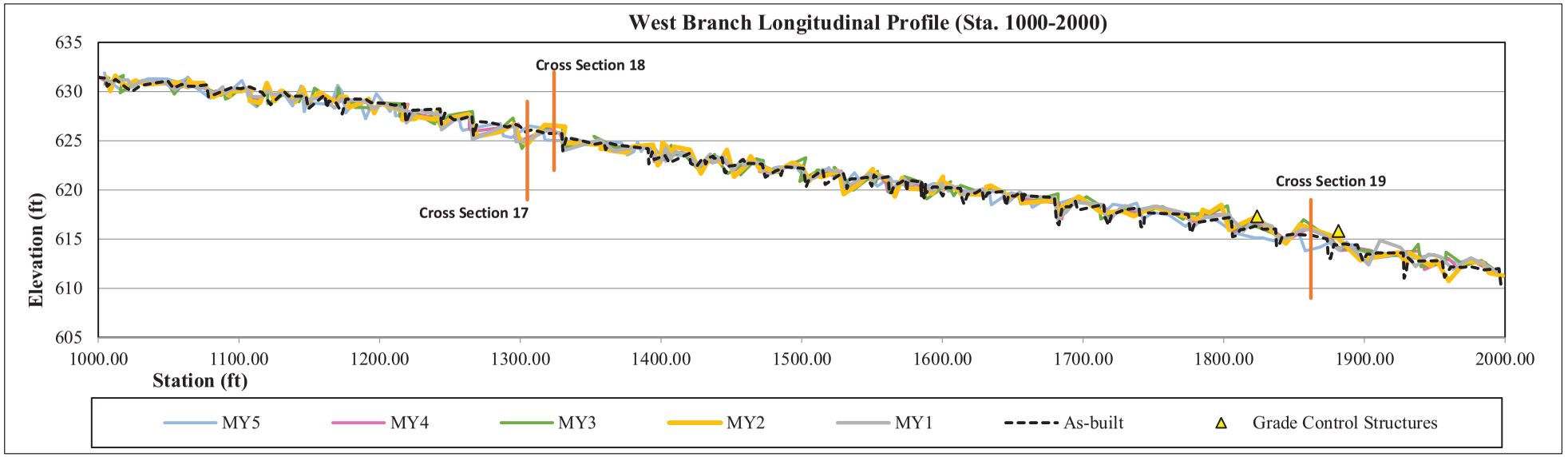

Back Creek Longitudinal Profile (Sta. 5000-6200)
Elevation (ft)
600
598
596
594
592
590
588
586
584
582
Cross Section 14
Cross Section 15
Cross Section 16
5000
5100
5200
5300
5400
5500
5600
5700
5800
5900
6000
6100
6200
Station (ft)
MY5
MY4
MY3
MY2
MY1
As-built
Bankfull
Grade Control Structures

Figure 4.2. Longitudinal Profile – West Branch



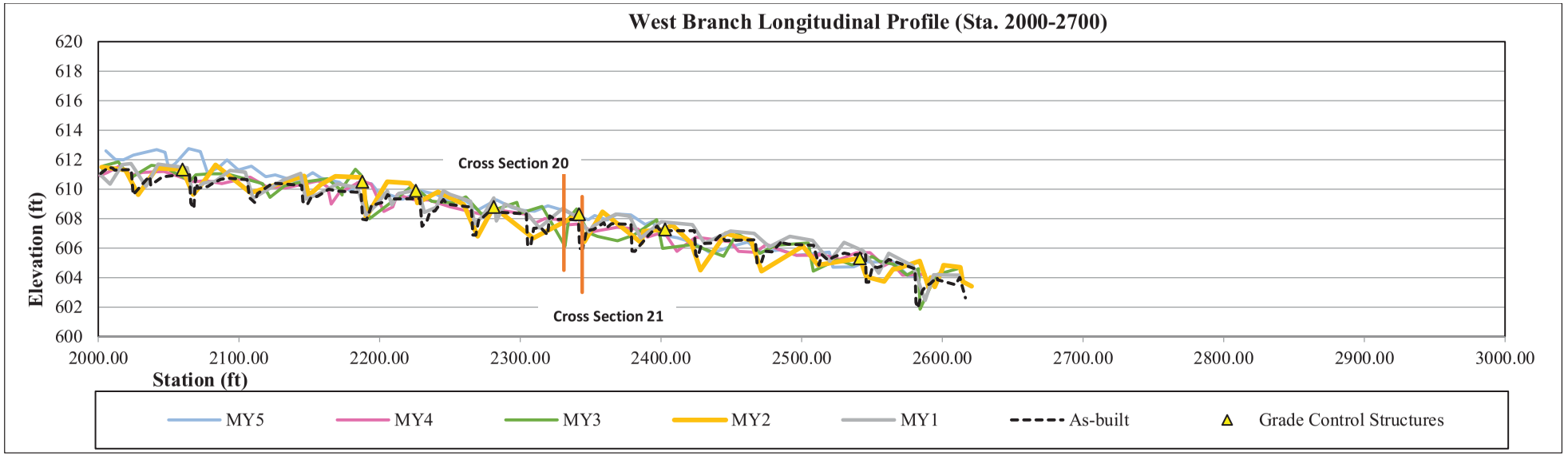


Figure 4.3. Longitudinal Profile – East Branch

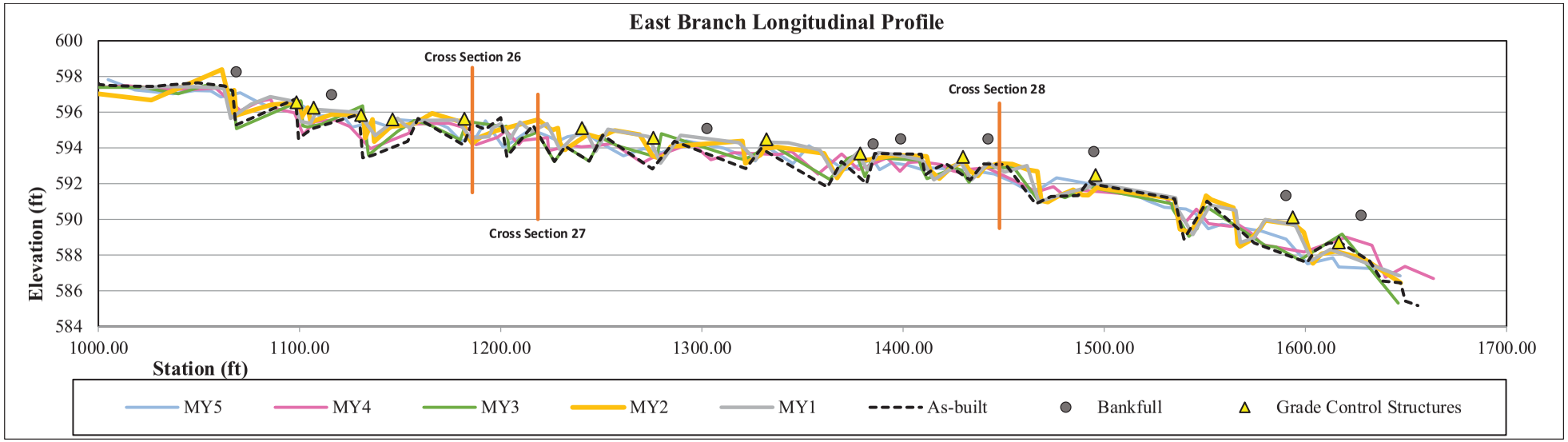
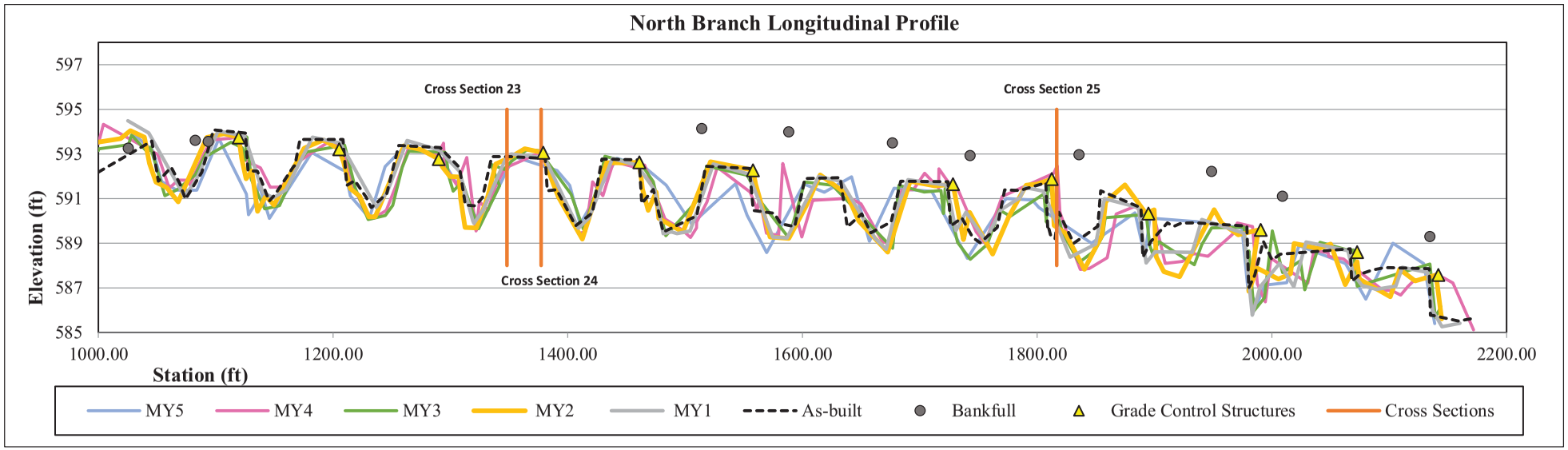


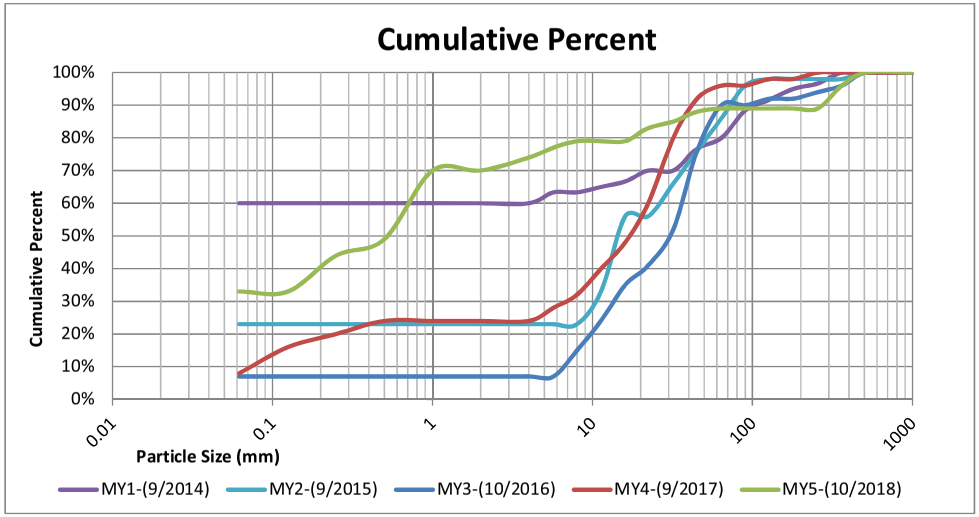
Figure 4.4. Longitudinal Profile – North Branch

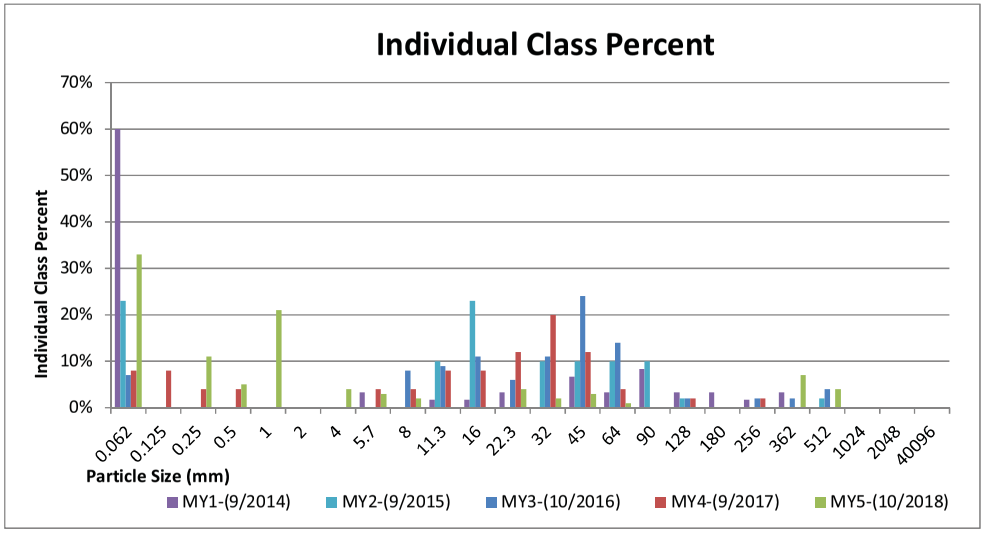


Appendix D: Stream Survey Data
Figure 5.1 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 5

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Pool (XS 1)					
			MY5-(10/2018)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	33	33%	33%
Sand	very fine sand	0.125	0	0%	33%
	fine sand	0.250	11	11%	44%
	medium sand	0.50	5	5%	49%
	coarse sand	1.00	21	21%	70%
	very coarse sand	2.0	0	0%	70%
Gravel	very fine gravel	4.0	4	4%	74%
	fine gravel	5.7	3	3%	77%
	fine gravel	8.0	2	2%	79%
	medium gravel	11.3	0	0%	79%
	medium gravel	16.0	0	0%	79%
	course gravel	22.3	4	4%	83%
	course gravel	32.0	2	2%	85%
	very coarse gravel	45	3	3%	88%
	very coarse gravel	64	1	1%	89%
Cobble	small cobble	90	0	0%	89%
	medium cobble	128	0	0%	89%
	large cobble	180	0	0%	89%
	very large cobble	256	0	0%	89%
Boulder	small boulder	362	7	7%	96%
	small boulder	512	4	4%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count		-	100	100%	100%

Summary Data	
D50	0.5
D84	27.2
D95	346.9

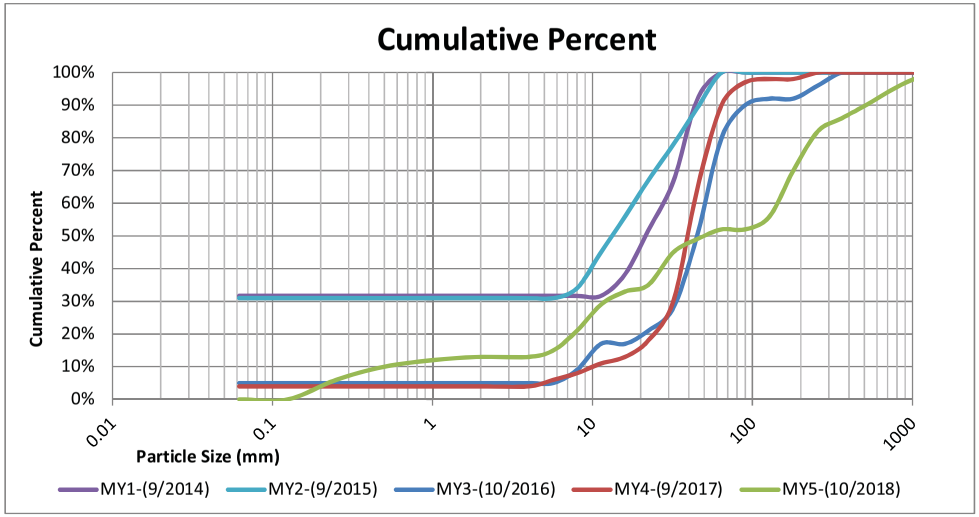


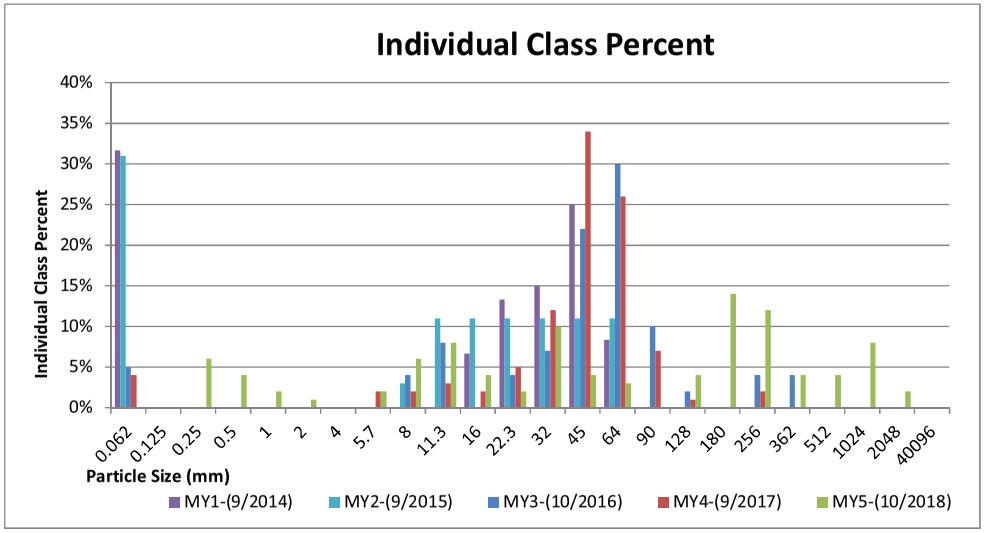


Appendix D: Stream Survey Data
Figure 5.2 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 5

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 2)					
			MY5-(10/2018)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	0	0%	0%
Sand	very fine sand	0.125	0	0%	0%
	fine sand	0.250	6	6%	6%
	medium sand	0.50	4	4%	10%
	coarse sand	1.00	2	2%	12%
	very coarse sand	2.0	1	1%	13%
Gravel	very fine gravel	4.0	0	0%	13%
	fine gravel	5.7	2	2%	15%
	fine gravel	8.0	6	6%	21%
	medium gravel	11.3	8	8%	29%
	medium gravel	16.0	4	4%	33%
	course gravel	22.3	2	2%	35%
	course gravel	32.0	10	10%	45%
	very coarse gravel	45	4	4%	49%
	very coarse gravel	64	3	3%	52%
Cobble	small cobble	90	0	0%	52%
	medium cobble	128	4	4%	56%
	large cobble	180	14	14%	70%
	very large cobble	256	12	12%	82%
Boulder	small boulder	362	4	4%	86%
	small boulder	512	4	4%	90%
	medium boulder	1024	8	8%	98%
	large boulder	2048	2	2%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count		-	100	100%	100%

Summary Data	
D50	51.3
D84	309.0
D95	832.0

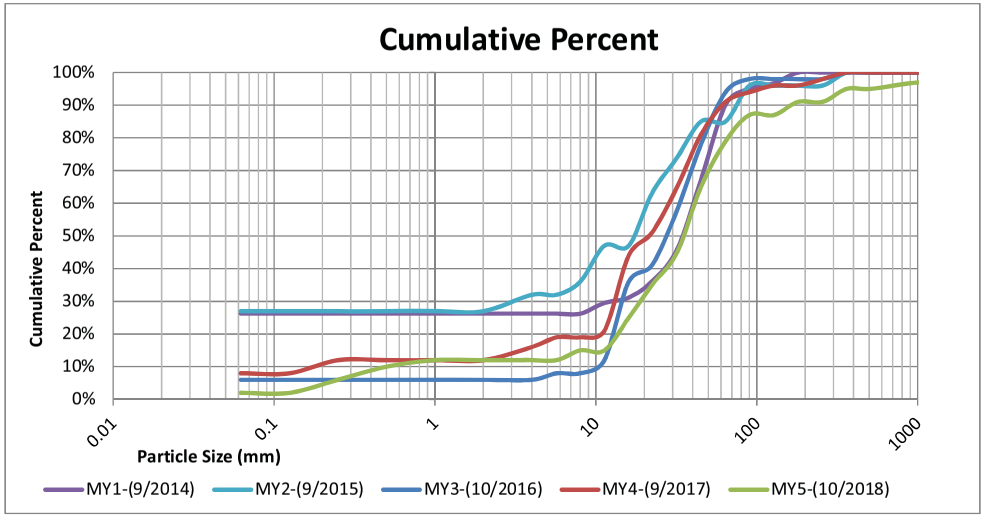


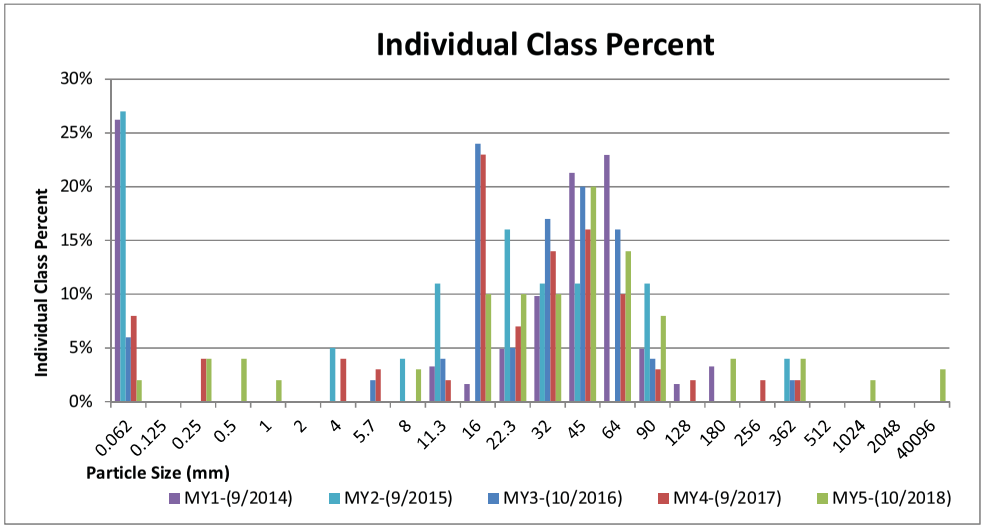


Appendix D: Stream Survey Data
Figure 5.3 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 5

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 3)					
			MY5-(10/2018)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	2	2%	2%
Sand	very fine sand	0.125	0	0%	2%
	fine sand	0.250	4	4%	6%
	medium sand	0.50	4	4%	10%
	coarse sand	1.00	2	2%	12%
	very coarse sand	2.0	0	0%	12%
Gravel	very fine gravel	4.0	0	0%	12%
	fine gravel	5.7	0	0%	12%
	fine gravel	8.0	3	3%	15%
	medium gravel	11.3	0	0%	15%
	medium gravel	16.0	10	10%	25%
	course gravel	22.3	10	10%	35%
	course gravel	32.0	10	10%	45%
	very coarse gravel	45	20	20%	65%
	very coarse gravel	64	14	14%	79%
Cobble	small cobble	90	8	8%	87%
	medium cobble	128	0	0%	87%
	large cobble	180	4	4%	91%
	very large cobble	256	0	0%	91%
Boulder	small boulder	362	4	4%	95%
	small boulder	512	0	0%	95%
	medium boulder	1024	2	2%	97%
	large boulder	2048	0	0%	97%
Bedrock	bedrock	40096	3	3%	100%
TOTAL % of whole count		-	100	100%	100%

Summary Data	
D50	35.3
D84	80.3
D95	362.0

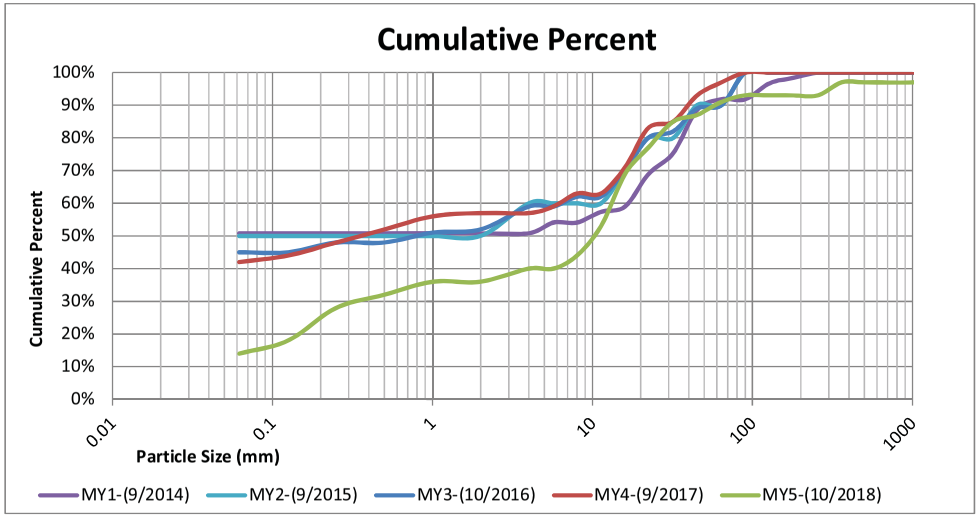


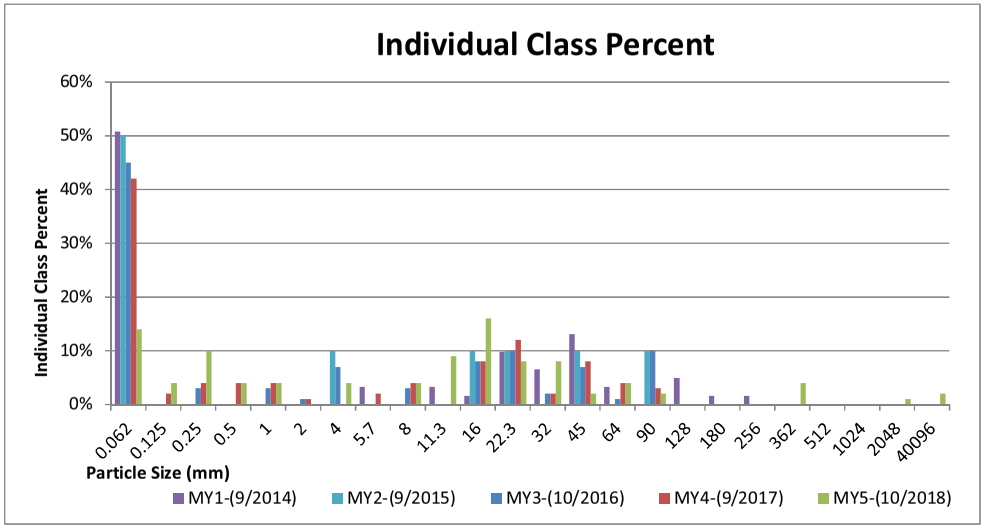


Appendix D: Stream Survey Data
Figure 5.4 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 5

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Pool (XS 4)					
			MY5-(10/2018)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	14	14%	14%
Sand	very fine sand	0.125	4	4%	18%
	fine sand	0.250	10	10%	28%
	medium sand	0.50	4	4%	32%
	coarse sand	1.00	4	4%	36%
	very coarse sand	2.0	0	0%	36%
Gravel	very fine gravel	4.0	4	4%	40%
	fine gravel	5.7	0	0%	40%
	fine gravel	8.0	4	4%	44%
	medium gravel	11.3	9	9%	53%
	medium gravel	16.0	16	16%	69%
	course gravel	22.3	8	8%	77%
	course gravel	32.0	8	8%	85%
	very coarse gravel	45	2	2%	87%
	very coarse gravel	64	4	4%	91%
Cobble	small cobble	90	2	2%	93%
	medium cobble	128	0	0%	93%
	large cobble	180	0	0%	93%
	very large cobble	256	0	0%	93%
Boulder	small boulder	362	4	4%	97%
	small boulder	512	0	0%	97%
	medium boulder	1024	0	0%	97%
	large boulder	2048	1	1%	98%
Bedrock	bedrock	40096	2	2%	100%
TOTAL % of whole count		-	100	100%	100%

Summary Data	
D50	10.2
D84	30.8
D95	309.0

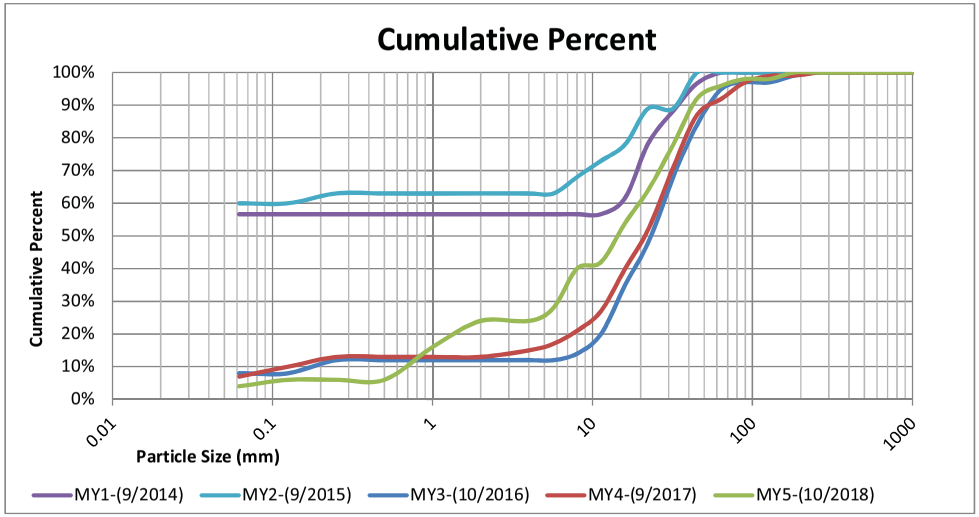


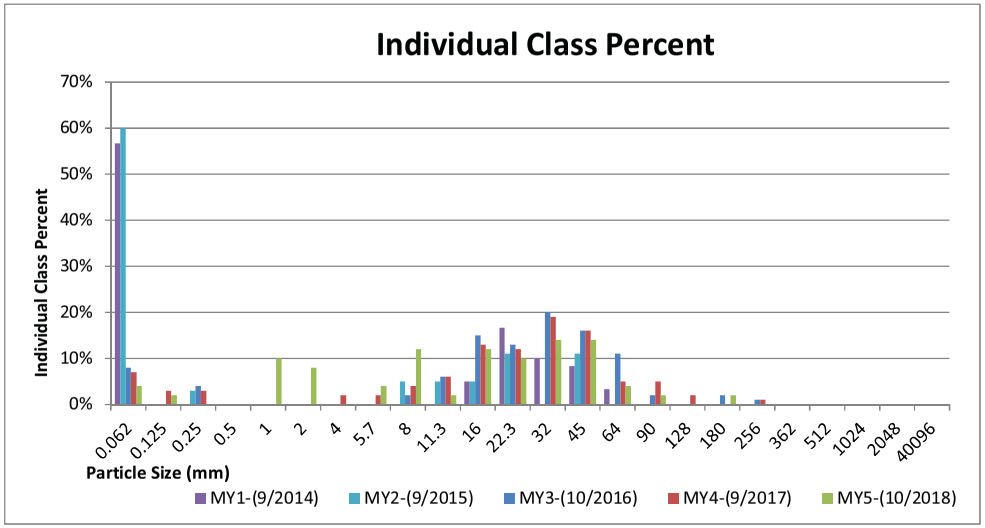


Appendix D: Stream Survey Data
Figure 5.5 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 5

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 6)					
			MY5-(10/2018)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	4	4%	4%
Sand	very fine sand	0.125	2	2%	6%
	fine sand	0.250	0	0%	6%
	medium sand	0.50	0	0%	6%
	coarse sand	1.00	10	10%	16%
	very coarse sand	2.0	8	8%	24%
Gravel	very fine gravel	4.0	0	0%	24%
	fine gravel	5.7	4	4%	28%
	fine gravel	8.0	12	12%	40%
	medium gravel	11.3	2	2%	42%
	medium gravel	16.0	12	12%	54%
	course gravel	22.3	10	10%	64%
	course gravel	32.0	14	14%	78%
	very coarse gravel	45	14	14%	92%
	very coarse gravel	64	4	4%	96%
Cobble	small cobble	90	2	2%	98%
	medium cobble	128	0	0%	98%
	large cobble	180	2	2%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count		-	100	100%	100%

Summary Data	
D50	14.4
D84	37.6
D95	59.3

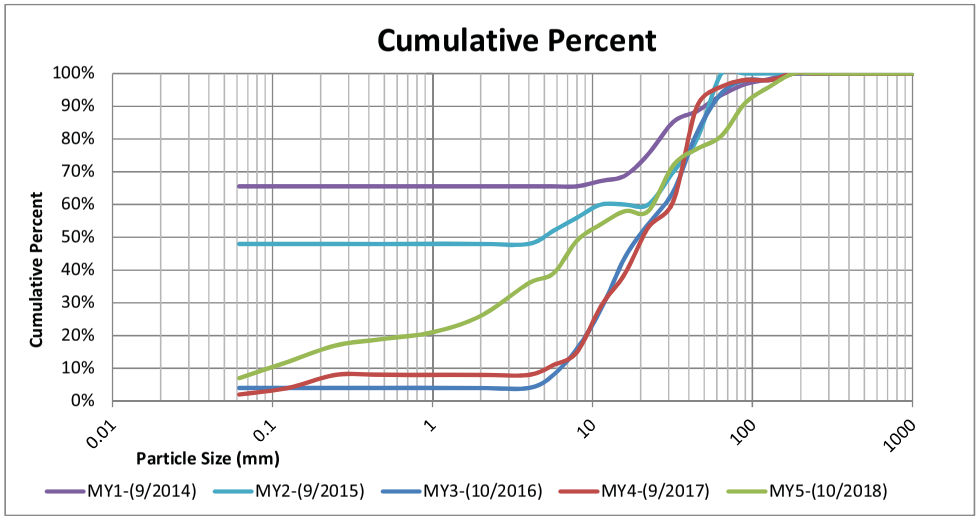


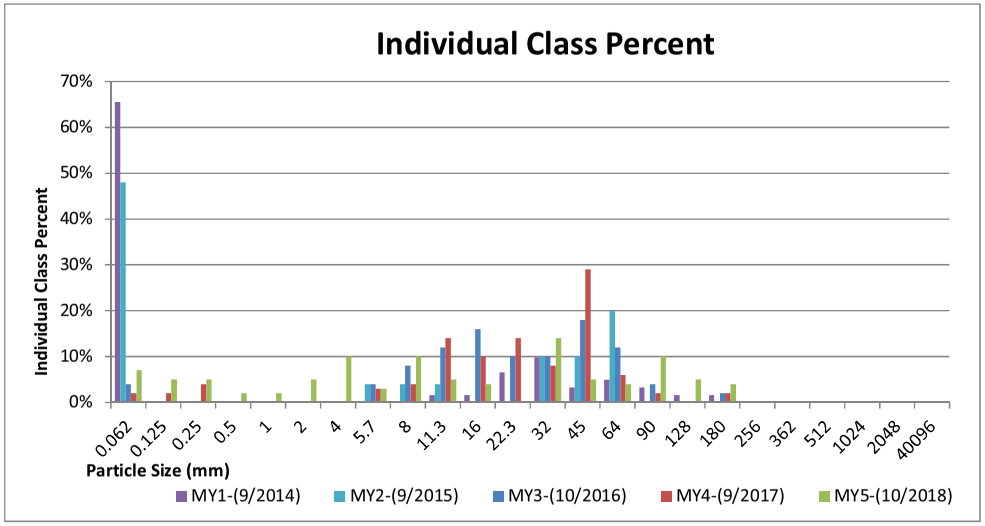


Appendix D: Stream Survey Data
Figure 5.6 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 5

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 8)					
			MY5-(10/2018)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	7	7%	7%
Sand	very fine sand	0.125	5	5%	12%
	fine sand	0.250	5	5%	17%
	medium sand	0.50	2	2%	19%
	coarse sand	1.00	2	2%	21%
	very coarse sand	2.0	5	5%	26%
Gravel	very fine gravel	4.0	10	10%	36%
	fine gravel	5.7	3	3%	39%
	fine gravel	8.0	10	10%	49%
	medium gravel	11.3	5	5%	54%
	medium gravel	16.0	4	4%	58%
	course gravel	22.3	0	0%	58%
	course gravel	32.0	14	14%	72%
	very coarse gravel	45	5	5%	77%
	very coarse gravel	64	4	4%	81%
Cobble	small cobble	90	10	10%	91%
	medium cobble	128	5	5%	96%
	large cobble	180	4	4%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count		-	100	100%	100%

Summary Data	
D50	8.7
D84	71.8
D95	120.4

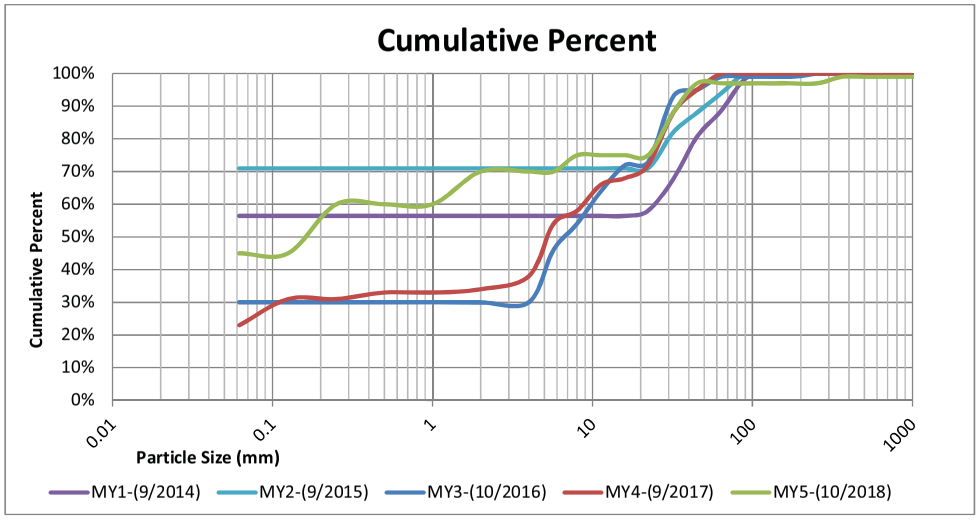


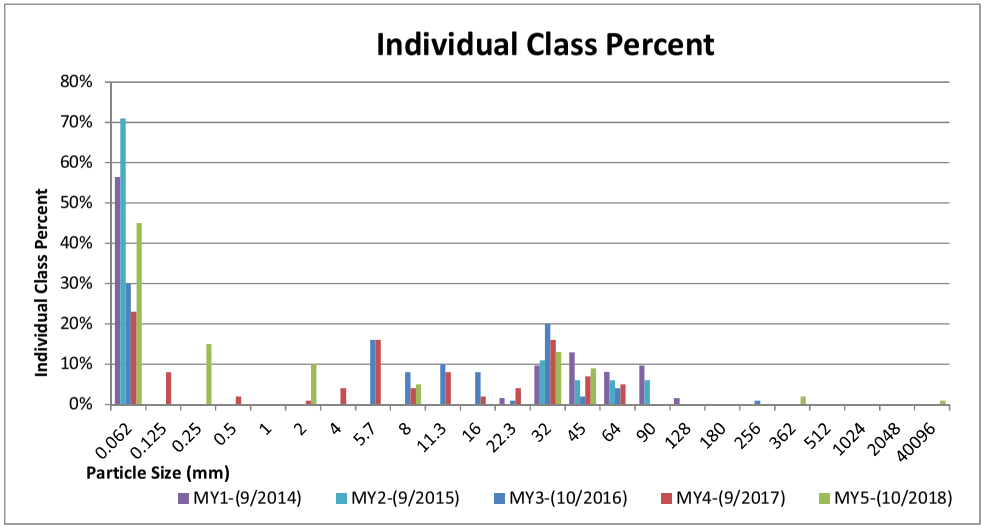


Appendix D: Stream Survey Data
Figure 5.7 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 5

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Pool (XS 9)					
			MY5-(10/2018)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	45	45%	45%
Sand	very fine sand	0.125	0	0%	45%
	fine sand	0.250	15	15%	60%
	medium sand	0.50	0	0%	60%
	coarse sand	1.00	0	0%	60%
	very coarse sand	2.0	10	10%	70%
Gravel	very fine gravel	4.0	0	0%	70%
	fine gravel	5.7	0	0%	70%
	fine gravel	8.0	5	5%	75%
	medium gravel	11.3	0	0%	75%
	medium gravel	16.0	0	0%	75%
	course gravel	22.3	0	0%	75%
	course gravel	32.0	13	13%	88%
	very coarse gravel	45	9	9%	97%
	very coarse gravel	64	0	0%	97%
Cobble	small cobble	90	0	0%	97%
	medium cobble	128	0	0%	97%
	large cobble	180	0	0%	97%
	very large cobble	256	0	0%	97%
Boulder	small boulder	362	2	2%	99%
	small boulder	512	0	0%	99%
	medium boulder	1024	0	0%	99%
	large boulder	2048	0	0%	99%
Bedrock	bedrock	40096	1	1%	100%
TOTAL % of whole count		-	100	100%	100%

Summary Data	
D50	0.2
D84	29.0
D95	42.1

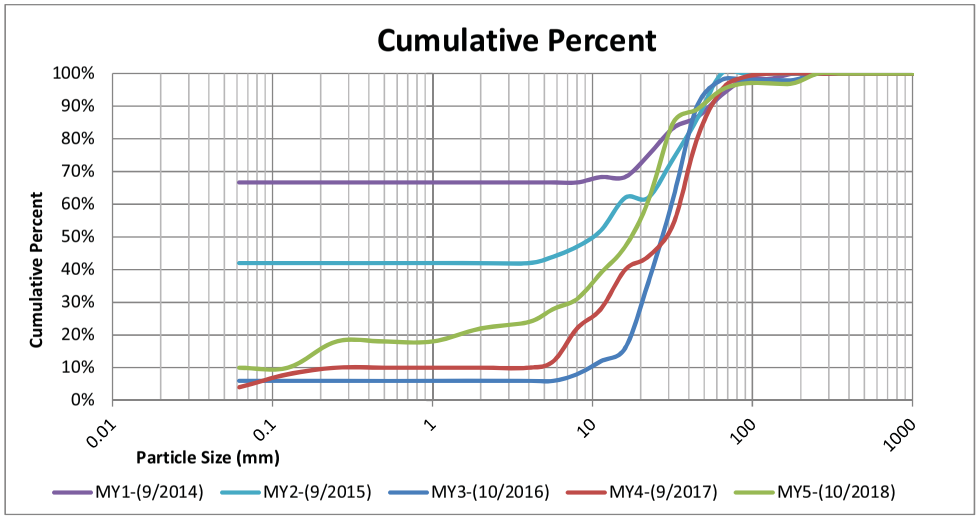


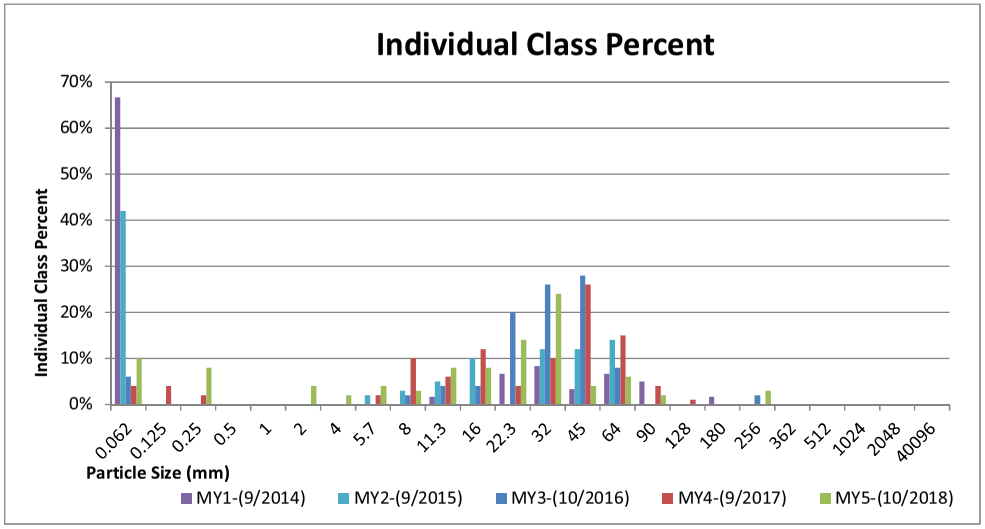


Appendix D: Stream Survey Data
Figure 5.8 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 5

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 10)					
			MY5-(10/2018)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	10	10%	10%
Sand	very fine sand	0.125	0	0%	10%
	fine sand	0.250	8	8%	18%
	medium sand	0.50	0	0%	18%
	coarse sand	1.00	0	0%	18%
	very coarse sand	2.0	4	4%	22%
Gravel	very fine gravel	4.0	2	2%	24%
	fine gravel	5.7	4	4%	28%
	fine gravel	8.0	3	3%	31%
	medium gravel	11.3	8	8%	39%
	medium gravel	16.0	8	8%	47%
	course gravel	22.3	14	14%	61%
	course gravel	32.0	24	24%	85%
	very coarse gravel	45	4	4%	89%
	very coarse gravel	64	6	6%	95%
Cobble	small cobble	90	2	2%	97%
	medium cobble	128	0	0%	97%
	large cobble	180	0	0%	97%
	very large cobble	256	3	3%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count		-	100	100%	100%

Summary Data	
D50	17.4
D84	31.6
D95	64.0

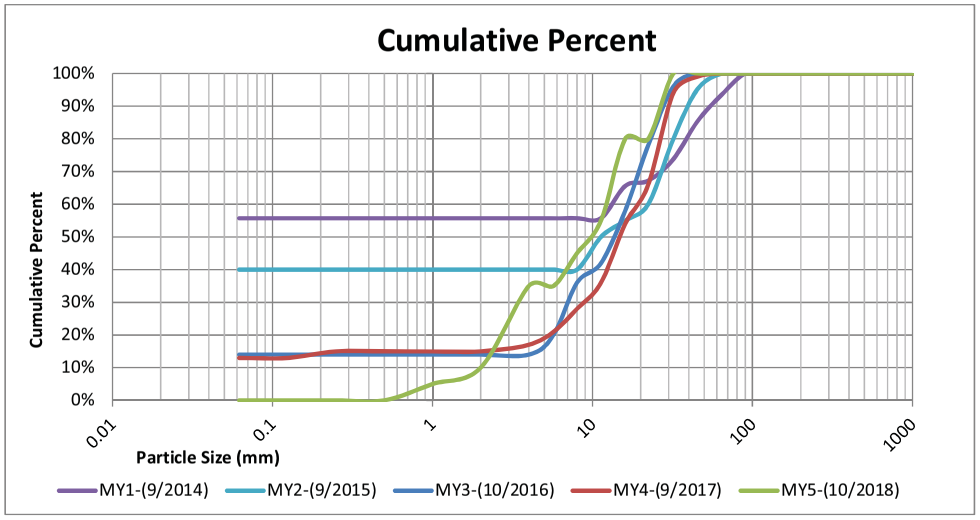


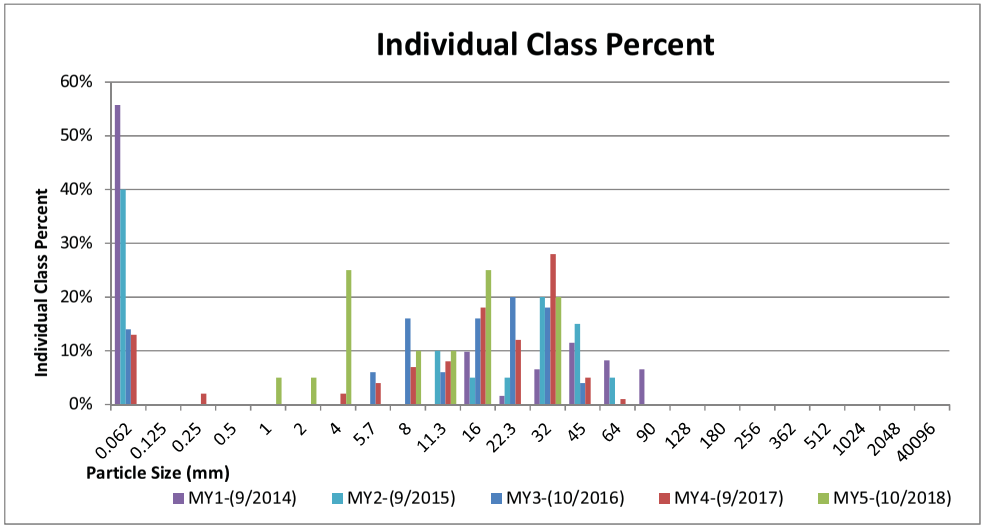


Appendix D: Stream Survey Data
Figure 5.9 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 5

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 12)					
			MY5-(10/2018)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	0	0%	0%
Sand	very fine sand	0.125	0	0%	0%
	fine sand	0.250	0	0%	0%
	medium sand	0.50	0	0%	0%
	coarse sand	1.00	5	5%	5%
	very coarse sand	2.0	5	5%	10%
Gravel	very fine gravel	4.0	25	25%	35%
	fine gravel	5.7	0	0%	35%
	fine gravel	8.0	10	10%	45%
	medium gravel	11.3	10	10%	55%
	medium gravel	16.0	25	25%	80%
	course gravel	22.3	0	0%	80%
	course gravel	32.0	20	20%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count		-	100	100%	100%

Summary Data	
D50	9.7
D84	24.2
D95	29.6

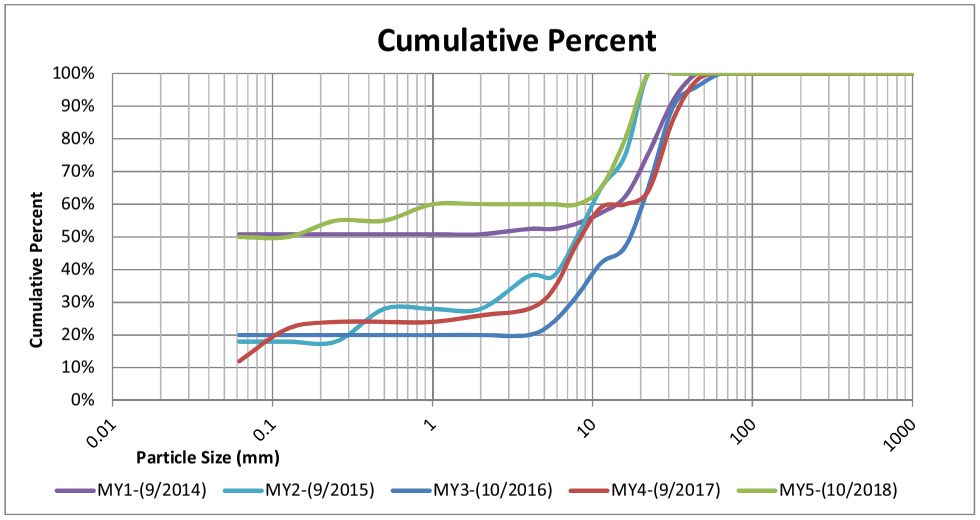


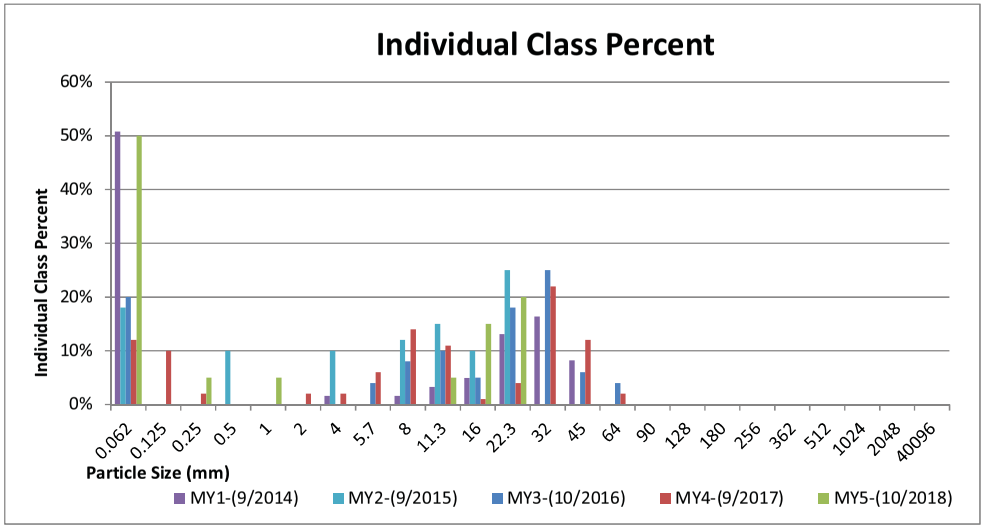


Appendix D: Stream Survey Data
Figure 5.10 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 5

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 14)					
			MY5-(10/2018)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	50	50%	50%
Sand	very fine sand	0.125	0	0%	50%
	fine sand	0.250	5	5%	55%
	medium sand	0.50	0	0%	55%
	coarse sand	1.00	5	5%	60%
	very coarse sand	2.0	0	0%	60%
Gravel	very fine gravel	4.0	0	0%	60%
	fine gravel	5.7	0	0%	60%
	fine gravel	8.0	0	0%	60%
	medium gravel	11.3	5	5%	65%
	medium gravel	16.0	15	15%	80%
	course gravel	22.3	20	20%	100%
	course gravel	32.0	0	0%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count		-	100	100%	100%

Summary Data	
D50	0.1
D84	17.3
D95	20.7

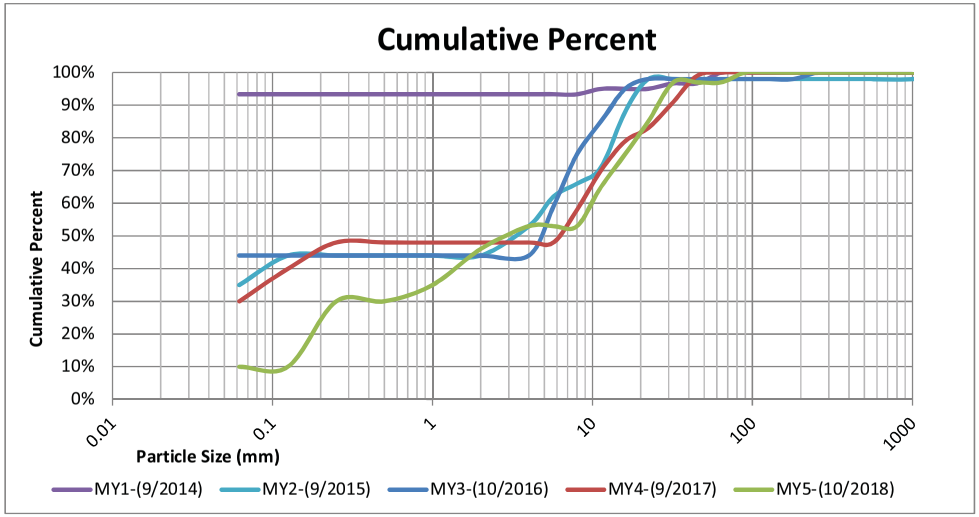


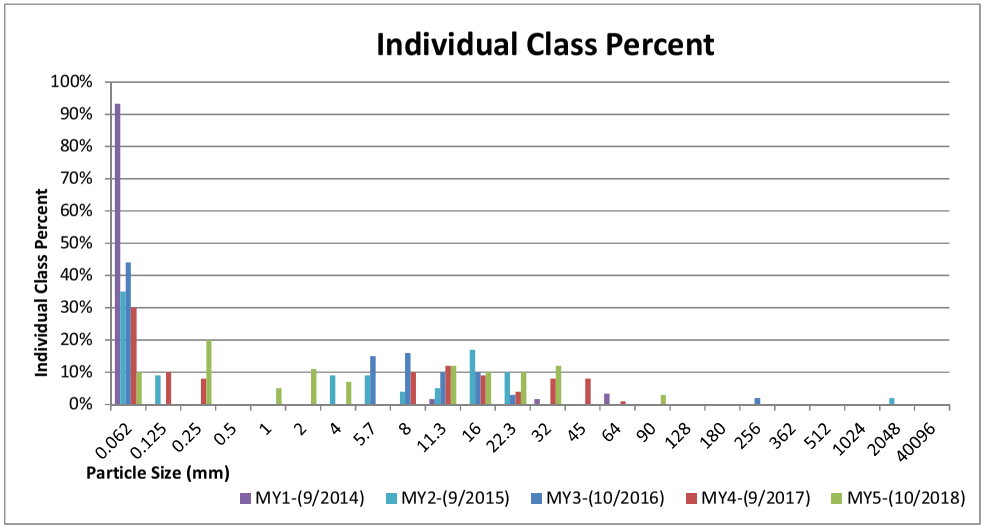


Appendix D: Stream Survey Data
Figure 5.11 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 5

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 16)					
			MY5-(10/2018)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	10	10%	10%
Sand	very fine sand	0.125	0	0%	10%
	fine sand	0.250	20	20%	30%
	medium sand	0.50	0	0%	30%
	coarse sand	1.00	5	5%	35%
	very coarse sand	2.0	11	11%	46%
Gravel	very fine gravel	4.0	7	7%	53%
	fine gravel	5.7	0	0%	53%
	fine gravel	8.0	0	0%	53%
	medium gravel	11.3	12	12%	65%
	medium gravel	16.0	10	10%	75%
	course gravel	22.3	10	10%	85%
	course gravel	32.0	12	12%	97%
	very coarse gravel	45	0	0%	97%
	very coarse gravel	64	0	0%	97%
Cobble	small cobble	90	3	3%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count		-	100	100%	100%

Summary Data	
D50	3.1
D84	21.7
D95	30.4

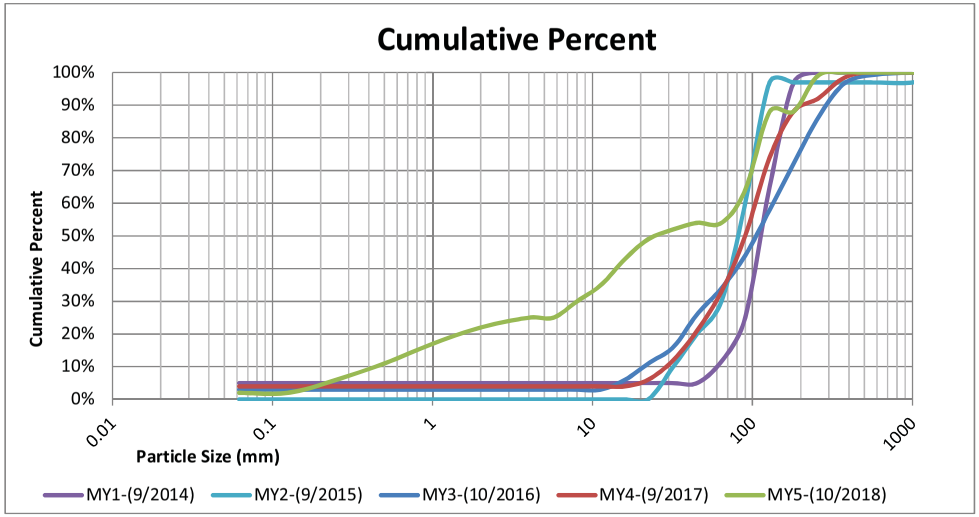


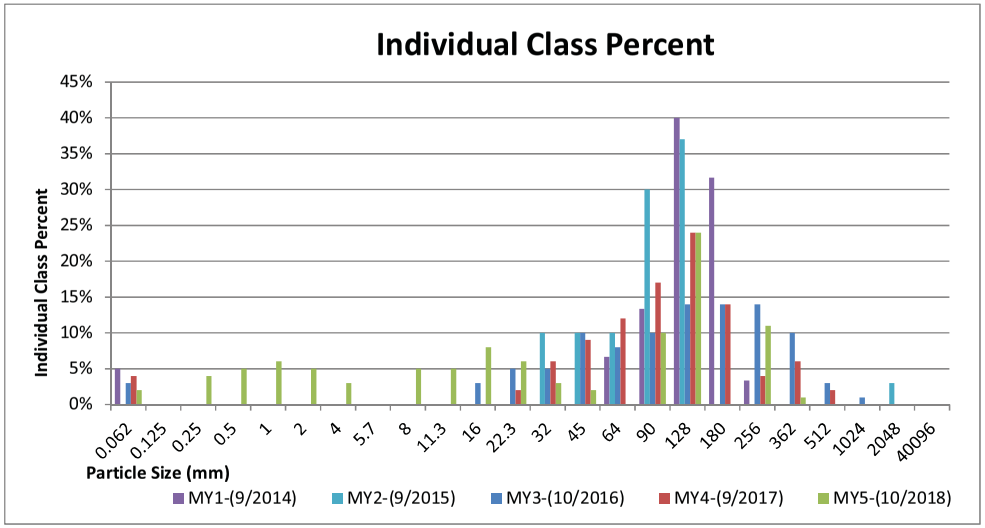


Appendix D: Stream Survey Data
Figure 5.12 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 5

Project Name: Heath Dairy					
Reach: West Branch to Back Creek					
Feature: Riffle (XS 19)					
			MY5-(10/2018)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	2	2%	2%
Sand	very fine sand	0.125	0	0%	2%
	fine sand	0.250	4	4%	6%
	medium sand	0.50	5	5%	11%
	coarse sand	1.00	6	6%	17%
	very coarse sand	2.0	5	5%	22%
Gravel	very fine gravel	4.0	3	3%	25%
	fine gravel	5.7	0	0%	25%
	fine gravel	8.0	5	5%	30%
	medium gravel	11.3	5	5%	35%
	medium gravel	16.0	8	8%	43%
	course gravel	22.3	6	6%	49%
	course gravel	32.0	3	3%	52%
	very coarse gravel	45	2	2%	54%
	very coarse gravel	64	0	0%	54%
Cobble	small cobble	90	10	10%	64%
	medium cobble	128	24	24%	88%
	large cobble	180	0	0%	88%
	very large cobble	256	11	11%	99%
Boulder	small boulder	362	1	1%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count		-	100	100%	100%

Summary Data	
D50	25.5
D84	121.7
D95	228.4

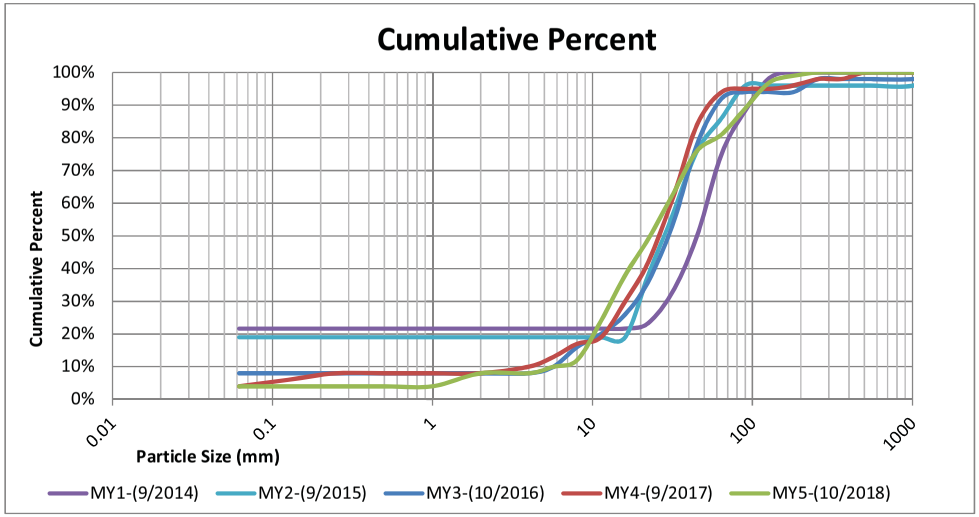


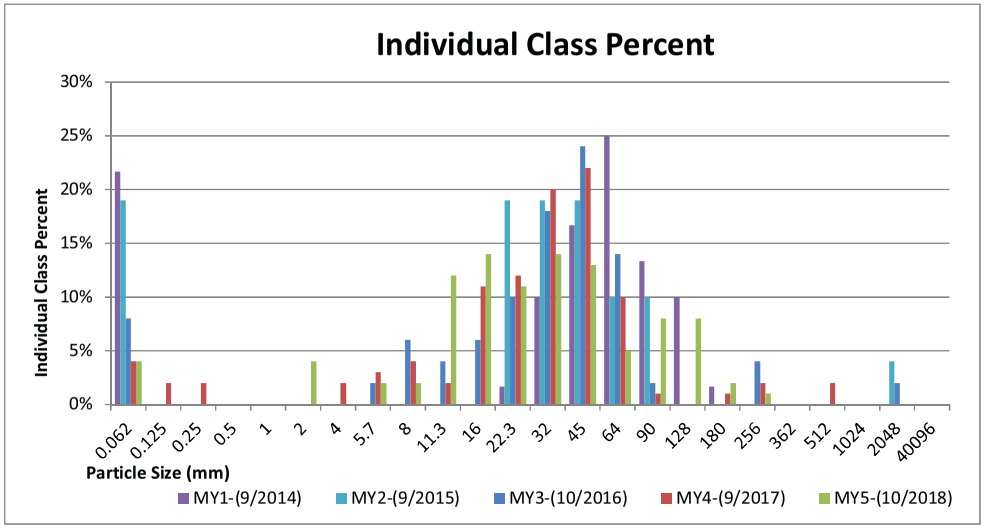


Appendix D: Stream Survey Data
Figure 5.13 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 5

Project Name: Heath Dairy					
Reach: West Branch to Back Creek					
Feature: Riffle (XS 20)					
			MY5-(10/2018)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	4	4%	4%
Sand	very fine sand	0.125	0	0%	4%
	fine sand	0.250	0	0%	4%
	medium sand	0.50	0	0%	4%
	coarse sand	1.00	0	0%	4%
	very coarse sand	2.0	4	4%	8%
Gravel	very fine gravel	4.0	0	0%	8%
	fine gravel	5.7	2	2%	10%
	fine gravel	8.0	2	2%	12%
	medium gravel	11.3	12	12%	24%
	medium gravel	16.0	14	14%	38%
	course gravel	22.3	11	11%	49%
	course gravel	32.0	14	14%	63%
	very coarse gravel	45	13	13%	76%
	very coarse gravel	64	5	5%	81%
Cobble	small cobble	90	8	8%	89%
	medium cobble	128	8	8%	97%
	large cobble	180	2	2%	99%
	very large cobble	256	1	1%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count		-	100	100%	100%

Summary Data	
D50	23.0
D84	73.8
D95	118.5

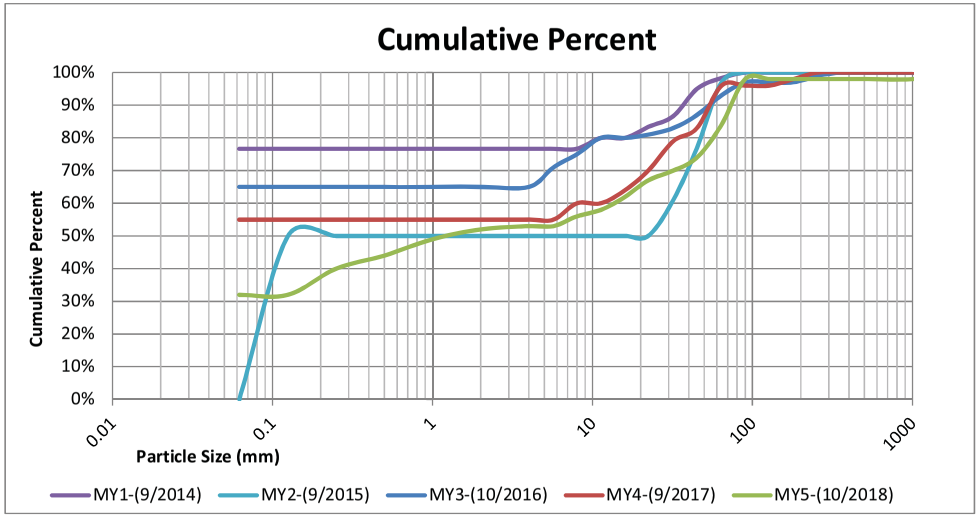


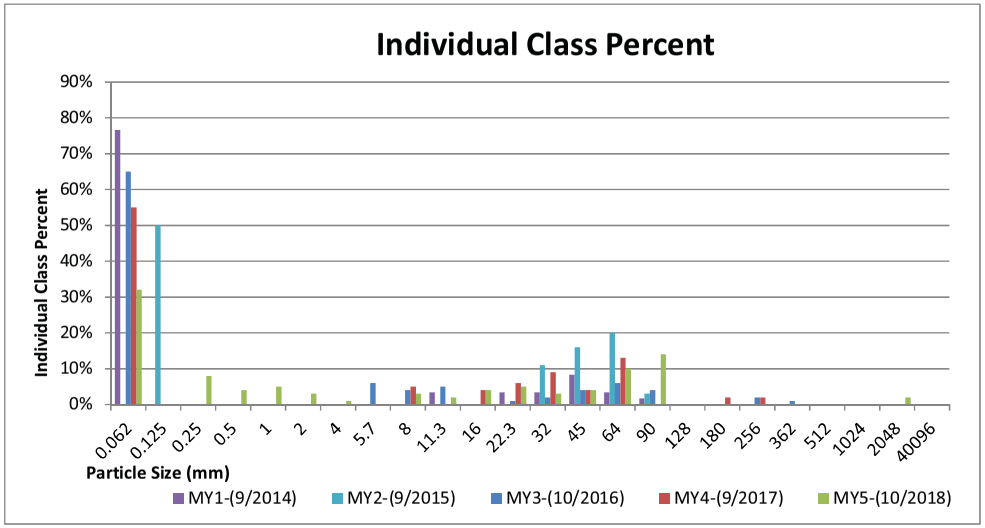


Appendix D: Stream Survey Data
Figure 5.14 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 5

Project Name: Heath Dairy					
Reach: West Branch to Back Creek					
Feature: Pool (XS 21)					
			MY5-(10/2018)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	32	32%	32%
Sand	very fine sand	0.125	0	0%	32%
	fine sand	0.250	8	8%	40%
	medium sand	0.50	4	4%	44%
	coarse sand	1.00	5	5%	49%
	very coarse sand	2.0	3	3%	52%
Gravel	very fine gravel	4.0	1	1%	53%
	fine gravel	5.7	0	0%	53%
	fine gravel	8.0	3	3%	56%
	medium gravel	11.3	2	2%	58%
	medium gravel	16.0	4	4%	62%
	course gravel	22.3	5	5%	67%
	course gravel	32.0	3	3%	70%
	very coarse gravel	45	4	4%	74%
	very coarse gravel	64	10	10%	84%
Cobble	small cobble	90	14	14%	98%
	medium cobble	128	0	0%	98%
	large cobble	180	0	0%	98%
	very large cobble	256	0	0%	98%
Boulder	small boulder	362	0	0%	98%
	small boulder	512	0	0%	98%
	medium boulder	1024	0	0%	98%
	large boulder	2048	2	2%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count		-	100	100%	100%

Summary Data	
D50	1.3
D84	64.0
D95	84.4

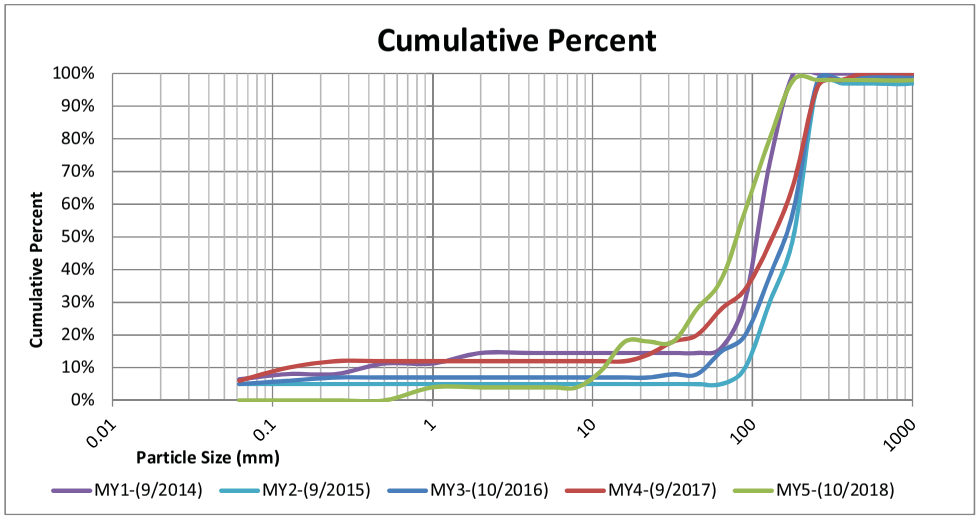


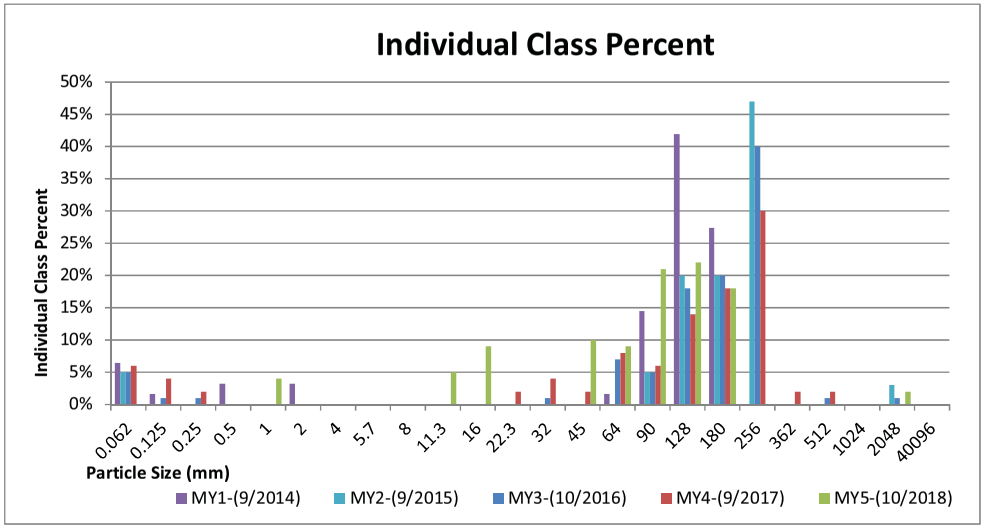


Appendix D: Stream Survey Data
Figure 5.15 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 5

Project Name: Heath Dairy					
Reach: West Branch to Back Creek					
Feature: Riffle (XS 22)					
			MY5-(10/2018)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	0	0%	0%
Sand	very fine sand	0.125	0	0%	0%
	fine sand	0.250	0	0%	0%
	medium sand	0.50	0	0%	0%
	coarse sand	1.00	4	4%	4%
	very coarse sand	2.0	0	0%	4%
Gravel	very fine gravel	4.0	0	0%	4%
	fine gravel	5.7	0	0%	4%
	fine gravel	8.0	0	0%	4%
	medium gravel	11.3	5	5%	9%
	medium gravel	16.0	9	9%	18%
	course gravel	22.3	0	0%	18%
	course gravel	32.0	0	0%	18%
	very coarse gravel	45	10	10%	28%
	very coarse gravel	64	9	9%	37%
Cobble	small cobble	90	21	21%	58%
	medium cobble	128	22	22%	80%
	large cobble	180	18	18%	98%
	very large cobble	256	0	0%	98%
Boulder	small boulder	362	0	0%	98%
	small boulder	512	0	0%	98%
	medium boulder	1024	0	0%	98%
	large boulder	2048	2	2%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count		-	100	100%	100%

Summary Data	
D50	80.1
D84	139.6
D95	171.3

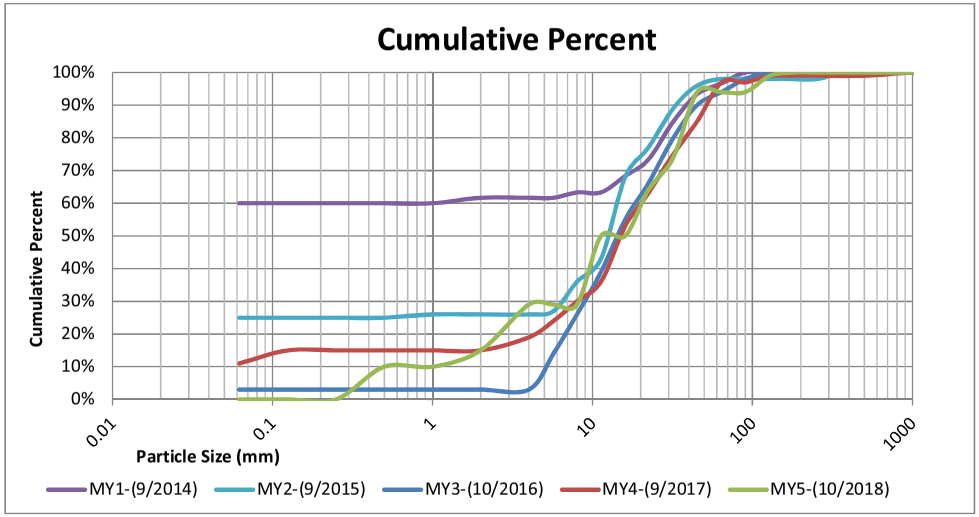


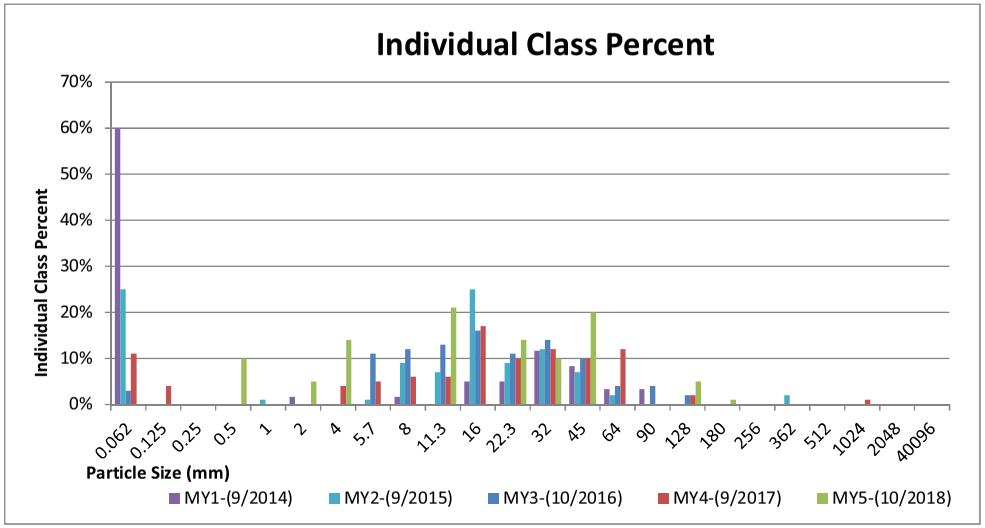


Appendix D: Stream Survey Data
Figure 5.16 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 5

Project Name: Heath Dairy					
Reach: North Branch to Back Creek					
Feature: Riffle (XS 24)					
			MY5-(10/2018)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	0	0%	0%
Sand	very fine sand	0.125	0	0%	0%
	fine sand	0.250	0	0%	0%
	medium sand	0.50	10	10%	10%
	coarse sand	1.00	0	0%	10%
	very coarse sand	2.0	5	5%	15%
Gravel	very fine gravel	4.0	14	14%	29%
	fine gravel	5.7	0	0%	29%
	fine gravel	8.0	0	0%	29%
	medium gravel	11.3	21	21%	50%
	medium gravel	16.0	0	0%	50%
	course gravel	22.3	14	14%	64%
	course gravel	32.0	10	10%	74%
	very coarse gravel	45	20	20%	94%
	very coarse gravel	64	0	0%	94%
Cobble	small cobble	90	0	0%	94%
	medium cobble	128	5	5%	99%
	large cobble	180	1	1%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count		-	100	100%	100%

Summary Data	
D50	11.3
D84	38.5
D95	97.6

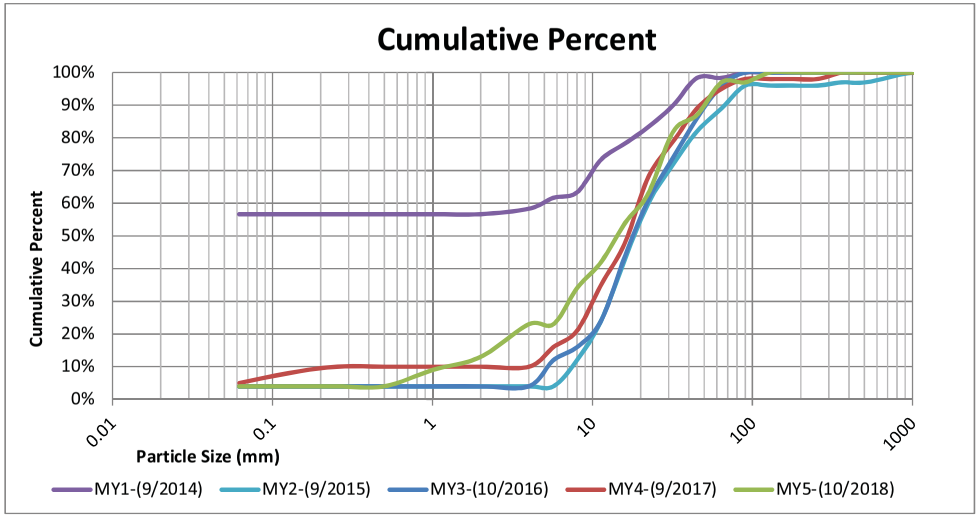


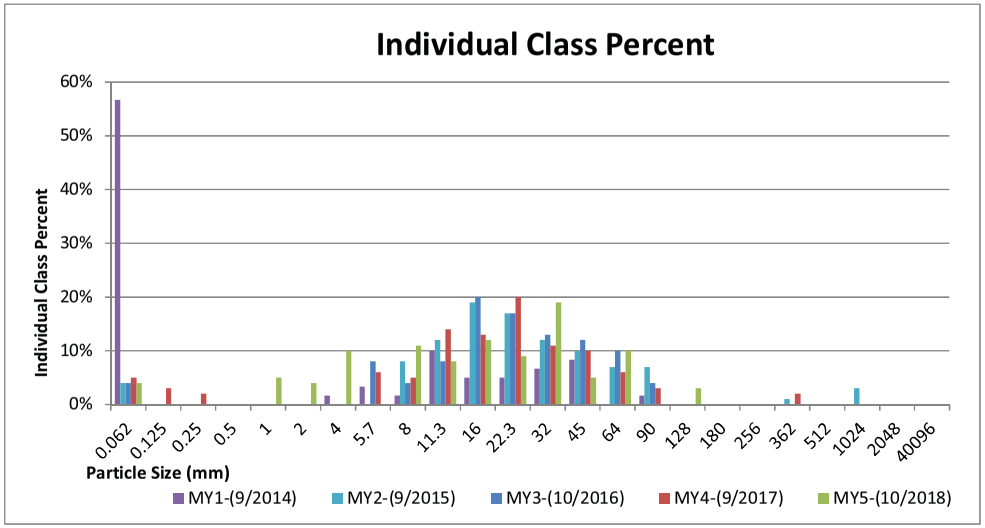


Appendix D: Stream Survey Data
Figure 5.17 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 5

Project Name: Heath Dairy					
Reach: North Branch to Back Creek					
Feature: Riffle (XS 25)					
			MY5-(10/2018)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	4	4%	4%
Sand	very fine sand	0.125	0	0%	4%
	fine sand	0.250	0	0%	4%
	medium sand	0.50	0	0%	4%
	coarse sand	1.00	5	5%	9%
	very coarse sand	2.0	4	4%	13%
Gravel	very fine gravel	4.0	10	10%	23%
	fine gravel	5.7	0	0%	23%
	fine gravel	8.0	11	11%	34%
	medium gravel	11.3	8	8%	42%
	medium gravel	16.0	12	12%	54%
	course gravel	22.3	9	9%	63%
	course gravel	32.0	19	19%	82%
	very coarse gravel	45	5	5%	87%
	very coarse gravel	64	10	10%	97%
Cobble	small cobble	90	0	0%	97%
	medium cobble	128	3	3%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count		-	100	100%	100%

Summary Data	
D50	14.4
D84	37.2
D95	60.2

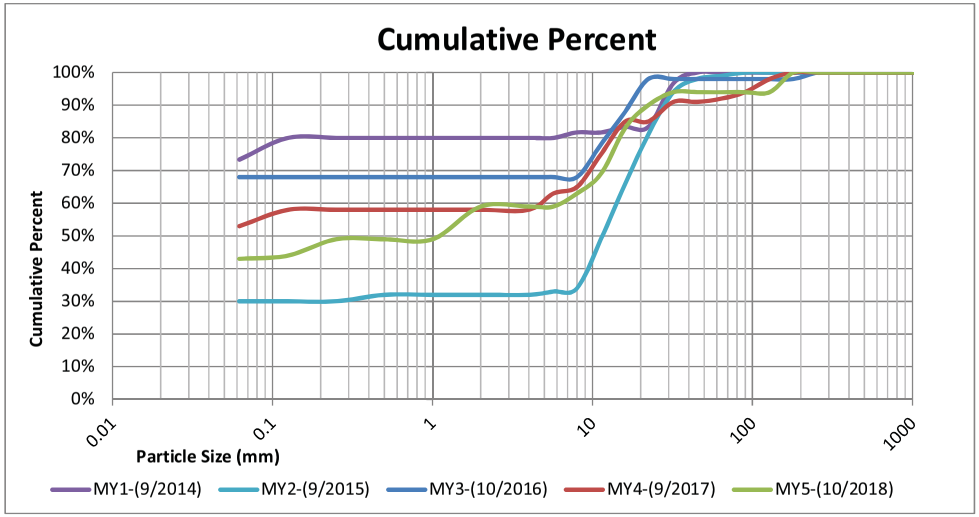


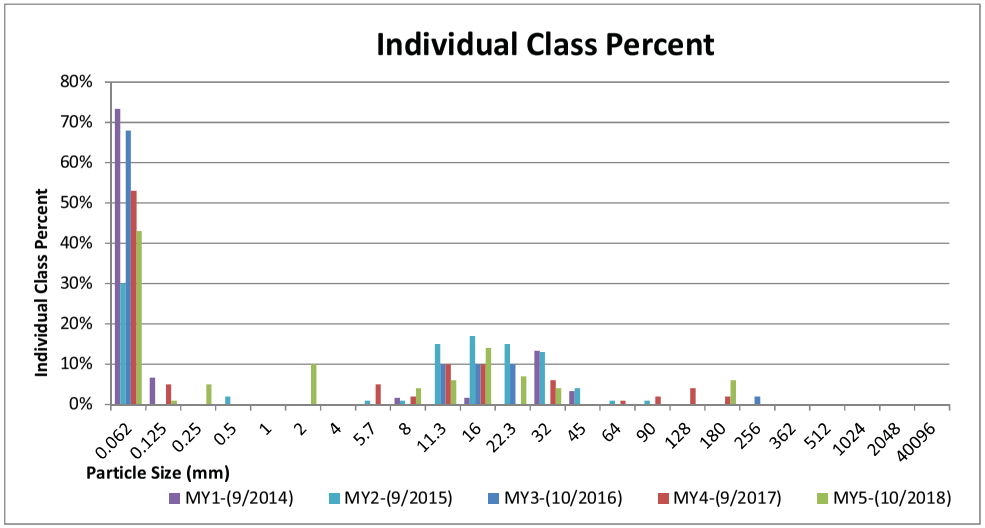


Appendix D: Stream Survey Data
Figure 5.18 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 5

Project Name: Heath Dairy					
Reach: East Branch to Back Creek					
Feature: Pool (XS 26)					
			MY5-(10/2018)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	43	43%	43%
Sand	very fine sand	0.125	1	1%	44%
	fine sand	0.250	5	5%	49%
	medium sand	0.50	0	0%	49%
	coarse sand	1.00	0	0%	49%
	very coarse sand	2.0	10	10%	59%
Gravel	very fine gravel	4.0	0	0%	59%
	fine gravel	5.7	0	0%	59%
	fine gravel	8.0	4	4%	63%
	medium gravel	11.3	6	6%	69%
	medium gravel	16.0	14	14%	83%
	course gravel	22.3	7	7%	90%
	course gravel	32.0	4	4%	94%
	very coarse gravel	45	0	0%	94%
	very coarse gravel	64	0	0%	94%
Cobble	small cobble	90	0	0%	94%
	medium cobble	128	0	0%	94%
	large cobble	180	6	6%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count		-	100	100%	100%

Summary Data	
D50	1.1
D84	16.9
D95	136.7

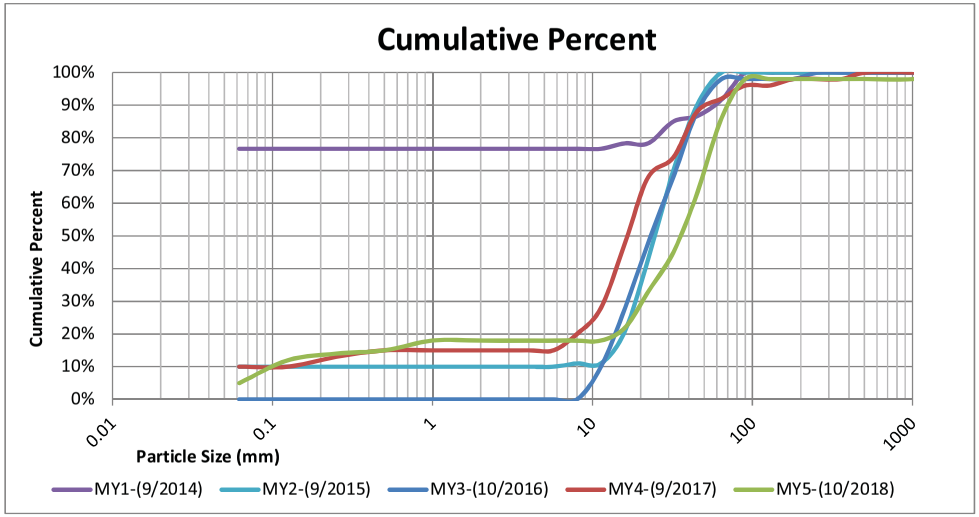


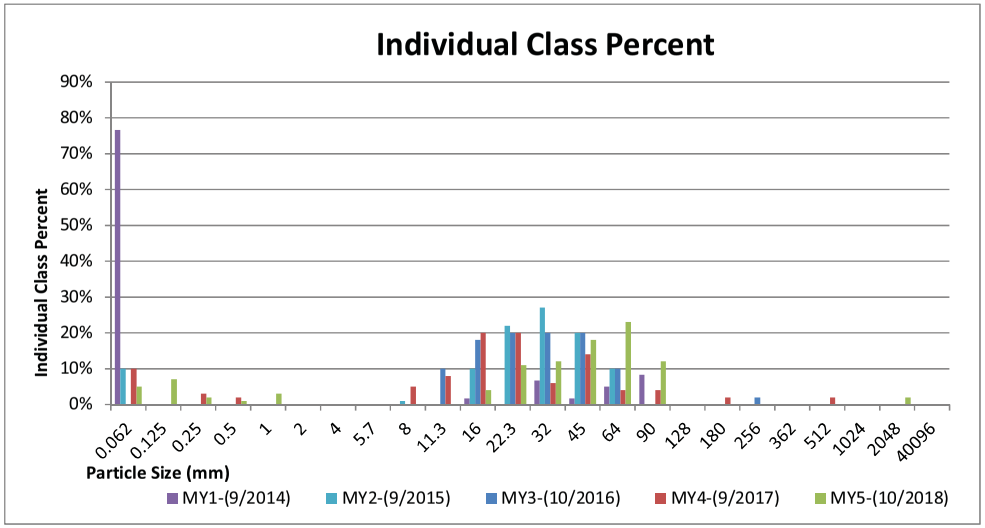


Appendix D: Stream Survey Data
Figure 5.19 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 5

Project Name: Heath Dairy					
Reach: East Branch to Back Creek					
Feature: Riffle (XS 27)					
			MY5-(10/2018)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	5	5%	5%
Sand	very fine sand	0.125	7	7%	12%
	fine sand	0.250	2	2%	14%
	medium sand	0.50	1	1%	15%
	coarse sand	1.00	3	3%	18%
	very coarse sand	2.0	0	0%	18%
Gravel	very fine gravel	4.0	0	0%	18%
	fine gravel	5.7	0	0%	18%
	fine gravel	8.0	0	0%	18%
	medium gravel	11.3	0	0%	18%
	medium gravel	16.0	4	4%	22%
	course gravel	22.3	11	11%	33%
	course gravel	32.0	12	12%	45%
	very coarse gravel	45	18	18%	63%
	very coarse gravel	64	23	23%	86%
Cobble	small cobble	90	12	12%	98%
	medium cobble	128	0	0%	98%
	large cobble	180	0	0%	98%
	very large cobble	256	0	0%	98%
Boulder	small boulder	362	0	0%	98%
	small boulder	512	0	0%	98%
	medium boulder	1024	0	0%	98%
	large boulder	2048	2	2%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count		-	100	100%	100%

Summary Data	
D50	35.6
D84	62.3
D95	83.5

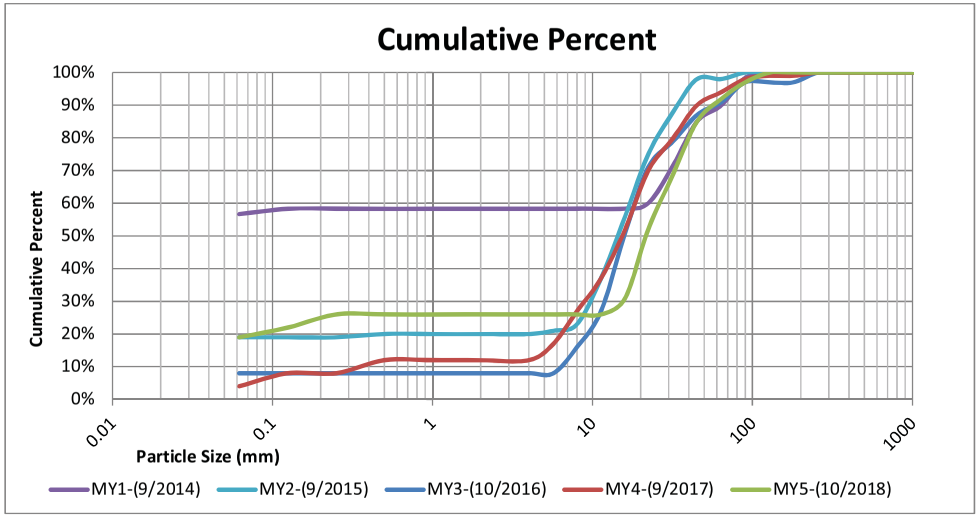




Appendix D: Stream Survey Data
Figure 5.20 Pebble Count Plots with Annual Overlays
Heath Dairy Stream Restoration/DMS Project No. 170
Monitoring Year 5

Project Name: Heath Dairy					
Reach: East Branch to Back Creek					
Feature: Riffle (XS 28)					
			MY5-(10/2018)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	19	19%	19%
Sand	very fine sand	0.125	3	3%	22%
	fine sand	0.250	4	4%	26%
	medium sand	0.50	0	0%	26%
	coarse sand	1.00	0	0%	26%
	very coarse sand	2.0	0	0%	26%
Gravel	very fine gravel	4.0	0	0%	26%
	fine gravel	5.7	0	0%	26%
	fine gravel	8.0	0	0%	26%
	medium gravel	11.3	0	0%	26%
	medium gravel	16.0	5	5%	31%
	course gravel	22.3	21	21%	52%
	course gravel	32.0	17	17%	69%
	very coarse gravel	45	16	16%	85%
	very coarse gravel	64	7	7%	92%
Cobble	small cobble	90	5	5%	97%
	medium cobble	128	3	3%	100%
	large cobble	180	0	0%	100%
	very large cobble	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count		-	100	100%	100%

Summary Data	
D50	21.7
D84	44.2
D95	79.6



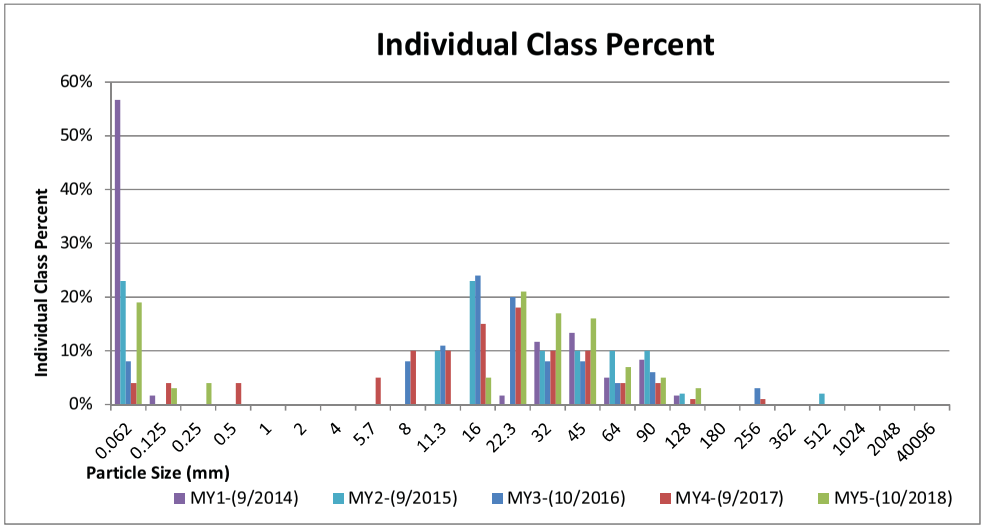


Table 9.1 Baseline Stream Data Summary

	Existing Conditions	Reference Reach	Design			Existing Conditions	Reference Reach	Design	Reference Reach	Design	
Stream Reach	**Back Creek Upper**	**Fork Creek**	**Back Cr. Reach 1***	**Back Cr. Reach 2***	**Back Cr. Reach 3***	**Back Creek Lower**	**UT to Polecat Cr.**	**Back Creek Reach 4***	**Fork Creek**	**Back Cr. Reach 4b***	**Back Cr. Reach 5***
Stream Type	G4	B4c	B4c	B4c	B4c	E4	E4	E4	B4c	B4c	B4c
Drainage Area (mi^2)	0.94	2.2	1.04	1.08	1.22	2.5	0.4	1.3	2.2	1.34	2.69
Bankfull Width (ft)	10.1	20.1	16.5	16.6	17.5	13.8	9.4	16.5	20.1	17.5	22.5
Mean Depth (ft)	1.68	1.73	1.2	1.2	1.3	3.07	1.13	1.4	1.73	1.2	1.6
Bankfull XS_{AREA} (ft^2)	17	34.8	19	19	22	42.3	10.6	23	34.8	22	36
Bankfull Discharge (cfs)	75	163	86	88	101	167	37.4	101	163	101	174
Bkf Mean Velocity (ft/s)	4.4	4.7	4.5	4.5	4.5	3.9	3.5	3	4.7	3	4.5
Width/Depth Ratio	6	12	14	14	14	4.5	8.3	12	12	14	14
Max. Riffle Depth (ft)	2.4	2	1.6	1.6	1.7	4.1	1.6	2	2	1.7	2.2
Riffle Depth Ratio	1.4	1.2	1.3	1.3	1.3	1.3	1.4	1.45	1.2	1.4	1.4
Max. Pool Depth (ft)	2.8	2.6	2.4	2.5	2.6	5	1.6	3.5	2.6	2.6	3.3
Pool Depth Ratio	1.7	1.5	2	2	2	1.6	1.8	2.2	1.5	2.1	2.1
Flood Prone Width (ft)	29	63	30 – 45	28 – 77	34 – 120	200	50	200	63	35	45
Entrenchment Ratio	1.4 – 4.5	2.7 – 3.1	1.9 – 2.9	1.7 – 4.8	2.0 – 7.0	14.5	5.3	12.5	2.7 – 3.1	2	2
Bank Height Ratio	1.4 – 2.3	1.2	1	1	1	1.5	1.2	1	1.2	1	1
Meander Length (ft)	190	37 – 172	110 – 120	125 – 145	130 – 145	160	56 – 85	135 – 155	37 – 172	115	145
Meander Length Ratio	19	1.8 – 8.6	7.1 – 7.7	7.8 – 9.1	7.6 – 8.5	12	6 – 9	8.4 – 9.7	1.8 – 8.6	6.6	6.6
Radius of Curvature (ft)	18	47 – 318	31 – 46	32 – 48	34 – 51	15	19 – 50	32 – 48	47 – 318	35 – 52	44 – 66
Rc Ratio	1.8	2.3 – 16	2 – 3	2 – 3	2 – 3	1.1	2.0 – 5.3	2 – 3	2.3 – 16	2 – 3	2 – 3
Belt Width (ft)	25	33 – 40	30 – 35	40 – 50	45 – 60	23	28 – 50	90	33 – 40	40	60
Meander Width Ratio	2.5	1.6 – 2.0	1.9 – 2.2	2.5 – 3.1	2.6 – 3.5	1.7	3.0 – 5.3	5.6	1.6 – 2.0	2.3	2.7
Sinuosity	1	1.05	1.1	1.1	1.1	1	1.4	1.3	1.05	1.1	1.1
Channel Slope (ft/ft)	0.0087	0.0079	0.006	0.0062	0.0062	0.0045	0.012	0.0023	0.0079	0.0095	0.0095
Valley Slope (ft/ft)	0.0087	0.0083	0.0066	0.0068	0.0068	0.0045	0.017	0.003	0.0083	0.0105	0.0105
Riffle Slope (ft/ft)	0.023	0.013	0.006	0.0062	0.0062	0.0037	0.027	0.0023	0.013	0.0095	0.0095
Riffle Slope Ratio	2.6	0.1	1	1	1	0.8	2.3	1	0.1	1	1
Pool Slope (ft/ft)	0	0.001	0	0	0	0	0.017	0	0.001	0	0
Pool Slope Ratio	0	0.1	0	0	0	0	1.4	0	0.1	0	0
Pool Width (ft)	7.8	19.9	18.1	18.3	19.2	13.4	7.1	18.1	19.9	19.2	24.7
Pool Width Ratio	0.8	1	1.1	1.1	1.1	1	0.8	1.1	1	1.1	1.1
Pool Spacing (ft)	57.6	71 – 134	66 – 99	66 – 99	70 – 105	43	34 – 52	66 – 99	71 – 134	70 – 105	90 – 135
Pool Spacing Ratio	5.7	3.5 – 6.7	6-Apr	4 – 6	4 – 6	3.1	3.6 – 5.5	4 – 6	3.5 – 6.7	4 – 6	4 – 6
D_{50} (mm)	25	28	25	25	25	25	15	25	28	25	25
D_{84} (mm)	63	81	63	63	63	81	91	81	81	81	81

Table 9.2 Baseline Stream Data Summary

	Existing Conditions	Reference Reach	Design	Existing Conditions	Reference Reach	Design	Existing Conditions	Reference Reach	Design		
Stream Reach	**North Branch**	**Fork Creek**	**North Branch**	**East Branch**	**Fork Creek**	**East Branch**	**West Branch**	**Fork Creek**	**West Branch Reach 1***	**West Branch Reach 2***	**West Branch Reach 3***
Stream Type	E4	B4c	B4c	G4	B4c	B4c	G4	B4c	B4c	B4c	B4c
Drainage Area (mi^2)	2.5	2.2	1.14	0.05	2.2	0.25	0.05	2.2	0.05	0.06	0.14
Bankfull Width (ft)	13.8	20.1	16.5	5	20.1	10	5	20.1	5.8	6.2	8.2
Mean Depth (ft)	3.07	1.73	1.2	0.62	1.73	0.7	0.62	1.73	0.4	0.44	0.6
Bankfull XS_{AREA} (ft^2)	42.3	34.8	20	3.1	34.8	7	3.1	34.8	2.4	2.7	4.7
Bankfull Discharge (cfs)	167	163	92	8.5	163	30	8.5	163	9	10	19
Bkf Mean Velocity (ft/s)	3.9	4.7	4.5	2.7	4.7	4.5	2.7	4.7	4.5	4.5	4.5
Width/Depth Ratio	4.5	12	13	8	12	14	8	12	14	14	14
Max. Riffle Depth (ft)	4.1	2	1.7	0.8	2	1	0.8	2	0.55	0.6	0.8
Riffle Depth Ratio	1.3	1.2	1.4	1.3	1.2	1.4	1.3	1.2	1.38	1.36	1.36
Max. Pool Depth (ft)	5	2.6	2.6	1.4	2.6	1.5	1.4	2.6	0.8	0.9	1
Pool Depth Ratio	1.6	1.5	2.1	2.3	1.5	2.1	2.3	1.5	2	2	2
Flood Prone Width (ft)	200	63	40 – 57	5.8	63	26 – 42	5.8	63	12 – 22	12 – 30	16
Entrenchment Ratio	14.5	2.7 – 3.1	2.4 – 3.4	1.2	2.7 – 3.1	2.7 – 4.4	1.2	2.7 – 3.1	2.0 – 3.8	2.0 – 4.8	2
Bank Height Ratio	1.5	1.2	1	2.6	1.2	1	2.6	1.2	1	1	1
Meander Length (ft)	55	37 – 172	150 – 160	80	37 – 172	90	60 – 120	37 – 172	50 – 55	50 – 60	60 – 70
Meander Length Ratio	4	1.8 – 8.6	9.1 – 9.7	16	1.8 – 8.6	9.5	12 – 24	1.8 – 8.6	8.6 – 9.5	8.1 – 9.7	7.3 – 8.5
Radius of Curvature (ft)	13	47 – 318	33 – 49	9 – 43	47 – 318	21 – 31	9 – 43	47 – 318	12 – 17	12 – 19	16 – 25
Rc Ratio	1	2.3 – 16	2 – 3	1.8 – 8.6	2.3 – 16	2 – 3	1.8 – 8.6	2.3 – 16	2 – 3	2 – 3	2 – 3
Belt Width (ft)	35	33 – 40	40 – 50	16	33 – 40	25	20	33 – 40	15 – 20	15 – 20	25 – 30
Meander Width Ratio	2.5	1.6 – 2.0	2.4 – 3.0	3.2	1.6 – 2.0	2.6	4	1.6 – 2.0	2.6 – 3.4	2.4 – 3.2	3.1 – 3.7
Sinuosity	1	1.05	1.1	1.05	1.05	1.1	1.07	1.05	1.1	1.2	1.1
Channel Slope (ft/ft)	0.0045	0.0079	0.0036	0.011	0.0079	0.008	0.011	0.0079	0.0128	0.0174	0.00108
Valley Slope (ft/ft)	0.0045	0.0083	0.004	0.012	0.0083	0.0088	0.019	0.0083	0.0141	0.0209	0.00119
Riffle Slope (ft/ft)	0.0037	0.013	0.0036	0.31	0.013	0.008	0.31	0.013	0.0128	0.0174	0.0108
Riffle Slope Ratio	0.8	0.1	1	28	0.1	1	28	0.1	1	1	1
Pool Slope (ft/ft)	0	0.001	0	0	0.001	0	0	0.001	0	0	0
Pool Slope Ratio	0	0.1	0	0	0.1	0	0	0.1	0	0	0
Pool Width (ft)	13.4	19.9	16.5	4.4	19.9	11	4.4	19.9	6.4	6.8	9
Pool Width Ratio	1	1	1	0.9	1	1.1	0.9	1	1.1	1.1	1.1
Pool Spacing (ft)	43	71 – 134	66 – 99	9 – 45	71 – 134	40 – 60	9 – 45	71 – 134	23 – 35	25 – 37	32 – 49
Pool Spacing Ratio	3.1	3.5 – 6.7	4 – 6	2 – 9	3.5 – 6.7	4 – 6	2 – 9	3.5 – 6.7	4 – 6	4 – 6	4 – 6
D_{50} (mm)	25	28	25	9	28	25	9	28	9	9	9
D_{84} (mm)	81	81	81	19	81	81	19	81	19	19	19

Table 10.1 Monitoring – Cross Section Morphology

Morphology and Hydraulic Monitoring Summary (Dimensional Parameters – Cross Sections)

Heath Dairy Road Stream Restoration/DMS # 170 Segment/Reach: Back Creek XS1 - 10

	Cross Section 1 (Pool)							Cross Section 2 (Riffle)							Cross Section 3 (Riffle)							Cross Section 4 (Pool)							Cross Section 5 (Pool)						
Based on fixed baseline bankfull elevation	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	21.8	14.3	17.7	20.3	20.8	22.2		16.9	13.8	15.6	16.7	17.0	17.6		15.3	13.6	29.6	34.8	15.3	13.6		15.0	20.2	17.8	19.0	15.0	16.2		18.3	16.2	14.5	14.9	14.4	12.3	
Floodprone Width (ft)	32.0	32.0	32.0	32.0	32.0	32.0		26.0	25.3	26.0	26.0	26.0	26.0		100.0	100.0	100.0	100.0	100.0	100.0		100.0	100.0	100.0	100.0	100.0	100.0		50.0	50.0	50.0	50.0	50.0	50.0	
Bankfull Mean Depth (ft)	1.5	1.1	1.3	1.3	1.4	1.4		1.0	0.8	0.9	1.0	0.9	1.0		1.6	1.6	1.1	1.0	2.0	1.8		1.7	1.9	1.7	1.5	1.6	1.6		1.6	2.2	2.0	2.1	2.3	2.4	
Bankfull Max Depth (ft)	2.4	1.5	1.6	2.0	2.5	2.5		1.4	1.0	1.3	1.6	1.4	1.5		2.4	2.8	3.0	3.3	3.1	2.9		2.7	2.9	2.9	2.7	2.6	2.7		2.8	3.3	3.3	3.3	3.3	3.1	
Bankfull Cross Sectional Area (ft^2)	32.0	16.1	22.1	26.9	29.8	32.0		17.0	10.4	14.1	16.0	14.7	17.0		24.6	21.4	32.8	34.1	31.2	24.6		25.3	37.7	30.3	27.8	24.6	25.3		29.3	34.9	29.8	31.1	33.8	29.3	
Bankfull Width/Depth Ratio	14.8	12.7	14.2	15.3	14.5	15.4		16.7	18.1	17.4	17.5	19.6	18.2		9.5	8.6	26.6	35.6	7.5	7.5		8.9	10.8	10.4	12.9	9.1	10.4		11.4	7.5	7.1	7.2	6.1	5.2	
Bankfull Entrenchment Ratio	2.2	2.3	1.8	1.6	1.5	1.4		2.4	1.8	1.7	1.6	1.5	1.5		6.6	7.3	3.4	2.9	6.5	7.4		6.7	5.0	5.6	5.3	6.7	6.2		2.7	8.2	3.4	3.4	3.5	4.1	
Bankfull Bank Height Ratio			0.7	1.2	1.0	0.8				0.8	0.8	1.1	0.9				1.0	0.8	1.0	1.0				1.0	1.0	1.0	0.9				1.0	0.9	1.0	1.2	
d50 (mm)		0.05	16	30	17.1	0.5			30.8	16	45	39.6	51.3			34.5	22	38	21.4	35.3			0.06	0.06	1	0.4	10.2			NA	NA	NA	NA	NA	

	Cross Section 6 (Riffle)							Cross Section 7 (Pool)							Cross Section 8 (Riffle)							Cross Section 9 (Pool)							Cross Section 10 (Riffle)						
Based on fixed baseline bankfull elevation	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	14.3	14.8	15.1	13.8	14.2	13.0		18.8	19.5	23.1	16.8	15.9	15.5		26.3	21.3	22.6	21.5	21.9	20.1		20.7	22.5	21.3	21.8	21.3	18.0		22.9	15.7	37.5	35.5	22.5	22.0	
Floodprone Width (ft)	75.0	75.0	75.0	75.0	75.0	75.0		100.0	100.0	100.0	100.0	100.0	100.0		100.0	100.0	100.0	100.0	100.0	100.0		100.0	100.0	100.0	100.0	100.0	100.0		100.0	100.0	100.0	100.0	100.0	100.0	
Bankfull Mean Depth (ft)	0.9	1.0	0.9	0.8	0.8	1.0		1.6	1.9	1.5	1.9	2.3	1.9		1.0	1.2	0.6	0.8	1.4	1.3		1.8	2.3	2.1	2.0	2.0	2.1		1.1	1.1	0.8	0.7	1.1	1.1	
Bankfull Max Depth (ft)	1.3	1.7	1.4	1.5	1.5	1.7		3.1	3.0	3.2	2.6	3.4	3.0		2.2	1.7	2.0	1.9	2.4	2.1		2.8	3.7	3.5	3.3	3.2	3.2		1.8	1.4	2.0	1.8	1.9	2.0	
Bankfull Cross Sectional Area (ft^2)	12.4	14.9	13.7	11.5	10.9	12.4		29.9	37.2	35.4	31.3	36.9	29.9		25.6	26.2	32.2	31.2	30.5	25.6		37.4	52.2	44.7	42.8	42.8	37.4		25.1	16.6	28.4	25.5	23.9	25.1	
Bankfull Width/Depth Ratio	16.4	14.6	16.6	16.5	18.5	13.6		11.8	10.3	15.1	9.0	6.9	8.0		27.3	17.3	85.8	55.1	15.7	15.8		11.4	9.7	10.2	11.1	10.6	8.7		20.8	14.8	49.7	49.4	21.2	19.3	
Bankfull Entrenchment Ratio	5.3	5.0	5.0	5.4	5.3	5.8		5.3	5.1	4.3	6.0	6.3	6.5		3.8	4.7	1.9	2.4	4.6	5.0		4.8	4.4	4.7	4.6	4.7	5.6		4.4	6.4	2.7	2.8	4.4	4.5	
Bankfull Bank Height Ratio			1.0	0.9	1.1	1.0				0.7	1.1	0.8	0.9				1.0	1.0	0.9	1.1				1.0	1.0	1.0	0.9				0.9	1.0	1.0	0.9	
d50 (mm)		0.05	0.1	21	21.3	14.4			NA	NA	NA	NA	NA			0.05	5	18	21	8.7			0.06	0.6	7	5.3	0.2			0.05	9	26	28.1	17.4	

Table 10.2 Monitoring – Cross Section Morphology

Morphology and Hydraulic Monitoring Summary (Dimensional Parameters – Cross Sections)

Heath Dairy Road Stream Restoration/DMS # 170 Segment/Reach: Back Creek XS11-16; West Branch XS17-20

	Cross Section 11 (Pool)							Cross Section 12 (Riffle)							Cross Section 13 (Pool)							Cross Section 14 (Riffle)							Cross Section 15 (Pool)						
Based on fixed baseline bankfull elevation	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	22.55	16.96	18.41	16.81	16.9	21.8		18.44	17.94	19.55	18.25	17.5	19.1		20.02	16.42	18.45	16.42	14.8	13.7		17.3	15.48	17.89	19.3	17	21.1		16.12	13.76	15.21	11.79	14.1	12.6	
Floodprone Width (ft)	100	100	100	100	100	100		100	100	100	100	100	100		100	100	100	100	100	100		70	70	70	70	70	70		100	100	100	100	100	100	
Bankfull Mean Depth (ft)	1.51	1.69	1.633	1.864	1.485	1.564		1.28	1.26	1.185	1.268	1.198	1.236		1.43	1.93	1.657	1.897	2.173	2.088		1.54	1.19	1.146	1.148	1.167	1.261		1.81	1.99	1.827	2.196	2.054	2.31	
Bankfull Max Depth (ft)	2.91	2.94	2.918	3.079	2.094	3.18		1.78	1.73	1.68	1.724	1.85	2.02		2.69	2.81	2.94	2.827	3.09	2.91		2.39	1.92	1.969	2.092	1.94	2.25		3.96	3.38	2.984	3.19	3.17	3.43	
Bankfull Cross Sectional Area (ft^2)	34.05	28.68	30.07	31.34	25.1	34.1		23.57	22.69	23.16	23.14	20.96	23.6		28.58	31.75	30.56	31.15	32.16	28.6		26.6	18.37	20.5	22.16	19.83	26.6		29.14	27.4	27.79	25.9	28.97	29.1	
Bankfull Width/Depth Ratio	14.93	10.04	11.27	9.021	11.38	13.94		14.41	14.24	16.5	14.39	14.61	15.46		14	8.51	11.14	8.658	6.81	6.563		11.23	13.01	15.61	16.81	14.57	16.74		8.91	6.91	8.321	5.368	6.864	5.5	
Bankfull Entrenchment Ratio	4.43	5.9	5.431	5.95	5.917	4.587		5.42	5.6	5.115	5.48	5.714	5.236		4.99	6	5.421	6.09	6.757	7.299		4.00	4.5	3.914	3.63	4.118	3.318		6.20	7.3	6.576	8.48	7.092	7.94	
Bankfull Bank Height Ratio			0.976	0.99	0.864	0.981				0.875	0.959	1.022	0.896				0.663	0.995	0.812	1.052				0.998	1.065	0.845	1.013				1.047	1.178	1.142	1.00	
d50 (mm)		NA	NA	NA	NA	NA			0.06	11	15	15	9.7			NA	NA	NA	NA	NA			0.06	8	18	8.6	0.1				NA	NA	NA	NA	NA	

	Cross Section 16 (Pool)							Cross Section 17 (Riffle)							Cross Section 18 (Pool)							Cross Section 19 (Riffle)							Cross Section 20 (Riffle)						
Based on fixed baseline bankfull elevation	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	18.22	16.95	17.59	17.93	18	16.2		6.65	4.96	7.67	8.511	6.5	5.05		6.86	5.82	9.961	7.492	8.5	6.86		6.7	6.23	14.57	6.351	6.9	9.8		8.79	7.74	12.23	11.66	9.5	9.6	
Floodprone Width (ft)	57	57	60	60	60	57		20	20	20	20	20	20		26	26	30	30	30	26			27.7	30	30	30	27.7			29	30	30.00	30	29	
Bankfull Mean Depth (ft)	2.34	2.53	2.31	2.499	2.505	2.636		0.62	0.97	0.966	0.951	1.232	0.814		0.58	0.6	0.544	0.576	0.484	0.579		0.59	0.47	0.274	0.503	0.722	0.406		0.78	0.58	0.317	0.49	0.701	0.711458	
Bankfull Max Depth (ft)	3.12	3.22	2.964	3.075	3.82	3.08		0.99	1.22	1.69	1.53	1.8	1.01		0.92	1.03	1.09	1.003	0.81	0.85		0.83	0.62	0.588	0.67	0.78	0.72		1.01	0.75	0.852	0.97	1.18	1.14	
Bankfull Cross Sectional Area (ft^2)	42.73	42.85	40.64	44.8	45.09	42.7		4.11	4.82	7.407	8.094	8.01	4.11		3.97	3.51	5.422	4.317	4.11	3.97		3.98	2.91	3.998	3.192	4.98	3.98		6.83	4.53	7.047	5.76	6.66	6.83	
Bankfull Width/Depth Ratio	7.79	6.7	7.615	7.176	7.186	6.146		10.73	5.1	7.943	8.948	5.275	6.205		11.83	9.7	18.3	13	17.58	11.85		11.36	13.26	53.08	12.64	9.56	24.13		11.27	13.34	70.14	23.57	13.55	13.49	
Bankfull Entrenchment Ratio	3.13	3.4	3.411	3.35	3.333	3.519		3.69	4.22	2.608	2.35	3.077	3.96		3.78	4.43	3.012	4.004	3.529	3.79		6.00	4.45	2.059	4.723	4.348	2.827		4.53	3.71	1.349	2.57	3.158	3.02	
Bankfull Bank Height Ratio			1.082	0.997	1.031	1.159				0.817	0.614	0.939	1.317				1	0.98	0.815	1.059				1.019	1.188	1.154	0.903				0.771	1.00	1.059	0.88	
d50 (mm)		0.03	3	5	1.8	3.1			NA	NA	NA	NA	NA			NA	NA	NA	NA	NA			113	80	100	90	25.5			45	30	30	26.2	23	

Table 10.3 Monitoring – Cross Section Morphology

Morphology and Hydraulic Monitoring Summary (Dimensional Parameters – Cross Sections)

Heath Dairy Road Stream Restoration/DMS # 170 Segment/Reach: West Branch XS21, UT to West Branch XS22; North Branch XS23-25; East Branch XS26-28

	Cross Section 21 (Pool)							Cross Section 22 (Riffle)							Cross Section 23 (Pool)							Cross Section 24 (Riffle)							Cross Section 25 (Riffle)						
Based on fixed baseline bankfull elevation	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	7.72	10.54	19.27	12.37	10.2	6.61		8.59	8.52	17.73	22.42	14	7.5		19.17	15.83	18.83	18.59	20.31	15.6		18.46	18.94	21.93	21.68	18.5	20.6		18.86	17.76	18.37	20.4	18	18.8	
Floodprone Width (ft)	40	40	40	40	40	40		75	75	75	75	75	75		200	200	200	200	200	200		200	200	200	200	200	200		100	100	100	100	100	100	
Bankfull Mean Depth (ft)	0.83	0.93	0.589	0.829	1.294	0.974		0.52	0.51	0.436	0.371	0.625	0.595		2.68	2.67	2.788	2.697	2.555	3.294		1.32	1.39	1.32	1.174	1.2	1.186		1.36	1.38	1.253	1.182	1.372	1.365957	
Bankfull Max Depth (ft)	1.31	2.13	1.841	1.846	2.12	1.37		0.84	0.67	0.794	0.78	0.89	0.55		4.72	4.83	5.197	5.353	5.183	5.27		1.93	2.21	1.958	1.945	2.22	2.37		1.82	1.85	1.581	1.792	1.98	2.03	
Bankfull Cross Sectional Area (ft^2)	6.44	9.83	11.35	10.25	13.2	6.44		4.46	4.37	7.725	8.326	8.75	4.46		51.38	42.32	52.52	50.15	51.9	51.38		24.43	26.37	28.94	25.45	22.2	24.43		25.68	24.46	23.03	24.11	24.7	25.68	
Bankfull Width/Depth Ratio	9.3	11.33	32.72	14.93	7.882	6.784		16.52	16.71	40.71	60.39	22.4	12.61		7.15	5.93	6.755	6.893	7.95	4.736		13.98	13.63	16.62	18.47	15.42	17.37		13.87	12.87	14.66	17.27	13.12	13.76324	
Bankfull Entrenchment Ratio	5.17	3.74	2.076	3.233	3.922	6.051		8.50	8.52	4.229	3.345	5.357	10		10.43	12.63	10.62	10.76	9.846	12.82		10.83	10.56	9.12	9.225	10.81	9.709		5.30	5.63	5.443	4.901	5.556	5.319149	
Bankfull Bank Height Ratio			0.847	0.746	0.887	1.036				1.05	1.165	0.989	1.109				0.878	0.902	1.02	1.023				1.009	0.96	1.00	1.025				1.1	1.003	0.955	0.926108	
d50 (mm)		0.04	0.1	0	0	1.3			108	180	160	133.8	80.1			NA	NA	NA	NA	NA			0.05	14	15	15.2	11.3			0.05	18	18	16.6	14.4	

	Cross Section 26 (Pool)							Cross Section 27 (Riffle)							Cross Section 28 (Riffle)						
Based on fixed baseline bankfull elevation	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	8.75	8.78	11.17	9.594	11.4	10.1		10.23	8.64	8.731	12.91	8.7	13		9.84	9.88	9.538	9.198	11.2	9	
Floodprone Width (ft)	50	50	50	50	50	50		50	50	50	50	50	50		50	50	50	50	50	50	
Bankfull Mean Depth (ft)	0.93	0.82	0.648	0.877	0.73	0.802		0.62	0.54	0.307	0.436	0.838	0.485		0.69	0.68	0.547	0.516	0.522	0.759	
Bankfull Max Depth (ft)	1.73	1.34	1.404	1.538	1.61	1.59		1.04	0.83	0.658	0.885	1.14	1.16		1.11	1.09	0.885	0.923	1.16	1.19	
Bankfull Cross Sectional Area (ft^2)	8.1	7.24	7.234	8.411	8.32	8.1		6.31	4.7	5.759	5.628	7.29	6.31		6.83	6.74	5.22	4.746	5.85	6.83	
Bankfull Width/Depth Ratio	9.41	10.71	17.24	10.94	15.62	12.59		16.5	16	28.4	29.62	10.38	26.78		14.26	14.53	17.43	17.83	21.44	11.86	
Bankfull Entrenchment Ratio	5.71	5.69	4.477	5.212	4.386	4.95		4.88	5.78	2.67	3.873	5.747	3.846		5.08	5.06	5.24	5.436	4.464	5.556	
Bankfull Bank Height Ratio			0.935	1.064	0.969	0.906				1.027	1.129	0.851	0.966				1.146	1.196	0.983	1.008	
d50 (mm)		0.04	12	0	0	1.1			0.04	25	25	16.6	35.6			0.05	15	15	15.4	21.7	

Table 11. Monitoring – As-built Stream Reach Morphology

	Stream Reach Data Summary MY0 (2013)											
Parameter	As-built Baseline Back Creek			As-built Baseline West Branch			As-built Baseline East Branch			As-built Baseline North Branch		
Dimension and Substrate - Riffle	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Bankfull Width (ft)	16.83	22.50	13.57	7.21	10.54	4.96	15.83	18.94	17.51	8.64	9.88	9.1
Floodprone Width (ft)	81.83	100.00	25.30	37.74	75.00	20.00	100.00	200.00	166.67	50	50	50.00
Bankfull Mean Depth (ft)	1.60	2.53	0.76	0.70	0.97	0.47	1.38	2.67	1.81	0.54	0.82	0.68
[1]Bankfull Max Depth (ft)	2.44	3.69	1.01	1.13	2.13	0.62	1.85	4.83	2.96	0.83	1.34	1.09
Bankfull Cross Sectional Area (ft^2)	27.45	52.17	10.42	5.09	9.83	2.91	24.46	42.32	31.05	4.7	7.24	6.23
Width/Depth Ratio	11.49	18.13	6.70	11.22	16.71	5.10	5.93	13.63	10.81	10.71	16	13.75
Entrenchment Ratio	5.18	8.20	1.84	5.07	8.52	3.74	5.63	12.63	9.61	5.06	5.78	5.51
Bank Height Ratio												
Profile												
Riffle Length (ft)	5.6	41.35	20.69	8.18	37.21	19.88	11.7	29.52	18.41	14.96	36.16	26.28
Riffle Slope (ft/ft)	0.006	0.054	0.018	0.004	0.07	0.031	0.008	0.034	0.02	0.004	0.043	0.015
Pool Length (ft)	27.56	87.25	52.19	9.94	28.1	17.28	8.34	35.61	18.91	44.48	66.09	56.48
Pool Max depth (ft)	1.64	4.44	3.36	1.07	3.1	2.1	0.14	2.89	2.1	3.46	5.76	4.67
Pool Spacing (ft)	36.25	96.07	63.7	15.16	59.89	33.5	18.82	48.83	32.26	65.69	96.16	83.13
Pattern												
Channel Beltwidth (ft)	20.92	71.71	47.45	10.31	20.44	15.85	15.2	33.72	21.23	16.97	44.48	33.65
Radius of Curvature (ft)	27.45	46.2	38.7	27.45	33.95	29.61	6.55	19.17	15.14	21.07	36.63	29.39
Rc/Bankfull width (ft/ft)	1.63	2.05	2.85	3.81	3.22	5.97	0.41	1.01	0.86	2.44	3.71	3.23
Meander Wavelength (ft)	131	157	146.3	47	65.5	55.1	87	131	110	157	170	163
Meander Width Ratio			3.50			3.20			1.21			3.70
Transport parameters												
Reach Shear Stress (competency) lb/f^2												
Max part size (mm) mobilized at bankfull												
Stream Power (transport capacity) W/m^2												
Additional Reach Parameters												
Rosgen Classification	B4c/E4			B4c			B4c			B4c		
Bankfull Velocity (fps)												
Bankfull Discharge (cfs)												
Valley length (ft)	4400			927			612			1082		
Channel Thalweg length (ft)	5296			1616			647			1168		
Sinuosity (ft)	1.2			1.7			1.1			1.1		
Water Surface Slope (Channel) (ft/ft)	0.0056			0.018			0.009			0.0061		
BF slope (ft/ft)	0.005			0.019			0.014			0.0054		
Bankfull Floodplain Area (acres)												
Proportion over wide (%)												
Channel Stability or Habitat Metric												
Biological or Other												

Table 11. Monitoring – MY1 (2014) Stream Reach Morphology

Stream Reach Data Summary MY1 (2014)												
Parameter	MY 1 Back Creek			MY 1 West Branch			MY 1 East Branch			MY 1 North Branch		
Dimension and Substrate - Riffle	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Bankfull Width (ft)	16.83	22.50	13.57	7.21	10.54	4.96	15.83	18.94	17.51	8.64	9.88	9.1
Floodprone Width (ft)	81.83	100.00	25.30	37.74	75.00	20.00	100.00	200.00	166.67	50	50	50.00
Bankfull Mean Depth (ft)	1.60	2.53	0.76	0.70	0.97	0.47	1.38	2.67	1.81	0.54	0.82	0.68
[1]Bankfull Max Depth (ft)	2.44	3.69	1.01	1.13	2.13	0.62	1.85	4.83	2.96	0.83	1.34	1.09
Bankfull Cross Sectional Area (ft^2)	27.45	52.17	10.42	5.09	9.83	2.91	24.46	42.32	31.05	4.7	7.24	6.23
Width/Depth Ratio	11.49	18.13	6.70	11.22	16.71	5.10	5.93	13.63	10.81	10.71	16	13.75
Entrenchment Ratio	5.18	8.20	1.84	5.07	8.52	3.74	5.63	12.63	9.61	5.06	5.78	5.51
Bank Height Ratio												
Profile												
Riffle Length (ft)	5.6	41.35	20.69	8.18	37.21	19.88	11.7	29.52	18.41	14.96	36.16	26.28
Riffle Slope (ft/ft)	0.006	0.054	0.018	0.004	0.07	0.031	0.008	0.034	0.02	0.004	0.043	0.015
Pool Length (ft)	27.56	87.25	52.19	9.94	28.1	17.28	8.34	35.61	18.91	44.48	66.09	56.48
Pool Max depth (ft)	1.64	4.44	3.36	1.07	3.1	2.1	0.14	2.89	2.1	3.46	5.76	4.67
Pool Spacing (ft)	36.25	96.07	63.7	15.16	59.89	33.5	18.82	48.83	32.26	65.69	96.16	83.13
Pattern												
Channel Beltwidth (ft)	20.92	71.71	47.45	10.31	20.44	15.85	15.2	33.72	21.23	16.97	44.48	33.65
Radius of Curvature (ft)	27.45	46.2	38.7	27.45	33.95	29.61	6.55	19.17	15.14	21.07	36.63	29.39
Rc/Bankfull width (ft/ft)	1.63	2.05	2.85	3.81	3.22	5.97	0.41	1.01	0.86	2.44	3.71	3.23
Meander Wavelength (ft)	131	157	146.3	47	65.5	55.1	87	131	110	157	170	163
Meander Width Ratio			3.50			3.20			1.21			3.70
Transport parameters												
Reach Shear Stress (competency) lb/f^2												
Max part size (mm) mobilized at bankfull												
Stream Power (transport capacity) W/m^2												
Additional Reach Parameters												
Rosgen Classification	B4c/E4			B4c			B4c			B4c		
Bankfull Velocity (fps)												
Bankfull Discharge (cfs)												
Valley length (ft)	4400			927			612			1082		
Channel Thalweg length (ft)	5296			1616			647			1168		
Sinuosity (ft)	1.2			1.7			1.1			1.1		
Water Surface Slope (Channel) (ft/ft)	0.0056			0.018			0.009			0.0061		
BF slope (ft/ft)	0.005			0.019			0.014			0.0054		
Bankfull Floodplain Area (acres)												
Proportion over wide (%)												
Channel Stability or Habitat Metric												
Biological or Other												

Table 11. Monitoring – MY2 (2015) Stream Reach Morphology

	Stream Reach Data Summary MY2 (2015)											
Parameter	MY 2 Back Creek			MY 2 West Branch			MY 2 East Branch			MY 2 North Branch		
Dimension and Substrate - Riffle	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Bankfull Width (ft)	15.12	52.59	26.84	7.67	22.23	14.82	9.54	18.73	14.13	18.37	21.93	20.15
Floodprone Width (ft)	26.00	100.00	81.57	20.00	30.00	26.67	50.00	50.00	50.00	100	200	150.00
Bankfull Mean Depth (ft)	0.61	1.18	0.95	0.27	0.97	0.52	0.31	0.55	0.43	1.253	1.32	1.29
[1]Bankfull Max Depth (ft)	1.26	2.97	1.90	0.59	1.69	1.04	0.66	0.88	0.77	1.581	1.958	1.77
Bankfull Cross Sectional Area (ft^2)	13.73	32.84	23.56	4.00	7.41	6.15	5.22	5.76	5.49	23.03	28.94	25.98
Width/Depth Ratio	15.61	85.79	32.60	7.94	70.14	43.72	17.43	60.92	39.17	14.66	16.62	15.64
Entrenchment Ratio	1.66	5.12	3.37	1.35	2.61	2.01	2.67	5.24	3.96	5.443	9.12	7.28
Bank Height Ratio			0.93			0.87			1.09			1.05
Profile												
Riffle Length (ft)	4.82	46.11	25.72	6.638	32.38	19.54	11.07	28.32	16.17	22.7	40	33.64
Riffle Slope (ft/ft)	3E-04	0.073	0.018	0.009	0.269	0.091	0.001	0.041	0.017	0.002	0.038	0.017
Pool Length (ft)	27.56	87.25	52.19	9.94	28.1	17.28	8.34	35.61	18.91	44.48	66.09	56.48
Pool Max depth (ft)	1.64	4.44	3.36	1.07	3.1	2.1	0.14	2.89	2.1	3.46	5.76	4.67
Pool Spacing (ft)	14.83	97.38	55.54	4.352	63.53	29.43	18.82	48.83	32.26	56.5	160.9	86.85
Pattern												
Channel Beltwidth (ft)	20.92	71.71	47.45	10.31	20.44	15.85	15.2	33.72	21.23	16.97	44.48	33.65
Radius of Curvature (ft)	27.45	46.2	38.7	27.45	33.95	29.61	6.55	19.17	15.14	21.07	36.63	29.39
Rc/Bankfull width (ft/ft)	1.63	2.05	2.85	3.81	3.22	5.97	0.41	1.01	0.86	2.44	3.71	3.23
Meander Wavelength (ft)	131	157	146.3	47	65.5	55.1	87	131	110	157	170	163
Meander Width Ratio			3.50			3.20			1.21			3.70
Transport parameters												
Reach Shear Stress (competency) lb/f^2												
Max part size (mm) mobilized at bankfull												
Stream Power (transport capacity) W/m^2												
Additional Reach Parameters												
Rosgen Classification	B4c/E4			B4c			B4c			B4c		
Bankfull Velocity (fps)												
Bankfull Discharge (cfs)												
Valley length (ft)	4400			927			612			1082		
Channel Thalweg length (ft)	5296			1616			647			1168		
Sinuosity (ft)	1.2			1.7			1.1			1.1		
Water Surface Slope (Channel) (ft/ft)	0.0056			0.018			0.009			0.0061		
BF slope (ft/ft)	0.005			0.019			0.014			0.0054		
Bankfull Floodplain Area (acres)												
Proportion over wide (%)												
Channel Stability or Habitat Metric												
Biological or Other												

Table 11. Monitoring – MY3 (2016) Stream Reach Morphology

	Stream Reach Data Summary MY3 (2016)											
Parameter	MY 3 Back Creek			MY 3 West Branch			MY 3 East Branch			MY 3 North Branch		
Dimension and Substrate - Riffle	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Bankfull Width (ft)	13.78	41.46	23.41	6.35	11.66	8.84	9.20	12.91	11.05	20.4	21.68	21.04
Floodprone Width (ft)	26.00	100.00	81.57	20.00	30.00	26.67	50.00	50.00	50.00	100	200	150.00
Bankfull Mean Depth (ft)	0.72	1.47	1.02	0.49	0.95	0.65	0.44	0.52	0.48	1.174	1.182	1.18
[1]Bankfull Max Depth (ft)	1.48	572.40	83.29	0.67	1.53	1.06	0.89	0.92	0.90	1.792	1.945	1.87
Bankfull Cross Sectional Area (ft^2)	11.48	31.20	22.45	3.19	8.09	5.68	4.75	5.63	5.19	24.11	25.45	24.78
Width/Depth Ratio	12.94	55.08	26.09	8.95	23.57	15.05	17.83	29.62	23.72	17.27	18.47	17.87
Entrenchment Ratio	1.56	5.48	3.80	2.35	4.72	3.22	3.87	5.44	4.65	4.901	9.225	7.06
Bank Height Ratio			0.97			0.93			1.16			0.98
Profile												
Riffle Length (ft)	6.741	39.56	22.65	6.638	32.38	19.54	6.013	28.49	17.56	13.86	39.96	29.46
Riffle Slope (ft/ft)	0.004	0.128	0.026	0.009	0.269	0.091	0.002	0.074	0.021	0.001	0.101	0.03
Pool Length (ft)	10.1	41.55	27.74	9.94	28.1	17.28	7.161	24.39	13.37	40.71	46.13	43.36
Pool Max depth (ft)	2.37	3.96	2.946	0.92	1.31	1.08	1.73	1.73	1.73	4.72	4.72	4.72
Pool Spacing (ft)	17.84	121.2	53.08	4.352	63.53	29.43	18.82	48.83	32.26	31.98	105.6	66.73
Pattern												
Channel Beltwidth (ft)	20.92	71.71	47.45	10.31	20.44	15.85	15.2	33.72	21.23	16.97	44.48	33.65
Radius of Curvature (ft)	27.45	46.2	38.7	27.45	33.95	29.61	6.55	19.17	15.14	21.07	36.63	29.39
Rc/Bankfull width (ft/ft)	1.63	2.05	2.85	3.81	3.22	5.97	0.41	1.01	0.86	2.44	3.71	3.23
Meander Wavelength (ft)	131	157	146.3	47	65.5	55.1	87	131	110	157	170	163
Meander Width Ratio			3.50			3.20			1.21			3.70
Transport parameters												
Reach Shear Stress (competency) lb/f^2												
Max part size (mm) mobilized at bankfull												
Stream Power (transport capacity) W/m^2												
Additional Reach Parameters												
Rosgen Classification	B4c/E4			B4c			B4c			B4c		
Bankfull Velocity (fps)												
Bankfull Discharge (cfs)												
Valley length (ft)	4400			927			612			1082		
Channel Thalweg length (ft)	5296			1616			647			1168		
Sinuosity (ft)	1.2			1.7			1.1			1.1		
Water Surface Slope (Channel) (ft/ft)	0.0056			0.018			0.009			0.0061		
BF slope (ft/ft)	0.005			0.019			0.014			0.0054		
Bankfull Floodplain Area (acres)												
Proportion over wide (%)												
Channel Stability or Habitat Metric												
Biological or Other												

Table 11. Monitoring – MY4 (2017) Stream Reach Morphology

	Stream Reach Data Summary MY4 (2017)											
Parameter	MY 4 Back Creek			MY 4 West Branch			MY 4 East Branch			MY 4 North Branch		
Dimension and Substrate - Riffle	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Bankfull Width (ft)	17.91	22.52	14.20	6.35	11.66	8.84	9.20	12.91	11.05	18.00	18.00	18.00
Floodprone Width (ft)	81.57	100.00	26.00	20.00	30.00	26.67	50.00	50.00	50.00	100.00	200.00	150.00
Bankfull Mean Depth (ft)	1.21	2.04	0.77	0.49	0.95	0.65	0.44	0.52	0.48	1.13	1.37	1.25
[1]Bankfull Max Depth (ft)	2.01	3.09	1.41	0.67	1.53	1.06	0.89	0.92	0.90	1.98	2.18	2.08
Bankfull Cross Sectional Area (ft^2)	21.71	31.20	10.90	3.19	8.09	5.68	4.75	5.63	5.19	20.30	24.70	22.50
Width/Depth Ratio	15.96	21.21	7.50	8.95	23.57	15.05	17.83	29.62	23.72	13.12	15.96	14.54
Entrenchment Ratio	4.60	6.54	1.53	2.35	4.72	3.22	3.87	5.44	4.65	5.56	11.11	8.33
Bank Height Ratio			1.01			0.93			1.16			0.95
Profile												
Riffle Length (ft)	7.65	43.15	23.05	7.41	34.80	19.71	10.12	28.96	17.64	18.02	39.08	28.08
Riffle Slope (ft/ft)	0.00	0.10	0.02	0.01	0.17	0.06	0.01	0.05	0.02	0.001	0.432	0.099
Pool Length (ft)	10.10	41.55	27.74	9.94	28.10	17.28	7.16	24.39	13.37	40.71	46.13	43.36
Pool Max depth (ft)	2.07	5.66	3.64	1.03	2.65	1.85	0.54	2.60	2.01	3.25	5.51	4.38
Pool Spacing (ft)	28.46	109.59	63.21	9.76	61.71	31.46	18.82	48.83	32.26	54.97	114.70	79.96
Pattern												
Channel Beltwidth (ft)	20.92	71.71	47.45	10.31	20.44	15.85	15.2	33.72	21.23	16.97	44.48	33.65
Radius of Curvature (ft)	27.45	46.2	38.7	27.45	33.95	29.61	6.55	19.17	15.14	21.07	36.63	29.39
Rc/Bankfull width (ft/ft)	1.63	2.05	2.85	3.81	3.22	5.97	0.41	1.01	0.86	2.44	3.71	3.23
Meander Wavelength (ft)	131	157	146.33	47	65.5	55.1	87	131	110	157	170	163
Meander Width Ratio			3.50			3.20			1.21			3.70
Transport parameters												
Reach Shear Stress (competency) lb/ft^2												
Max part size (mm) mobilized at bankfull												
Stream Power (transport capacity) W/m^2												
Additional Reach Parameters												
Rosgen Classification	B4c/E4			B4c			B4c			B4c		
Bankfull Velocity (fps)												
Bankfull Discharge (cfs)												
Valley length (ft)	4400			927			612			1082		
Channel Thalweg length (ft)	5296			1616			647			1168		
Sinuosity (ft)	1.2			1.7			1.1			1.1		
Water Surface Slope (Channel) (ft/ft)	0.0056			0.018			0.009			0.0061		
BF slope (ft/ft)	0.005			0.019			0.014			0.0054		
Bankfull Floodplain Area (acres)												
Proportion over wide (%)												
Channel Stability or Habitat Metric												
Biological or Other												

Table 11. Monitoring – MY5 (2018) Stream Reach Morphology

Stream Reach Data Summary MY5 (2018)												
Parameter	MY 5 Back Creek			MY 5 West Branch			MY 5 East Branch			MY 5 North Branch		
Dimension and Substrate - Riffle	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Bankfull Width (ft)	13.00	22.00	18.07	5.05	9.80	8.15	9.00	13.00	11.00	18.80	20.60	19.70
Floodprone Width (ft)	26.00	100.00	81.57	20.00	29.00	25.57	50.00	50.00	50.00	100.00	200.00	150.00
Bankfull Mean Depth (ft)	0.95	1.81	1.23	0.41	0.81	0.64	0.49	0.76	0.62	1.19	1.37	1.28
[1]Bankfull Max Depth (ft)	1.51	2.86	2.07	0.72	1.14	0.96	1.16	1.19	1.18	2.03	2.37	2.20
Bankfull Cross Sectional Area (ft^2)	12.40	26.60	22.13	3.98	6.83	4.97	6.31	6.83	6.57	24.43	25.68	25.06
Width/Depth Ratio	7.52	19.28	15.23	6.20	24.13	14.61	11.86	26.78	19.32	13.76	17.37	15.57
Entrenchment Ratio	1.48	7.35	4.67	2.83	3.96	3.27	3.85	5.56	4.70	5.32	9.71	7.51
Bank Height Ratio			0.98			1.03			0.99			0.98
Profile												
Riffle Length (ft)	5.14	59.45	28.16	7.41	34.80	19.71	10.12	28.96	17.64	17.30	40.80	29.20
Riffle Slope (ft/ft)	0.005	0.56	0.07	0.01	0.17	0.06	0.01	0.05	0.02	0.003	0.130	0.040
Pool Length (ft)	10.10	41.55	27.74	9.94	28.10	17.28	7.16	24.39	13.37	40.71	46.13	43.36
Pool Max depth (ft)	1.46	8.27	3.69	1.03	2.65	1.85	0.54	2.60	2.01	2.14	6.17	4.52
Pool Spacing (ft)	27.99	130.95	69.33	9.76	61.71	31.46	18.82	48.83	32.26	25.24	130.33	83.14
Pattern												
Channel Beltwidth (ft)	20.92	71.71	47.45	10.31	20.44	15.85	15.2	33.72	21.23	16.97	44.48	33.65
Radius of Curvature (ft)	27.45	46.2	38.7	27.45	33.95	29.61	6.55	19.17	15.14	21.07	36.63	29.39
Rc/Bankfull width (ft/ft)	1.63	2.05	2.85	3.81	3.22	5.97	0.41	1.01	0.86	2.44	3.71	3.23
Meander Wavelength (ft)	131	157	146.33	47	65.5	55.1	87	131	110	157	170	163
Meander Width Ratio			3.50			3.20			1.21			3.70
Transport parameters												
Reach Shear Stress (competency) lb/f^2												
Max part size (mm) mobilized at bankfull												
Stream Power (transport capacity) W/m^2												
Additional Reach Parameters												
Rosgen Classification	B4c/E4			B4c			B4c			B4c		
Bankfull Velocity (fps)												
Bankfull Discharge (cfs)												
Valley length (ft)	4400			927			612			1082		
Channel Thalweg length (ft)	5296			1616			647			1168		
Sinuosity (ft)	1.2			1.7			1.1			1.1		
Water Surface Slope (Channel) (ft/ft)	0.0056			0.018			0.009			0.0061		
BF slope (ft/ft)	0.005			0.019			0.014			0.0054		
Bankfull Floodplain Area (acres)												
Proportion over wide (%)												
Channel Stability or Habitat Metric												
Biological or Other												

Appendix E: Hydrologic Data

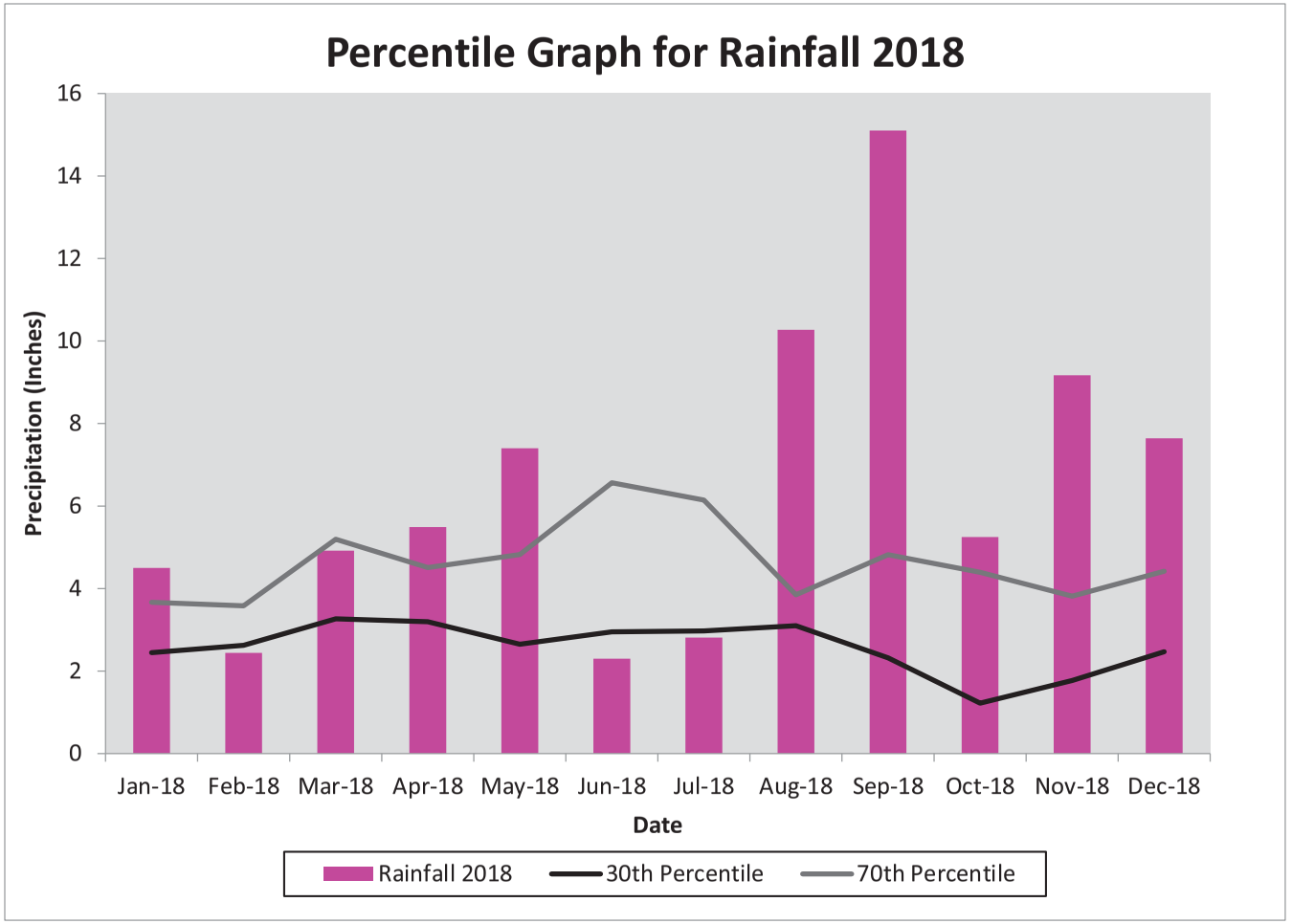
HDR #170 Table 13 Bankfull events MY5 (2018)

Date of Collection	Date of occurance	Method and Location	Photo (If Available)	Feet Above Bankfull
Sep-15	May-Sept/2015	CSG on Main Trib	NA	0.4
Nov-15	11/9/2015	HOBO on North Trib	NA	0.7
Dec-15	12/22/2015	HOBO on North Trib	NA	6.8
Dec-15	12/30/2015	HOBO on North Trib	NA	6.5
Feb-16	2/16/2016	HOBO on North Trib	NA	0.4
Feb-16	2/24/2016	HOBO on North Trib	NA	2
Aug-16	8/8/2016	HOBO on North Trib	NA	1.4
Oct-16	Summer-Fall 2016	CSG on Main Trib	NA	1.4
Sep-17	Summer-Fall 2017	CSG on Main Trib	Below	2.5
Sep-17	4/25/2017; 6/20/2017	HOBO on North Trib	NA	>2
Apr-18	Fall 2017- Spring 2018	CSG on Main Trib	NA	0.5
Apr-18	Fall 2017- Spring 2018	CSG on Main Trib	NA	0.3
Oct-18	Summer-Fall 2018	CSG on Main Trib & Wrack	Below	>1

Downstream Crest Stage Gauge, September 2017

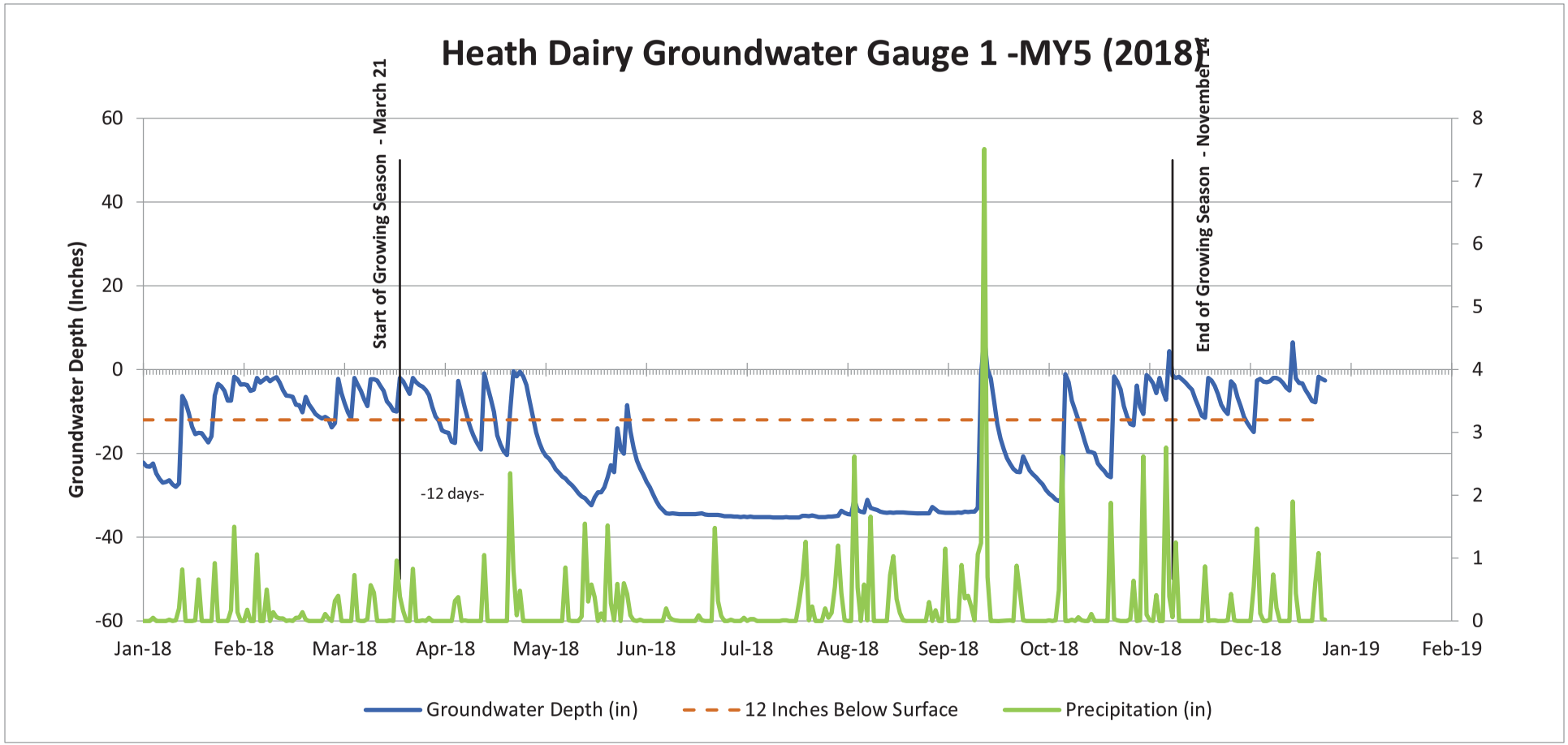
Flattened Vegetation near Veg Plot 14, October 2018

Figure 6. Rainfall Percentile



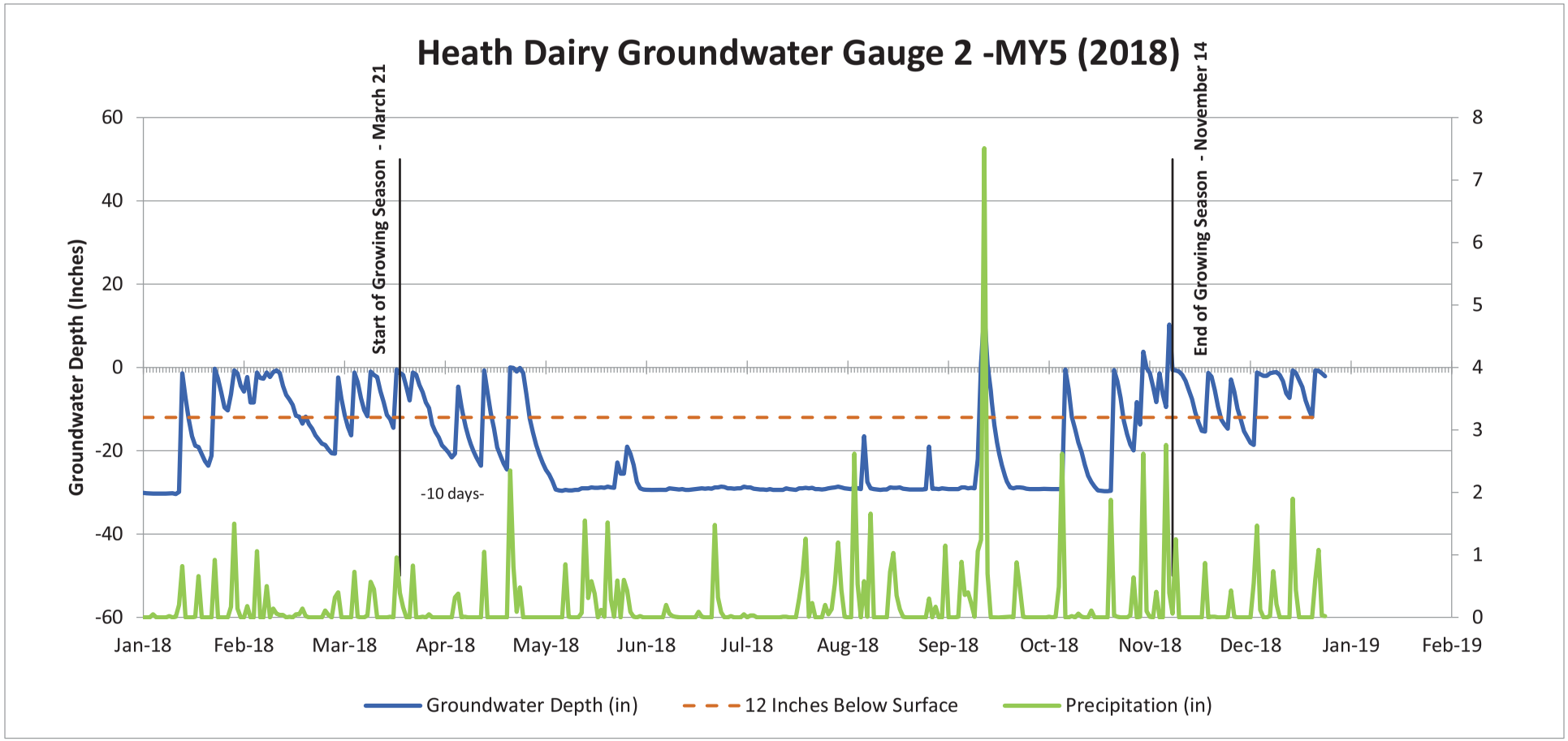
- Monthly rainfall data from CRONOS Station ID: 310286, Asheboro, NC

Figure 7.1. Groundwater Data



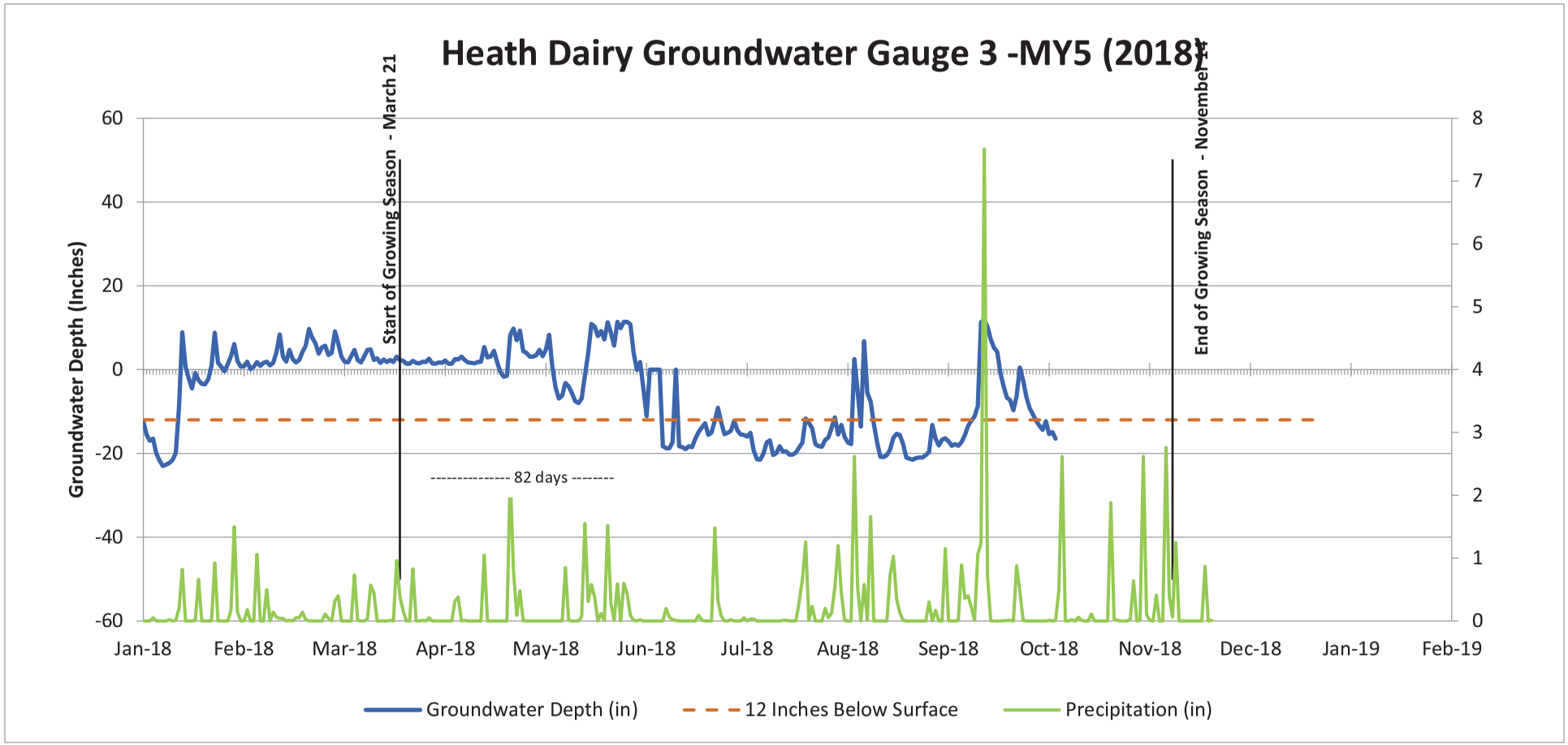
- Daily rainfall data from CRONOS Station ID: 310286, Asheboro, NC
- Gauge offset height for 2018 data was adjusted to match the actual water table height measured by manual check at the end of 2018.

Figure 7.2. Groundwater Data



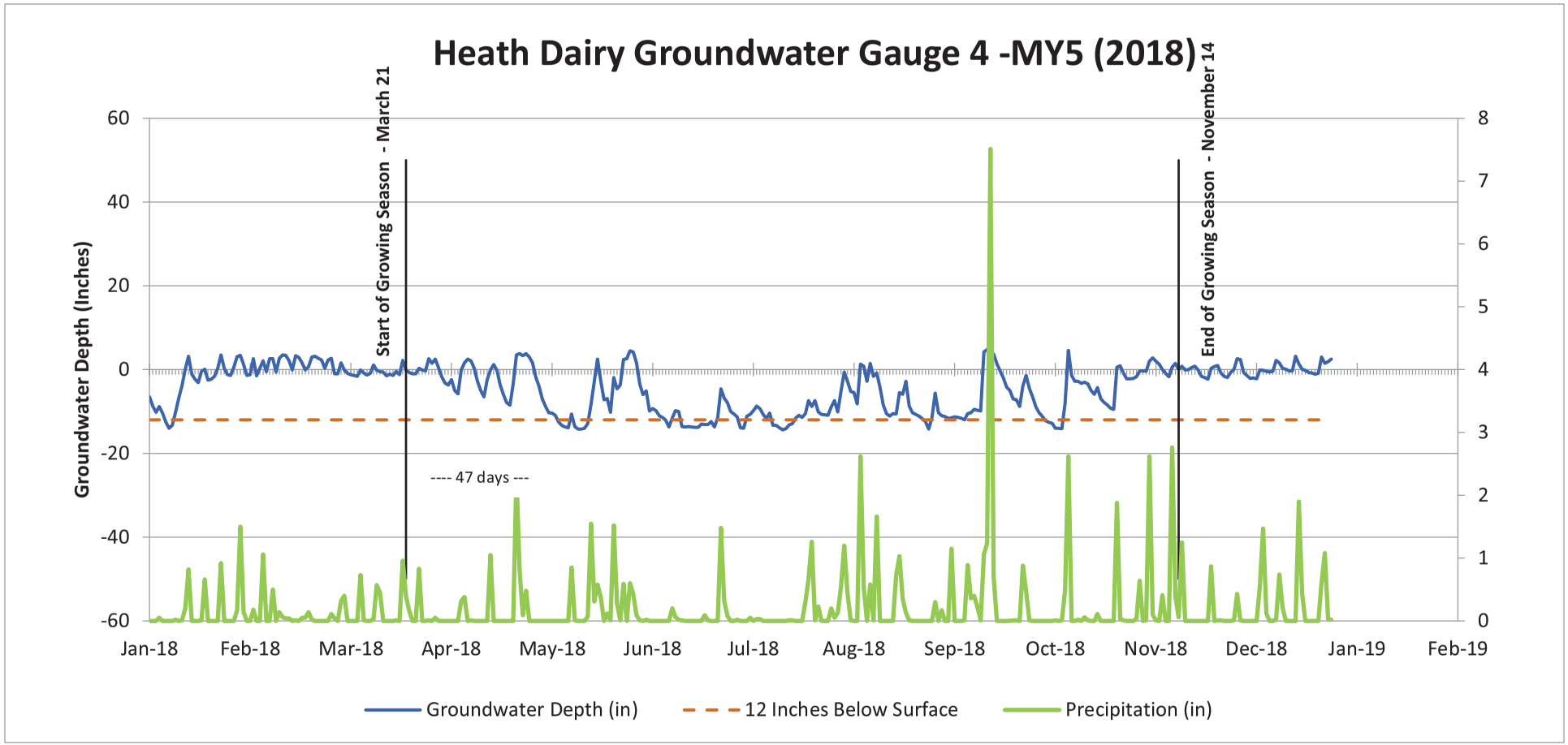
- Daily rainfall data from CRONOS Station ID: 310286, Asheboro, NC
- Gauge offset height for 2018 data was adjusted to match the actual water table height measured by manual check at the end of 2018.

Figure 7.3. Groundwater Data



- Daily rainfall data from CRONOS Station ID: 310286, Asheboro, NC
- Gauge offset height for 2018 data was adjusted to match the actual water table height measured by manual check at the end of 2018.

Figure 7.4. Groundwater Data



- Daily rainfall data from CRONOS Station ID: 310286, Asheboro, NC
- Gauge offset height for 2018 data was adjusted to match the actual water table height measured by manual check at the end of 2018.

Table 13. Wetland Gauge Attainment

	MY5 2018			
Gage #	% of Growing Season Monitored	Max # Consec. Days	% of Growing Season	Success Critera Attained?
1	100%	12	5	***No***
2	100%	10	4	***No***
3	84%	82	34	***Yes***
4	100%	47	20	***Yes***

Gage # 4 is located in a reference wetland.

12.5% of growing season needed to meet success criteria.

Growing season dates are based on the WETS table for Ashboro 2W, NC
Date Range: 1981-2010, 50% Probability at 28 F or higher.
http://efotg.sc.egov.usda.gov/efotg_locator.aspx