

Heath Dairy Road Stream Restoration Site Randolph County, North Carolina

DMS Project #170

USACE Action Item # SAW 2008 02860



MY – 03 Fall Monitoring Report

Data Collected: September/October 2016

Final Draft Submitted: February 2017

Prepared for:

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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. The site lies within the Yadkin-Pee Dee watershed (HUC #03040103-050050). This project includes restoration, enhancement and preservation of approximately 7,708 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 and benthic macroinvertebrate 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 7,781 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 0.6 acres of wetlands from the existing 0.6 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***

Due to watershed dynamics, 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 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 as per the mitigation plan.

1.2.3 Hydrologic Success

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 growing season during average climatic conditions, OR if the restored area is within 20% of the reference wetland's hydroperiod during drought conditions.

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 03040103050050, 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 grazing pasture. The surrounding land uses consist of pastureland, woodland, and residential lots.

1.4 Project Components and Mitigation Assets

The project components are summarized in Table 1 of Appendix A and depicted on Figure 2.9.

1.5 Project Design Approach

The Heath Dairy Site restored and/or enhanced approximately 7,708 linear feet of degraded 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.

Nine separate wetland areas totaling 1.78 acres were identified on the Heath Dairy Site. These wetland areas were enhanced by removal of grazing activity and planting of native wetland vegetation.

1.6. Current Conditions and Performance Summary

Based on our field observations and data collected during the spring and fall site visits of 2016, the Heath Dairy Site appears to be trending towards a successful restoration project with very few minor concerns at this time. During our fall assessment no signs of cattle within the easement were observed and the fence line integrity was intact. Several minor problems that were noted in the spring (i.e. minor bank erosion, loose geotech fabric, etc.) were difficult to reassess in the fall due to higher water in the tributaries. We have continued to denote these locations on the CCPV (as yellow triangles) for this report so that they will continue to be monitored closely.

The only new, larger issue we observed during the fall site visit is located on East Branch at approximately station 15+20, where the stream is beginning to undercut and flow below the large culvert at the access trail crossing. At this time, the piping below the culvert does not pose any imminent threat for erosion however a repair to this section may help prevent longer-term issues from arising. Otherwise, all streams reaches generally appear to be stable and functioning as intended, with only a few minor issues as detailed below.

In general, native woody stem densities visually appear adequate across the site, despite the failure of many permanent plots to meet success criteria. The evidence of the supplementary planting of smaller woody saplings is obvious in most areas and our visual assessment revealed one small area (0.28 ac) of potential low stem density. Thick herbaceous growth remains especially problematic between North Branch and Back Creek above their confluence, and in the upper reaches of West Branch.

1.6.1. Stream Assessment

During our fall assessment, water was found through the extent of all reaches, with levels sufficient in all reaches to cover all riffles to a depth of a few inches. In general, all reaches appear to be relatively stable and functioning as intended. Back Creek and West Branch show some numerical evidence of widening and deepening at cross sections compared to the As-built elevations. In a few cases (e.g. XS 3), the numerical evidence of a large width increase at as-built bankful elevations has resulted as a function of very minor bank erosion combined with banks that gently slope away from the creek. However, during our field assessment we did not see that these changes were visibly obvious and, in general, profile feature characteristics appear to be generally stable across all reaches.

Several new minor structural stream problem areas were noted near the downstream end of the project on Back Creek and East Branch. These include: **1)** piping under a riffle section on East Branch (~ sta. 14+50; fig 2.8), **2)** piping below the culvert at the access trail crossing on East Branch (~sta. 15+20; fig 2.8), **3)** piping below a riffle section at the confluence of East Branch and Back Creek (~ sta. 16+00; fig 2.8), and piping below a riffle section of Back Creek just above the confluence with North Branch (~sta. 59+50; fig 2.8). Locations of these problems are depicted by yellow triangles on the CCPV and photos of the more severe cases issues are included in the electronic submission.

The hoof shear along West Branch that was noted in the spring site visit was no longer evident, however West Branch continues to be inundated with a thick herbaceous understory and native vines. One problem area was noted upstream of the confluence with the unnamed tributary to West Branch, whereby a large fallen tree is draped across the channel and may create erosion problems or minor stream diversion in the future (~sta. 19+20; fig 2.1).

All stream reaches were sampled for pebble counts in riffles and several pool sections. All reaches sampled indicated stable conditions with little to no constructed-riffle migration. The rocks and gravel used for riffle construction appear very entrenched and not moving much. In a few cases, increases in size class distributions compared to MY2 may be due to the flushing of trapped silt which was more prominent last year due to the dry conditions. Overall, our observations did not reveal any major issues with stream substrate and an acceptable level of gravel transport seems to be occurring.

1.6.2. Wetlands

Enhancement wetlands were assessed for vegetative success. The reference gauge, GW4, exhibited 55 consecutive days of inundation/saturation resulting in a 23% hydroperiod. Gauge 1, located in the restored wetland upstream closest to the existing jurisdictional wetland, logged 33 consecutive days of inundation/saturation resulting in a maximum hydroperiod of 14% for the 2016 growing season meeting the 12.5% established success criterion. The other two gauges located in the restoration area reported 3% and 4% maximum hydroperiods in 2016. Five months falling within the NRCS WET Table designed growing season of March 21 – November 11 (March, April, June, August, October) exhibited below normal rainfall during 2016. May and September exceeded the average monthly rainfall while July and October were between the 30th and 70th percentile seventy year averages.

1.6.3. Vegetation Assessment

All permanent vegetation plots were monitored prior to leaf-drop in September 2016. Many of the plots had new woody stems added to their CVS database file due as a result of the supplemental planting in 2016. Despite the supplemental planting, the project wide success criteria attainment remained consistent with MY2 observation with approximately 30% of all plots meeting threshold woody stem densities. The success rate across all plots increases to 43% if volunteered native woody species are considered. Despite the fact that numerous plots did not meet success criteria, our visual assessment of the site revealed only one small (0.28 ac) low stem-density areas of mappable threshold west of Vegetation Plot 15 (Figure 2.10). Stem density is not uniform across the site, and many areas are showing a healthy recruitment of volunteered woody species. We do not generally see the low stem density as indicated by the vegetation plots to be a potential problem at this time - the number of successful plots may increase in following years as a function of reduced criteria thresholds and the establishment of more native woody volunteers.

Non-native woody species were observed in several locations throughout the easement area (Table 6; Figure 2.10). Thickets of Chinese privet (*Ligustrum sinense*) are beginning to increase in abundance in isolated pockets on the right bank of Back Creek downstream of the confluence with West Branch in the vicinity of Veg Plots # 15 & 16. Isolated stems of Privet are also scattered throughout the hillside between North Branch and Back Creek in the vicinity of Veg Plots #19-20, and along the south side of the upstream end of East Branch. Several large clusters of Multiflora Rose (*Rosa multiflora*) were found throughout the restored wetland area in the vicinity of Groundwater Gages #1-3. We flagged several of the larger clusters of non-native woody plants in the field, and denoted the general areas where invasives were observed as polygons on the current CCPV (Figure 2). In future monitoring years, we will record woody invasive volunteers with the vegetation plot stem data.

An additional 1,129 stems (239 sycamore, 430 blackgum, 230 sugarberry, 230 scarlet oak) were planted in February of 2017 in low stem density areas throughout the project site. The areas of invasive species identified during the 2016 monitoring assessment were also addressed via basil bark treatment.

1.6.4. Hydrology Assessment

We estimate that several flood events accessed the bank during 2016 (Table 12). The peak stage reading for the cork crest gage on Back Creek (~60 feet upstream of the confluence with West Branch) was 1.4 feet above the bankfull elevation at that location. HOBO gage observations show a dozen episodes of stream level increase greater than 0.2 feet, which likely resulted in at least 3 episodes of overbank flooding compared to design bankfull elevations near the in-stream HOBO gage on North Branch.

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). On several plots, origin corners were re-labelled for consistency in orientation across the site. Beginning in MY4, non-native woody volunteers will be included in the plot data but not included towards the success criteria.

2.2. Wetland Methodologies

All four (4) RDS groundwater Monitoring Gauges were downloaded most recently in January, 2017 and will continue to be downloaded at regular intervals to ensure that the gauges are functioning properly.

2.3. Stream Methodologies

Longitudinal Profiles were conducted 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, and 51+42 to 62+22). All twenty eight (28) of the permanent stream cross sections established on the site were surveyed using a Trimble RDK survey-grade GPS unit. 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>

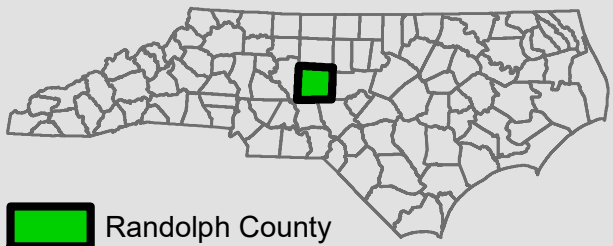
AECOM March 2015. Monitoring Report Year #1

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

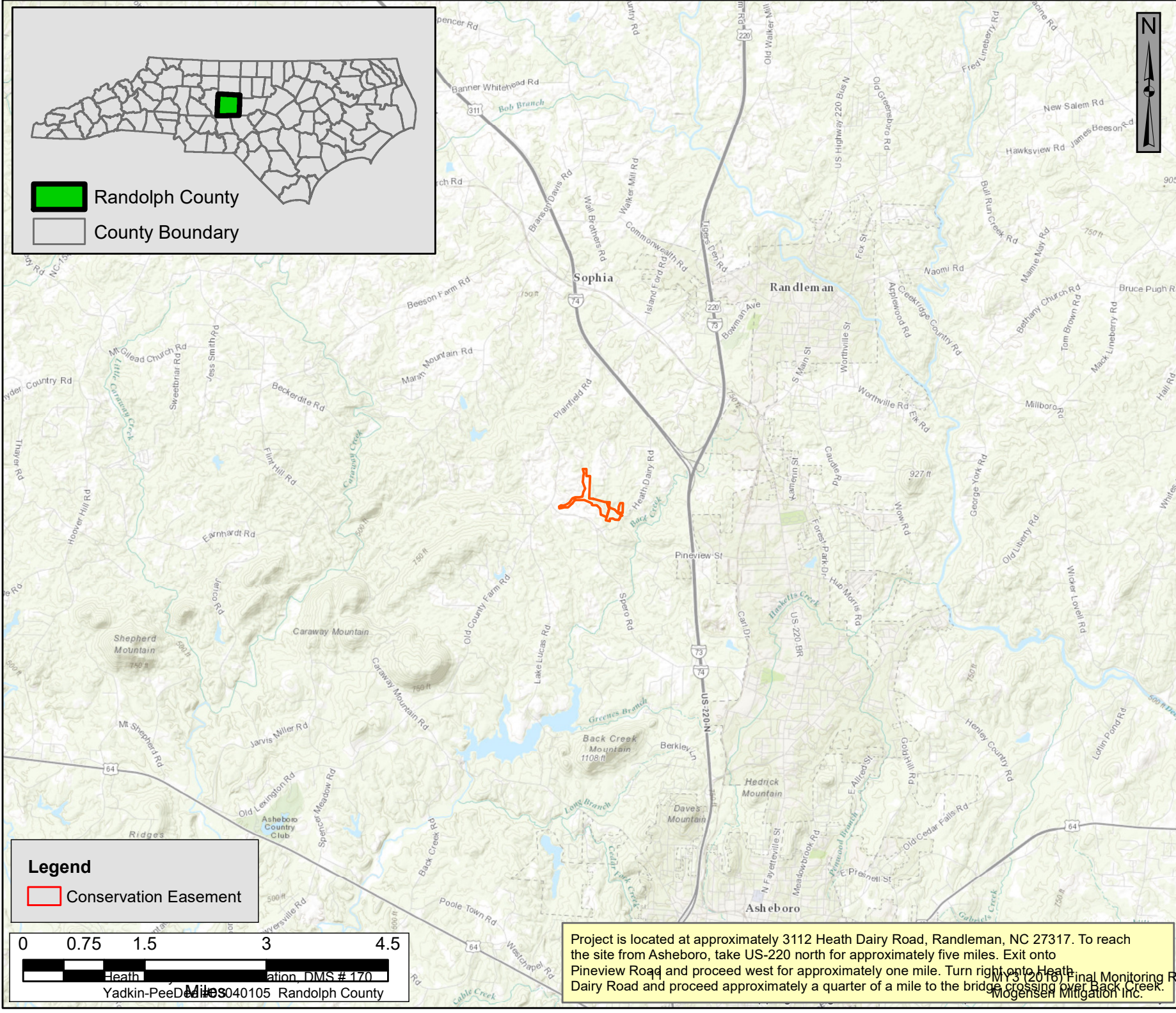
Weakley, A.S. (2011) *Flora of the Carolinas, Virginia, Georgia and the Surrounding Areas* University of North Carolina at Chapel Hill

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

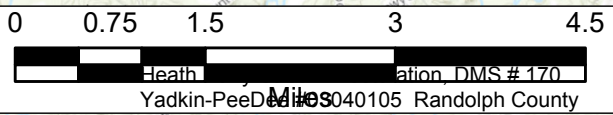
Appendix A: Project Background Data



Randolph County
County Boundary



Legend
 Conservation Easement



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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NOVEMBER 2016

HEATH DAIRY MONITORING YEAR 3
 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		0.136 AC		Enhancement	Restoration	0.136 AC	2:1	
Wetland B	NA		0.307 AC		Enhancement	Restoration	0.307 AC	2:1	
Wetland C	NA		0.104 AC		Enhancement	Restoration	0.104 AC	2:1	
Wetland E	NA		0.010 AC		Enhancement	Restoration	0.010 AC	2:1	
Wetland F	NA		0.036 AC		Enhancement	Restoration	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	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 Monitoring	Nov-14	Mar-15
Year 2 Monitoring	Sep-15	Jan-16
Supplemental Planting	NA	Apr-16
Year 3 Monitoring	Sep/Oct-16	Nov-16
Year 4 Monitoring		
Year 5 Monitoring		

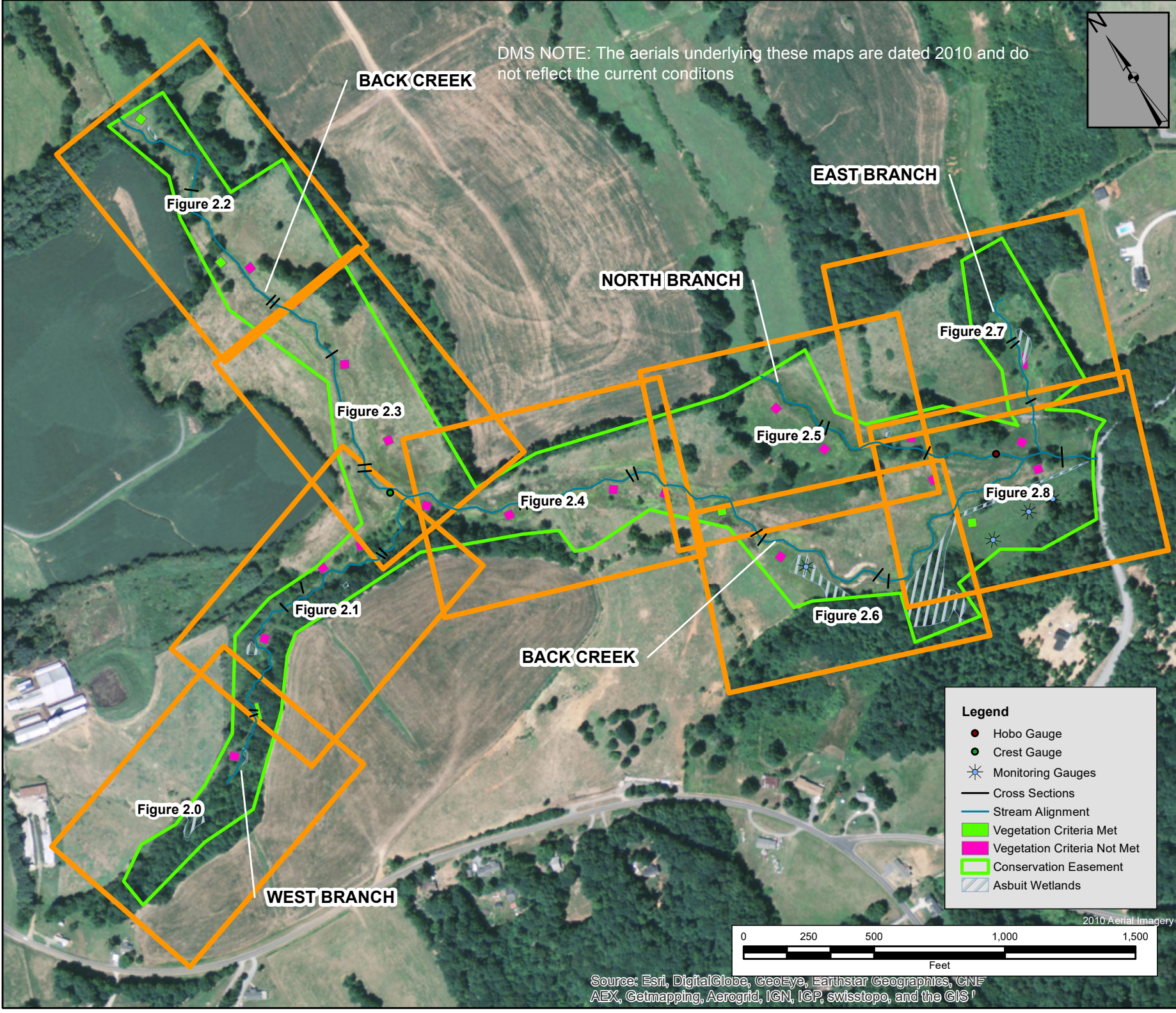
Table 3. Project Contacts

Table 3. Project Contact Table Heath Dairy Road Stream Restoration/ DMS No. 170	
Owner NCDENR Division of Mitigation Services	Melonie Allen 217 W. Jones Street Suite 300A Raleigh, NC 27603 919-368-9352
Designer Wolf Creek Engineering, PLLC	Grant Ginn 7 Florida Avenue Weaverville, NC, 28787 828-658-3649
Landowner Mr. Phillip Ridge Dr. Edward Shackelford	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	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 Concurrence Letter		
CZMA/CAMA	No	NA			
FEMA Floodplain Compliance	Yes	Yes			
Essential Fisheries Habitat	No	NA			

Appendix B: Visual Assessment Data



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NOVEMBER 2016

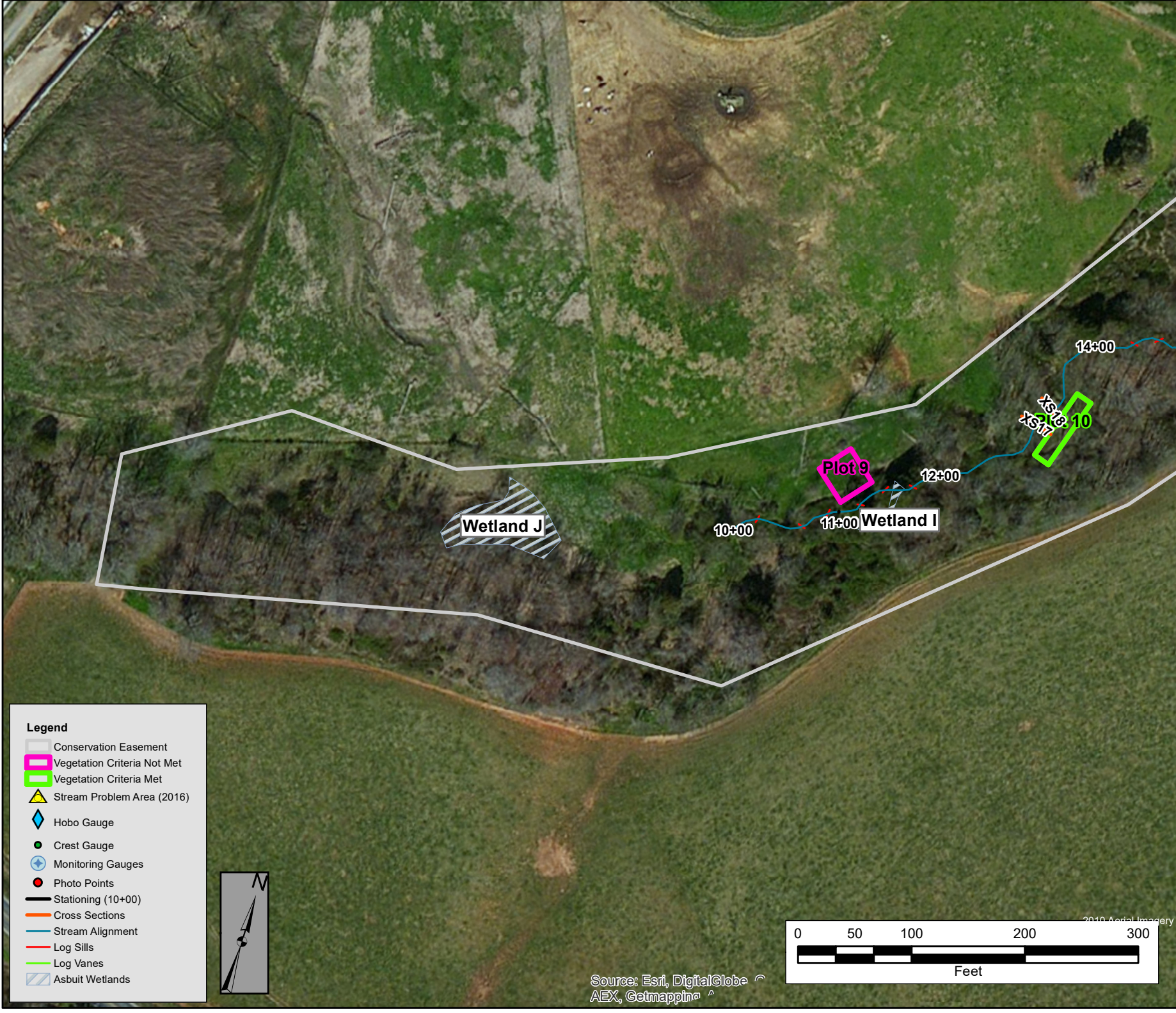
HEATH DAIRY MONITORING YEAR 3
CURRENT CONDITIONS PLAN VIEW OVERVIEW
DMS #170

Randolph County, North Carolina



FIGURE 2

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNF AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS I



Legend

- Conservation Easement
- Vegetation Criteria Not Met
- Vegetation Criteria Met
- Stream Problem Area (2016)
- Hobo Gauge
- Crest Gauge
- Monitoring Gauges
- Photo Points
- Stationing (10+00)
- Cross Sections
- Stream Alignment
- Log Sills
- Log Vanes
- Asbut Wetlands



Source: Esri, DigitalGlobe, AEX, Getmapping

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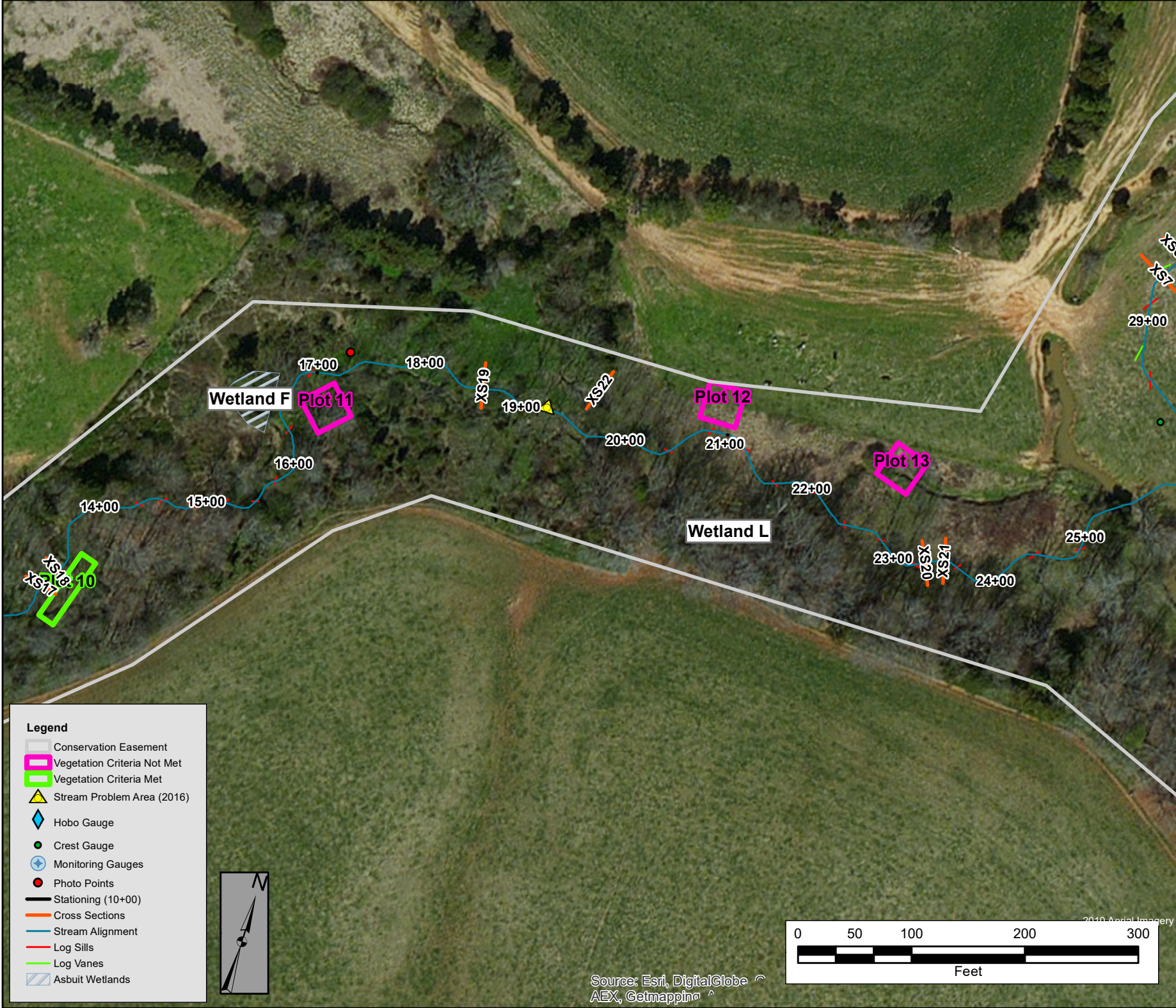
NOVEMBER 2016

HEATH DAIRY MONITORING YEAR 3
CURRENT CONDITIONS PLAN VIEW OVERVIEW
DMS #170 - WEST BRANCH

Randolph County, North Carolina

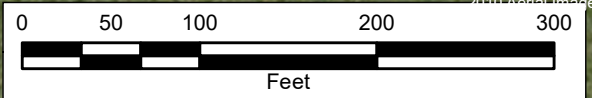


Figure 2.0



Legend

- Conservation Easement
- Vegetation Criteria Not Met
- Vegetation Criteria Met
- Stream Problem Area (2016)
- Hobo Gauge
- Crest Gauge
- Monitoring Gauges
- Photo Points
- Stationing (10+00)
- Cross Sections
- Stream Alignment
- Log Sills
- Log Vanes
- Asbuilt Wetlands



Source: Esri, DigitalGlobe, AEX, Getmapping

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HEATH DAIRY MONITORING YEAR 3
CURRENT CONDITIONS PLAN VIEW OVERVIEW
DMS #170 - WEST BRANCH

Randolph County, North Carolina



Figure 2.1



Legend

- Conservation Easement
- Vegetation Criteria Not Met
- Vegetation Criteria Met
- Stream Problem Area (2016)
- Hobo Gauge
- Crest Gauge
- Monitoring Gauges
- Photo Points
- Stationing (10+00)
- Cross Sections
- Stream Alignment
- Log Sills
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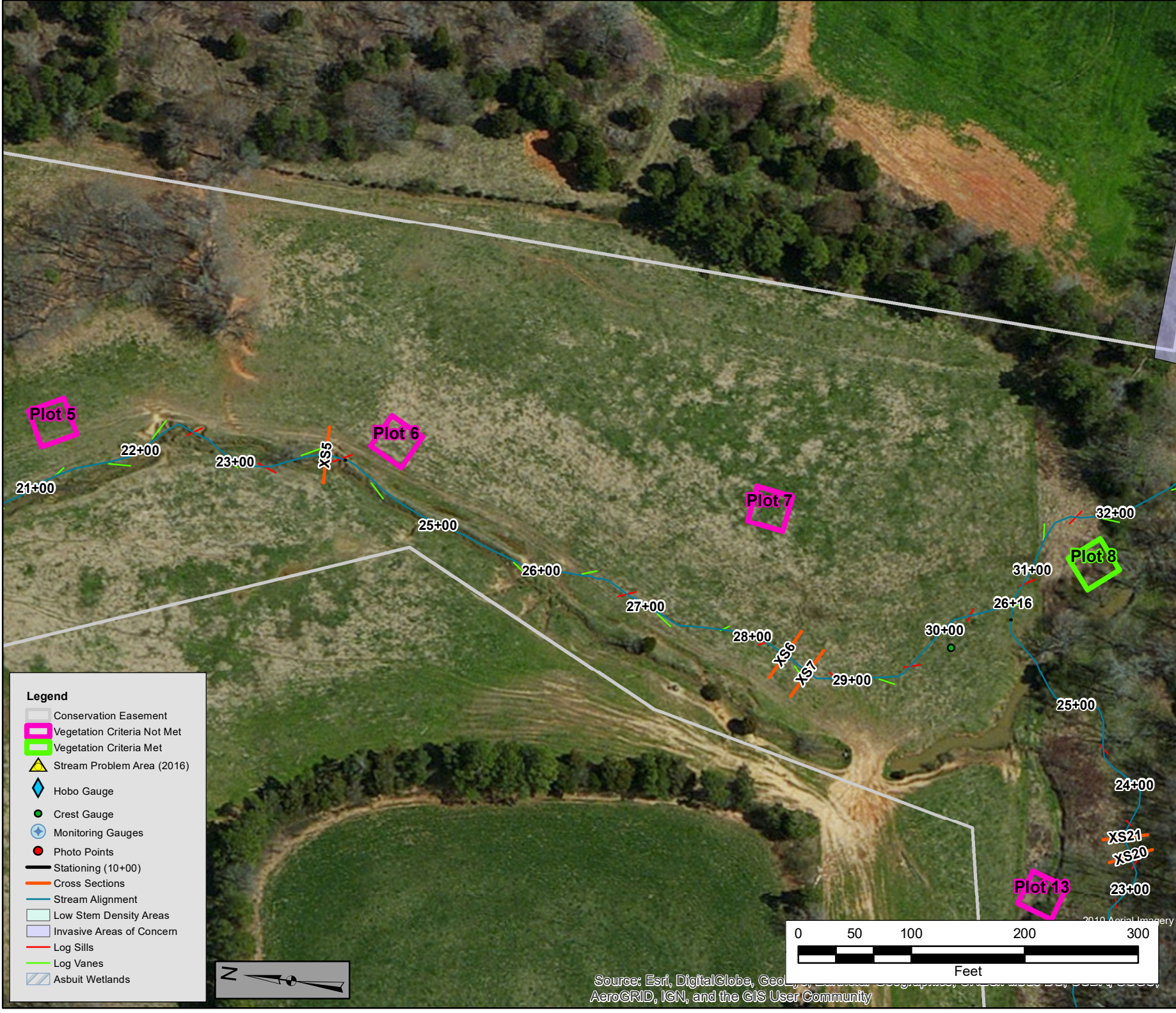
NOVEMBER 2016

HEATH DAIRY MONITORING YEAR 3
CURRENT CONDITIONS PLAN VIEW OVERVIEW
DMS #170 - BACK CREEK

Randolph County, North Carolina

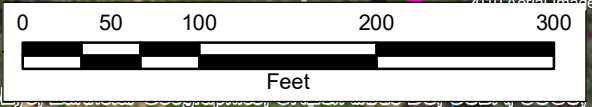
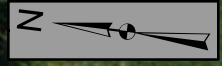
Figure 2.2

Source: Esri, DigitalGlobe, GeoEye, AeroGRID, IGN, IGP, swisstopo, and the GIS User Community



Legend

- Conservation Easement
- Vegetation Criteria Not Met
- Vegetation Criteria Met
- Stream Problem Area (2016)
- Hobo Gauge
- Crest Gauge
- Monitoring Gauges
- Photo Points
- Stationing (10+00)
- Cross Sections
- Stream Alignment
- Low Stem Density Areas
- Invasive Areas of Concern
- Log Sills
- Log Vanes
- Asbut Wetlands



Source: Esri, DigitalGlobe, GeoEye, AeroGRID, IGN, and the GIS User Community

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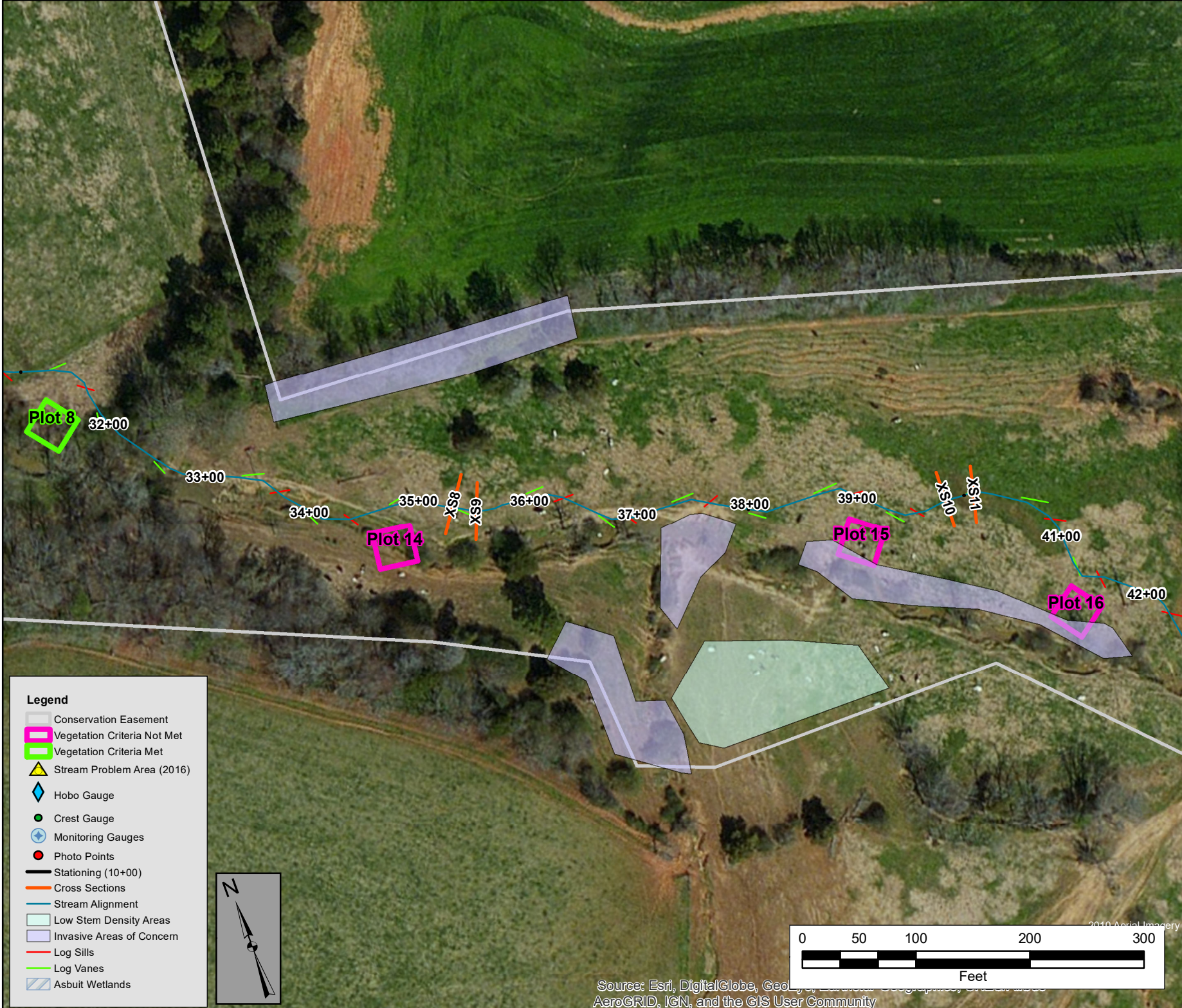
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HEATH DAIRY MONITORING YEAR 3
CURRENT CONDITIONS PLAN VIEW OVERVIEW
DMS #170 - WEST BRANCH

Randolph County, North Carolina



Figure 2.3



Legend

- Conservation Easement
- Vegetation Criteria Not Met
- Vegetation Criteria Met
- Stream Problem Area (2016)
- Hobo Gauge
- Crest Gauge
- Monitoring Gauges
- Photo Points
- Stationing (10+00)
- Cross Sections
- Stream Alignment
- Low Stem Density Areas
- Invasive Areas of Concern
- Log Sills
- Log Vanes
- Asbut Wetlands



Source: Esri, DigitalGlobe, GeoEye, AeroGRID, IGN, and the GIS User Community

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HEATH DAIRY MONITORING YEAR 3
CURRENT CONDITIONS PLAN VIEW OVERVIEW
DMS #170 - WEST BRANCH

Randolph County, North Carolina

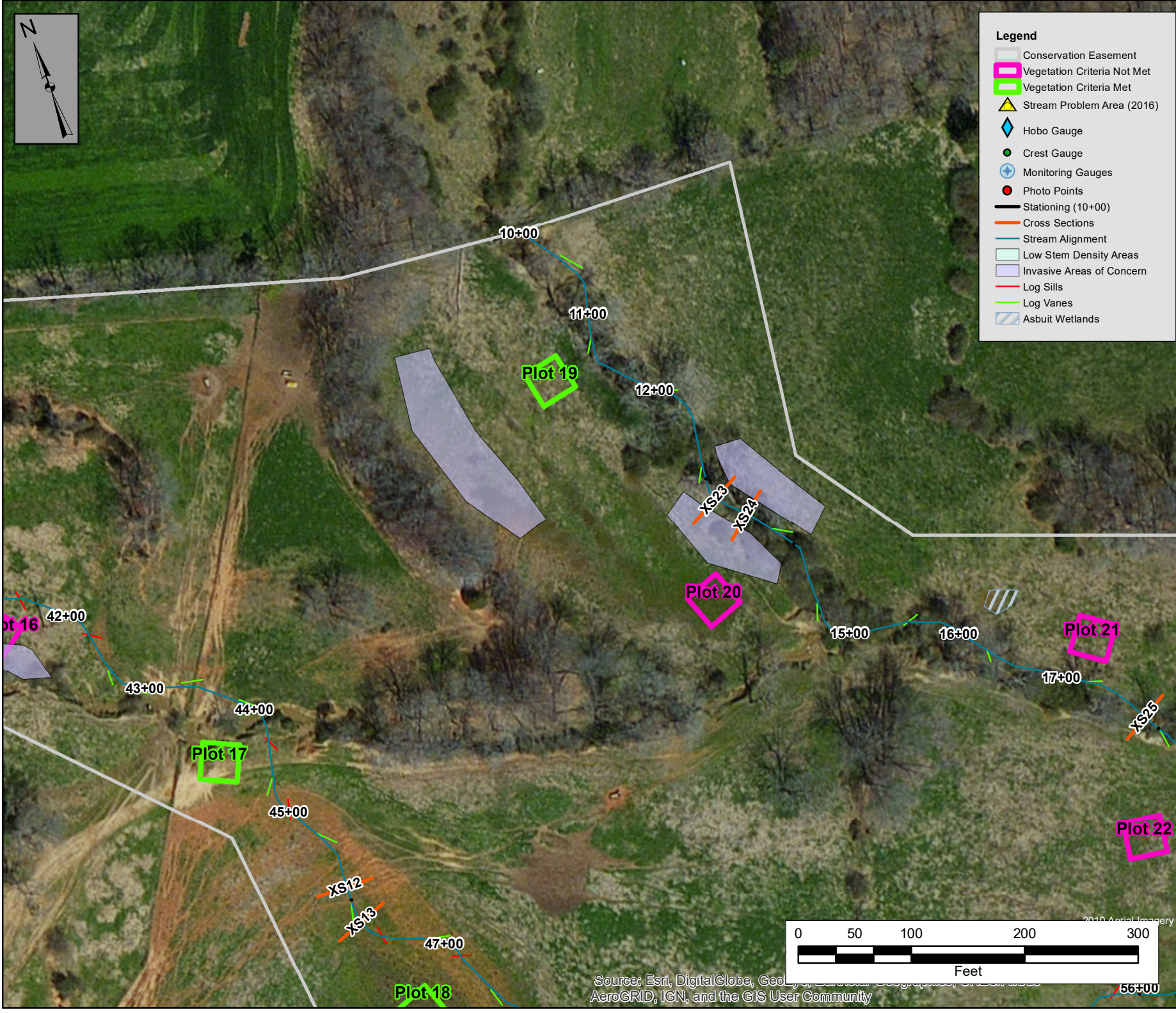


Figure 2.4



Legend

- Conservation Easement
- Vegetation Criteria Not Met
- Vegetation Criteria Met
- Stream Problem Area (2016)
- Hobo Gauge
- Crest Gauge
- Monitoring Gauges
- Photo Points
- Stationing (10+00)
- Cross Sections
- Stream Alignment
- Low Stem Density Areas
- Invasive Areas of Concern
- Log Sills
- Log Vanes
- Asbut Wetlands



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HEATH DAIRY MONITORING YEAR 3
 CURRENT CONDITIONS PLAN VIEW OVERVIEW
 DMS #170 - WEST BRANCH

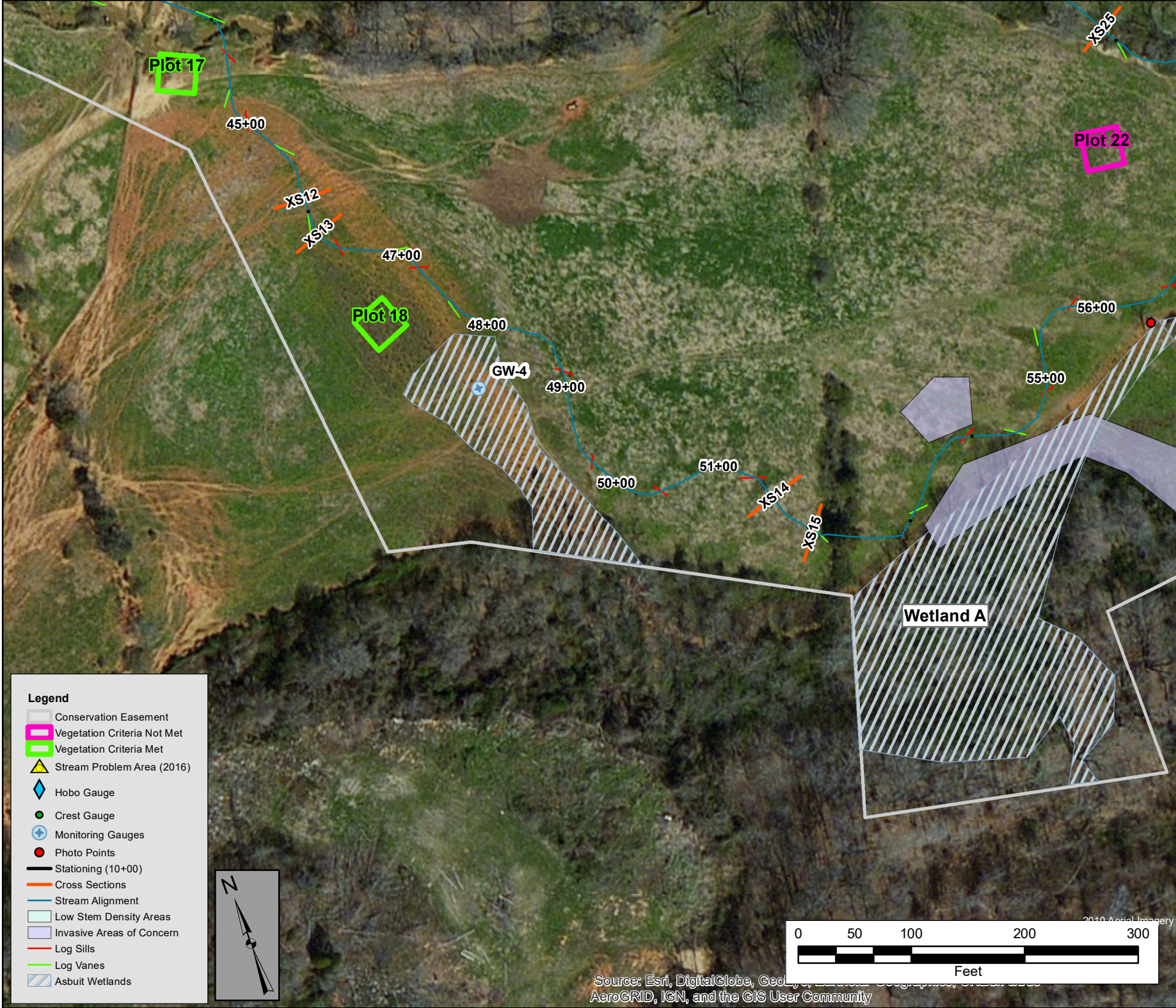
Randolph County, North Carolina



Figure 2.5

Source: Esri, DigitalGlobe, GeoEye, AeroGRID, IGN, and the GIS User Community

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Legend

- Conservation Easement
- Vegetation Criteria Not Met
- Vegetation Criteria Met
- Stream Problem Area (2016)
- Hobo Gauge
- Crest Gauge
- Monitoring Gauges
- Photo Points
- Stationing (10+00)
- Cross Sections
- Stream Alignment
- Low Stem Density Areas
- Invasive Areas of Concern
- Log Sills
- Log Vanes
- Asbut Wetlands



Source: Esri, DigitalGlobe, GeoEye, AeroGRID, IGN, and the GIS User Community

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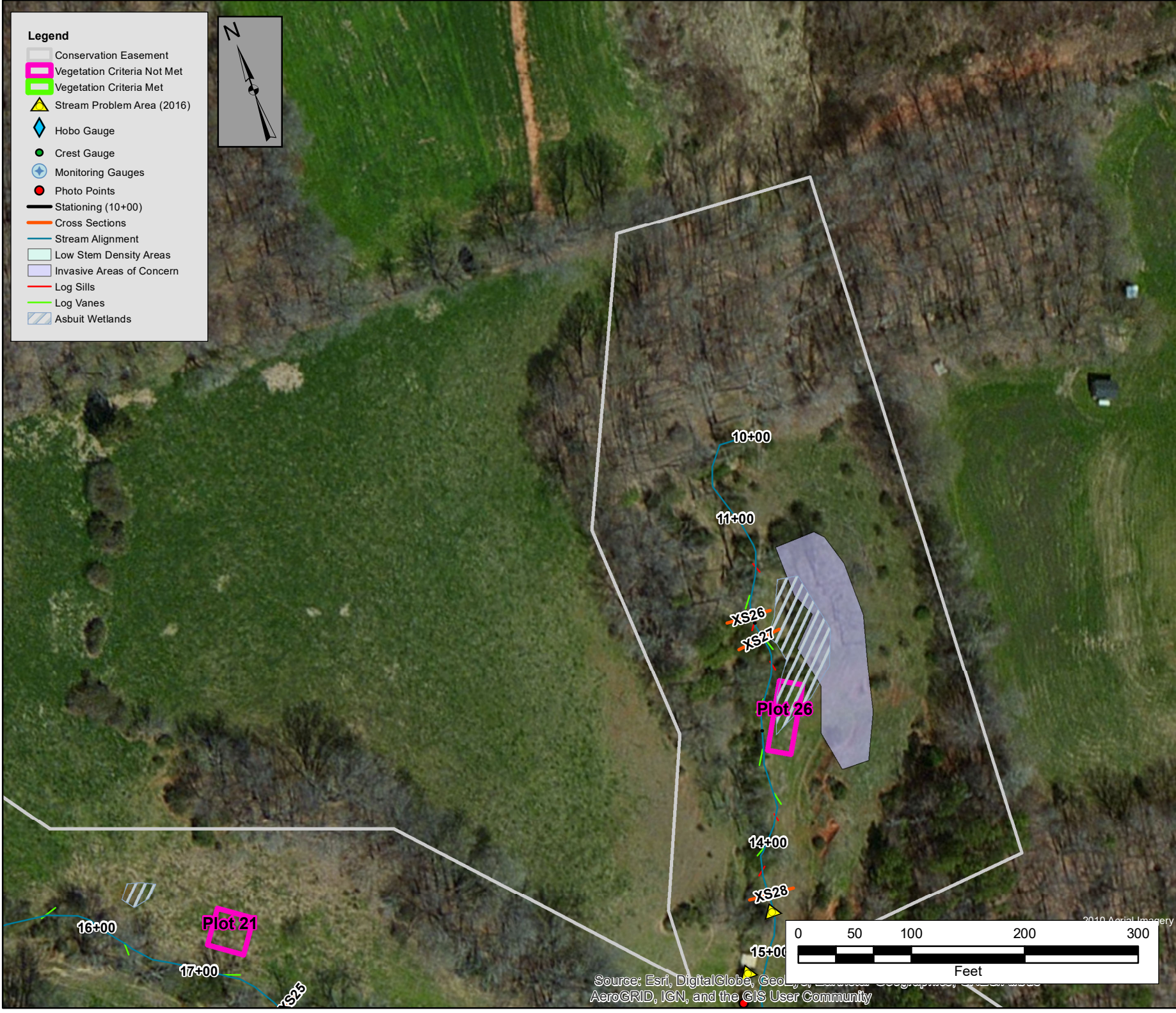
NOVEMBER 2016

HEATH DAIRY MONITORING YEAR 3
CURRENT CONDITIONS PLAN VIEW OVERVIEW
DMS #170 - WEST BRANCH

Randolph County, North Carolina



Figure 2.6



- Legend**
- Conservation Easement
 - Vegetation Criteria Not Met
 - Vegetation Criteria Met
 - Stream Problem Area (2016)
 - Hobo Gauge
 - Crest Gauge
 - Monitoring Gauges
 - Photo Points
 - Stationing (10+00)
 - Cross Sections
 - Stream Alignment
 - Low Stem Density Areas
 - Invasive Areas of Concern
 - Log Sills
 - Log Vanes
 - Asbuilt Wetlands



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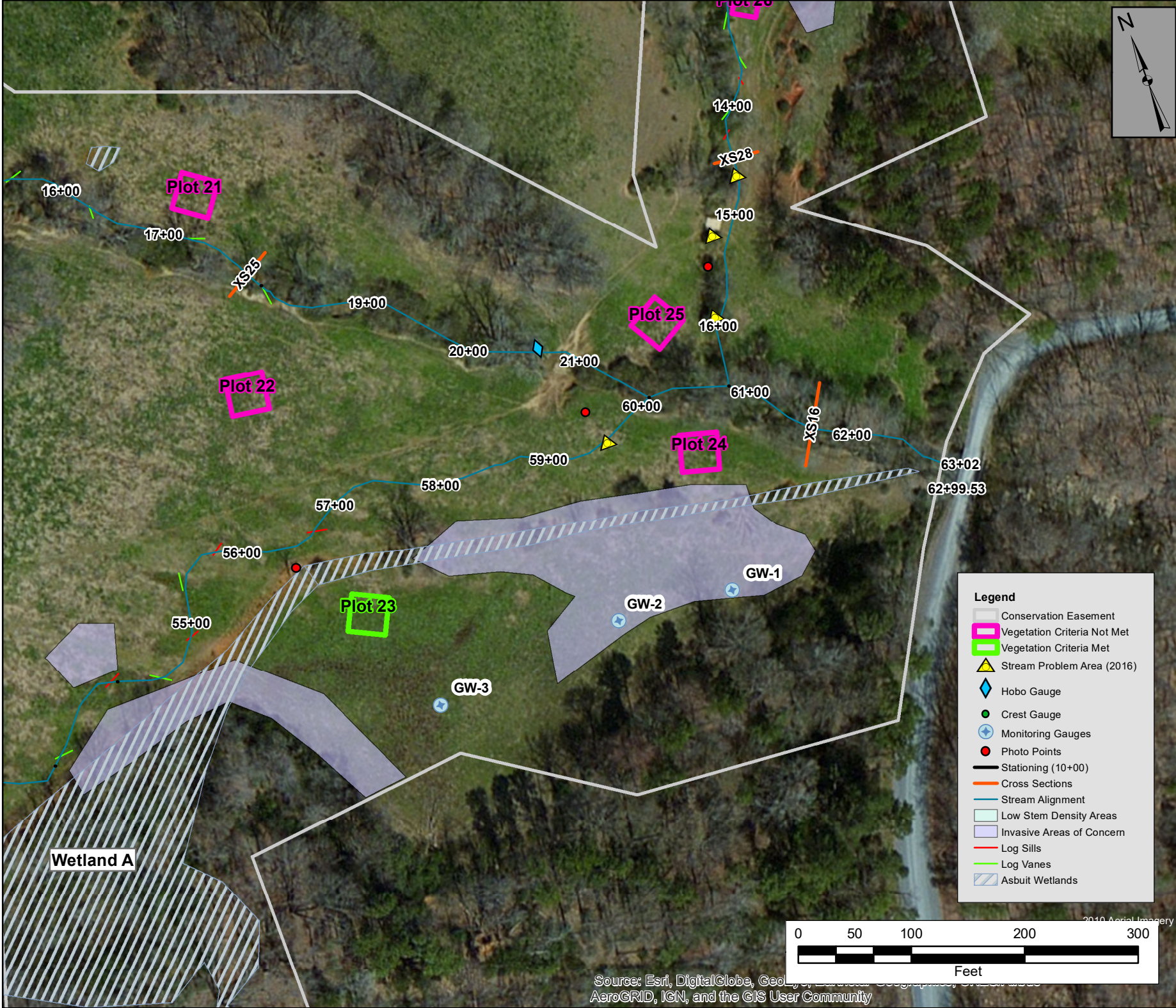
HEATH DAIRY MONITORING YEAR 3
CURRENT CONDITIONS PLAN VIEW OVERVIEW
DMS #170 - WEST BRANCH

Randolph County, North Carolina



Figure 2.7

Source: Esri, DigitalGlobe, GeoEye, AeroGRID, IGN, and the GIS User Community



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HEATH DAIRY MONITORING YEAR 3
 CURRENT CONDITIONS PLAN VIEW OVERVIEW
 DMS #170 - WEST BRANCH

Randolph County, North Carolina

Legend

- Conservation Easement
- Vegetation Criteria Not Met
- Vegetation Criteria Met
- Stream Problem Area (2016)
- Hobo Gauge
- Crest Gauge
- Monitoring Gauges
- Photo Points
- Stationing (10+00)
- Cross Sections
- Stream Alignment
- Low Stem Density Areas
- Invasive Areas of Concern
- Log Sills
- Log Vanes
- Asbut Wetlands



Source: Esri, DigitalGlobe, GeoEye, AeroGRID, IGN, and the GIS User Community



Figure 2.8

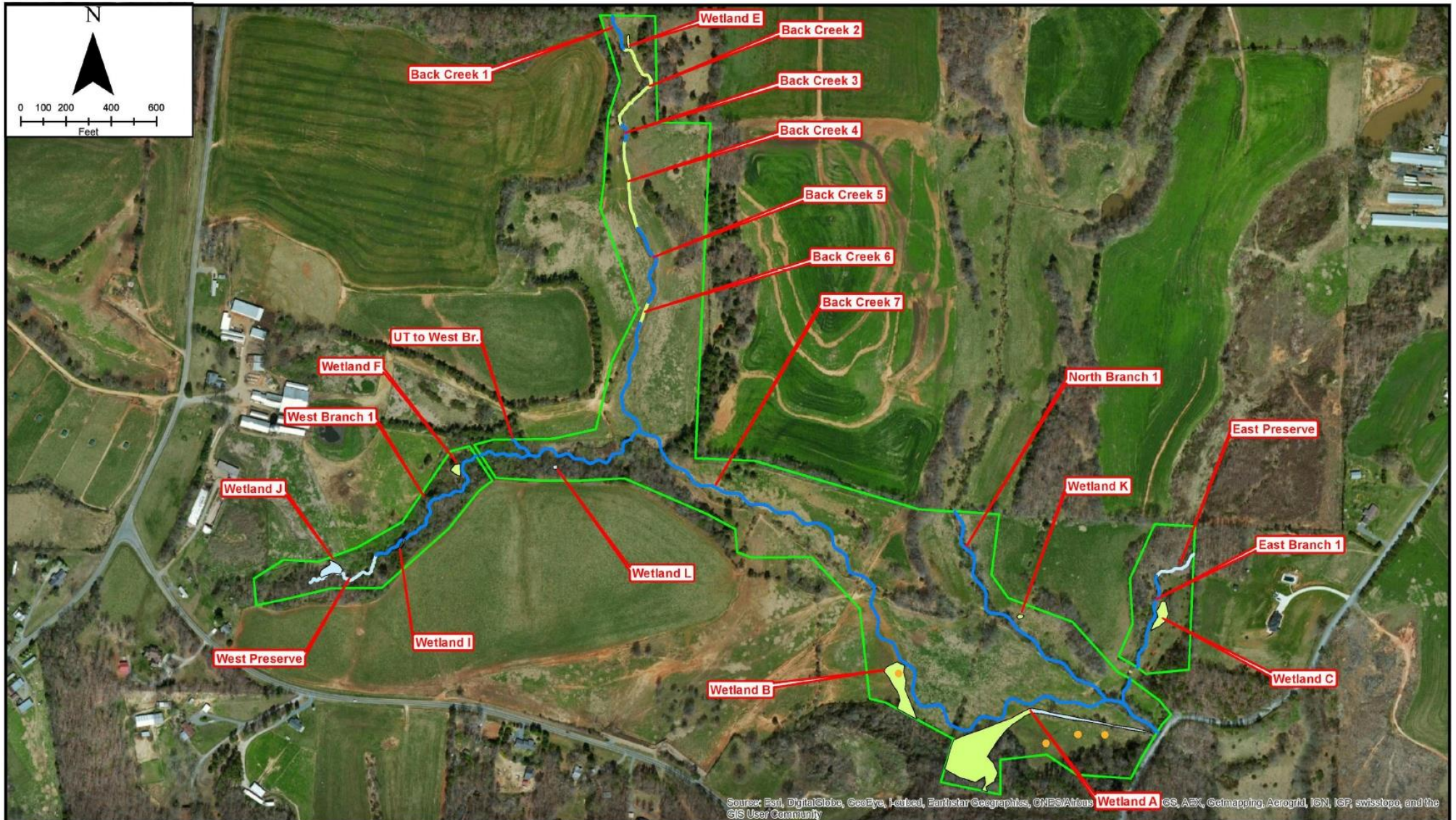


Figure 2.9

COMPONENT ASSESSMENT MAP
 HEATH DAIRY ROAD
 STREAM RESTORATION SITE
 RANDOLPH COUNTY, NORTH CAROLINA
 MONITORING YEAR 3
 DMS # 170



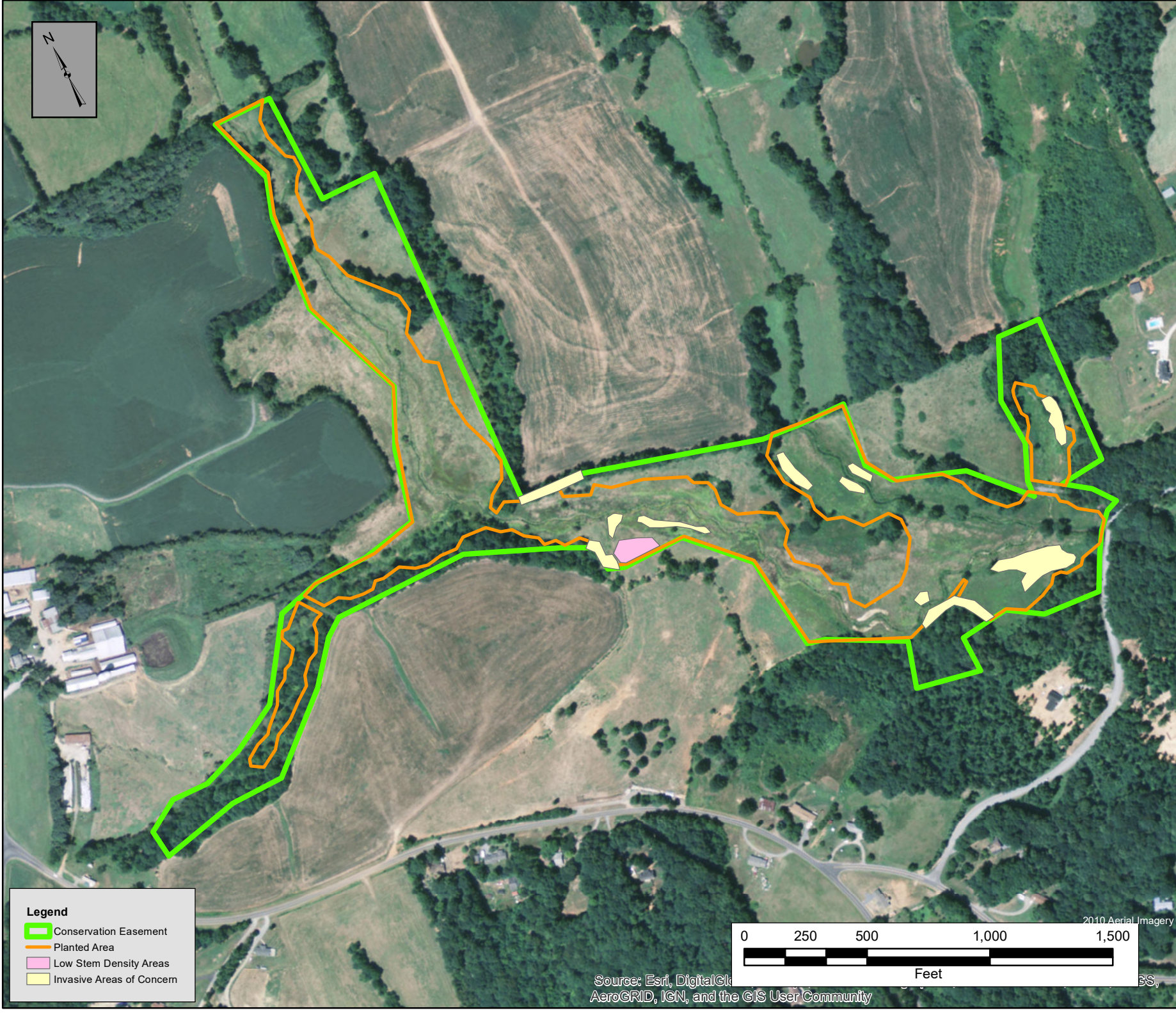
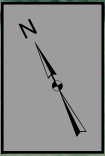
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Reproduced from the
 HDR As-built report;
 Figure 2, July 2014

DATE:
 January 2017

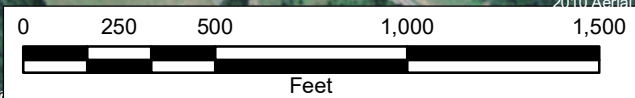
Legend

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



Legend

- Conservation Easement
- Planted Area
- Low Stem Density Areas
- Invasive Areas of Concern



Source: Esri, DigitalGlobe, GeoEye, AeroGRID, IGN, and the GIS User Community

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HEATH DAIRY MONITORING YEAR 3
VEGETATION PROBLEM AREAS
CURRENT CONDITIONS PLAN VIEW - DMS #170

Randolph County, North Carolina



Figure 2.10

Table 5.1. Visual Stream Assessment

Visual Stream Assessment - Back Creek							
Major Channel Category	Channel Sub-Category	Metric	Number 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. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	76	76			100%
		3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	76			76
	2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream 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				
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 <u>not</u> 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 \geq 1.6 Rootwads/logs providing some cover at base-flow.	104	104			100%

Table 5.2. Visual Stream Assessment

Visual Stream Assessment - West Branch to Back Creek

Major Channel Category	Channel Sub-Category	Metric	Number 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. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%		
		2. <u>Degradation</u> - Evidence of downcutting					100%		
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	52	52			100%		
		3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	52			52	100%	
	2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream 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 <u>NOT</u> include undercuts that are modest, appear sustainable and are providing habitat.							100%
	3. Mass Wasting	Bank slumping, calving, or collapse			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 <u>not</u> 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 \geq 1.6 Rootwads/logs providing some cover at base-flow.	84	84			100%		

Table 5.3. Visual Stream Assessment

Visual Stream Assessment - North Branch to Back Creek								
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing	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. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)				0	0	100%
		2. <u>Degradation</u> - Evidence of downcutting				0	0	100%
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	14	14				100%
		3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	14				14
	2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream 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						
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does <u>NOT</u> 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 <u>not</u> 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 \geq 1.6 Rootwads/logs providing some cover at base-flow.	15	15				100%

Table 5.4. Visual Stream Assessment

Visual Stream Assessment - East Branch to Back Creek							
Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing	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. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. <u>Degradation</u> - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	14	14			100%
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	14	14			100%
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream 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 <u>NOT</u> 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 <u>not</u> 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 \geq 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 MY3 criteria.	0.1 acres	green/pink polygon	1	0.28	0.9%
Total				0	0.28	0.9%
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				1	0.28	0.9%

Easement Acreage 56.8

Vegetation Category	Definitions	Mapping Threshold (SF)	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern	Areas or points (if too small to render as polygons at map scale).	0	blue/yellow polygon	11	2.10	3.7%
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%





Vegetation Monitoring Plot 1 MY-3, 2016



Vegetation Monitoring Plot 2 MY-3, 2016



Vegetation Monitoring Plot 3 MY-3, 2016



Vegetation Monitoring Plot 4 MY-3, 2016



Vegetation Monitoring Plot 5 MY-3, 2016



Vegetation Monitoring Plot 6 MY-3, 2016



Vegetation Monitoring Plot 7 MY-3, 2016



Vegetation Monitoring Plot 8 MY-3, 2016



Vegetation Monitoring Plot 9 MY-3, 2016



Vegetation Monitoring Plot 10 MY-3, 2016



Vegetation Monitoring Plot 11 MY-3, 2016



Vegetation Monitoring Plot 12 MY-3, 2016



Vegetation Monitoring Plot 13 MY-3, 2016



Vegetation Monitoring Plot 14 MY-3, 2016



Vegetation Monitoring Plot 15 MY-3, 2016



Vegetation Monitoring Plot 16 MY-3, 2016



Vegetation Monitoring Plot 17 MY-3, 2016



Vegetation Monitoring Plot 18 MY-3, 2016



Vegetation Monitoring Plot 19 MY-3, 2016



Vegetation Monitoring Plot 20 MY-3, 2016



Vegetation Monitoring Plot 21 MY-3, 2016



Vegetation Monitoring Plot 22 MY-3, 2016



Vegetation Monitoring Plot 23 MY-3, 2016



Vegetation Monitoring Plot 24 MY-3, 2016



Vegetation Monitoring Plot 25 MY-3, 2016



Vegetation Monitoring Plot 26 MY-3, 2016

Appendix C: Vegetation Plot Data

Table 7. Vegetation Plot Success Criteria Attainment Summary

Plot #	Stream/ Wetland Stems ¹	Volunteer Stems ²	Total Stems ³	Success Criteria Met?
1	445	40	486	Yes
2	405	283	688	Yes
3	567	283	850	Yes
4	243	0	243	No
5	283	0	283	No
6	243	0	243	No
7	162	0	162	No
8	324	1093	1416	Yes
9	0	769	769	No
10	324	81	405	Yes
11	243	0	243	No
12	162	81	243	No
13	162	81	243	No
14	283	121	121	No
15	81	121	202	No
16	283	40	324	No
17	526	324	850	Yes
18	445	40	486	Yes
19	486	40	526	Yes
20	121	0	121	No
21	40	40	81	No
22	243	0	243	No
23	486	0	486	Yes
24	243	202	445	No
25	81	0	81	No
26	162	243	405	No
Project Avg	271	149	409	No

¹Stream/Wetland Stems = Native planted trees and shrubs. Does NOT include live stakes or vines.

²Volunteers = Native volunteer trees and shrubs. Does NOT include vines or planted stems.

³Total = Planted + volunteer native woody stems, including live stakes. Excludes exotics & vines.

Table 8.1. Vegetation Plot Summary

Scientific Name	Common Name	Species Type	170-01-0001			170-01-0002			170-01-0003			170-01-0004			170-01-0005			170-01-0006		
			PnoLS	P-all	T	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	1	1	1
Carpinus	hornbeam	Tree																		
Carya glabra	pignut hickory	Tree							1	1	1									
Celtis laevigata	sugarberry	Tree																		
Diospyros virginiana	common persimmon	Tree	6	6	6	1	1	1	1	1	1							1	1	1
Fraxinus pennsylvanica	green ash	Tree						1	3	3	4							2	2	2
Juglans nigra	black walnut	Tree						3			5									
Liquidambar styraciflua	sweetgum	Tree			1			1												
Liriodendron tulipifera	tuliptree	Tree	2	2	2	1	1	3	1	1	1									
Nyssa sylvatica	blackgum	Tree				2	2	2												
Platanus occidentalis	American sycamore	Tree										3	3	3	2	2	2	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	1	1	1				1	1	1	1	1	1
Quercus rubra	northern red oak	Tree	2	2	2				5	5	5	3	3	3	1	1	1			
Quercus velutina	black oak	Tree				1	1	1							1	1	1			
Salix nigra	black willow	Tree																		
Sambucus nigra	elderberry	Shrub																		
Ulmus alata	winged elm	Tree									1									
Ulmus americana	American elm	Tree																		
Stem count			11	11	12	10	10	17	14	14	21	6	6	6	7	7	7	6	6	6
size (ares)			1			1			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			4	4	5	6	6	9	7	7	9	2	2	2	5	5	5	5	5	5
Stems per ACRE			445	445	486	405	405	688	567	567	850	243	243	243	283	283	283	243	243	243

Color Codes for Planted Tree Density
Exceeds 320 trees/acre requirements by 10%
Exceeds 320 trees/acre requirements, but by less than 10%
Fails to meet 320 trees/acre requirements, by less than 10%
Fails to meet 320 trees/acre requirements by more than 10%

Table 8.2. Vegetation Plot Summary

Scientific Name	Common Name	Species Type	170-01-0007			170-01-0008			170-01-0009			170-01-0010			170-01-0011			170-01-0012		
			PnoLS	P-all	T	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						7												
Betula nigra	river birch	Tree						1				1	1	1						
Carpinus	hornbeam	Tree										1	1	1						
Carya glabra	pignut hickory	Tree												1	2	2	2			
Celtis laevigata	sugarberry	Tree												1	1	1				
Diospyros virginiana	common persimmon	Tree										2	2	2						
Fraxinus pennsylvanica	green ash	Tree	2	2	2	2	2	3						1				3	3	3
Juglans nigra	black walnut	Tree								19										2
Liquidambar styraciflua	sweetgum	Tree						8												
Liriodendron tulipifera	tuliptree	Tree				3	3	7				1	1	1	2	2	2	1	1	1
Nyssa sylvatica	blackgum	Tree																		
Platanus occidentalis	American sycamore	Tree				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				1	1	1												
Quercus palustris	pin oak	Tree																		
Quercus phellos	willow oak	Tree	1	1	1	1	1	1				1	1	1						
Quercus rubra	northern red oak	Tree	1	1	1							1	1	1	1	1	1			
Quercus velutina	black oak	Tree																		
Salix nigra	black willow	Tree						1												
Sambucus nigra	elderberry	Shrub																		
Ulmus alata	winged elm	Tree																		
Ulmus americana	American elm	Tree						5												
Stem count			4	4	4	8	8	35	0	0	19	8	8	10	6	6	6	4	4	6
size (ares)			1			1			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			3	3	3	5	5	10	0	0	1	7	7	9	4	4	4	2	2	3
Stems per ACRE			162	162	162	324	324	1416	0	0	769	324	324	405	243	243	243	162	162	243

Color Codes for Planted Tree Density
Exceeds 320 trees/acre requirements by 10%
Exceeds 320 trees/acre requirements, but by less than 10%
Fails to meet 320 trees/acre requirements, by less than 10%
Fails to meet 320 trees/acre requirements by more than 10%

Table 8.3. Vegetation Plot Summary

Scientific Name	Common Name	Species Type	170-01-0013			170-01-0014			170-01-0015			170-01-0016			170-01-0017			170-01-0018		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer negundo	boxelder	Tree																		2
Baccharis	baccharis	Shrub								1										1
Betula nigra	river birch	Tree																	1	1
Carpinus	hornbeam	Tree																		
Carya glabra	pignut hickory	Tree																		
Celtis laevigata	sugarberry	Tree																		
Diospyros virginiana	common persimmon	Tree				1	1	1	1	1	1	2	2	2	5	5	5			
Fraxinus pennsylvanica	green ash	Tree										2	2	2				9	9	9
Juglans nigra	black walnut	Tree			1															
Liquidambar styraciflua	sweetgum	Tree								1			1							1
Liriodendron tulipifera	tuliptree	Tree	1	1	1	1	1	1							2	2	4			
Nyssa sylvatica	blackgum	Tree				1	1	1												1
Platanus occidentalis	American sycamore	Tree	1	1	1															1
Quercus	oak	Tree				2	2	2												
Quercus falcata	southern red oak	Tree																		
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				
Quercus rubra	northern red oak	Tree	1	1	1				1	1	1	1	1	1	3	3	3	1	1	1
Quercus velutina	black oak	Tree								1	1	1	1							
Salix nigra	black willow	Tree			1			3												1
Sambucus nigra	elderberry	Shrub	1	1	1															
Ulmus alata	winged elm	Tree																		
Ulmus americana	American elm	Tree				1	1	1	1	1	1									
		Stem count	4	4	6	7	7	10	3	3	6	7	7	8	13	13	21	11	11	12
		size (ares)	1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	4	4	6	6	6	7	3	3	6	5	5	6	4	4	9	3	3	4
		Stems per ACRE	162	162	243	283	283	405	121	121	243	283	283	324	526	526	850	445	445	486

Color Codes for Planted Tree Density	
Exceeds 320 trees/acre requirements by 10%	
Exceeds 320 trees/acre requirements, but by less than 10%	
Fails to meet 320 trees/acre requirements, by less than 10%	
Fails to meet 320 trees/acre requirements by more than 10%	

Table 8.4. Vegetation Plot Summary

Scientific Name	Common Name	Species Type	170-01-0019			170-01-0020			170-01-0021			170-01-0022			170-01-0023			170-01-0024		
			PnoLS	P-all	T	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				1	1	1	1	1	1			
Carpinus	hornbeam	Tree																		
Carya glabra	pignut hickory	Tree																		
Celtis laevigata	sugarberry	Tree																		
Diospyros virginiana	common persimmon	Tree										1	1	1	3	3	3			
Fraxinus pennsylvanica	green ash	Tree	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	1	1	4
Juglans nigra	black walnut	Tree			1						1									2
Liquidambar styraciflua	sweetgum	Tree																		
Liriodendron tulipifera	tuliptree	Tree	1	1	1															
Nyssa sylvatica	blackgum	Tree	1	1	1										2	2	2	1	1	1
Platanus occidentalis	American sycamore	Tree				1	1	1							1	1	1			
Quercus	oak	Tree																		
Quercus falcata	southern red oak	Tree	3	3	3															
Quercus michauxii	swamp chestnut oak	Tree										1	1	1						
Quercus nigra	water oak	Tree																2	2	2
Quercus palustris	pin oak	Tree										1	1	1						
Quercus phellos	willow oak	Tree	2	2	2										1	1	1	2	2	2
Quercus rubra	northern red oak	Tree	3	3	3										1	1	1			
Quercus velutina	black oak	Tree													1	1	1			
Salix nigra	black willow	Tree																		
Sambucus nigra	elderberry	Shrub																		
Ulmus alata	winged elm	Tree																		
Ulmus americana	American elm	Tree	1	1	1															
	Stem count		12	12	13	3	3	3	1	1	2	6	6	6	12	12	12	6	6	11
	size (ares)		1			1			1			1			1			1		
	size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.02		
	Species count		7	7	8	3	3	3	1	1	2	5	5	5	8	8	8	4	4	5
	Stems per ACRE		486	486	526	121	121	121	40	40	81	243	243	243	486	486	486	243	243	445

Color Codes for Planted Tree Density
Exceeds 320 trees/acre requirements by 10%
Exceeds 320 trees/acre requirements, but by less than 10%
Fails to meet 320 trees/acre requirements, by less than 10%
Fails to meet 320 trees/acre requirements by more than 10%

Table 8.5. Vegetation Plot Summary

Scientific Name	Common Name	Species Type	Plot Data 2016						Project Total Stem Counts & Annual Mean Density														
			170-01-0025			170-01-0026			MY5 (****)			MY4 (****)			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							-	-	-	-	-	-			2						
Baccharis	baccharis	Shrub							-	-	-	-	-	-			9						
Betula nigra	river birch	Tree							-	-	-	-	-	-	11	11	12	3	3	3	2	2	2
Carpinus	hornbeam	Tree							-	-	-	-	-	-	1	1	1						
Carya glabra	pignut hickory	Tree							-	-	-	-	-	-	3	3	3	4	4	4	6	6	6
Celtis laevigata	sugarberry	Tree							-	-	-	-	-	-						1			
Diospyros virginiana	common persimmon	Tree							-	-	-	-	-	-	24	24	24	18	18	20	12	12	12
Fraxinus pennsylvanica	green ash	Tree	1	1	1	3	3	3	-	-	-	-	-	-	35	35	42	28	28	34	19	19	19
Juglans nigra	black walnut	Tree							-	-	-	-	-	-			34			25			
Liquidambar styraciflua	sweetgum	Tree							-	-	-	-	-	-			13	1	1	6			
Liriodendron tulipifera	tuliptree	Tree							-	-	-	-	-	-	16	16	24	17	17	23	7	7	7
Nyssa sylvatica	blackgum	Tree							-	-	-	-	-	-	7	7	8	3	3	4			
Platanus occidentalis	American sycamore	Tree						1	-	-	-	-	-	-	10	10	12	10	10	10	3	3	3
Quercus	oak	Tree							-	-	-	-	-	-	2	2	2	7	7	7	18	18	18
Quercus falcata	southern red oak	Tree				1	1	1	-	-	-	-	-	-	5	5	5	9	9	9	3	3	3
Quercus michauxii	swamp chestnut oak	Tree							-	-	-	-	-	-	2	2	2				1	1	1
Quercus nigra	water oak	Tree							-	-	-	-	-	-	3	3	3	4	4	4	3	3	3
Quercus palustris	pin oak	Tree							-	-	-	-	-	-	1	1	1						
Quercus phellos	willow oak	Tree							-	-	-	-	-	-	20	20	20	12	12	12	15	15	15
Quercus rubra	northern red oak	Tree	1	1	1				-	-	-	-	-	-	26	26	26	16	16	16	1	1	1
Quercus velutina	black oak	Tree							-	-	-	-	-	-	4	4	5						
Salix nigra	black willow	Tree						5	-	-	-	-	-	-			11			9			
Sambucus nigra	elderberry	Shrub							-	-	-	-	-	-	1	1	1						
Ulmus alata	winged elm	Tree							-	-	-	-	-	-			1			3			
Ulmus americana	American elm	Tree							-	-	-	-	-	-	1	1	6			3			
		Stem count	2	2	2	4	4	10	-	-	-	-	-	-	172	172	267	132	132	193	90	90	90
		size (ares)	1			1			26			26			26			26			26		
		size (ACRES)	0.02			0.02			0.64			0.64			0.64			0.64			0.64		
		Species count	2	2	2	2	2	4	-	-	-	-	-	-	18	18	24	13	13	18	12	12	12
		Stems per ACRE	81	81	81	162	162	405	-	-	-	-	-	-	268	268	416	205	205	300	140	140	140

Color Codes for Planted Tree Density
Exceeds 320 trees/acre requirements by 10%
Exceeds 320 trees/acre requirements, but by less than 10%
Fails to meet 320 trees/acre requirements, by less than 10%
Fails to meet 320 trees/acre requirements by more than 10%

Appendix D: Stream Survey Data

Figure 3.1 Cross Section Data

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-1, Pool	
Survey Date	10/2016	
SUMMARY DATA		
Bankfull Elevation (ft)	613.68	
Bankfull Cross-Sectional Area (ft ²)	26.9	
Bankfull Width (ft)	20.3	
Flood Prone Area Elevation (ft)	615.64	
Flood Prone Width (ft)	32.00	
Bankfull Mean Depth (ft)	1.33	
Bankfull Max Depth (ft)	1.96	
W/D Ratio	15.30	
Entrenchment Ratio	1.58	
Bank Height Ratio	1.21	

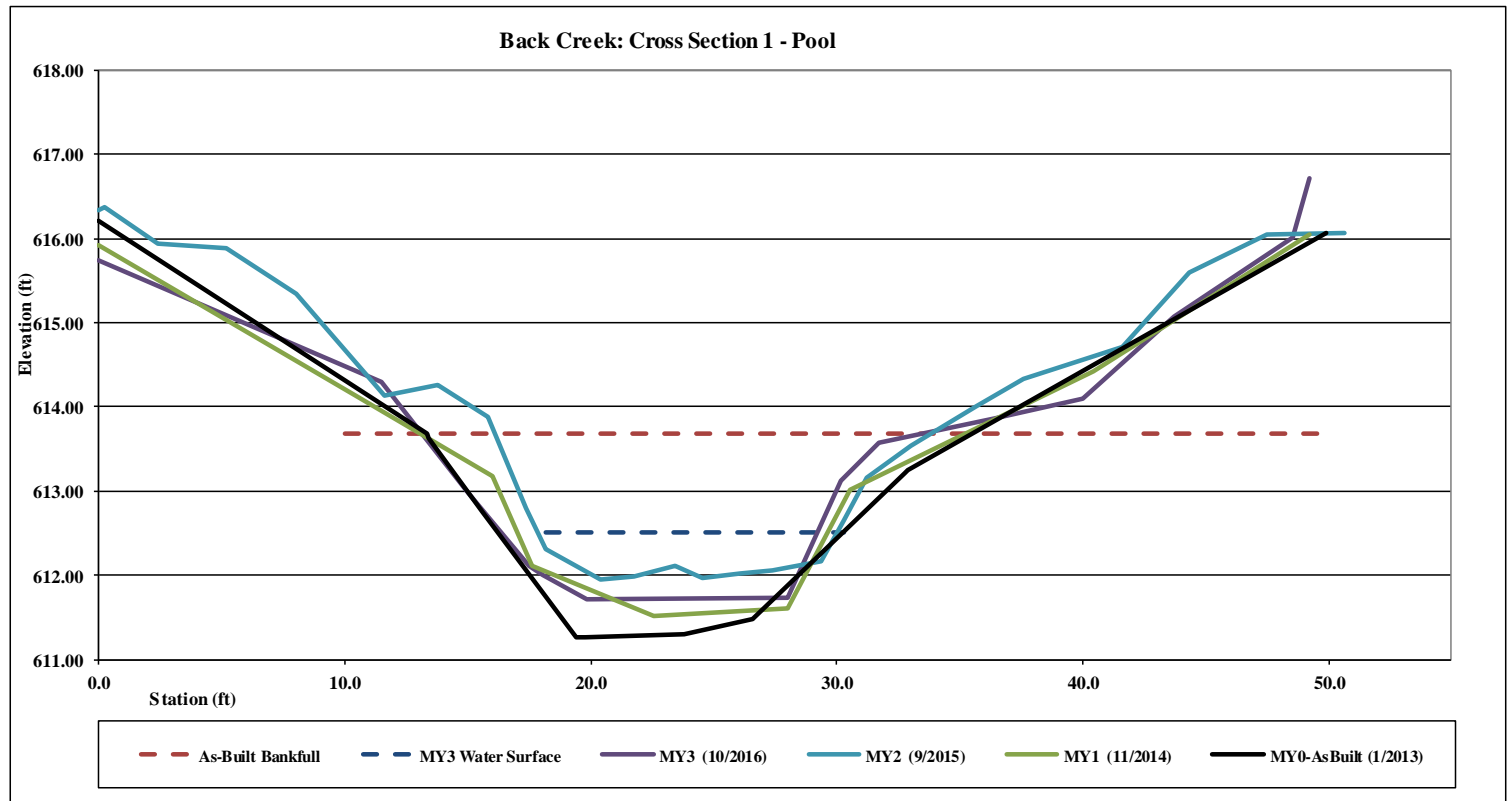


XS-1: Upstream



XS-1: Downstream

Station	Elevation	Notes
0.00	615.74	LPIN
11.50	614.30	TLB
15.00	612.97	
17.50	612.12	
18.06	612.00	
19.83	611.72	THW
27.98	611.74	
30.18	613.12	
31.69	613.58	
36.41	613.86	
40.01	614.10	TRB
43.69	615.07	
48.57	616.01	
49.24	616.72	RPIN



3.2 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-2, Riffle
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	613.66
Bankfull Cross-Sectional Area (ft ²)	15.95
Bankfull Width (ft)	16.71
Flood Prone Area Elevation (ft)	615.25
Flood Prone Width (ft)	26.00
Bankfull Mean Depth (ft)	0.95
Bankfull Max Depth (ft)	1.59
W/D Ratio	17.50
Entrenchment Ratio	1.56
Bank Height Ratio	0.85



XS-2: Upstream



XS-2: Downstream

Station	Elevation	Notes
0.00	615.02	LPIN
0.71	615.17	
4.29	614.93	
8.86	614.60	
11.59	614.44	
13.99	613.92	TLB
14.96	613.76	
16.87	613.16	
18.22	612.46	
20.05	612.41	
23.74	612.07	THW
25.38	612.30	
26.59	612.78	
28.15	612.64	
29.26	613.42	TRB
30.86	613.07	
30.87	613.13	
32.86	614.08	
35.66	614.50	
39.79	614.84	
44.23	615.80	
48.03	616.07	
50.34	616.68	
50.85	616.82	RPIN

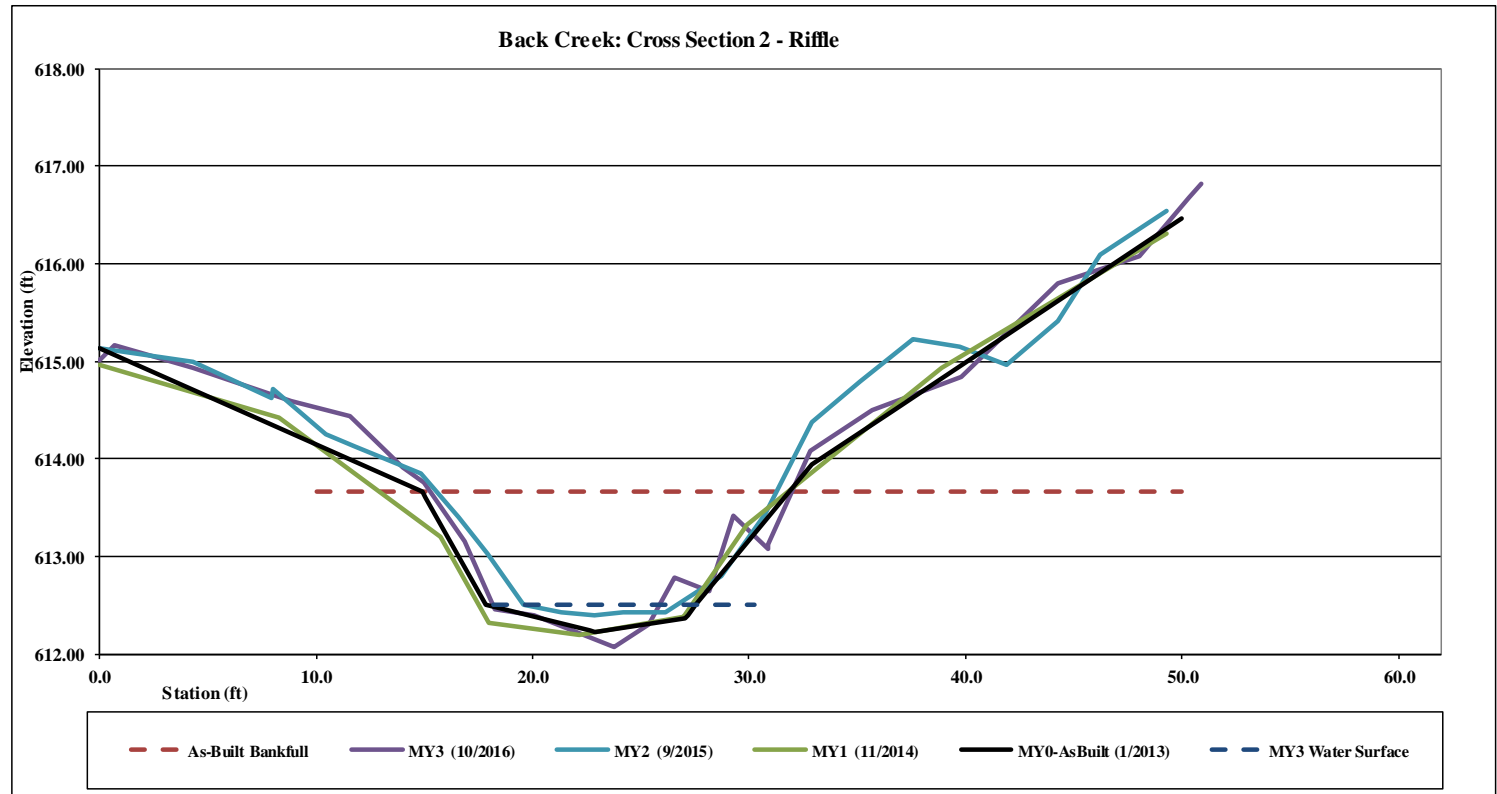


Figure 3.3 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-3, Riffle
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	611.43
Bankfull Cross-Sectional Area (ft²)	34.11
Bankfull Width (ft)	34.84
Flood Prone Area Elevation (ft)	614.72
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	0.98
Bankfull Max Depth (ft)	3.29
W/D Ratio	35.59
Entrenchment Ratio	2.87
Bank Height Ratio	0.78



XS-3: Upstream



XS-3: Downstream

Station	Elevation	Notes
0.00	611.43	LPIN
0.60	610.94	
3.37	611.05	
7.27	611.15	
11.07	611.35	
14.06	611.42	
17.10	611.37	
19.09	611.17	TLB
20.78	610.55	
20.93	609.90	
21.86	608.52	
23.06	608.25	
24.63	608.43	
26.74	608.14	THW
28.04	608.50	
29.44	608.83	
30.14	610.06	
31.70	610.70	TRB
32.75	611.02	
34.31	611.41	
36.50	611.49	
39.25	611.79	
41.98	612.49	
45.37	612.64	
48.10	612.70	
48.40	613.09	RPIN

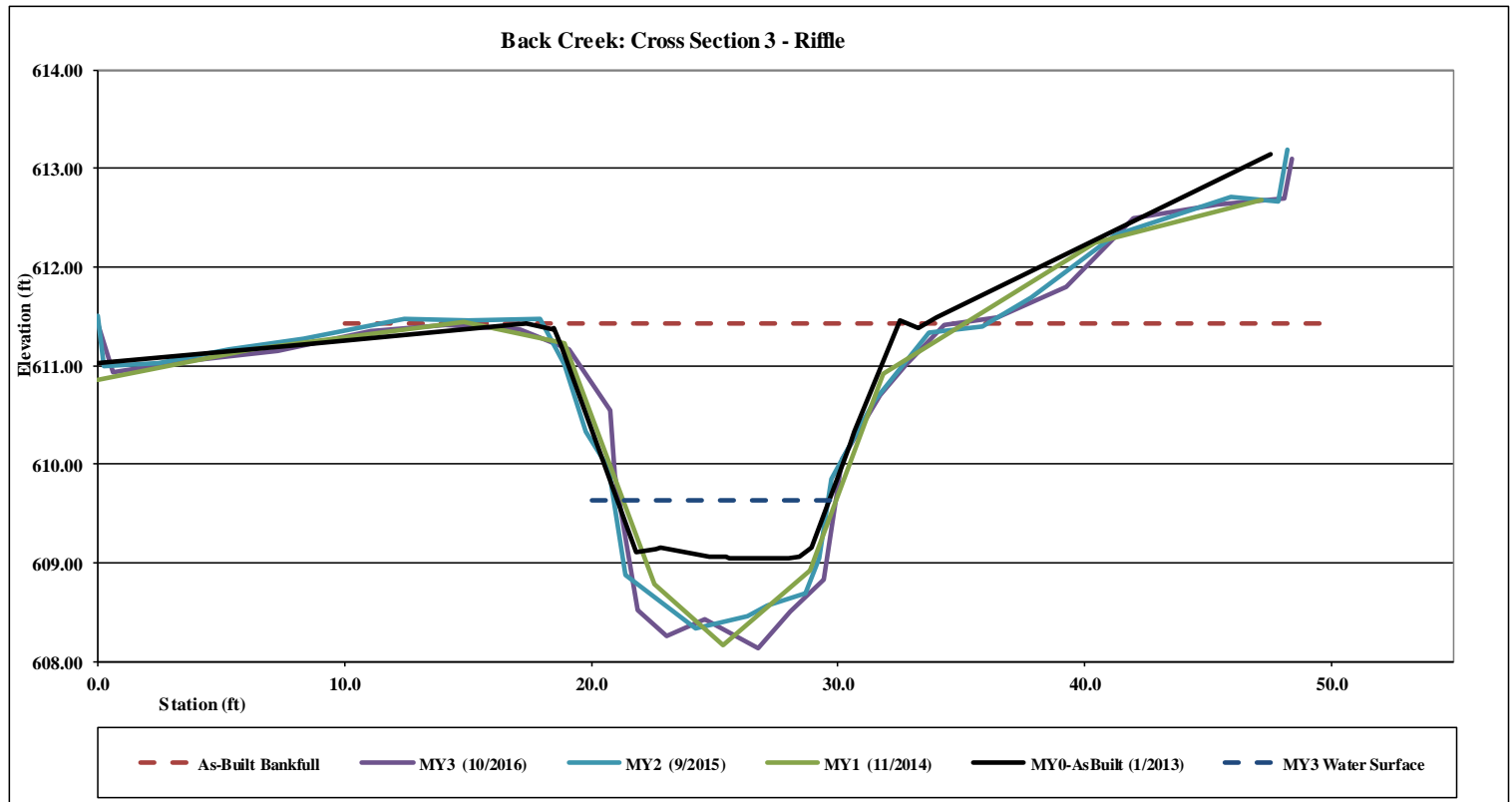


Figure 3.4 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-4, Pool
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	610.40
Bankfull Cross-Sectional Area (ft²)	27.77
Bankfull Width (ft)	18.95
Flood Prone Area Elevation (ft)	1752.86
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.47
Bankfull Max Depth (ft)	572.40
W/D Ratio	12.94
Entrenchment Ratio	5.28
Bank Height Ratio	1.01



XS-4: Upstream



XS-4: Downstream

Station	Elevation	Notes
0.00	610.80	LPIN
0.46	610.54	
4.67	610.69	
9.16	610.53	
12.54	610.93	TLB
15.10	610.52	
17.60	609.93	
19.43	609.60	
21.03	608.94	
22.00	607.73	
23.70	607.87	
28.78	608.06	TWG
29.64	608.50	
30.18	609.07	
30.76	609.25	
31.71	609.70	
32.97	609.87	
34.62	610.42	TRB
36.40	610.95	
40.45	611.61	
44.34	612.02	
48.38	612.14	
50.47	612.16	
50.64	612.47	RPIN

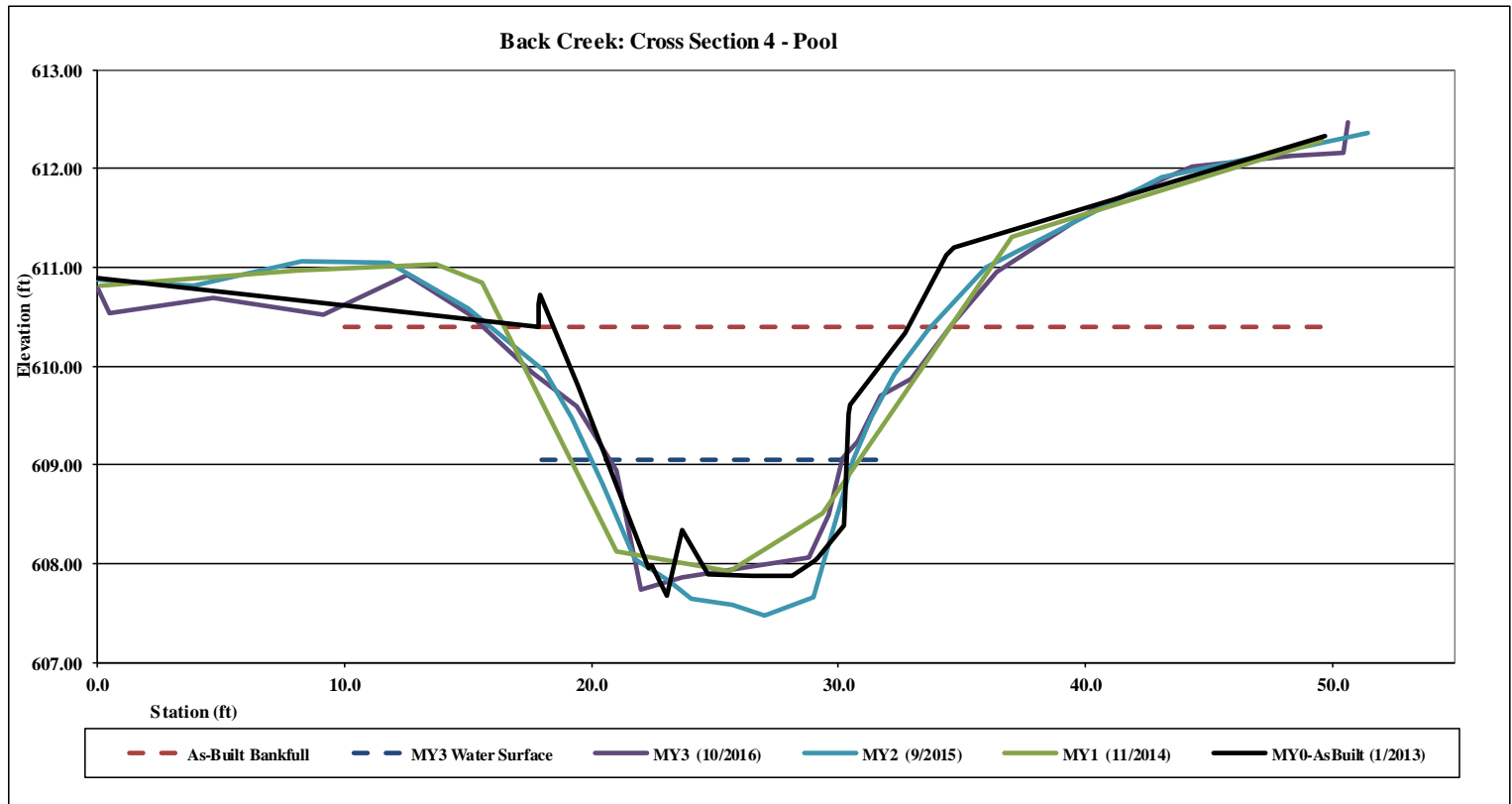


Figure 3.5 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-5, Pool
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	608.93
Bankfull Cross-Sectional Area (ft²)	31.05
Bankfull Width (ft)	14.92
Flood Prone Area Elevation (ft)	612.19
Flood Prone Width (ft)	50.00
Bankfull Mean Depth (ft)	2.08
Bankfull Max Depth (ft)	3.26
W/D Ratio	7.17
Entrenchment Ratio	3.35
Bank Height Ratio	0.87



XS-5: Upstream



XS-5: Downstream

Station	Elevation	Notes
0.00	610.19	LPIN
0.26	609.89	
3.11	610.03	
5.82	609.77	
9.30	609.60	
13.04	609.32	
15.57	609.57	
16.75	609.20	
17.41	608.52	TLB
19.51	607.05	
21.66	606.26	
22.15	605.88	
23.66	605.67	TWG
24.16	605.78	
25.55	606.05	
27.24	606.06	
28.51	606.60	
29.98	607.37	
30.79	608.90	
31.48	608.84	TRB
33.96	609.33	
37.53	609.09	
40.60	609.43	
43.46	610.03	
47.33	610.09	
50.35	610.08	
50.82	610.49	RPIN

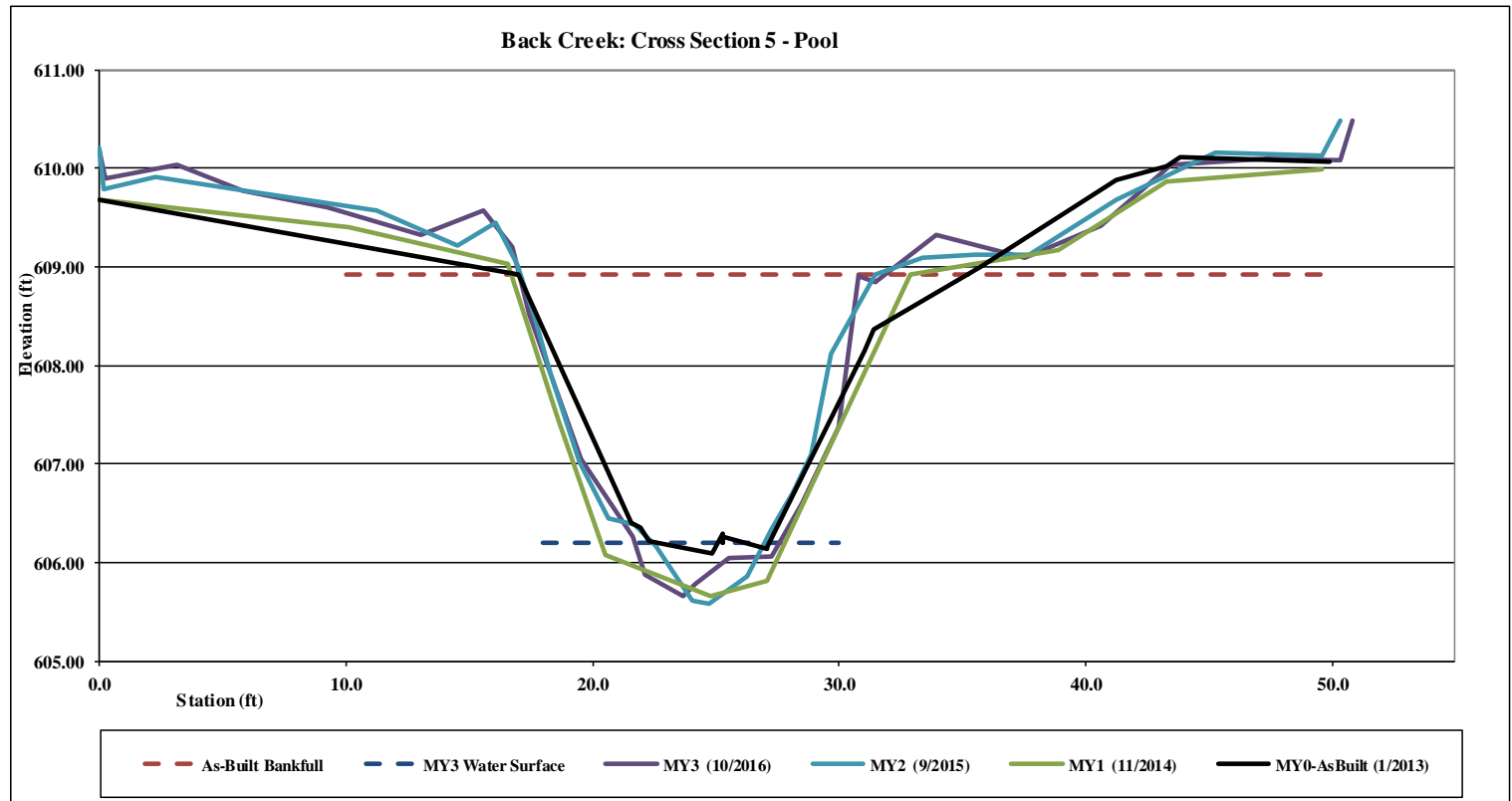


Figure 3.6 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-6, Riffle
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	606.49
Bankfull Cross-Sectional Area (ft²)	11.48
Bankfull Width (ft)	13.78
Flood Prone Area Elevation (ft)	607.97
Flood Prone Width (ft)	75.00
Bankfull Mean Depth (ft)	0.83
Bankfull Max Depth (ft)	1.48
W/D Ratio	16.54
Entrenchment Ratio	5.44
Bank Height Ratio	0.91



XS-6: Upstream



XS-6: Downstream

Station	Elevation	Notes
0.00	608.53	LPIN
0.24	608.04	
3.68	608.00	
8.33	607.24	
17.19	606.77	TLB
18.08	606.78	
19.90	606.43	
20.94	606.07	
21.87	605.74	
23.06	605.52	
24.18	605.21	
25.05	604.99	
26.06	605.01	TWG
27.71	605.14	
29.54	605.68	
30.84	606.11	
32.93	606.36	TRB
34.25	606.77	
35.27	607.08	
38.73	606.90	
43.47	607.12	
47.47	607.67	
50.19	607.73	
51.41	608.13	RPIN

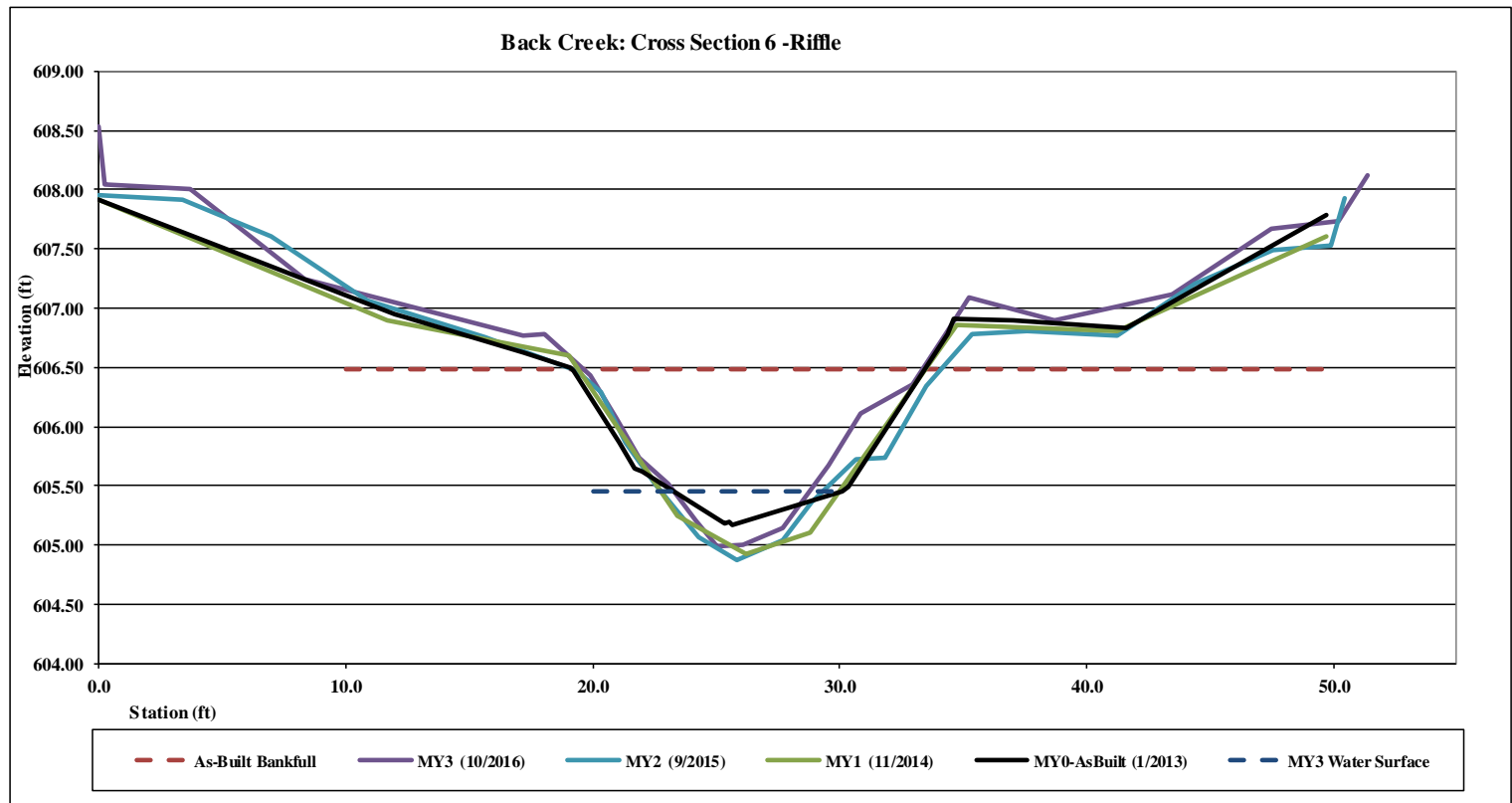


Figure 3.7 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-7, Pool
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	606.22
Bankfull Cross-Sectional Area (ft ²)	31.25
Bankfull Width (ft)	16.79
Flood Prone Area Elevation (ft)	608.81
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.86
Bankfull Max Depth (ft)	2.60
W/D Ratio	9.02
Entrenchment Ratio	5.96
Bank Height Ratio	1.05



XS-7: Upstream



XS-7: Downstream

Station	Elevation	Notes
0.00	607.87	LPIN
0.22	607.71	
2.94	607.80	
6.15	607.70	
9.44	606.99	
11.57	606.85	
13.12	606.72	TLB
15.07	606.17	
16.51	605.90	
17.36	605.51	
18.15	604.08	
24.46	603.36	
26.44	603.62	TWG
27.29	604.06	
28.52	604.36	
29.98	604.50	
31.14	606.09	
31.81	606.26	
34.09	606.35	TRB
36.98	606.32	
39.38	606.74	
43.67	607.39	
47.00	607.55	
49.90	607.66	
50.13	608.06	RPIN

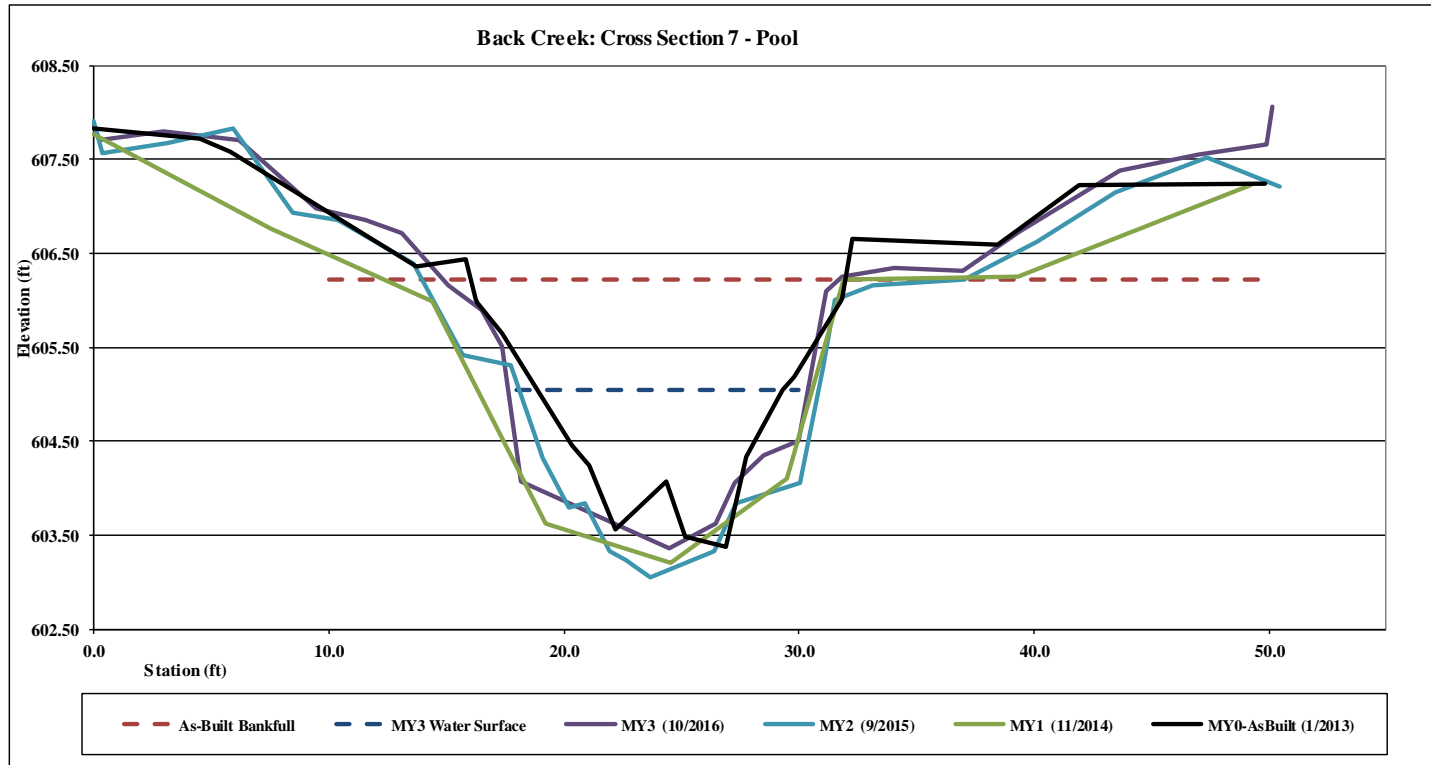


Figure 3.8 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-8 - Riffle
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	602.52
Bankfull Cross-Sectional Area (ft ²)	31.20
Bankfull Width (ft)	41.46
Flood Prone Area Elevation (ft)	604.43
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	0.75
Bankfull Max Depth (ft)	1.91
W/D Ratio	55.08
Entrenchment Ratio	2.41
Bank Height Ratio	1.02



XS-8: Upstream



XS-8: Downstream

Station	Elevation	Notes
0.00	602.45	LPIN
0.48	602.45	
0.81	602.47	
3.39	602.43	
8.43	602.43	
12.64	602.46	
17.02	602.61	
18.86	602.74	
19.98	602.92	TLB
21.32	602.25	
22.42	602.00	
23.11	601.34	
24.17	600.97	
25.45	600.62	
27.63	600.58	
30.17	600.45	
31.85	600.61	TWG
33.53	600.62	
35.91	601.03	
37.21	601.24	
38.28	601.66	
39.95	601.89	
41.89	602.30	
45.09	602.57	TRB
47.64	602.62	
51.72	602.51	
54.85	602.38	RPIN

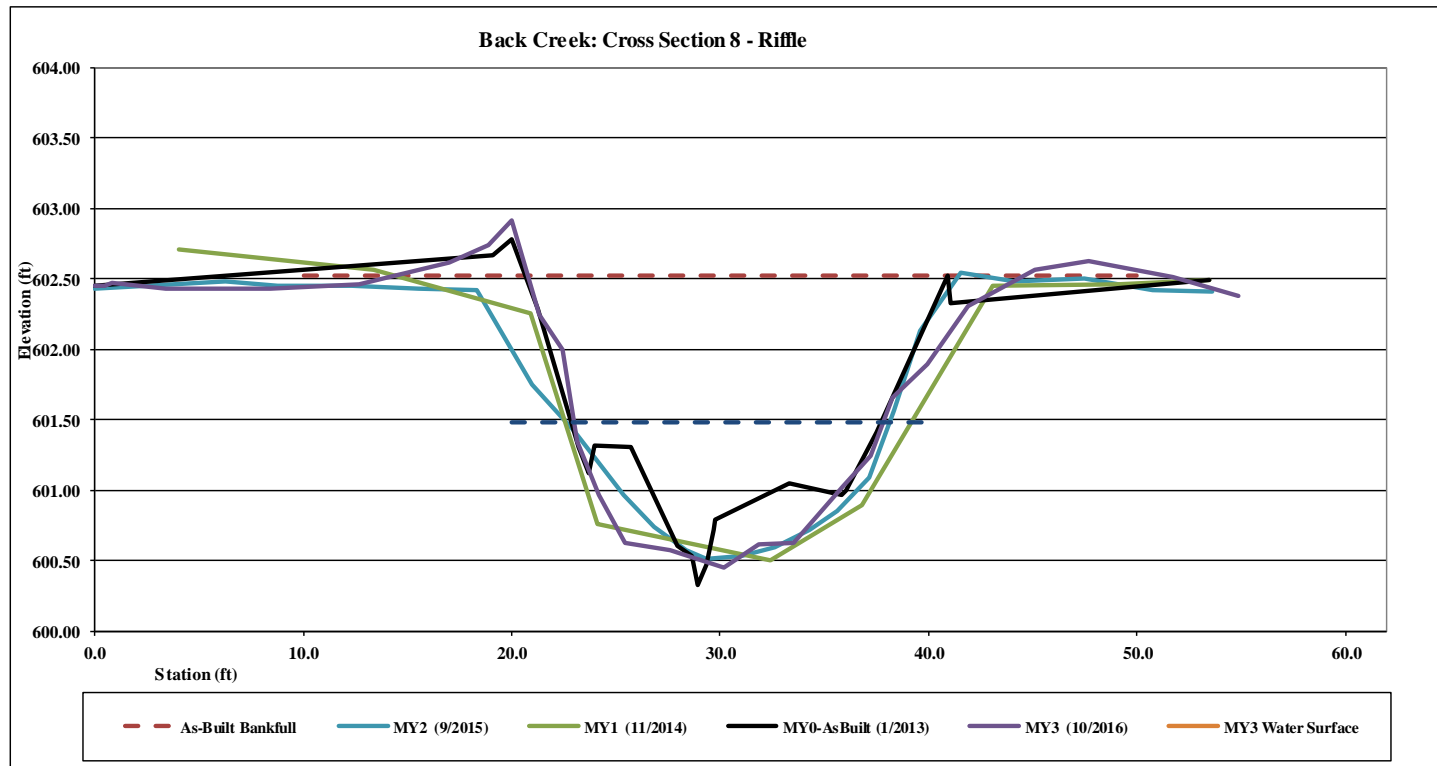


Figure 3.9 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-9, Pool
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	602.50
Bankfull Cross-Sectional Area (ft²)	42.81
Bankfull Width (ft)	21.78
Flood Prone Area Elevation (ft)	605.78
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.97
Bankfull Max Depth (ft)	3.28
W/D Ratio	11.08
Entrenchment Ratio	4.59
Bank Height Ratio	0.97



XS-9: Upstream



XS-9: Downstream

Station	Elevation	Notes
0.00	603.20	LPIN
0.21	602.83	
2.00	602.79	
5.34	602.78	
8.19	602.71	
11.04	602.72	
12.44	602.59	
13.63	602.41	TLB
15.05	601.56	
16.17	601.59	
18.08	600.38	
19.45	599.92	
21.22	599.86	
23.30	599.25	
24.63	599.22	TWG
26.40	599.42	
27.74	599.60	
28.73	599.86	
30.09	599.83	
30.82	601.26	
32.09	601.70	
33.61	602.13	
35.14	602.60	TRB
36.36	602.88	
38.91	602.77	
41.25	602.82	
43.51	602.79	
47.12	602.79	
50.22	602.85	
50.84	603.05	
50.85	603.08	RPIN

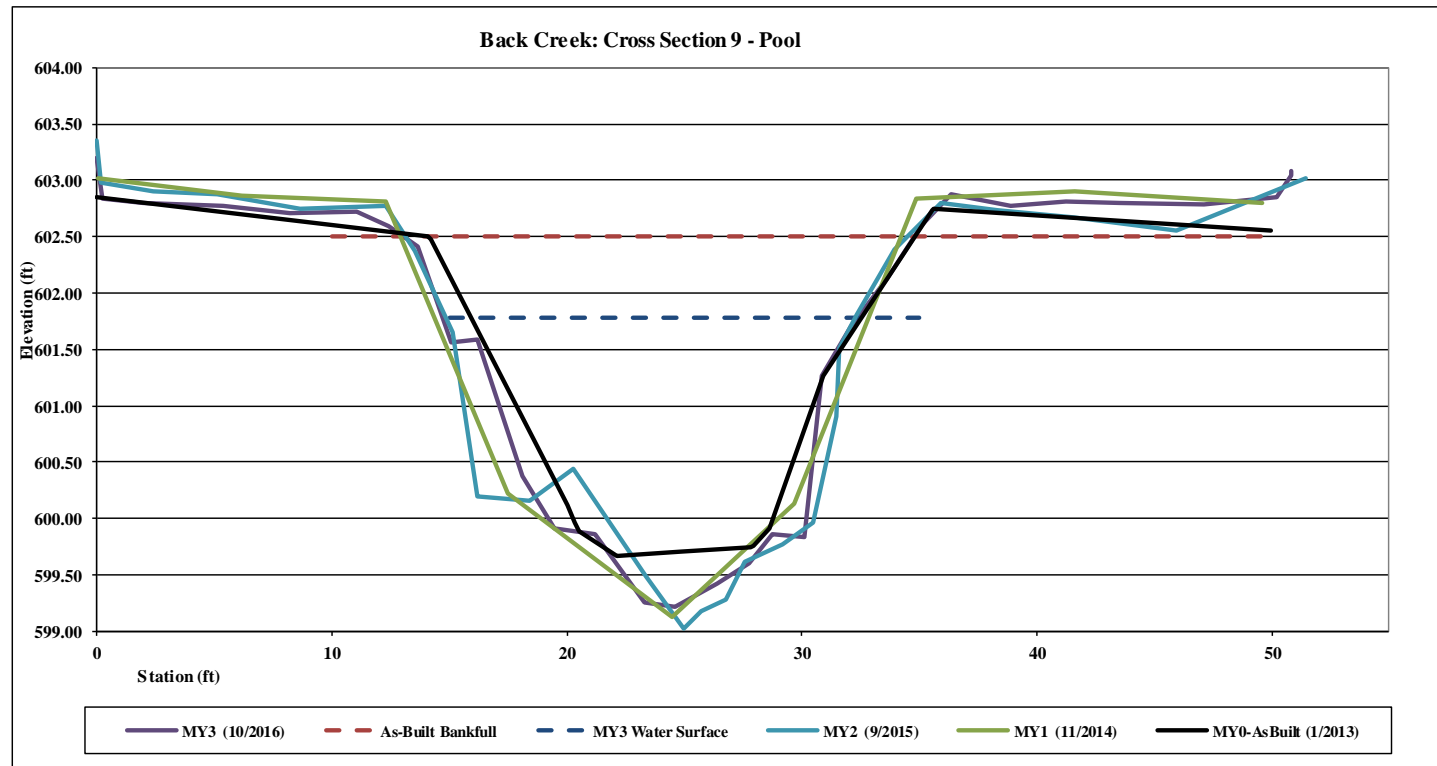


Figure 3.10 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-10, Riffle
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	600.10
Bankfull Cross-Sectional Area (ft²)	25.46
Bankfull Width (ft)	35.45
Flood Prone Area Elevation (ft)	601.91
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	0.72
Bankfull Max Depth (ft)	1.81
W/D Ratio	49.36
Entrenchment Ratio	2.82
Bank Height Ratio	0.99



XS-10: Upstream



XS-10: Downstream

Station	Elevation	Notes
0.00	600.11	LPIN
0.41	599.71	
4.28	599.93	
7.85	599.97	
11.98	599.97	
15.13	600.12	TLB
16.66	600.23	
17.61	599.96	
19.13	599.54	
20.05	599.19	
21.60	598.30	
23.42	598.29	TWG
27.89	598.37	
29.60	598.59	
31.20	598.52	
32.86	599.35	
34.11	599.74	
35.61	599.92	
37.31	600.08	TRB
40.57	600.19	
44.28	600.19	
49.96	600.23	
50.36	600.60	RPIN

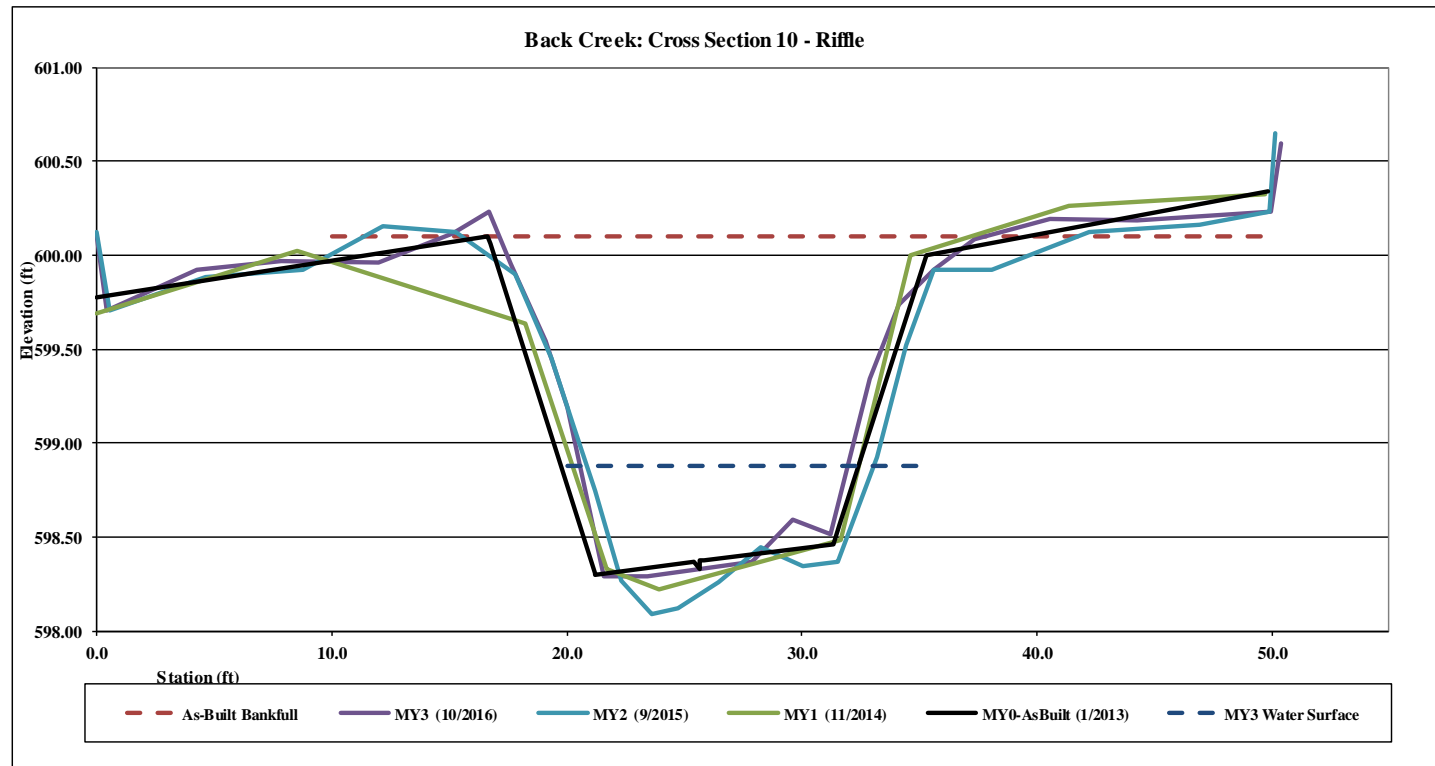


Figure 3.11 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-11, Pool
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	599.62
Bankfull Cross-Sectional Area (ft²)	31.34
Bankfull Width (ft)	16.81
Flood Prone Area Elevation (ft)	602.70
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.86
Bankfull Max Depth (ft)	3.08
W/D Ratio	9.02
Entrenchment Ratio	5.95
Bank Height Ratio	0.99



XS-11: Upstream



XS-11: Downstream

Station	Elevation	Notes
0.00	600.09	LPIN
0.54	600.10	
3.93	600.07	
7.92	600.09	
11.76	599.97	
14.16	600.06	
15.41	599.59	TLB
17.20	598.96	
18.42	597.37	
19.88	597.35	
21.38	596.81	
22.53	596.54	TWG
24.31	596.80	
25.52	596.53	
26.54	597.06	
28.60	597.52	
29.08	598.82	
30.15	599.13	
31.48	599.39	
32.51	599.75	
35.79	599.98	TRB
39.73	600.22	
42.58	600.38	
46.30	600.36	
50.23	600.40	
50.59	600.73	RPIN

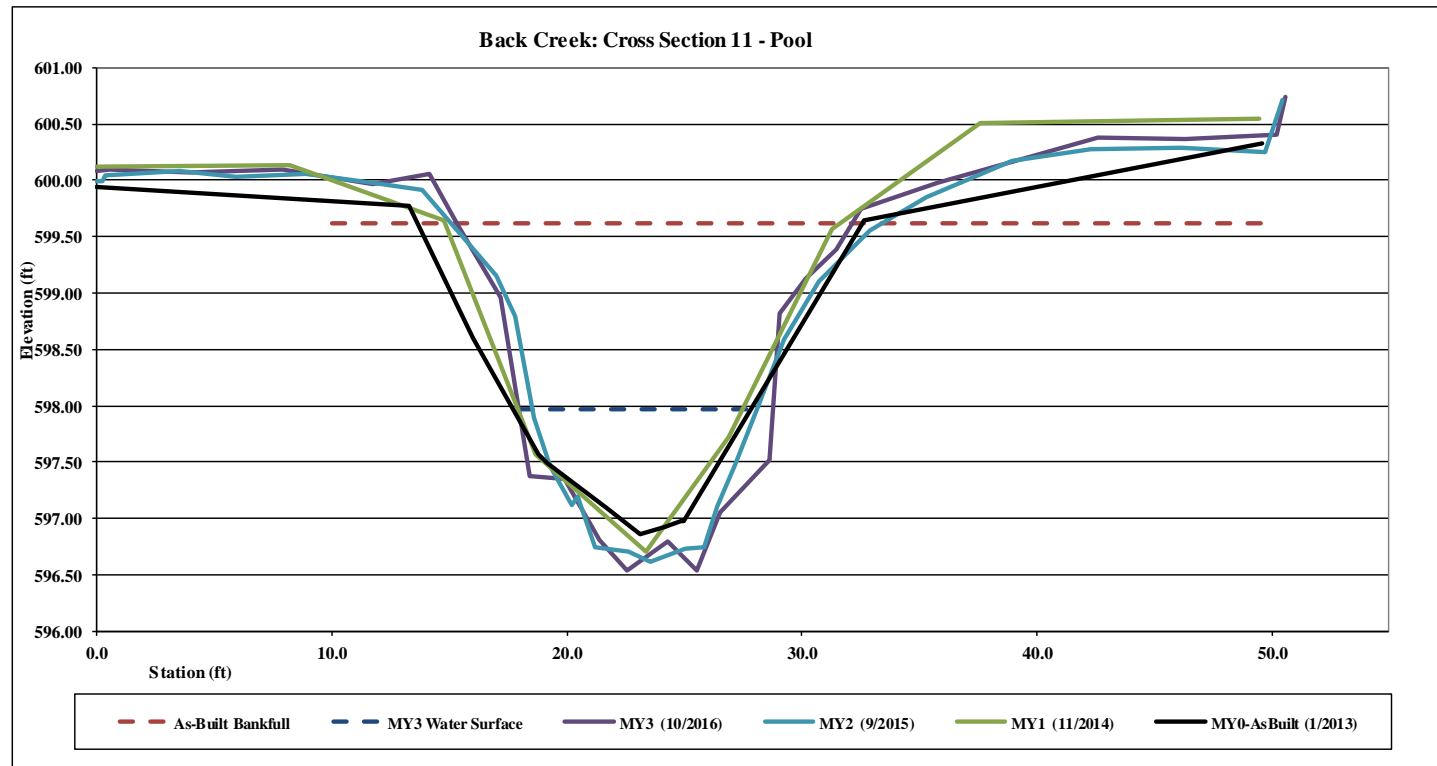


Figure 3.12 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-12, Riffle
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	596.12
Bankfull Cross-Sectional Area (ft²)	23.14
Bankfull Width (ft)	18.25
Flood Prone Area Elevation (ft)	597.84
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.27
Bankfull Max Depth (ft)	1.72
W/D Ratio	14.39
Entrenchment Ratio	5.48
Bank Height Ratio	0.96



XS-12: Upstream



XS-12: Downstream

Station	Elevation	Notes
0.00	596.38	LPIN
0.56	596.78	
3.14	596.62	
6.35	596.58	
8.73	596.62	
11.92	596.50	
14.10	596.40	
15.85	596.05	TLB
17.26	595.62	
18.13	595.15	
19.03	594.51	
20.21	594.34	
21.46	594.41	
22.64	594.37	
23.94	594.53	
25.52	594.45	
26.33	594.40	TWG
27.77	594.64	
28.86	594.39	
29.62	594.55	
30.31	594.76	
31.12	595.09	
31.80	595.46	
32.62	595.73	
33.36	595.92	
33.90	596.20	TRB
37.34	596.58	
41.54	596.92	
46.60	597.24	
50.57	597.47	
50.97	597.64	RPIN

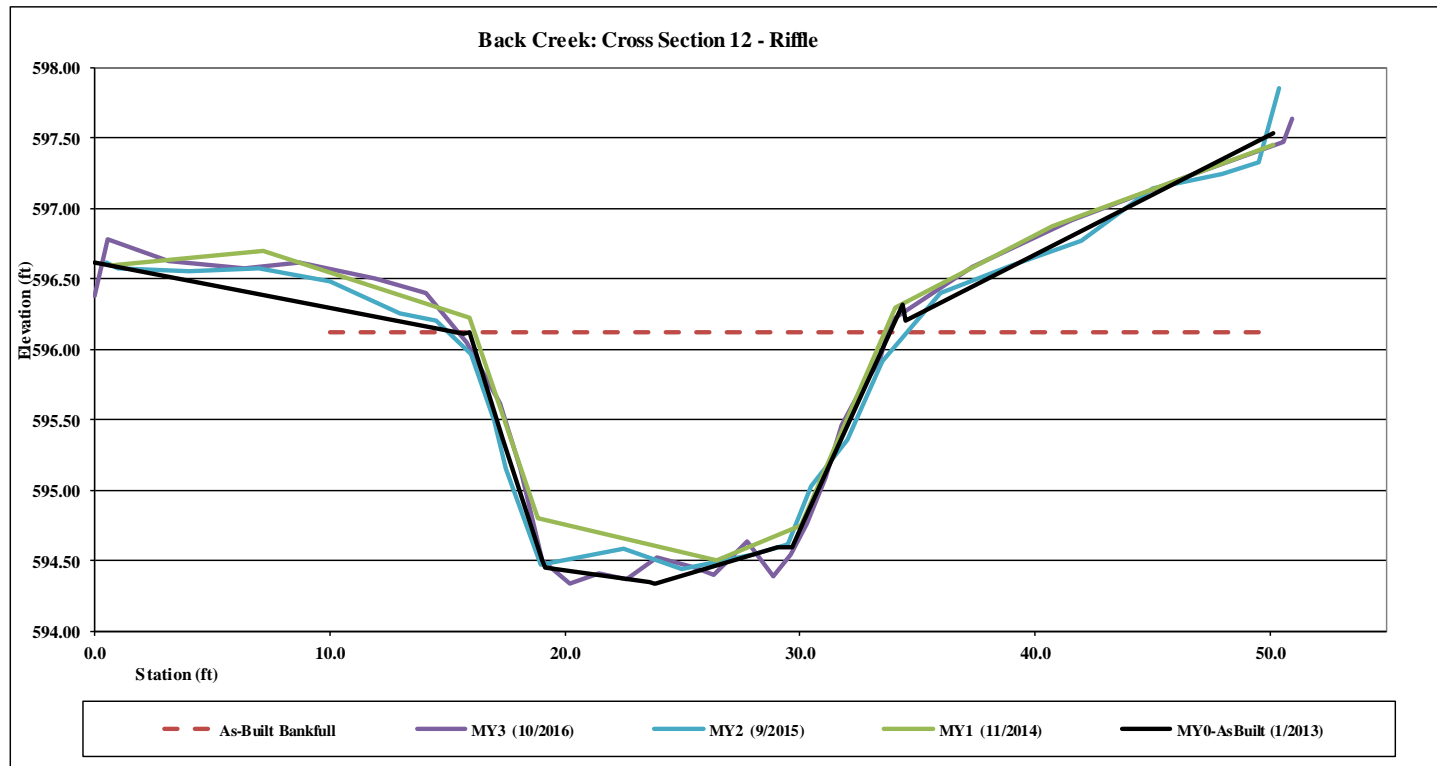


Figure 3.13 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-13, Pool
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	595.94
Bankfull Cross-Sectional Area (ft²)	31.15
Bankfull Width (ft)	16.42
Flood Prone Area Elevation (ft)	47.65
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.90
Bankfull Max Depth (ft)	2.83
W/D Ratio	8.66
Entrenchment Ratio	6.09
Bank Height Ratio	1.00



XS-13: Upstream



XS-13: Downstream

Station	Elevation	Notes
0.00	596.50	LPIN
0.15	596.69	
2.37	596.66	
5.01	596.62	
8.56	596.71	
12.15	596.59	
16.23	596.38	
19.15	596.24	TLB
20.19	596.21	
21.30	595.70	
22.05	595.34	
22.91	593.98	
23.81	593.44	
25.01	593.19	
25.98	593.10	
27.04	593.11	TWG
28.47	592.96	
29.81	593.00	
31.12	593.21	
32.34	593.72	
33.77	594.26	
33.89	594.51	
34.40	595.32	
35.48	595.87	
37.16	595.93	TRB
39.76	596.69	
43.26	596.48	
46.58	596.85	
50.00	597.10	
52.35	597.31	
52.00	597.47	RPIN

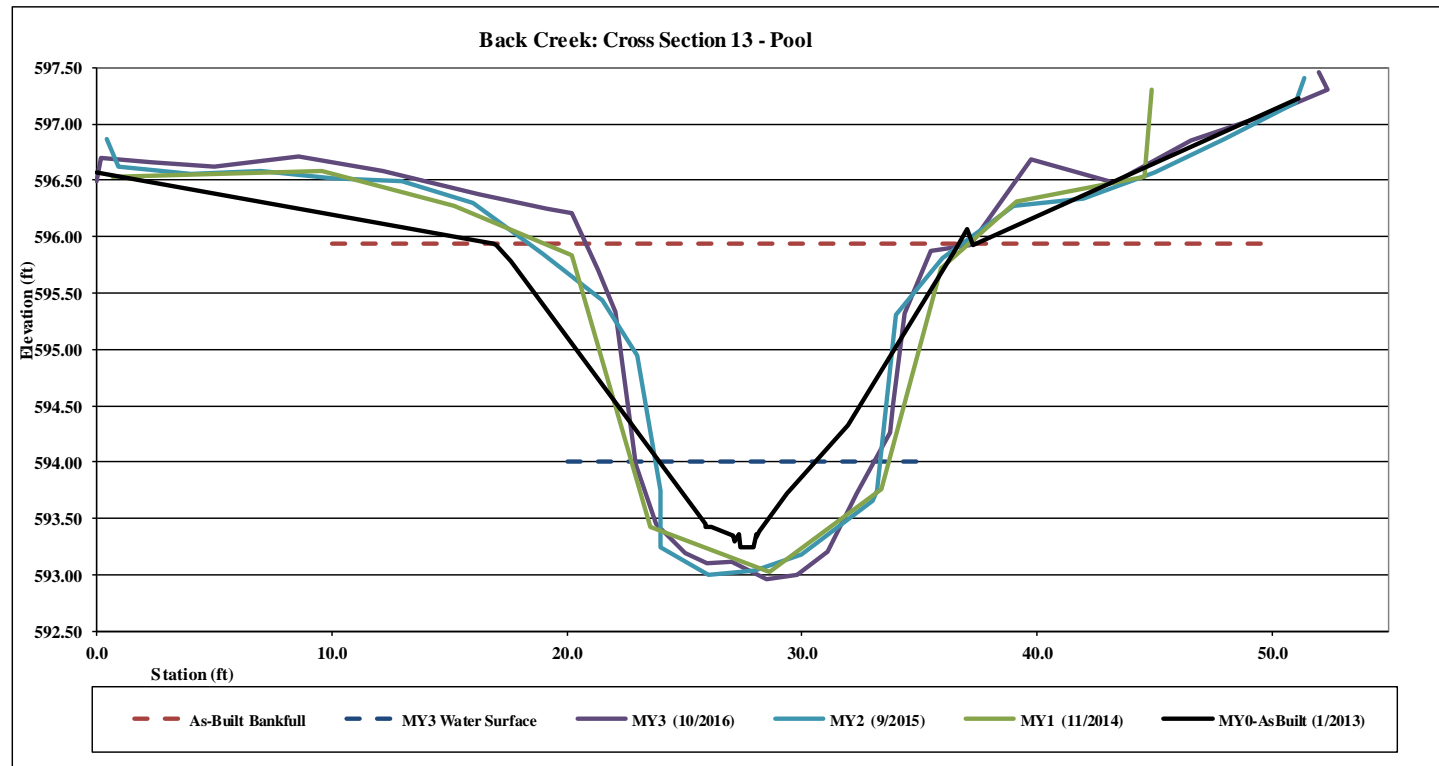


Figure 3.14 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-14, Riffle
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	594.56
Bankfull Cross-Sectional Area (ft²)	22.16
Bankfull Width (ft)	19.30
Flood Prone Area Elevation (ft)	596.65
Flood Prone Width (ft)	70.00
Bankfull Mean Depth (ft)	1.15
Bankfull Max Depth (ft)	2.09
W/D Ratio	16.81
Entrenchment Ratio	3.63
Bank Height Ratio	1.07



XS-14: Upstream



XS-14: Downstream

Station	Elevation	Notes
0.00	596.05	LPIN
0.58	595.85	
2.28	595.38	
4.58	594.86	
8.30	594.53	
11.70	594.63	
14.87	594.74	
17.40	594.59	
20.59	594.71	TLB
22.12	594.60	
23.16	594.30	
24.92	593.70	
26.58	593.06	
27.50	592.84	
28.66	592.71	
29.98	592.55	
30.75	592.42	
31.65	592.47	TWG
32.85	592.63	
33.83	592.71	
34.85	592.91	
36.25	593.55	
37.46	594.00	
39.24	594.48	
41.65	594.70	TRB
44.95	594.75	
47.95	594.73	
50.87	594.62	
53.75	594.67	
56.27	595.01	
58.28	595.40	
59.72	595.66	
59.84	595.91	RPIN

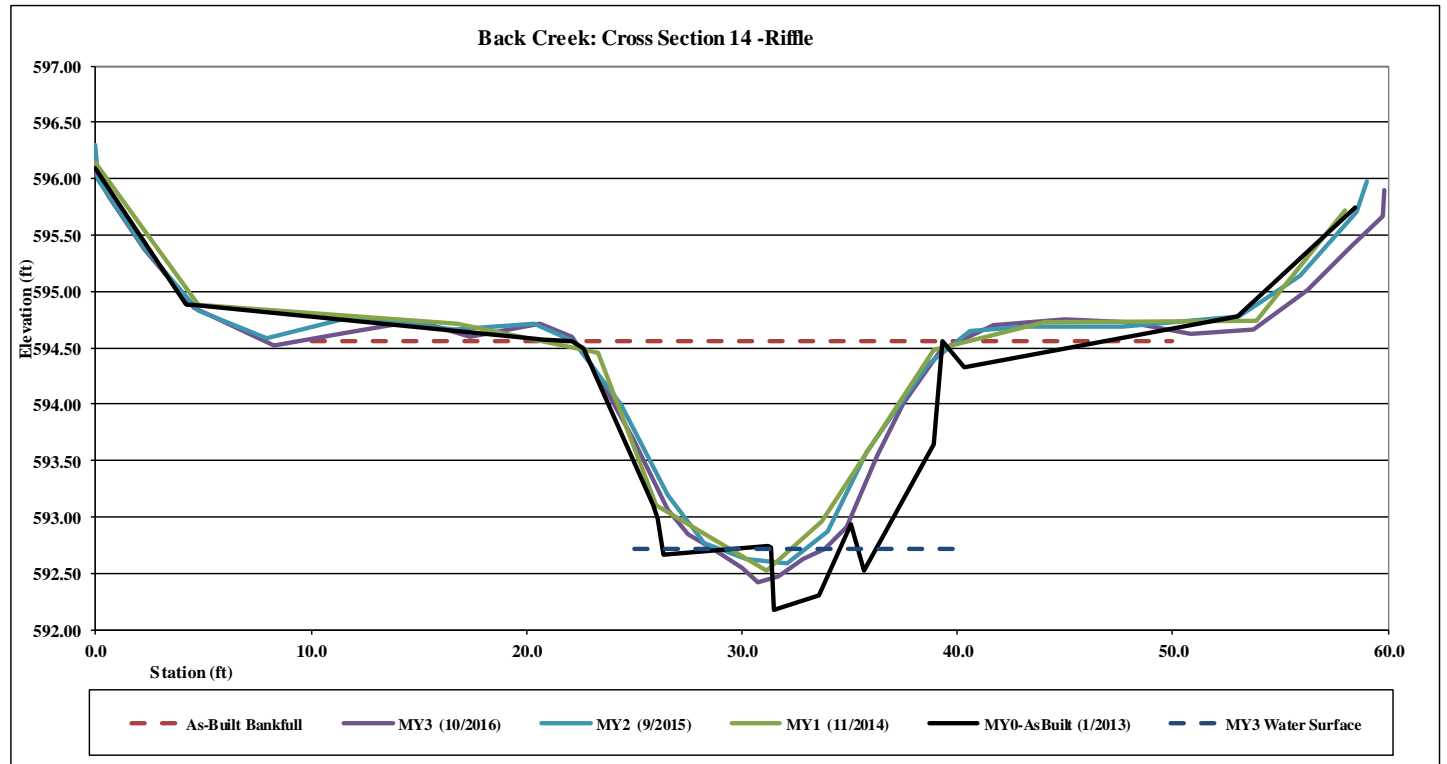


Figure 3.15 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-15, Pool
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	593.70
Bankfull Cross-Sectional Area (ft²)	25.90
Bankfull Width (ft)	11.79
Flood Prone Area Elevation (ft)	596.89
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	2.20
Bankfull Max Depth (ft)	3.19
W/D Ratio	5.37
Entrenchment Ratio	8.48
Bank Height Ratio	1.18



XS-15: Upstream



XS-15: Downstream

Station	Elevation	Notes
0.00	595.13	LPIN
0.18	594.70	
2.20	594.80	
5.42	594.39	
7.83	594.39	
11.38	594.56	
13.84	594.54	
16.64	594.33	
17.20	594.27	TLB
18.19	594.03	
19.28	593.82	
20.19	593.83	
21.05	593.50	
21.49	592.70	
22.15	592.25	
23.31	591.72	
24.24	591.31	
25.26	590.93	
26.34	590.55	
27.88	590.51	TWG
28.65	590.29	
29.16	590.15	
30.63	591.01	
31.02	592.99	
32.58	593.84	
33.53	594.27	TRB
35.58	594.62	
37.04	594.64	
39.43	594.55	
43.03	594.37	
46.86	594.54	
51.12	594.59	
51.83	595.04	RPIN

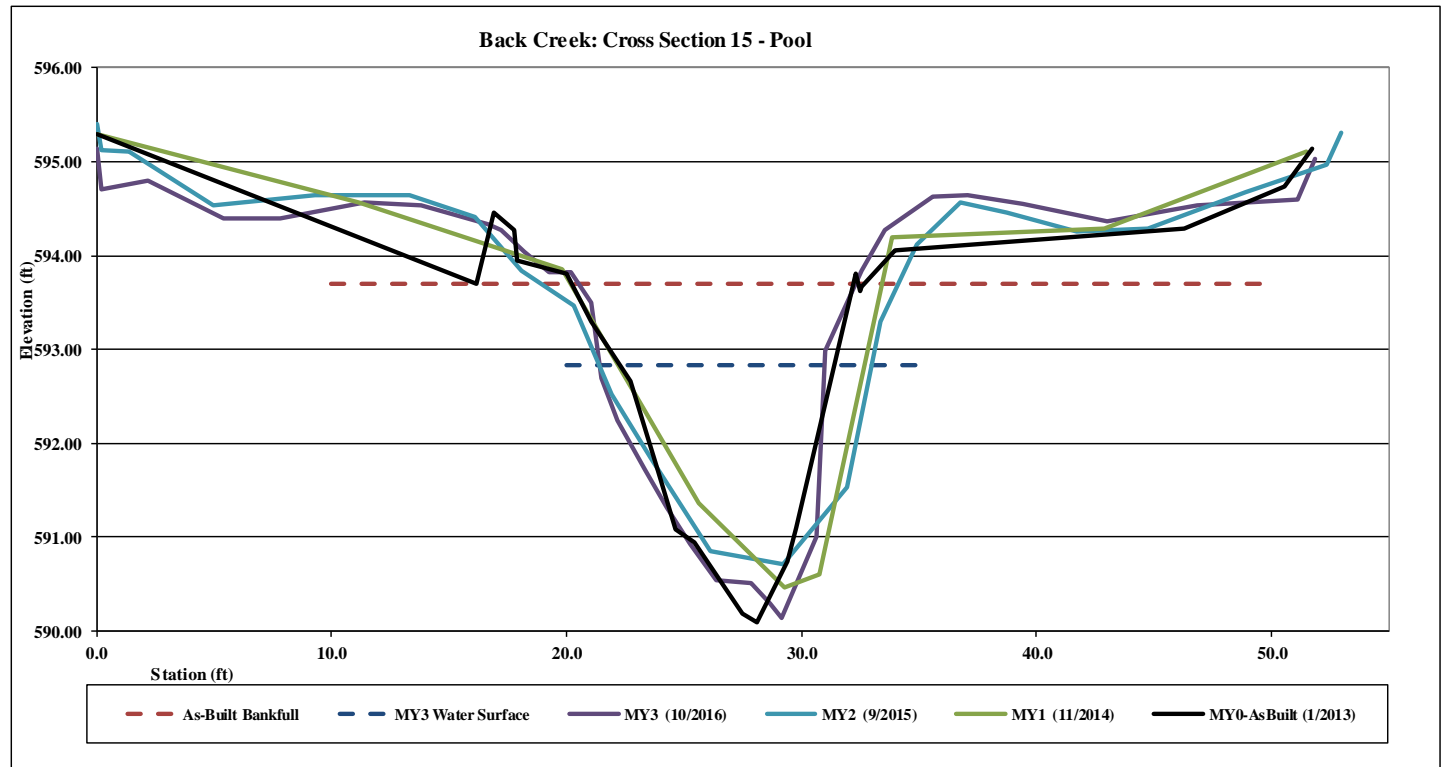


Figure 3.16 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-16, Pool
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	587.92
Bankfull Cross-Sectional Area (ft²)	44.80
Bankfull Width (ft)	17.93
Flood Prone Area Elevation (ft)	591.00
Flood Prone Width (ft)	60.00
Bankfull Mean Depth (ft)	2.50
Bankfull Max Depth (ft)	3.08
W/D Ratio	7.18
Entrenchment Ratio	3.35
Bank Height Ratio	1.00



XS-16: Upstream



XS-16: Downstream

Station	Elevation	Notes
0.00	592.21	LPIN
0.51	592.02	
2.38	592.16	
7.57	591.74	
12.65	590.88	
17.58	590.24	
21.45	589.78	
24.59	589.06	
27.35	589.12	
29.73	588.92	
31.29	588.32	
32.26	587.91	TLB
32.83	587.77	
33.58	586.68	
37.11	585.12	
40.07	584.85	TWG
45.05	584.86	
47.42	584.96	
48.59	585.18	
49.64	585.92	
49.67	587.50	
50.65	588.31	
51.68	588.71	TRB
52.50	588.92	
54.08	589.10	
56.86	589.42	
59.97	589.42	
62.77	589.59	
66.31	590.21	
68.76	590.75	
71.31	591.38	
72.95	591.91	
75.74	592.05	
75.82	592.39	RPIN

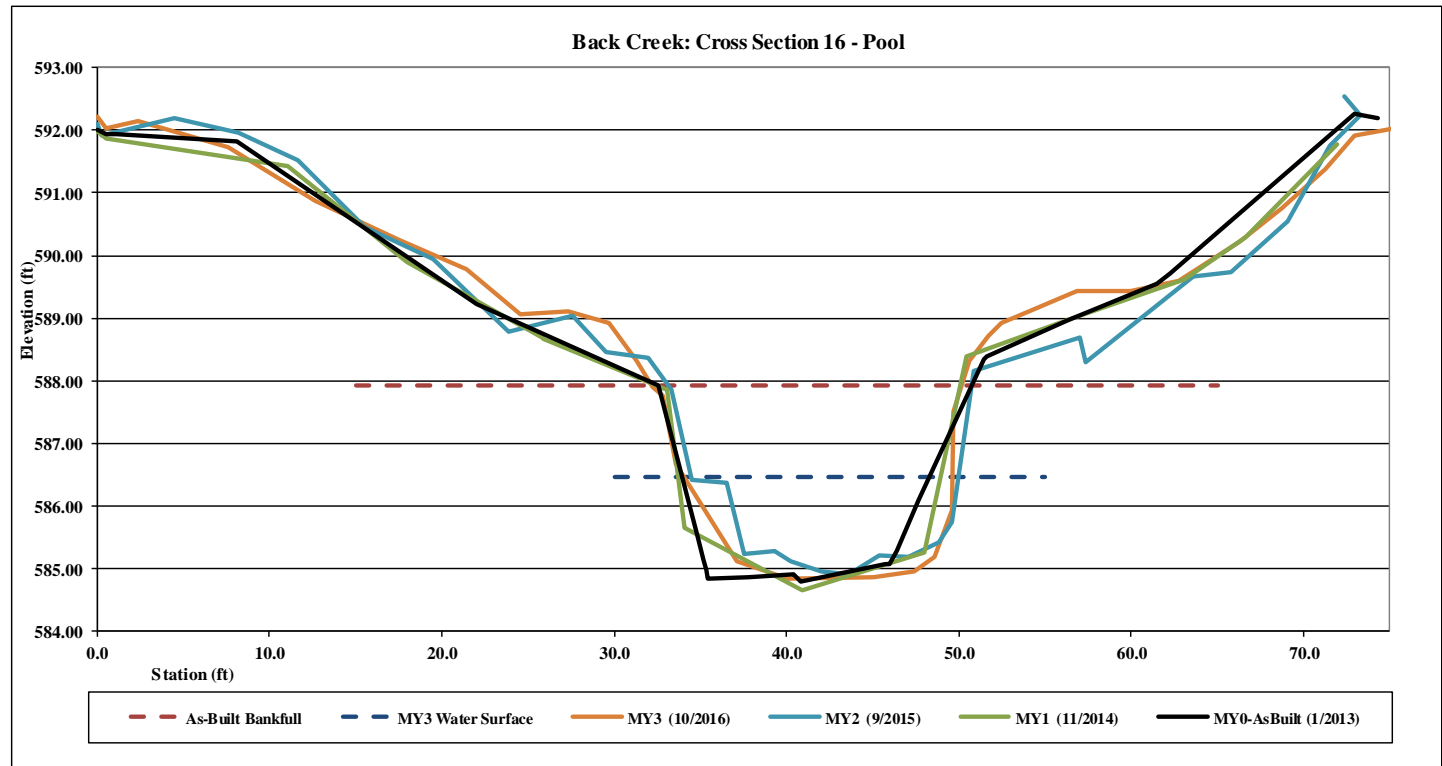


Figure 3.17 Cross Section Data

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-17, Pool	
Survey Date	10/2016	
SUMMARY DATA		
Bankfull Elevation (ft)	626.85	
Bankfull Cross-Sectional Area (ft²)	8.09	
Bankfull Width (ft)	8.51	
Flood Prone Area Elevation (ft)	628.38	
Flood Prone Width (ft)	20.00	
Bankfull Mean Depth (ft)	0.95	
Bankfull Max Depth (ft)	1.53	
W/D Ratio	8.95	
Entrenchment Ratio	2.35	
Bank Height Ratio	0.61	



XS-17: Upstream



XS-17: Downstream

Station	Elevation	Notes
0.00	629.06	LPIN
0.50	628.43	
6.00	627.62	
8.00	627.65	
11.50	626.62	TLB
12.70	625.40	
13.80	625.32	TWG
15.00	625.33	
18.00	626.26	RTB
20.00	627.22	
22.00	627.55	
30.00	627.89	RPIN

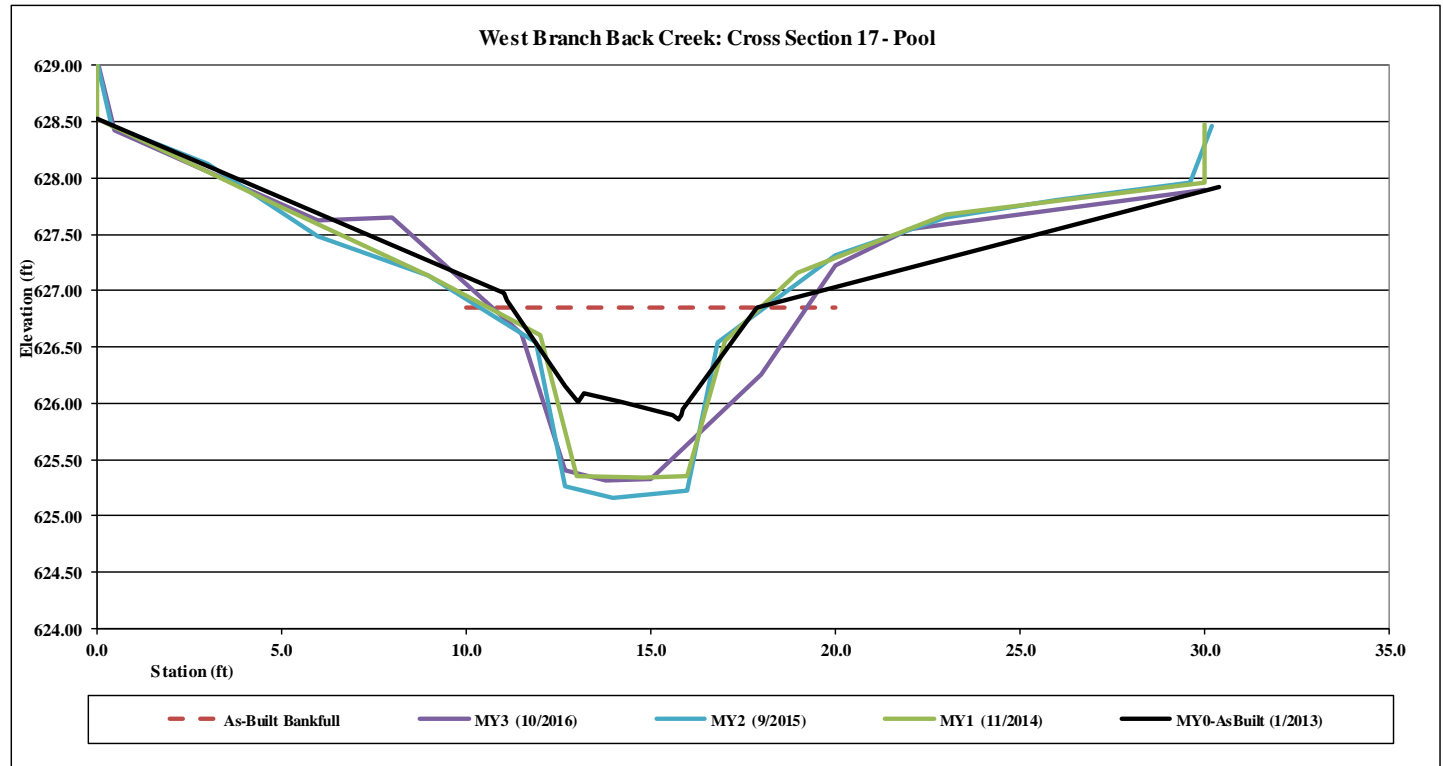


Figure 3.18 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-18, Riffle
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	626.62
Bankfull Cross-Sectional Area (ft²)	4.32
Bankfull Width (ft)	7.49
Flood Prone Area Elevation (ft)	627.62
Flood Prone Width (ft)	30.00
Bankfull Mean Depth (ft)	0.58
Bankfull Max Depth (ft)	1.00
W/D Ratio	13.00
Entrenchment Ratio	4.00
Bank Height Ratio	0.98



XS-18: Upstream



XS-18: Downstream

Station	Elevation	Notes
0.00	628.35	LPIN
0.20	628.05	
3.05	627.56	
6.45	626.91	
9.05	626.62	TLB
11.53	626.63	
12.84	625.62	TWG
14.56	625.68	
16.01	625.80	
17.69	626.60	TRB
21.55	626.94	
29.50	627.20	RPIN

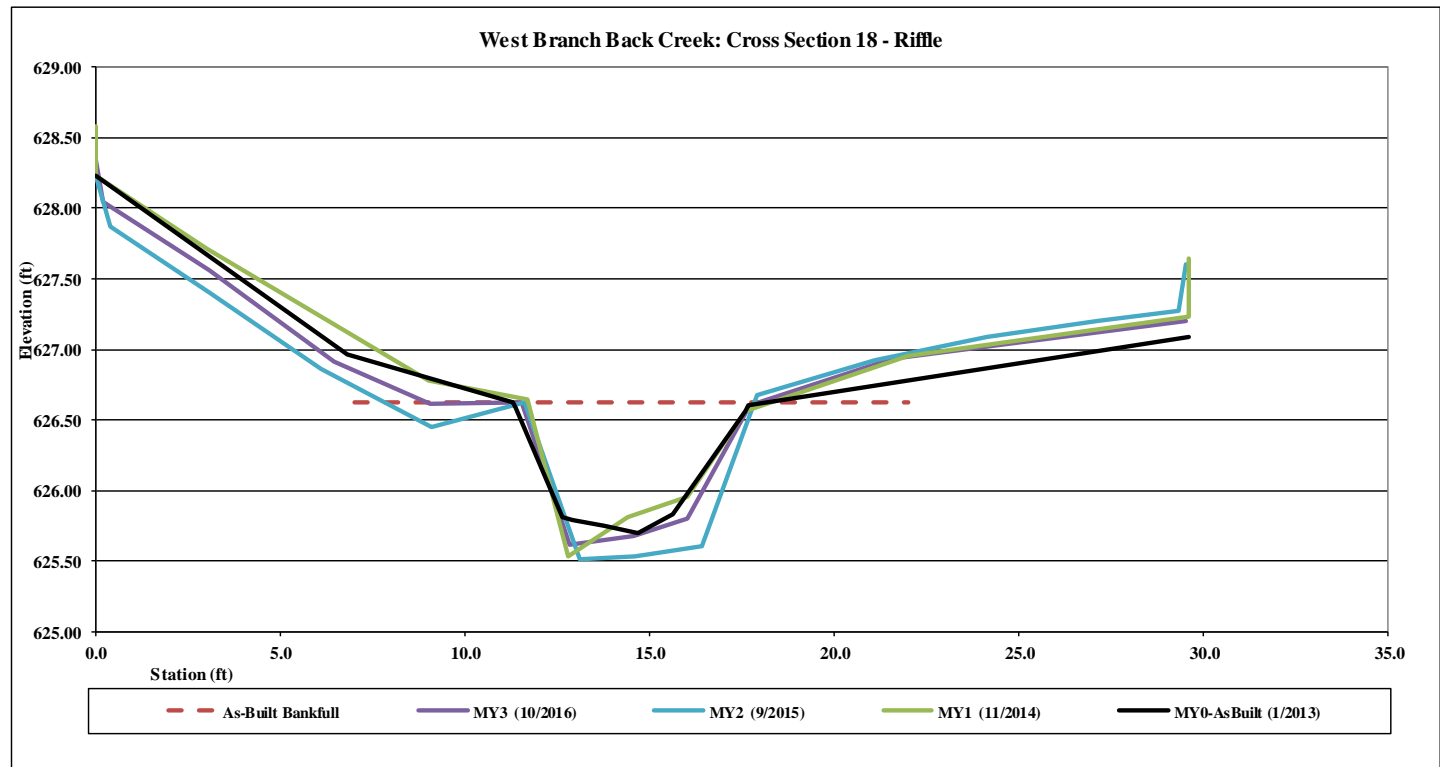


Figure 3.19 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-19, Riffle
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	616.15
Bankfull Cross-Sectional Area (ft²)	3.19
Bankfull Width (ft)	6.35
Flood Prone Area Elevation (ft)	616.82
Flood Prone Width (ft)	30.00
Bankfull Mean Depth (ft)	0.50
Bankfull Max Depth (ft)	0.67
W/D Ratio	12.64
Entrenchment Ratio	4.72
Bank Height Ratio	1.19



XS-19: Upstream



XS-19: Downstream

Station	Elevation	Notes
0.11	616.83	LPIN
6.78	616.93	
18.66	616.30	TLB
20.04	615.59	
20.85	615.60	
22.63	615.48	TWG
24.20	615.53	
25.53	616.28	TRB
34.16	616.28	
39.94	616.81	RPIN

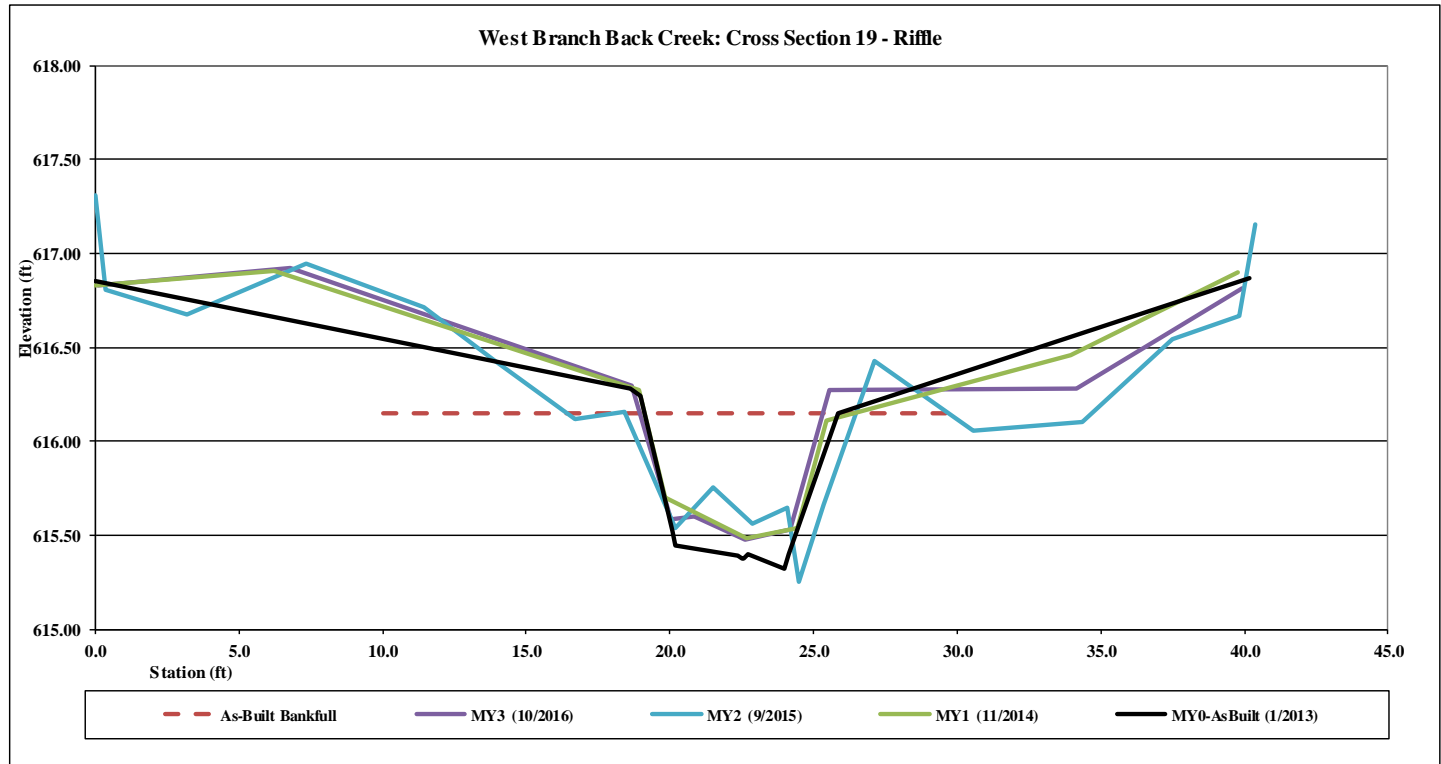


Figure 3.20 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-20, Riffle
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	608.97
Bankfull Cross-Sectional Area (ft²)	5.76
Bankfull Width (ft)	11.66
Flood Prone Area Elevation (ft)	609.94
Flood Prone Width (ft)	30.00
Bankfull Mean Depth (ft)	0.49
Bankfull Max Depth (ft)	0.97
W/D Ratio	23.57
Entrenchment Ratio	2.57
Bank Height Ratio	1.00



XS-20: Upstream



XS-20: Downstream

Station	Elevation	Notes
0.30	609.78	LPIN
11.05	609.42	
14.67	608.97	TLB
16.83	608.08	
19.33	608.01	TWG
20.99	608.03	
22.44	608.88	
27.25	608.99	TRB
29.98	609.08	
31.60	609.31	
39.84	609.60	RPIN

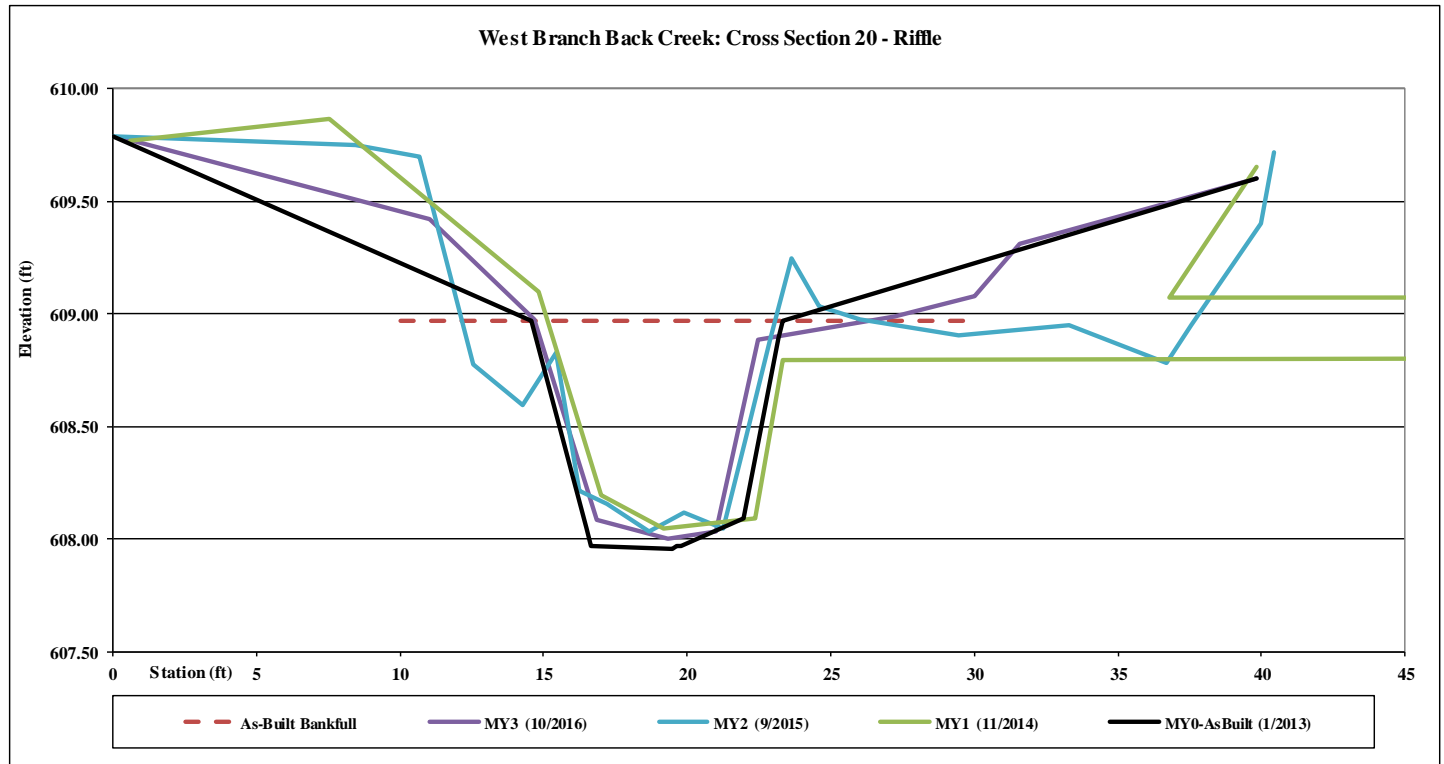


Figure 3.21 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-21, Pool
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	608.51
Bankfull Cross-Sectional Area (ft²)	10.25
Bankfull Width (ft)	12.37
Flood Prone Area Elevation (ft)	610.36
Flood Prone Width (ft)	40.00
Bankfull Mean Depth (ft)	0.83
Bankfull Max Depth (ft)	1.85
W/D Ratio	14.93
Entrenchment Ratio	3.23
Bank Height Ratio	0.75



XS-21: Upstream



XS-21: Downstream

Station	Elevation	Notes
0.00	609.41	LPIN
1.34	609.24	
3.34	609.30	
6.85	609.35	
10.56	609.03	
13.80	608.83	
14.73	608.44	
15.51	608.78	
15.66	608.04	TLB
16.67	607.63	
17.84	606.79	
18.94	606.66	TWG
22.20	607.60	
23.79	608.20	TRB
31.64	608.84	
42.00	609.26	RPIN

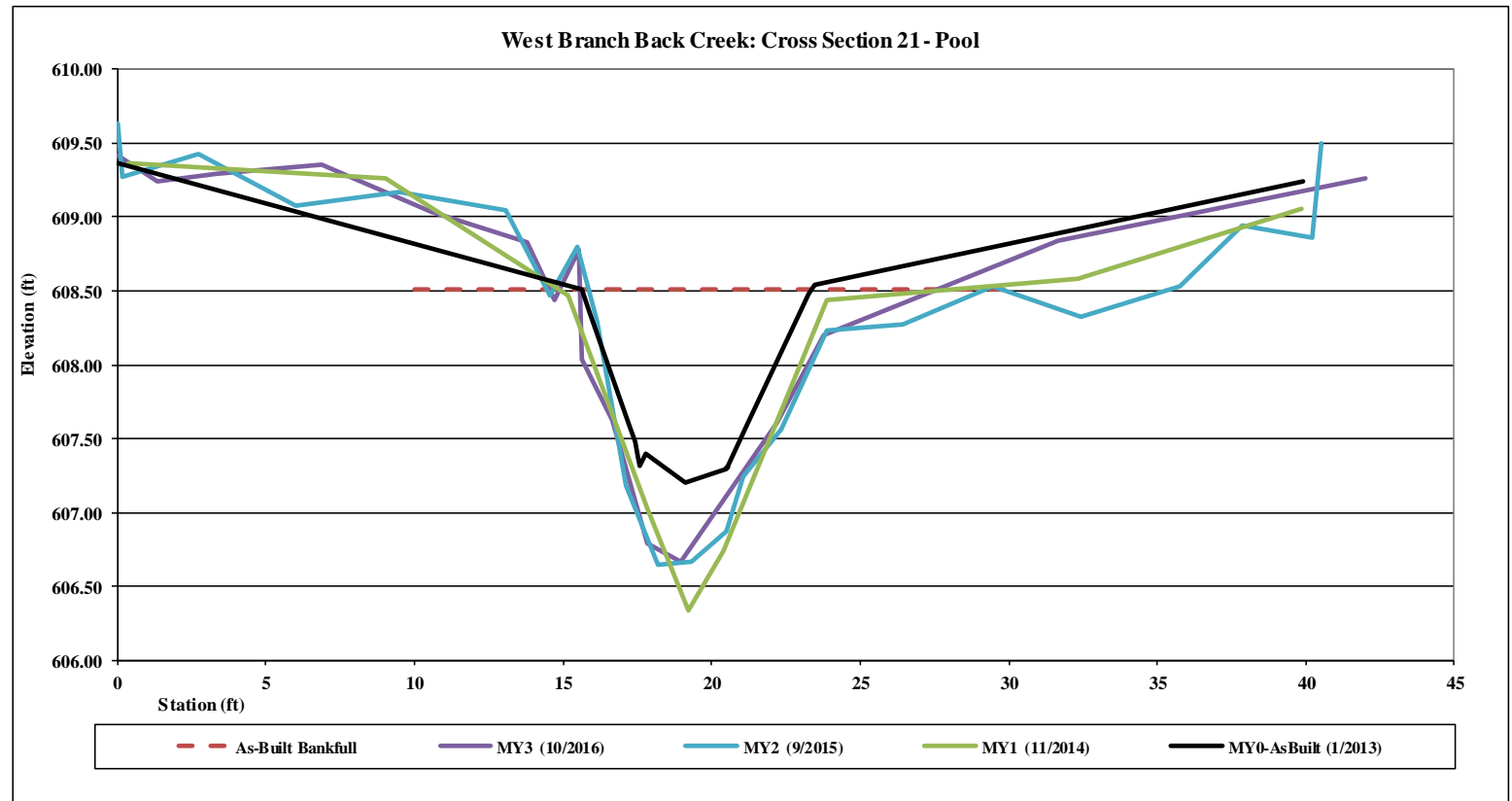


Figure 3.22 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-22, Riffle
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	613.85
Bankfull Cross-Sectional Area (ft ²)	8.33
Bankfull Width (ft)	22.42
Flood Prone Area Elevation (ft)	614.63
Flood Prone Width (ft)	75.00
Bankfull Mean Depth (ft)	0.37
Bankfull Max Depth (ft)	0.78
W/D Ratio	60.39
Entrenchment Ratio	3.34
Bank Height Ratio	1.17



XS-22: Upstream



XS-22: Downstream

Station	Elevation	Notes
0.30	614.18	LPIN
7.90	614.08	
12.61	614.03	
16.87	614.00	TLB
18.22	613.07	TWG
23.10	613.16	
24.12	613.88	TRB
25.57	613.68	
26.66	613.69	
27.77	613.60	
37.11	613.51	
39.74	613.64	RPIN

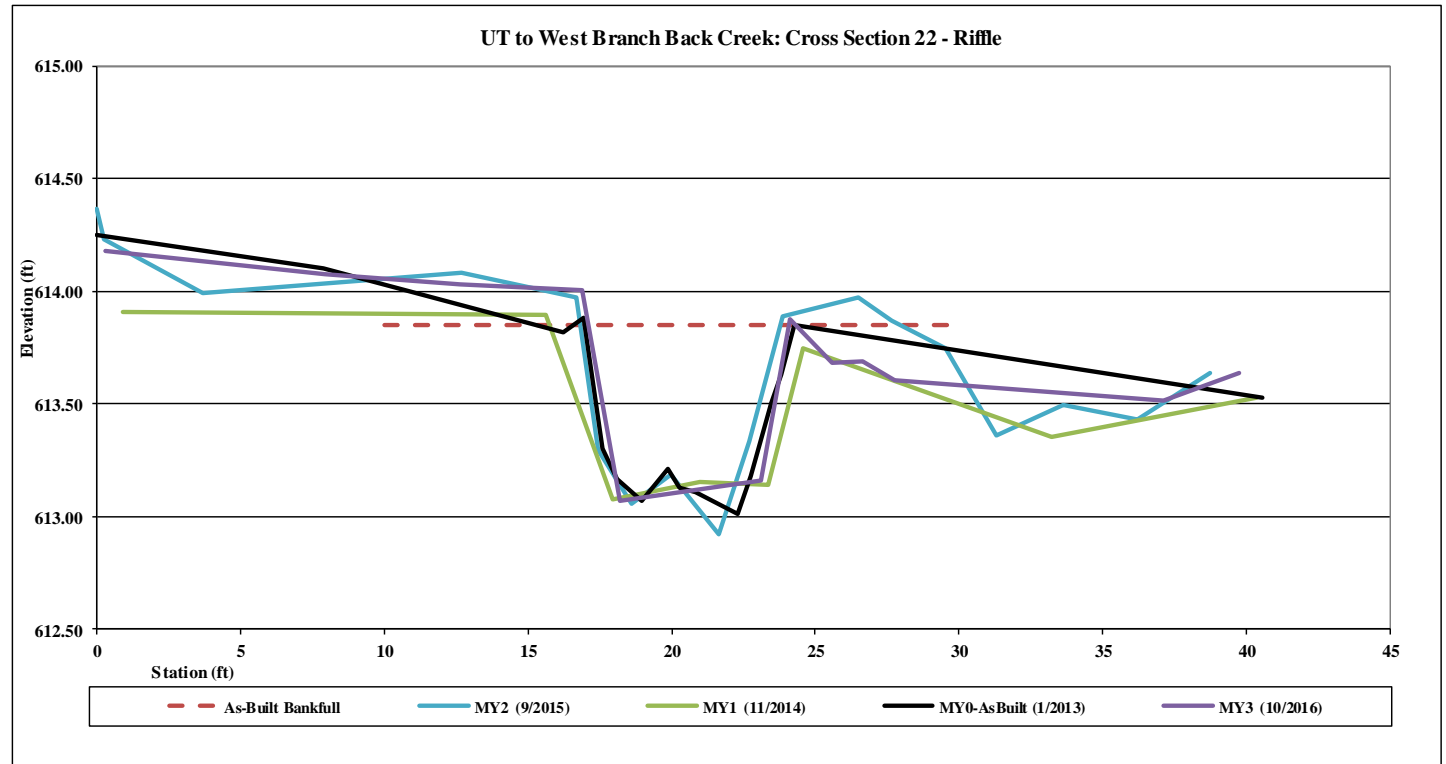


Figure 3.23 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-23, Pool
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	594.88
Bankfull Cross-Sectional Area (ft ²)	50.15
Bankfull Width (ft)	18.59
Flood Prone Area Elevation (ft)	600.23
Flood Prone Width (ft)	200.00
Bankfull Mean Depth (ft)	2.70
Bankfull Max Depth (ft)	5.35
W/D Ratio	6.89
Entrenchment Ratio	10.76
Bank Height Ratio	0.90



XS-23: Upstream



XS-23: Downstream

Station	Elevation	Notes
0.00	595.89	LPIN
0.53	595.71	
4.51	595.78	
8.94	595.37	
11.84	594.95	
15.11	595.03	TLB
17.28	594.82	
18.41	594.73	
19.62	594.79	
21.24	592.52	
22.14	591.88	
23.24	591.32	
24.12	590.82	
24.21	590.78	
25.46	590.63	
26.16	590.35	
26.80	589.57	
27.32	589.82	
27.78	589.55	
28.20	589.53	TWG
31.69	592.30	
32.77	592.55	
33.96	593.49	
34.44	594.36	TRB
35.37	594.97	
36.16	595.26	
39.96	595.40	
43.35	595.57	
46.79	595.77	
50.33	595.77	
52.96	595.53	
55.46	595.58	
55.67	595.69	RPIN

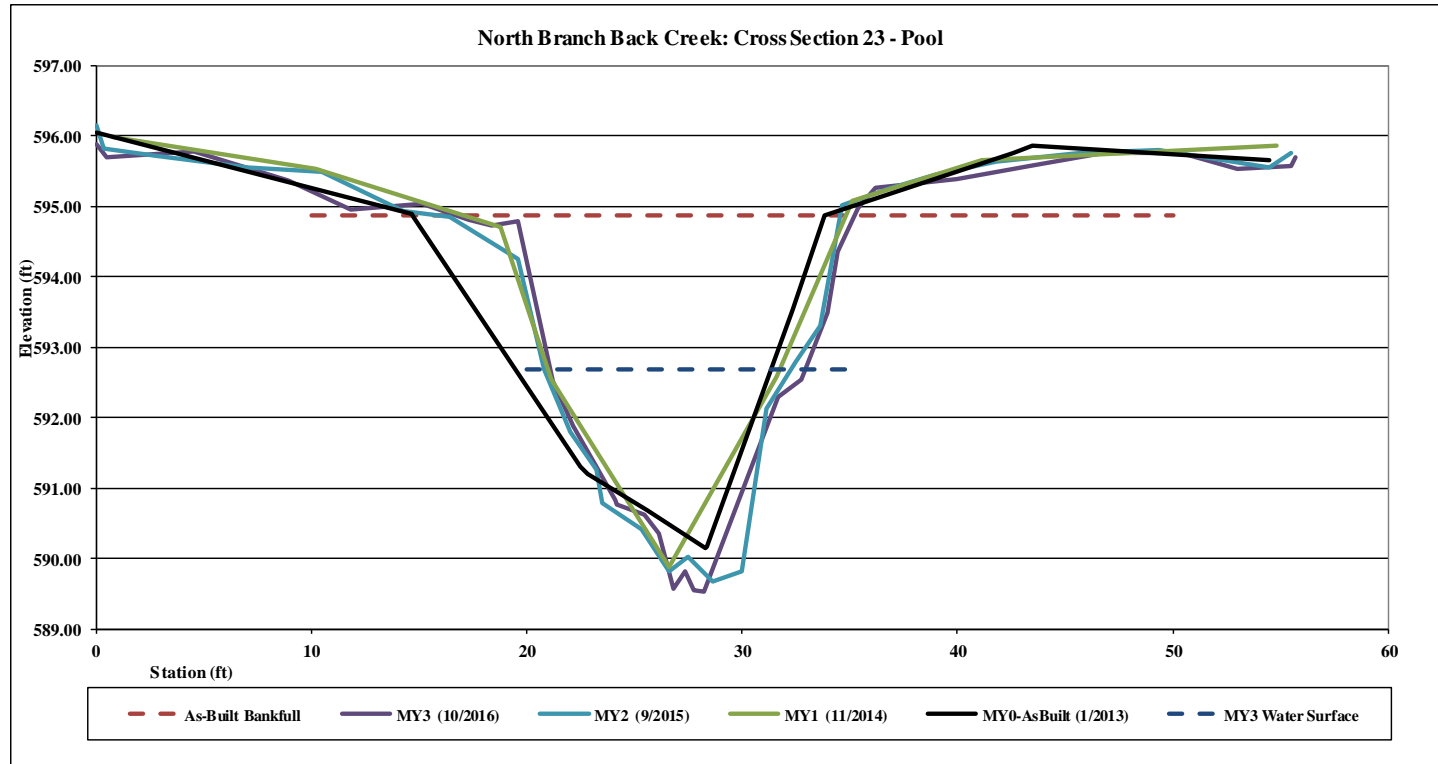


Figure 3.24 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-24, Riffle
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	594.81
Bankfull Cross-Sectional Area (ft ²)	25.45
Bankfull Width (ft)	21.68
Flood Prone Area Elevation (ft)	596.76
Flood Prone Width (ft)	200.00
Bankfull Mean Depth (ft)	1.17
Bankfull Max Depth (ft)	1.94
W/D Ratio	18.47
Entrenchment Ratio	9.23
Bank Height Ratio	0.96



XS-24: Upstream



XS-24: Downstream

Station	Elevation	Notes
0.00	596.17	LPIN
0.39	596.00	
4.08	595.78	
6.92	595.47	
9.64	595.17	
13.29	594.83	TLB
16.19	594.39	
17.28	594.17	
17.82	593.92	
18.51	593.49	
19.02	593.26	
20.24	593.16	
21.64	593.28	
22.84	593.14	
23.89	593.09	
25.05	592.97	
25.99	592.98	
28.58	592.87	TWG
29.81	592.82	
30.27	593.18	
31.11	594.01	
32.65	594.29	
34.40	594.73	TRB
43.91	595.76	
46.70	595.85	
49.82	596.22	RPIN

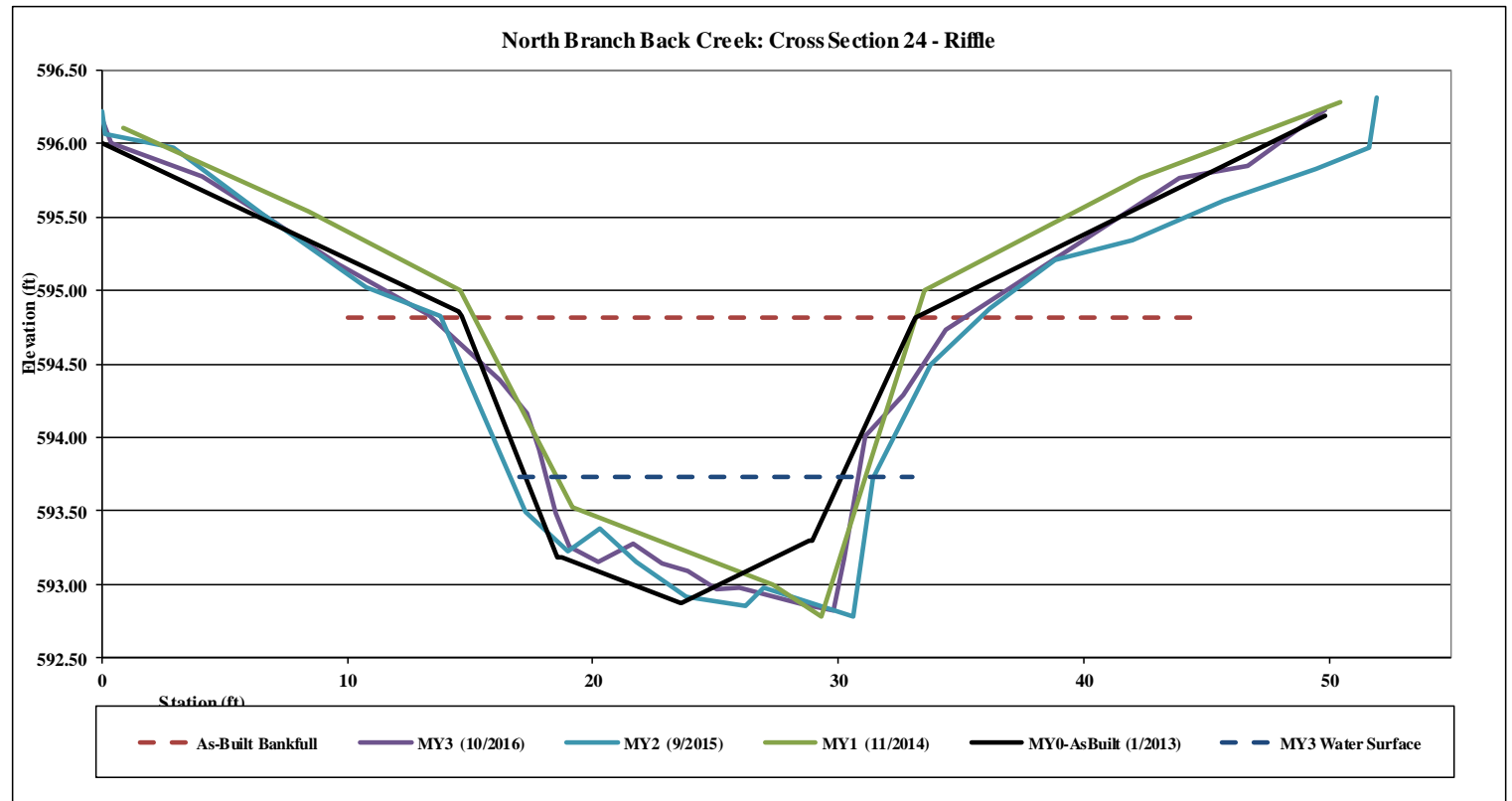


Figure 3.25 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-25, Riffle
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	593.18
Bankfull Cross-Sectional Area (ft ²)	24.11
Bankfull Width (ft)	20.40
Flood Prone Area Elevation (ft)	594.97
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.18
Bankfull Max Depth (ft)	1.79
W/D Ratio	17.27
Entrenchment Ratio	4.90
Bank Height Ratio	1.00



XS-25: Upstream



XS-25: Downstream

Station	Elevation	Notes
0.00	594.80	LPIN
0.26	594.66	
4.02	594.52	
7.36	594.26	
11.07	593.91	
14.19	593.54	
14.97	593.19	TLB
15.55	592.96	
16.33	593.06	
17.35	592.72	
18.51	592.57	
19.05	591.63	
19.55	591.34	
20.75	591.26	
22.14	591.30	
23.55	591.42	
25.00	591.39	TWG
26.42	591.34	
28.14	591.16	
30.37	592.40	
31.34	592.04	
32.06	592.59	
33.22	593.01	
34.74	592.84	
36.05	593.52	TRB
38.28	593.54	
41.28	593.72	
44.76	594.06	
50.05	594.17	
50.66	594.64	RPIN

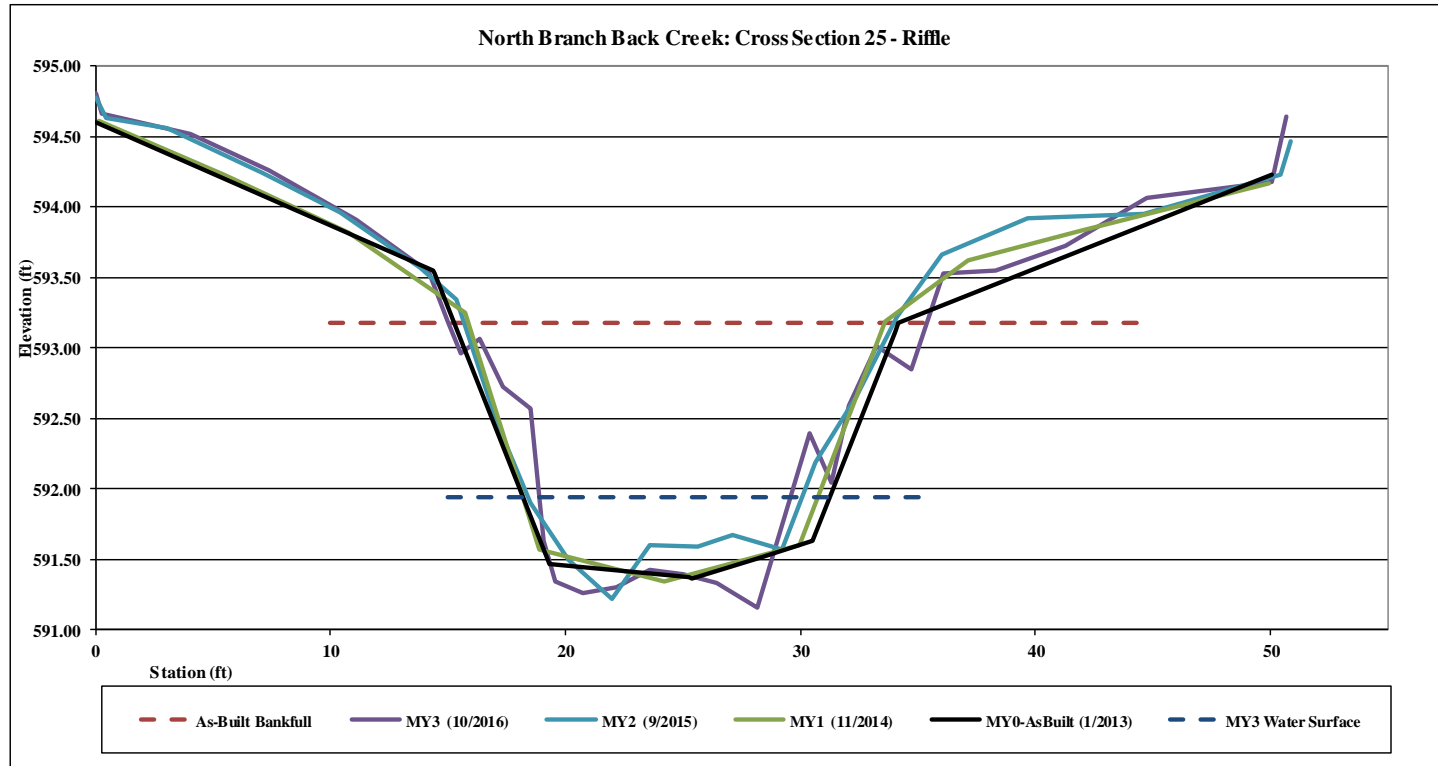


Figure 3.26 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-26, Pool
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	596.36
Bankfull Cross-Sectional Area (ft²)	8.41
Bankfull Width (ft)	9.59
Flood Prone Area Elevation (ft)	598.01
Flood Prone Width (ft)	50.00
Bankfull Mean Depth (ft)	0.88
Bankfull Max Depth (ft)	1.54
W/D Ratio	10.94
Entrenchment Ratio	5.21
Bank Height Ratio	1.06



XS-26: Upstream



XS-26: Downstream

Station	Elevation	Notes
0.00	596.57	LPIN
0.29	596.41	
2.57	596.58	
6.32	596.72	
9.36	596.65	
13.55	596.46	TLB
14.88	595.74	
16.44	595.78	
16.94	595.29	
17.91	595.01	
19.00	594.82	TWG
19.76	594.94	
20.83	595.07	
21.40	595.48	
21.99	595.91	
22.90	596.10	
23.75	596.62	TRB
25.75	596.43	
29.47	596.95	
32.76	597.49	
36.13	597.39	
39.92	597.76	
40.14	598.08	RPIN

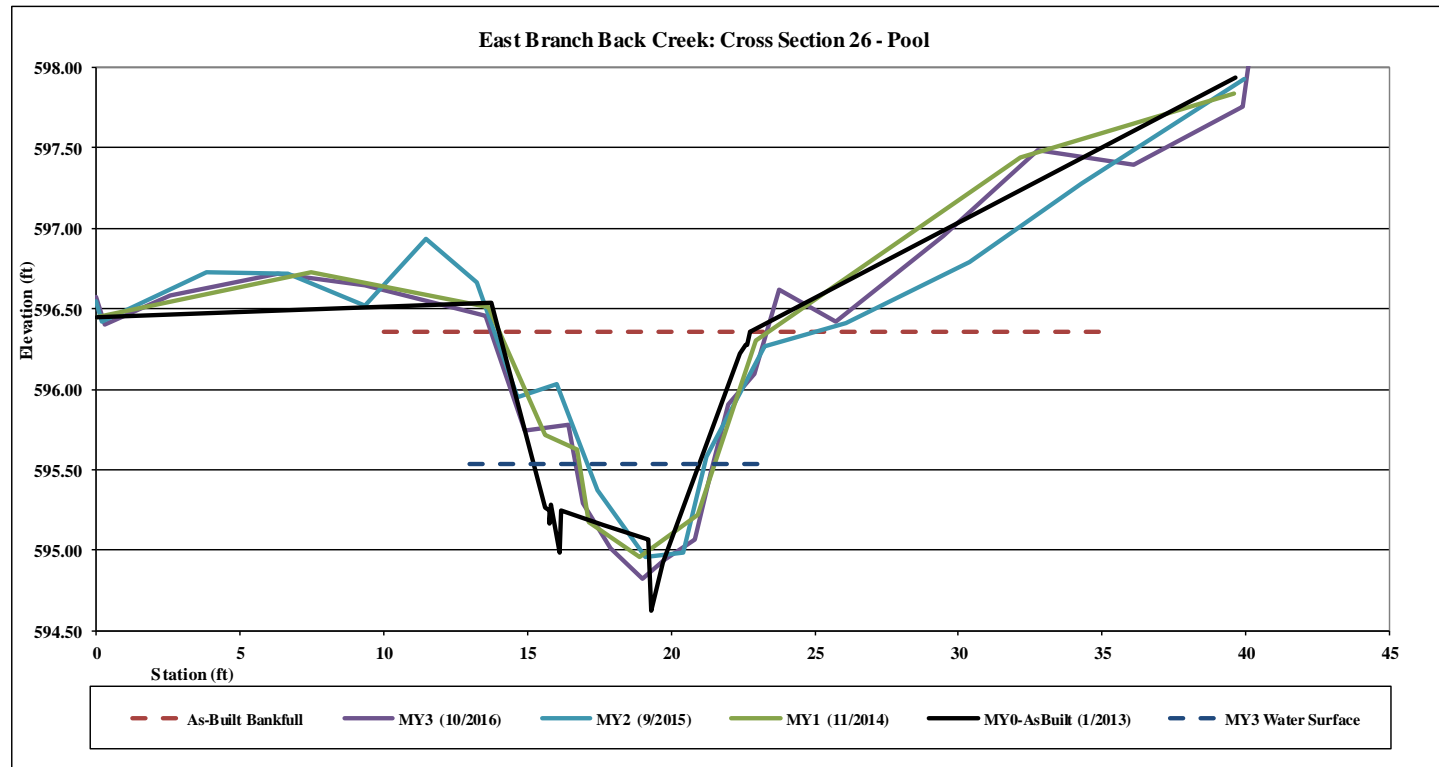


Figure 3.27 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-27, Riffle
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	596.24
Bankfull Cross-Sectional Area (ft²)	5.63
Bankfull Width (ft)	12.91
Flood Prone Area Elevation (ft)	597.13
Flood Prone Width (ft)	50.00
Bankfull Mean Depth (ft)	0.44
Bankfull Max Depth (ft)	0.89
W/D Ratio	29.62
Entrenchment Ratio	3.87
Bank Height Ratio	1.13



XS-27: Upstream



XS-27: Downstream

Station	Elevation	Notes
0.00	596.36	LPIN
0.36	596.13	
3.52	596.20	
6.37	596.44	
9.53	596.41	
11.95	596.31	
12.60	596.35	TLB
13.13	596.01	
14.30	595.75	
15.11	595.35	
16.17	595.33	
16.54	595.16	
17.29	595.36	TWG
18.40	595.30	
19.28	595.68	
20.79	596.11	
21.29	596.14	
22.58	596.37	TRB
25.15	596.48	
27.54	596.56	
30.38	596.60	
34.48	596.76	
39.54	597.40	
40.29	597.68	RPIN

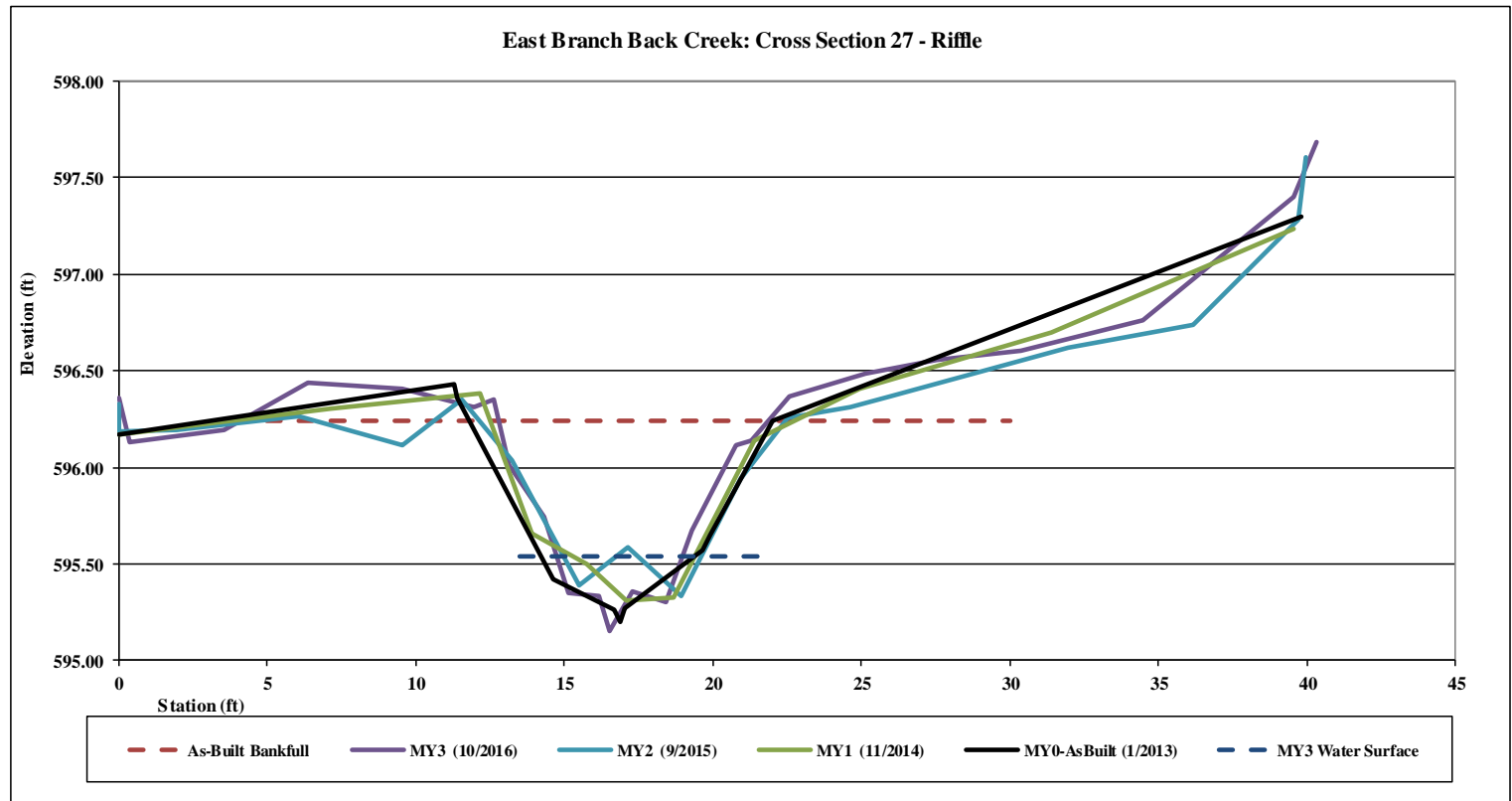


Figure 3.28 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-28,Riffle
Survey Date	10/2016
SUMMARY DATA	
Bankfull Elevation (ft)	594.18
Bankfull Cross-Sectional Area (ft²)	4.75
Bankfull Width (ft)	9.20
Flood Prone Area Elevation (ft)	595.10
Flood Prone Width (ft)	50.00
Bankfull Mean Depth (ft)	0.52
Bankfull Max Depth (ft)	0.92
W/D Ratio	17.83
Entrenchment Ratio	5.44
Bank Height Ratio	1.20



XS-28: Upstream



XS-28: Downstream

Station	Elevation	Notes
0.00	595.77	LPIN
0.19	595.82	
4.67	595.33	
8.83	594.84	
13.53	594.66	
17.08	594.63	
17.83	594.56	TLB
18.77	594.26	
19.83	593.92	
20.82	593.91	
21.60	593.49	
22.61	593.26	TWG
22.98	593.36	
24.60	593.32	
25.50	593.59	
26.55	593.84	
27.53	593.94	
28.74	594.36	TRB
30.43	594.32	
34.58	594.20	
37.81	594.24	
40.53	594.30	
40.70	594.62	RPIN

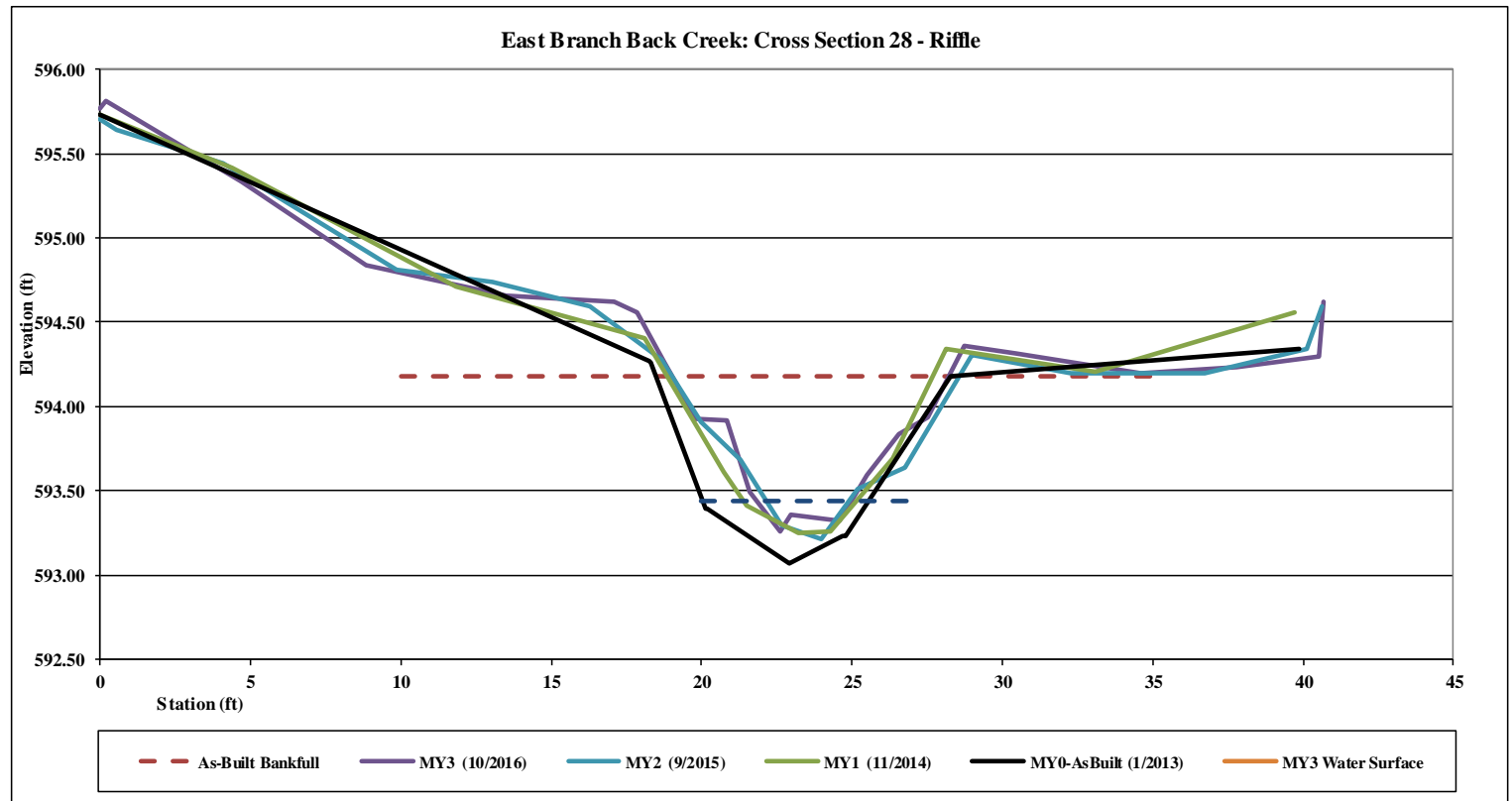
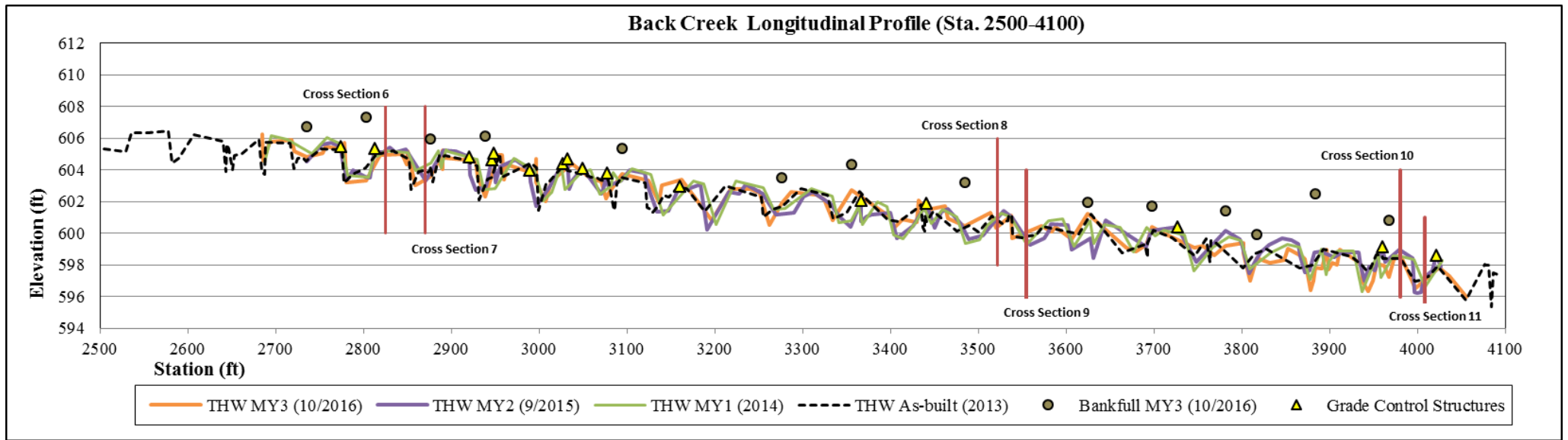
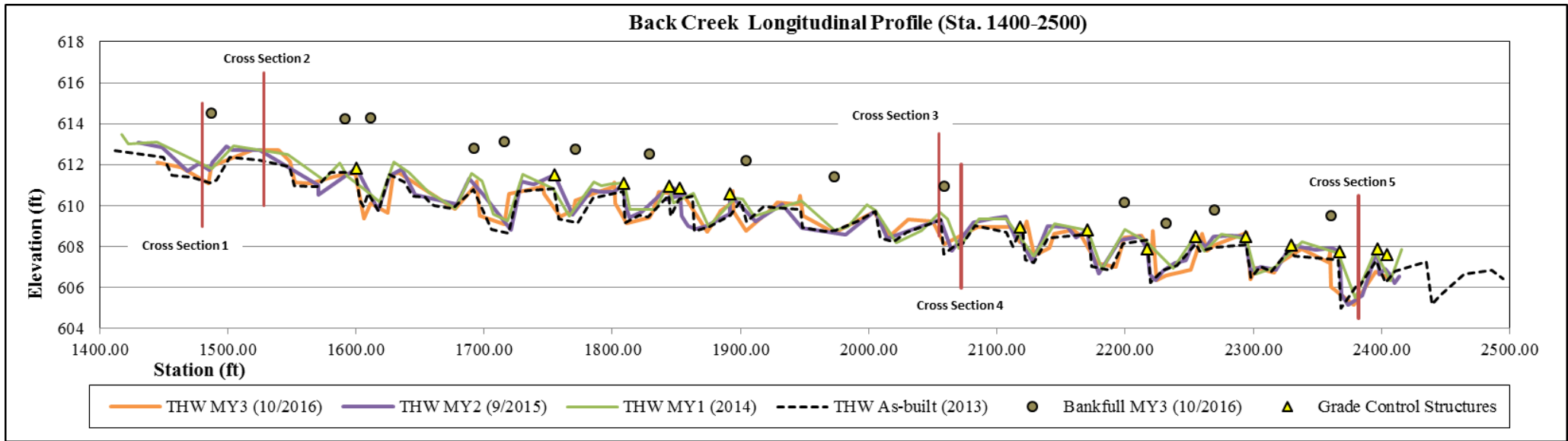


Figure 4.1. Longitudinal Profile



Back Creek Longitudinal Profile (Sta. 5000-6200)

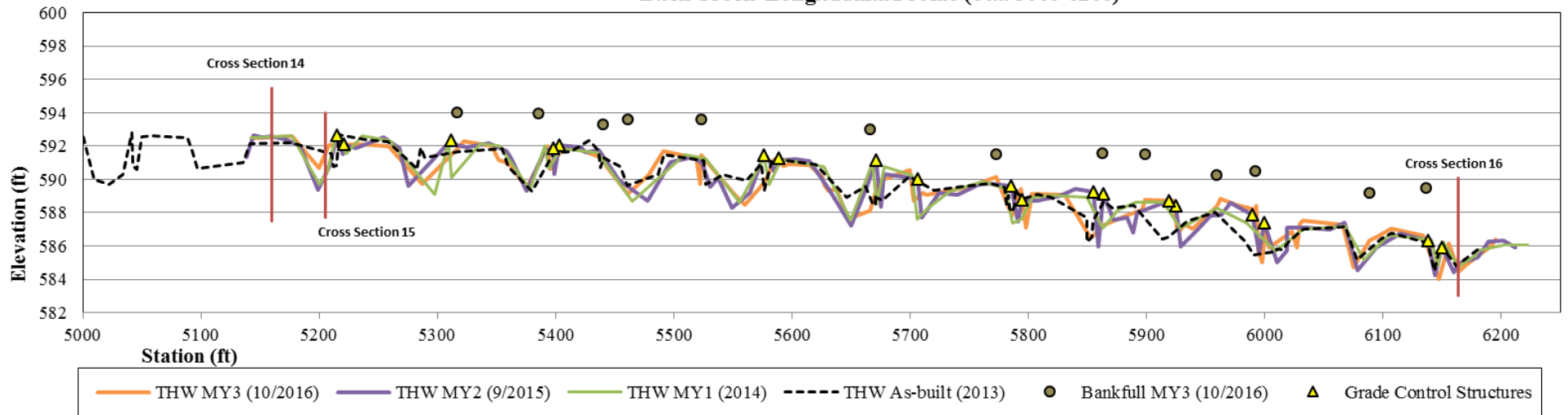


Figure 4.2. Longitudinal Profile

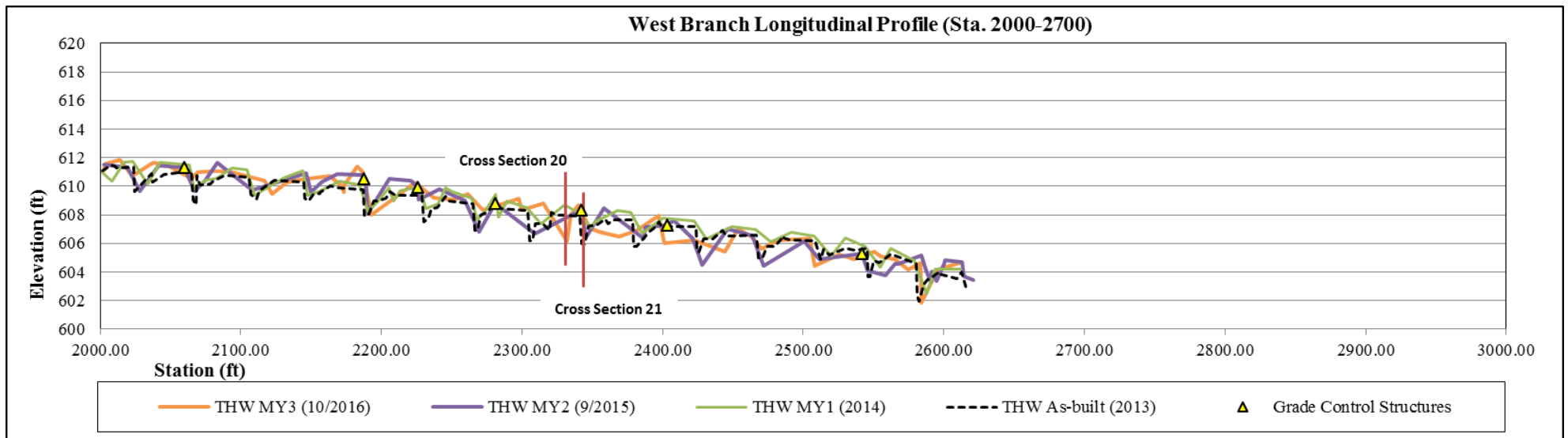
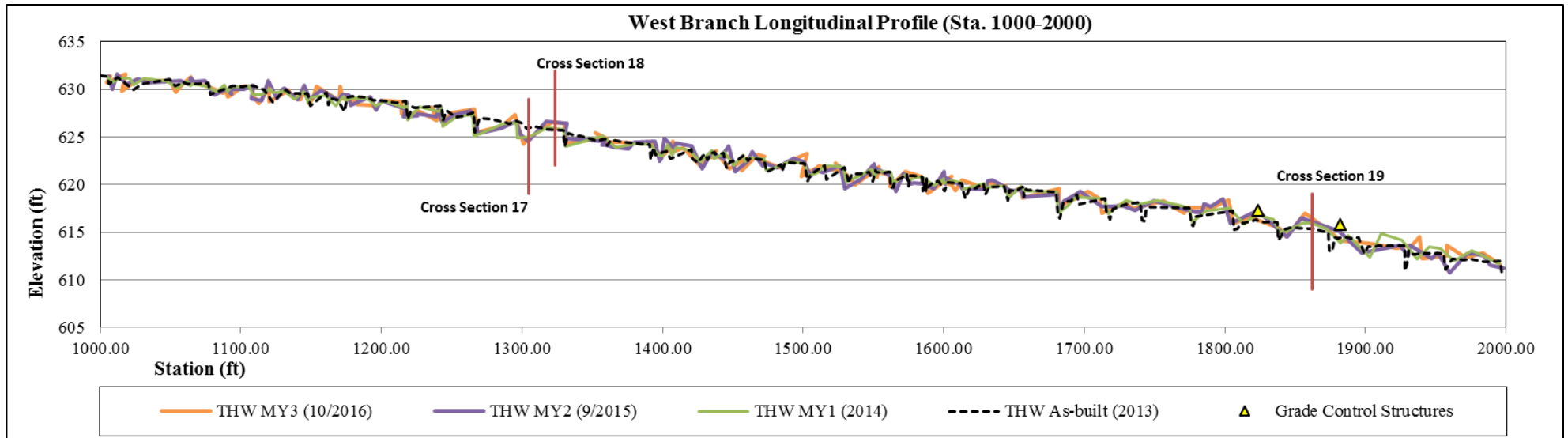


Figure 4.3. Longitudinal Profile

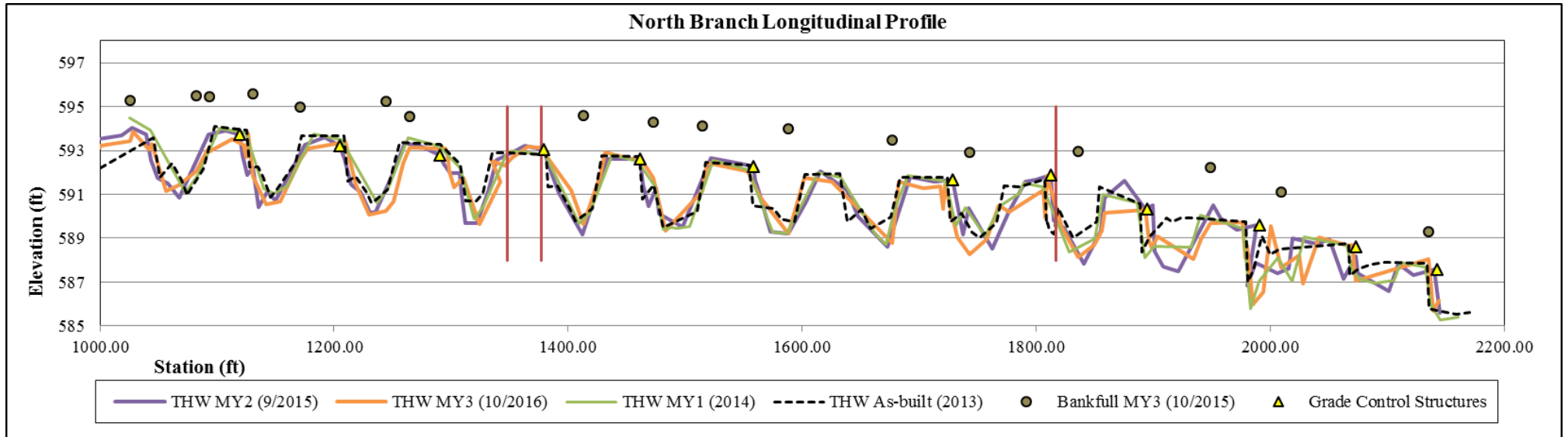


Figure 4.4. Longitudinal Profile

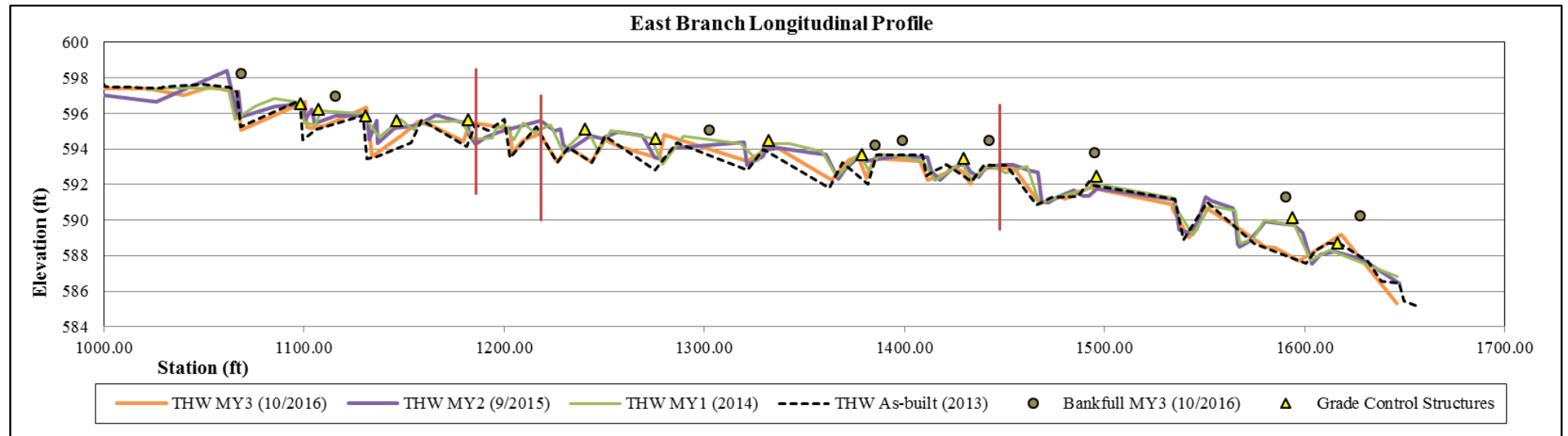


Figure 5.1. Pebble Counts

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Pool (XS 1)					
		MY3-(9/2016)			
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	7	7%	7%
Sand	very fine sand	0.125	0	0%	7%
	fine sand	0.250	0	0%	7%
	medium sand	0.50	0	0%	7%
	coarse sand	1.00	0	0%	7%
	very coarse sand	2.0	0	0%	7%
Gravel	very fine gravel	4.0	0	0%	7%
	fine gravel	5.7	0	0%	7%
	fine gravel	8.0	8	8%	15%
	medium gravel	11.3	9	9%	24%
	medium gravel	16.0	11	11%	35%
	course gravel	22.3	6	6%	41%
	course gravel	32.0	11	11%	52%
	very coarse gravel	45	24	24%	76%
	very coarse gravel	64	14	14%	90%
	Cobble	small cobble	90	0	0%
medium cobble		128	2	2%	92%
large cobble		180	0	0%	92%
very large cobble		256	2	2%	94%
Boulder	small boulder	362	2	2%	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	30.0
D84	54.0
D95	256.0

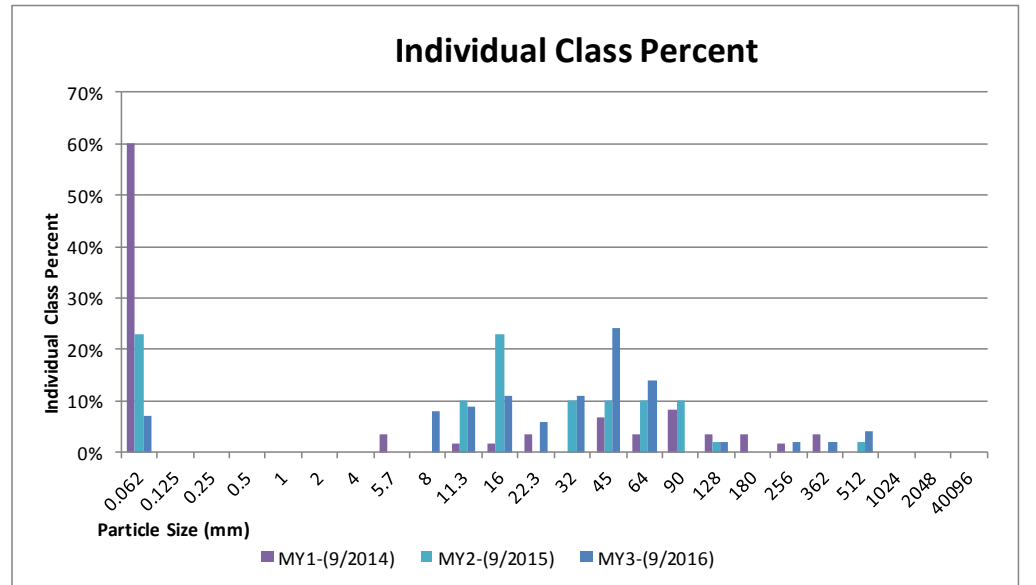
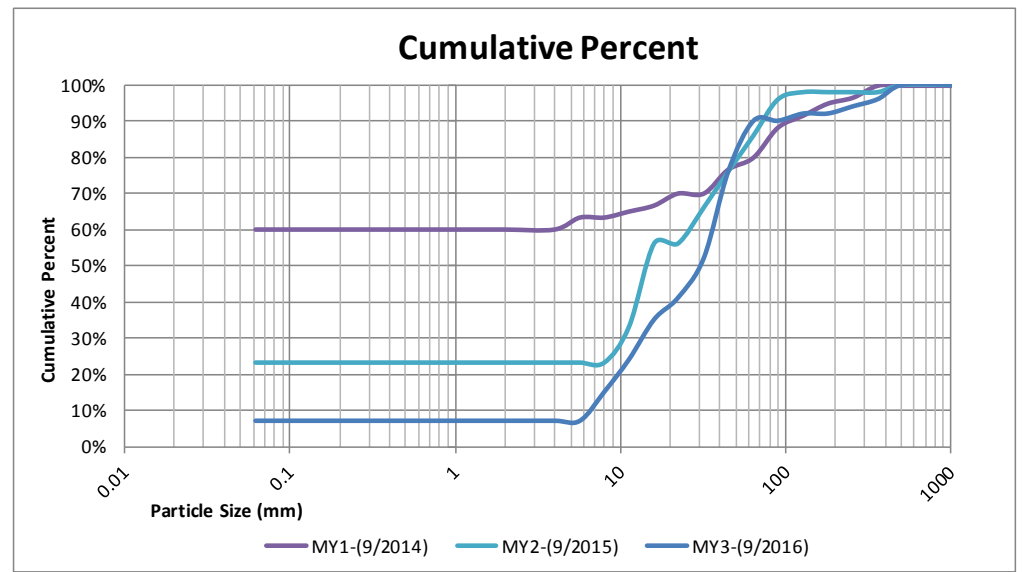


Figure 5.2. Pebble Counts

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 2)					
MY3-(9/2016)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	5	5%	5%
Sand	very fine sand	0.125	0	0%	5%
	fine sand	0.250	0	0%	5%
	medium sand	0.50	0	0%	5%
	coarse sand	1.00	0	0%	5%
	very coarse sand	2.0	0	0%	5%
Gravel	very fine gravel	4.0	0	0%	5%
	fine gravel	5.7	0	0%	5%
	fine gravel	8.0	4	4%	9%
	medium gravel	11.3	8	8%	17%
	medium gravel	16.0	0	0%	17%
	course gravel	22.3	4	4%	21%
	course gravel	32.0	7	7%	28%
	very coarse gravel	45	22	22%	50%
	very coarse gravel	64	30	30%	80%
	Cobble	small cobble	90	10	10%
medium cobble		128	2	2%	92%
large cobble		180	0	0%	92%
very large cobble		256	4	4%	96%
Boulder	small boulder	362	4	4%	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	45.0
D84	70.0
D95	200.0

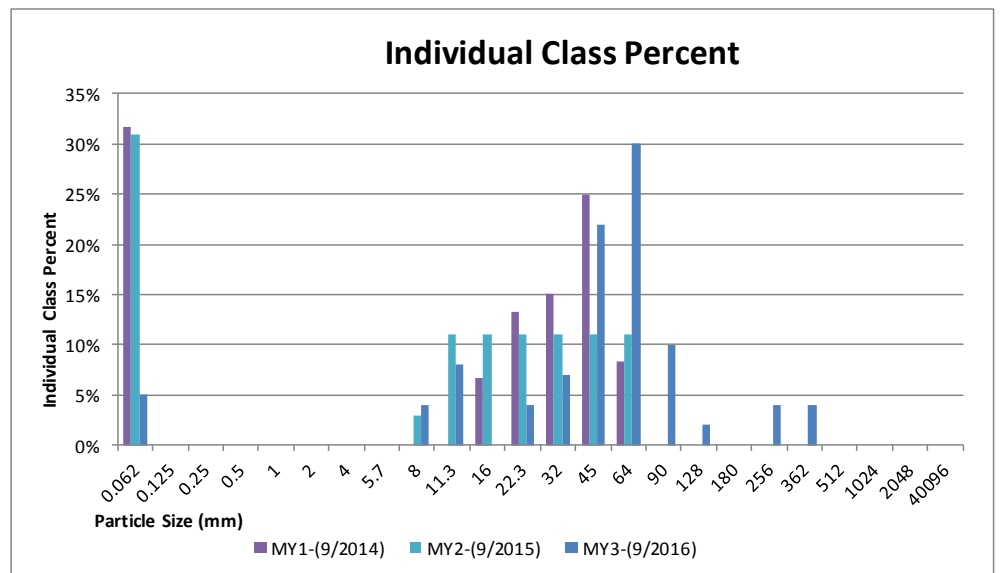
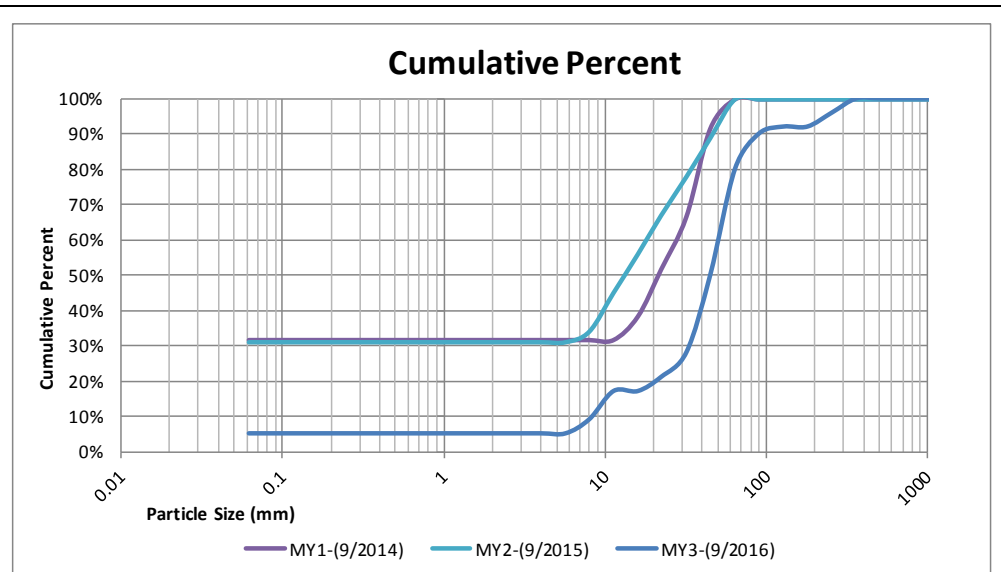


Figure 5.3. Pebble Counts

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 3)					
			MY3-(9/2016)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	6	6%	6%
Sand	very fine sand	0.125	0	0%	6%
	fine sand	0.250	0	0%	6%
	medium sand	0.50	0	0%	6%
	coarse sand	1.00	0	0%	6%
	very coarse sand	2.0	0	0%	6%
Gravel	very fine gravel	4.0	0	0%	6%
	fine gravel	5.7	2	2%	8%
	fine gravel	8.0	0	0%	8%
	medium gravel	11.3	4	4%	12%
	medium gravel	16.0	24	24%	36%
	course gravel	22.3	5	5%	41%
	course gravel	32.0	17	17%	58%
	very coarse gravel	45	20	20%	78%
	very coarse gravel	64	16	16%	94%
	Cobble	small cobble	90	4	4%
medium cobble		128	0	0%	98%
large cobble		180	0	0%	98%
very large cobble		256	0	0%	98%
Boulder	small boulder	362	2	2%	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%

Summary Data	
D50	38.0
D84	50.0
D95	70.0

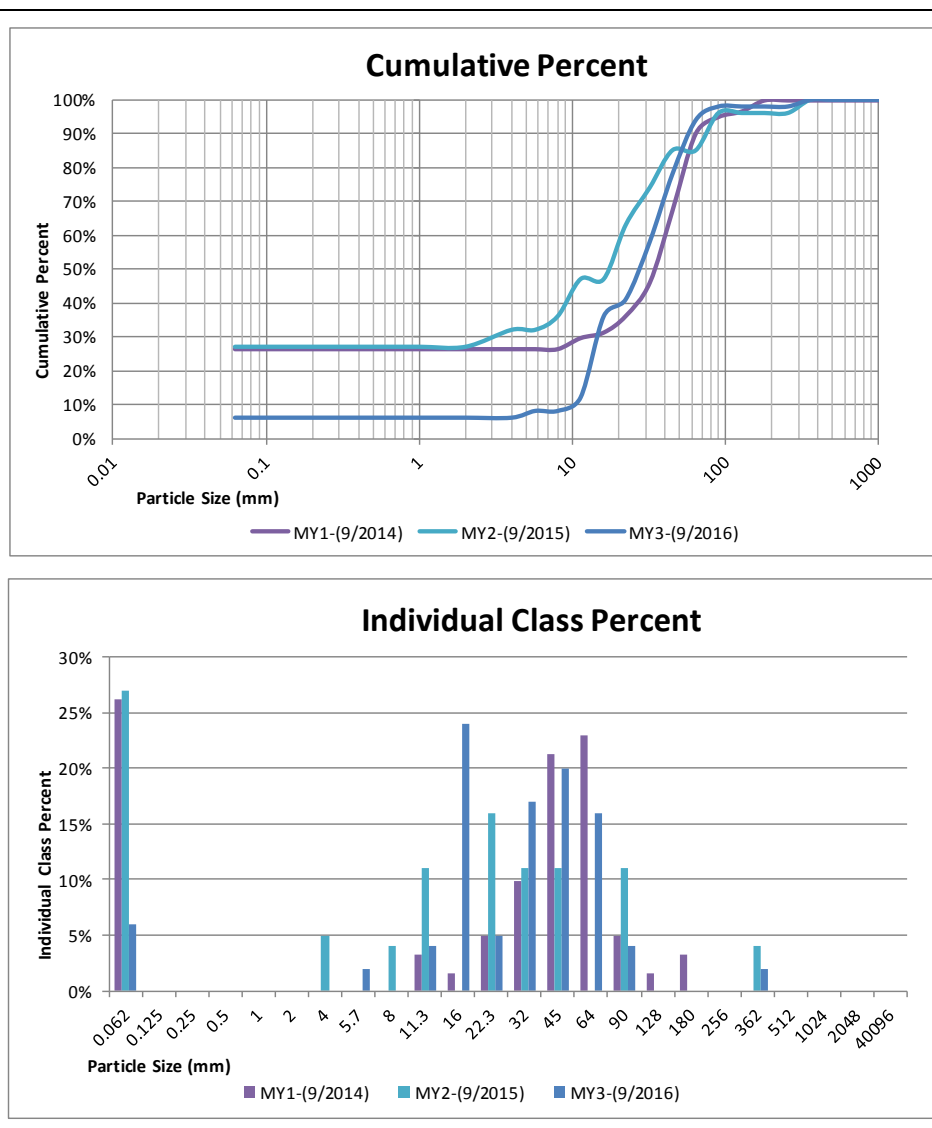


Figure 5.4. Pebble Counts

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Pool (XS 4)					
MY3-(9/2016)					
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	3	3%	48%
	medium sand	0.50	0	0%	48%
	coarse sand	1.00	3	3%	51%
	very coarse sand	2.0	1	1%	52%
Gravel	very fine gravel	4.0	7	7%	59%
	fine gravel	5.7	0	0%	59%
	fine gravel	8.0	3	3%	62%
	medium gravel	11.3	0	0%	62%
	medium gravel	16.0	8	8%	70%
	course gravel	22.3	10	10%	80%
	course gravel	32.0	2	2%	82%
	very coarse gravel	45	7	7%	89%
	very coarse gravel	64	1	1%	90%
	Cobble	small cobble	90	10	10%
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%

Summary Data	
D50	1.0
D84	35.0
D95	75.0

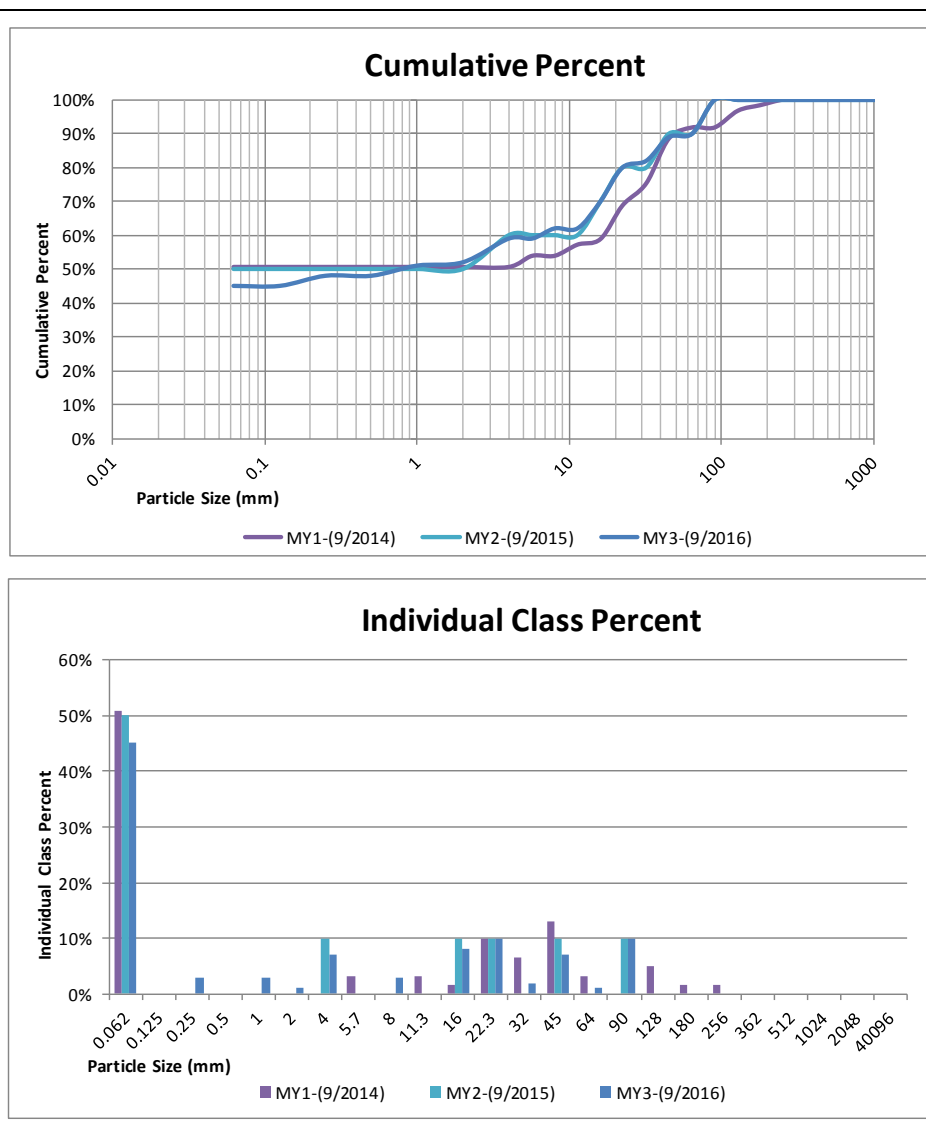


Figure 5.5. Pebble Counts

Project Name: Heath Dairy						
Reach: Back Creek						
Feature: Riffle (XS 6)						
			MY3-(9/2016)			
Description	Material	Size (mm)	Total #	Item %	Cum %	
Silt/Clay	silt/clay	0.062	8	8%	8%	
Sand	very fine sand	0.125	0	0%	8%	
	fine sand	0.250	4	4%	12%	
	medium sand	0.50	0	0%	12%	
	coarse sand	1.00	0	0%	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	2	2%	14%	
	medium gravel	11.3	6	6%	20%	
	medium gravel	16.0	15	15%	35%	
	course gravel	22.3	13	13%	48%	
	course gravel	32.0	20	20%	68%	
	very coarse gravel	45	16	16%	84%	
	very coarse gravel	64	11	11%	95%	
	Cobble	small cobble	90	2	2%	97%
medium cobble		128	0	0%	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	21.0					
D84	45.0					
D95	64.0					

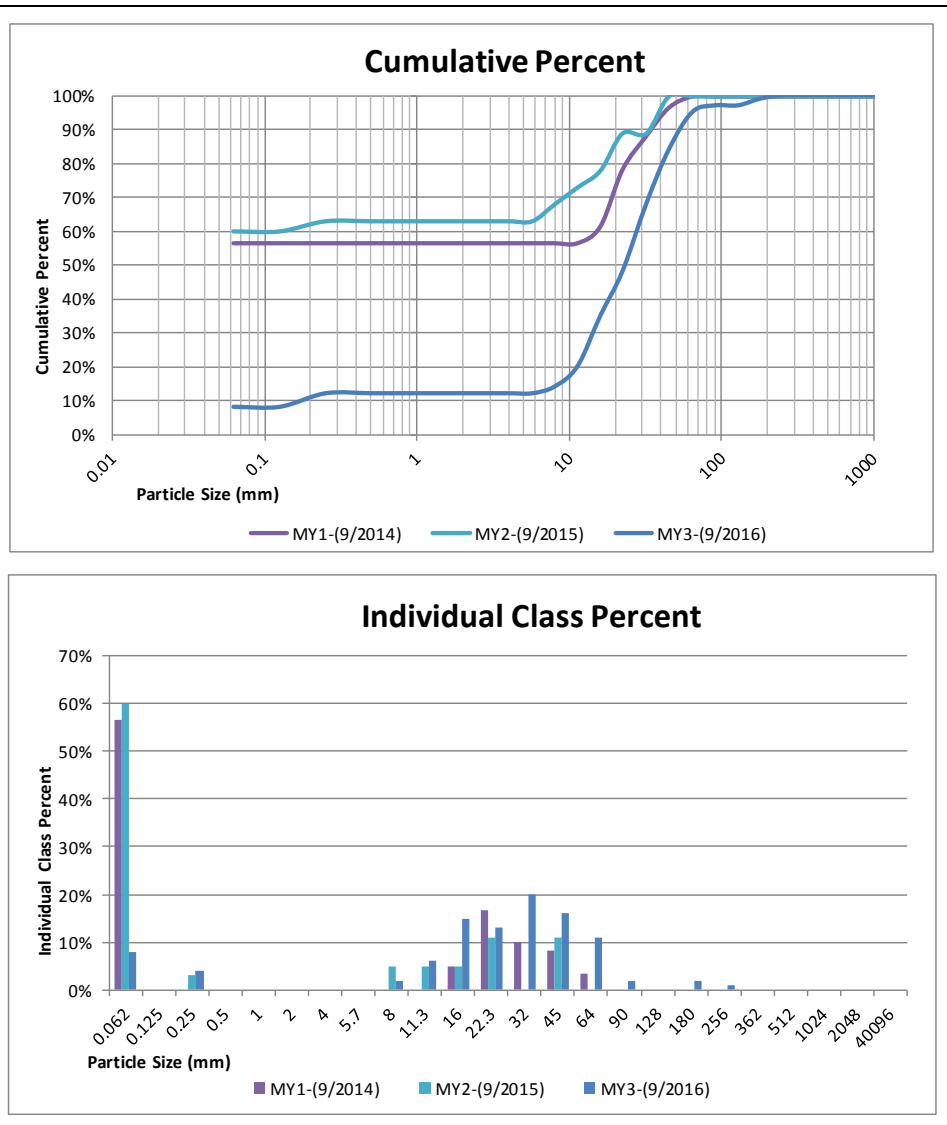


Figure 5.6. Pebble Counts

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 8)					
		MY3-(9/2016)			
Description	Material	Size	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	0	0%	4%
Gravel	very fine gravel	4.0	0	0%	4%
	fine gravel	5.7	4	4%	8%
	fine gravel	8.0	8	8%	16%
	medium gravel	11.3	12	12%	28%
	medium gravel	16.0	16	16%	44%
	course gravel	22.3	10	10%	54%
	course gravel	32.0	10	10%	64%
	very coarse gravel	45	18	18%	82%
	very coarse gravel	64	12	12%	94%
	Cobble	small cobble	90	4	4%
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	18.0
D84	47.0
D95	85.0

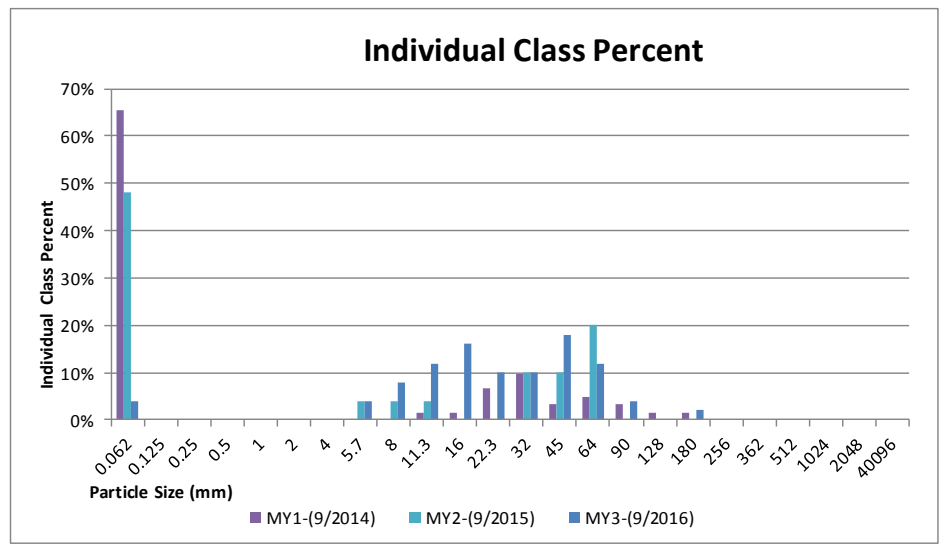
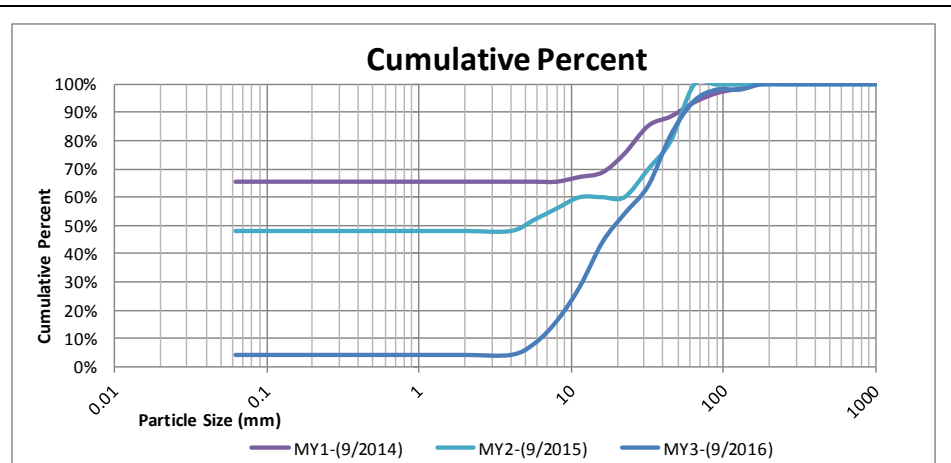


Figure 5.7. Pebble Counts

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Pool (XS 9)					
MY3-(9/2016)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	30	30%	30%
Sand	very fine sand	0.125	0	0%	30%
	fine sand	0.250	0	0%	30%
	medium sand	0.50	0	0%	30%
	coarse sand	1.00	0	0%	30%
	very coarse sand	2.0	0	0%	30%
Gravel	very fine gravel	4.0	0	0%	30%
	fine gravel	5.7	16	16%	46%
	fine gravel	8.0	8	8%	54%
	medium gravel	11.3	10	10%	64%
	medium gravel	16.0	8	8%	72%
	course gravel	22.3	1	1%	73%
	course gravel	32.0	20	20%	93%
	very coarse gravel	45	2	2%	95%
	very coarse gravel	64	4	4%	99%
	Cobble	small cobble	90	0	0%
medium cobble		128	0	0%	99%
large cobble		180	0	0%	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%

Summary Data	
D50	7.0
D84	26.0
D95	45.0

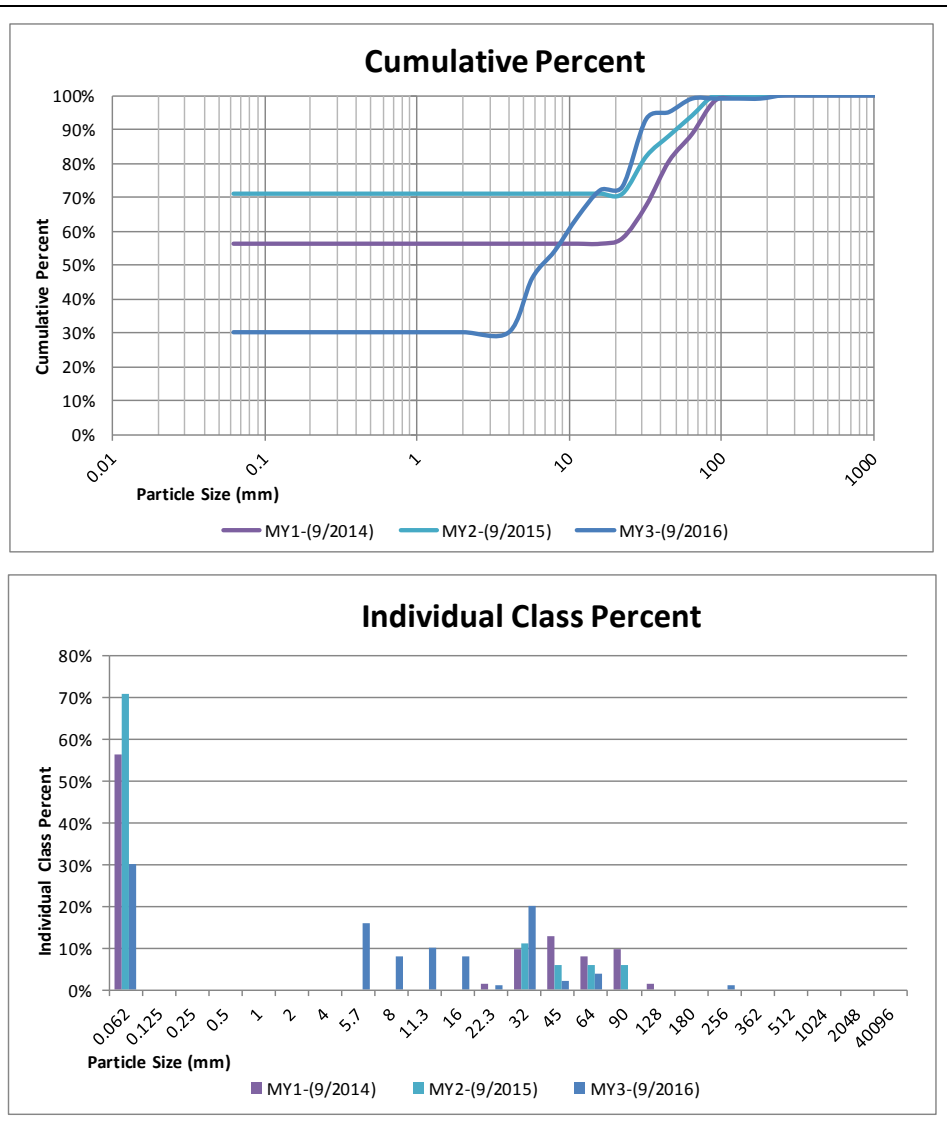


Figure 5.8. Pebble Counts

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 10)					
			MY3-(9/2016)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	6	6%	6%
Sand	very fine sand	0.125	0	0%	6%
	fine sand	0.250	0	0%	6%
	medium sand	0.50	0	0%	6%
	coarse sand	1.00	0	0%	6%
	very coarse sand	2.0	0	0%	6%
Gravel	very fine gravel	4.0	0	0%	6%
	fine gravel	5.7	0	0%	6%
	fine gravel	8.0	2	2%	8%
	medium gravel	11.3	4	4%	12%
	medium gravel	16.0	4	4%	16%
	course gravel	22.3	20	20%	36%
	course gravel	32.0	26	26%	62%
	very coarse gravel	45	28	28%	90%
	very coarse gravel	64	8	8%	98%
	Cobble	small cobble	90	0	0%
medium cobble		128	0	0%	98%
large cobble		180	0	0%	98%
very large cobble		256	2	2%	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%
Summary Data					
D50	26.0				
D84	40.0				
D95	58.0				

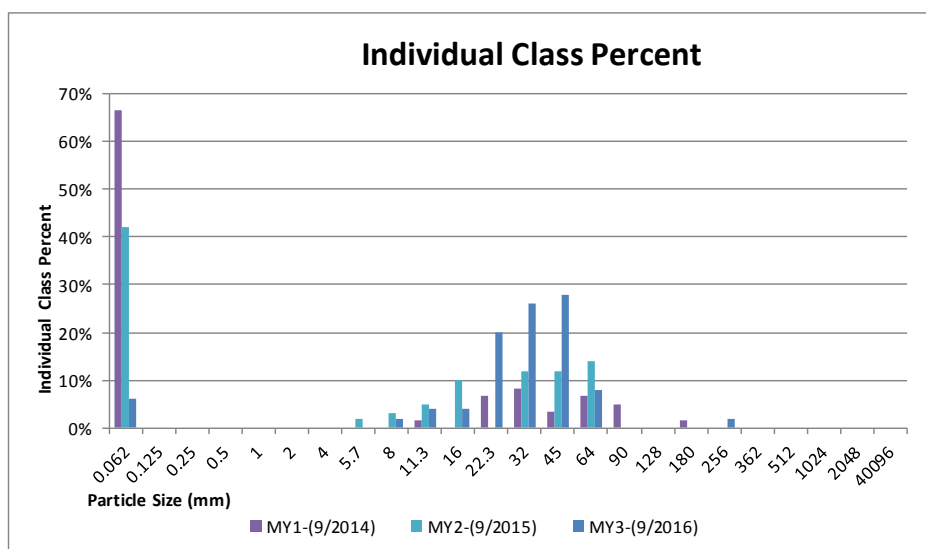
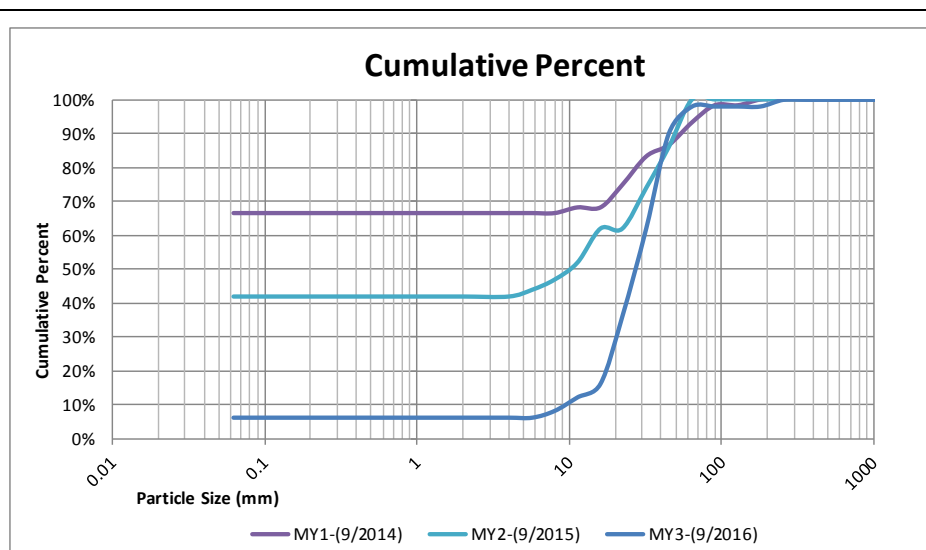


Figure 5.9. Pebble Counts

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 12)					
			MY3-(9/2016)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	14	14%	14%
Sand	very fine sand	0.125	0	0%	14%
	fine sand	0.250	0	0%	14%
	medium sand	0.50	0	0%	14%
	coarse sand	1.00	0	0%	14%
	very coarse sand	2.0	0	0%	14%
Gravel	very fine gravel	4.0	0	0%	14%
	fine gravel	5.7	6	6%	20%
	fine gravel	8.0	16	16%	36%
	medium gravel	11.3	6	6%	42%
	medium gravel	16.0	16	16%	58%
	course gravel	22.3	20	20%	78%
	course gravel	32.0	18	18%	96%
	very coarse gravel	45	4	4%	100%
	very coarse gravel	64	0	0%	100%
	Cobble	small cobble	90	0	0%
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%

Summary Data	
D50	15.0
D84	25.0
D95	30.0

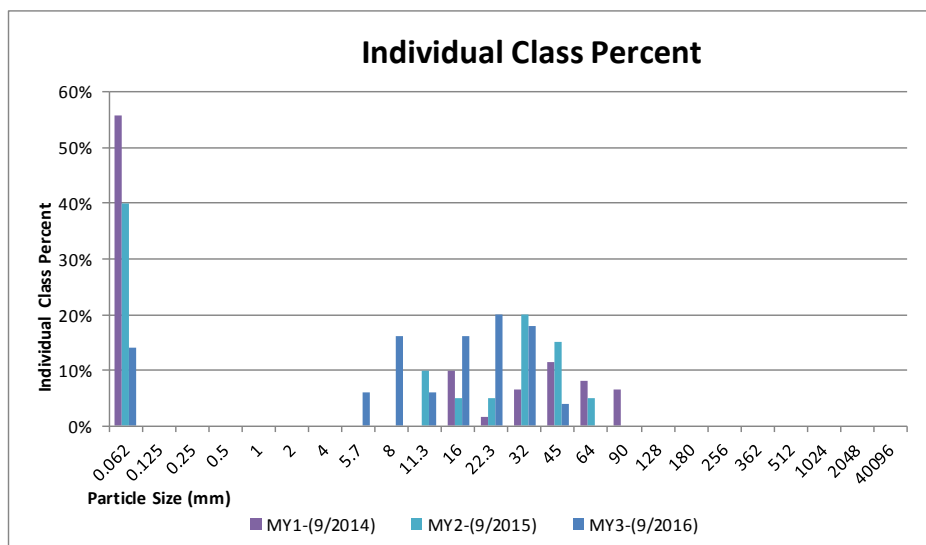
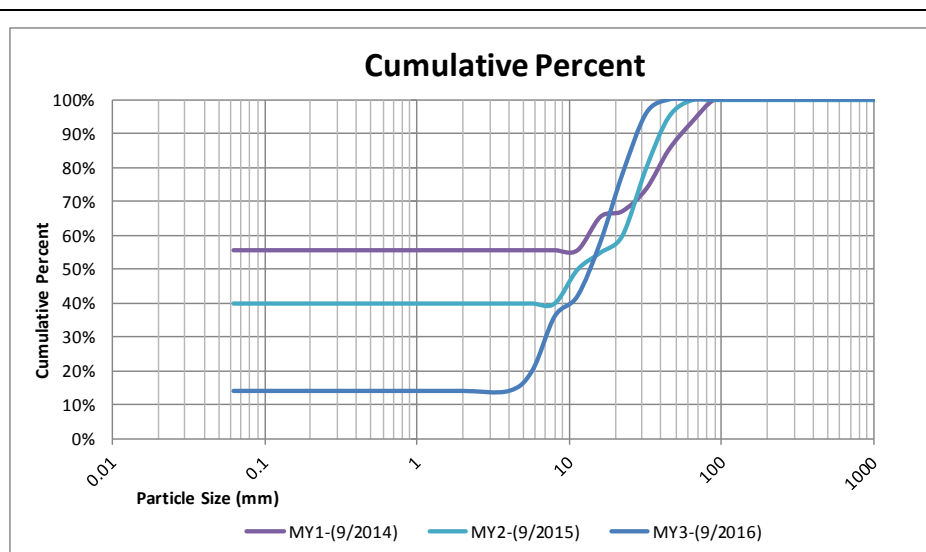


Figure 5.10. Pebble Counts

Project Name: Heath Dairy						
Reach: Back Creek						
Feature: Riffle (XS 14)						
			MY3-(9/2016)			
Description	Material	Size (mm)	Total #	Item %	Cum %	
Silt/Clay	silt/clay	0.062	20	20%	20%	
Sand	very fine sand	0.125	0	0%	20%	
	fine sand	0.250	0	0%	20%	
	medium sand	0.50	0	0%	20%	
	coarse sand	1.00	0	0%	20%	
	very coarse sand	2.0	0	0%	20%	
Gravel	very fine gravel	4.0	0	0%	20%	
	fine gravel	5.7	4	4%	24%	
	fine gravel	8.0	8	8%	32%	
	medium gravel	11.3	10	10%	42%	
	medium gravel	16.0	5	5%	47%	
	course gravel	22.3	18	18%	65%	
	course gravel	32.0	25	25%	90%	
	very coarse gravel	45	6	6%	96%	
	very coarse gravel	64	4	4%	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	18.0					
D84	29.0					
D95	44.0					

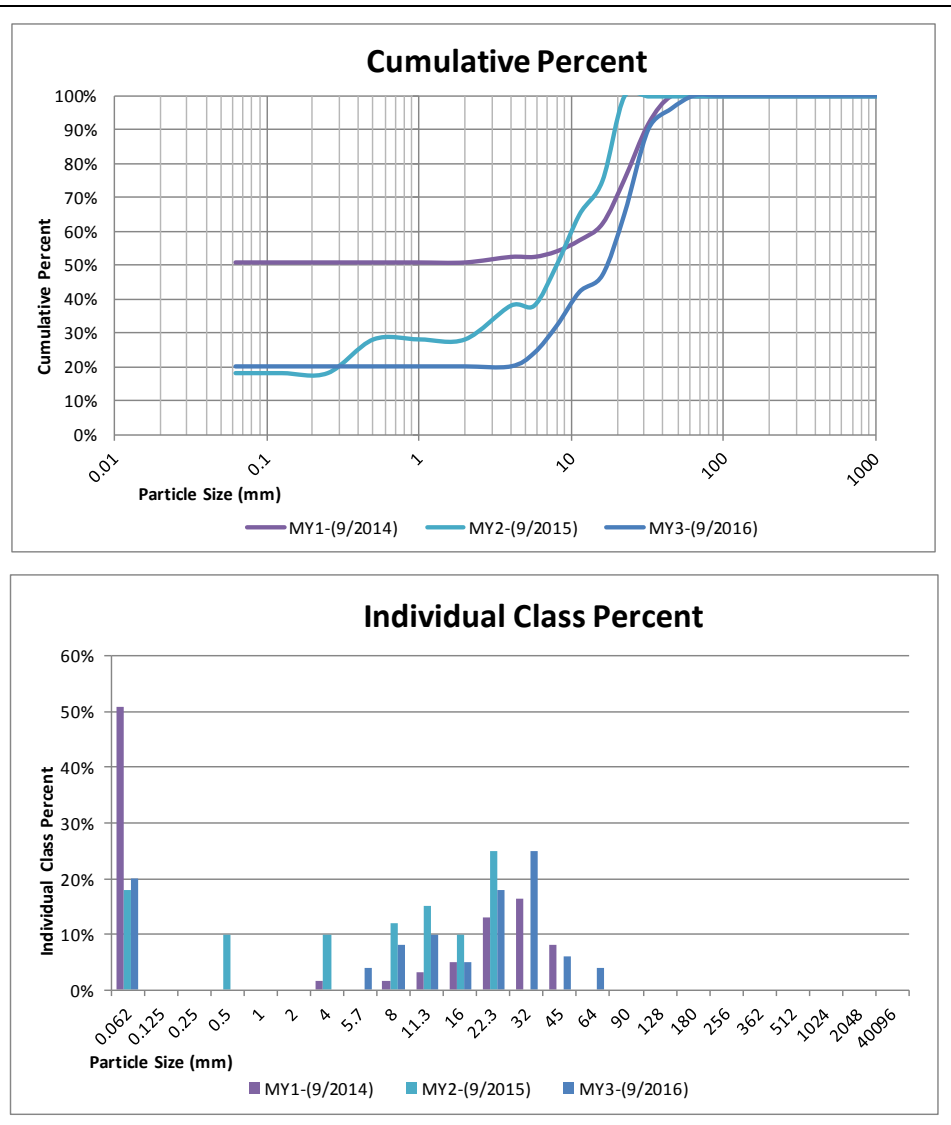


Figure 5.11. Pebble Counts

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 16)					
			MY3-(9/2016)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	44	44%	44%
Sand	very fine sand	0.125	0	0%	44%
	fine sand	0.250	0	0%	44%
	medium sand	0.50	0	0%	44%
	coarse sand	1.00	0	0%	44%
	very coarse sand	2.0	0	0%	44%
Gravel	very fine gravel	4.0	0	0%	44%
	fine gravel	5.7	15	15%	59%
	fine gravel	8.0	16	16%	75%
	medium gravel	11.3	10	10%	85%
	medium gravel	16.0	10	10%	95%
	course gravel	22.3	3	3%	98%
	course gravel	32.0	0	0%	98%
	very coarse gravel	45	0	0%	98%
	very coarse gravel	64	0	0%	98%
	Cobble	small cobble	90	0	0%
medium cobble		128	0	0%	98%
large cobble		180	0	0%	98%
very large cobble		256	2	2%	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%
Summary Data					
D50	5.0				
D84	11.0				
D95	16.0				

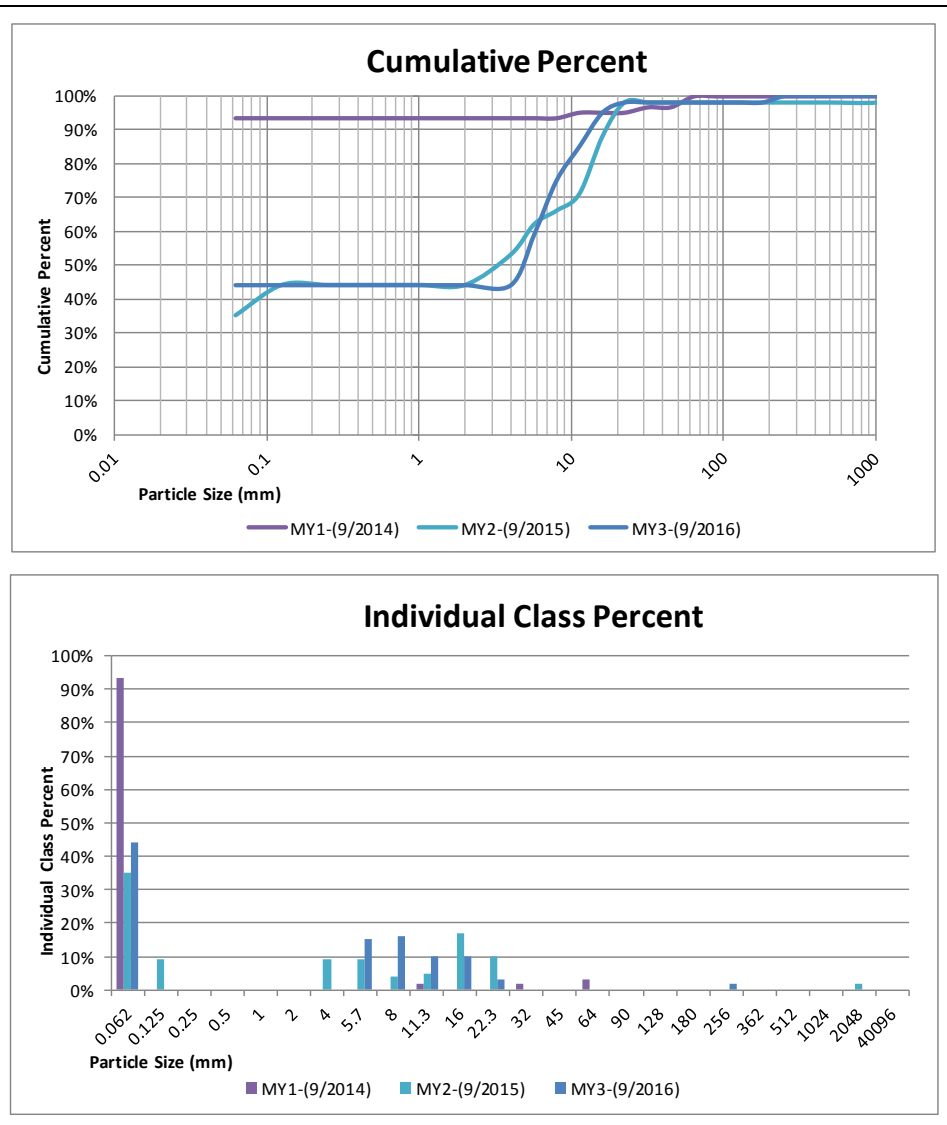


Figure 5.12. Pebble Counts

Project Name: Heath Dairy					
Reach: West Branch to Back Creek					
Feature: Riffle (XS 19)					
			MY3-(9/2016)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	3	3%	3%
Sand	very fine sand	0.125	0	0%	3%
	fine sand	0.250	0	0%	3%
	medium sand	0.50	0	0%	3%
	coarse sand	1.00	0	0%	3%
	very coarse sand	2.0	0	0%	3%
Gravel	very fine gravel	4.0	0	0%	3%
	fine gravel	5.7	0	0%	3%
	fine gravel	8.0	0	0%	3%
	medium gravel	11.3	0	0%	3%
	medium gravel	16.0	3	3%	6%
	course gravel	22.3	5	5%	11%
	course gravel	32.0	5	5%	16%
	very coarse gravel	45	10	10%	26%
	very coarse gravel	64	8	8%	34%
	Cobble	small cobble	90	10	10%
medium cobble		128	14	14%	58%
large cobble		180	14	14%	72%
very large cobble		256	14	14%	86%
Boulder	small boulder	362	10	10%	96%
	small boulder	512	3	3%	99%
	medium boulder	1024	1	1%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			-	100	100%

Summary Data	
D50	100.0
D84	240.0
D95	350.0

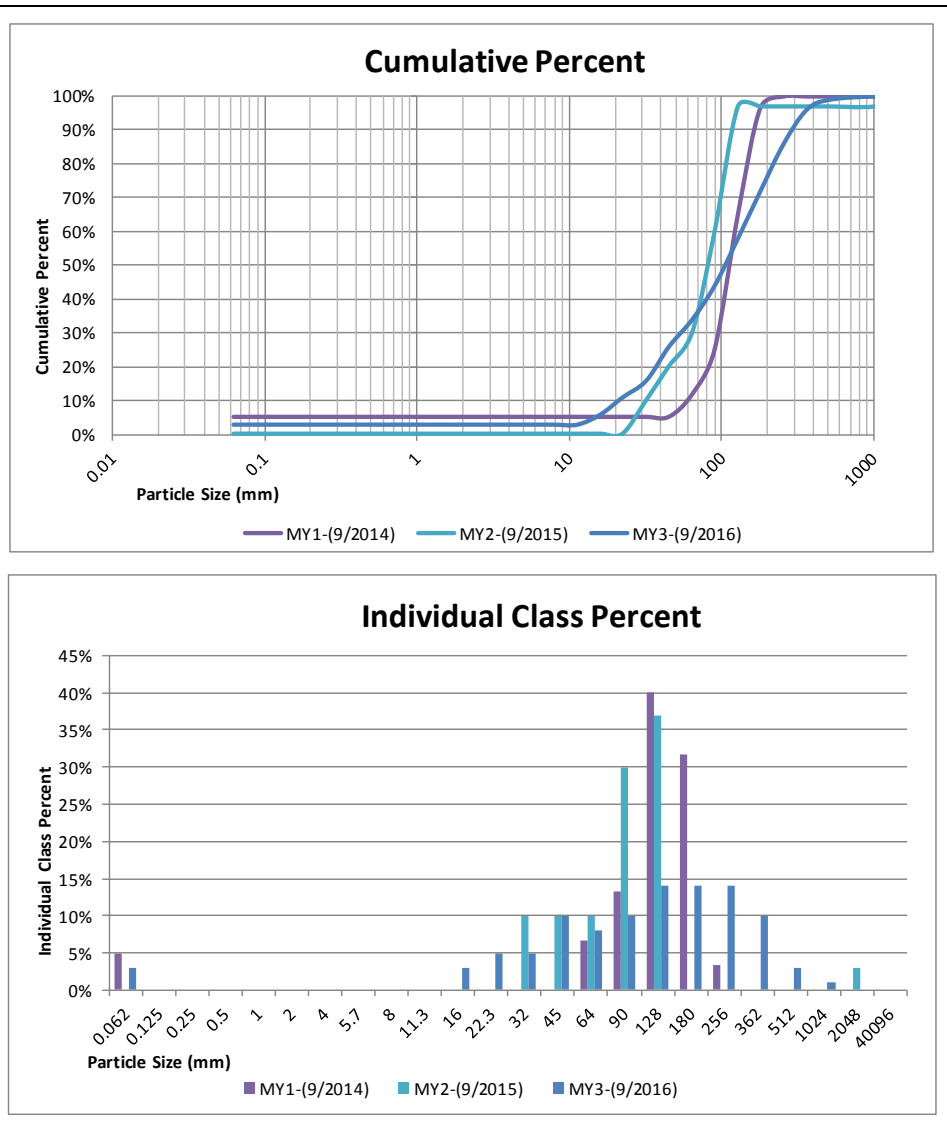


Figure 5.13. Pebble Counts

Project Name: Heath Dairy					
Reach: West Branch to Back Creek					
Feature: Riffle (XS 20)					
			MY3-(9/2016)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	8	8%	8%
Sand	very fine sand	0.125	0	0%	8%
	fine sand	0.250	0	0%	8%
	medium sand	0.50	0	0%	8%
	coarse sand	1.00	0	0%	8%
	very coarse sand	2.0	0	0%	8%
Gravel	very fine gravel	4.0	0	0%	8%
	fine gravel	5.7	2	2%	10%
	fine gravel	8.0	6	6%	16%
	medium gravel	11.3	4	4%	20%
	medium gravel	16.0	6	6%	26%
	course gravel	22.3	10	10%	36%
	course gravel	32.0	18	18%	54%
	very coarse gravel	45	24	24%	78%
	very coarse gravel	64	14	14%	92%
	Cobble	small cobble	90	2	2%
medium cobble		128	0	0%	94%
large cobble		180	0	0%	94%
very large cobble		256	4	4%	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%

Summary Data	
D50	30.0
D84	50.0
D95	190.0

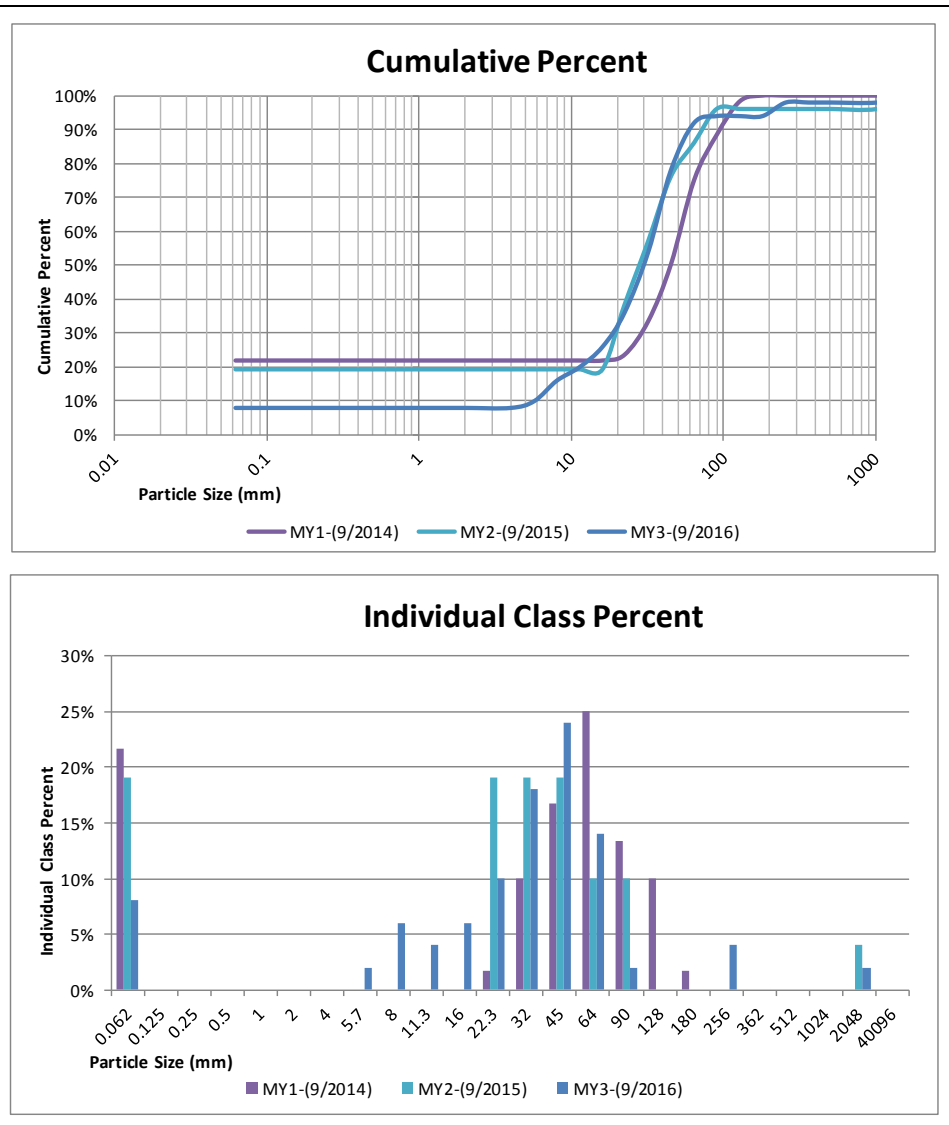


Figure 5.14. Pebble Counts

Project Name: Heath Dairy						
Reach: West Branch to Back Creek						
Feature: Pool (XS 21)						
			MY3-(9/2016)			
Description	Material	Size (mm)	Total #	Item %	Cum %	
Silt/Clay	silt/clay	0.062	65	65%	65%	
Sand	very fine sand	0.125	0	0%	65%	
	fine sand	0.250	0	0%	65%	
	medium sand	0.50	0	0%	65%	
	coarse sand	1.00	0	0%	65%	
	very coarse sand	2.0	0	0%	65%	
Gravel	very fine gravel	4.0	0	0%	65%	
	fine gravel	5.7	6	6%	71%	
	fine gravel	8.0	4	4%	75%	
	medium gravel	11.3	5	5%	80%	
	medium gravel	16.0	0	0%	80%	
	course gravel	22.3	1	1%	81%	
	course gravel	32.0	2	2%	83%	
	very coarse gravel	45	4	4%	87%	
	very coarse gravel	64	6	6%	93%	
	Cobble	small cobble	90	4	4%	97%
medium cobble		128	0	0%	97%	
large cobble		180	0	0%	97%	
very large cobble		256	2	2%	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	0.0					
D84	35.0					
D95	70.0					

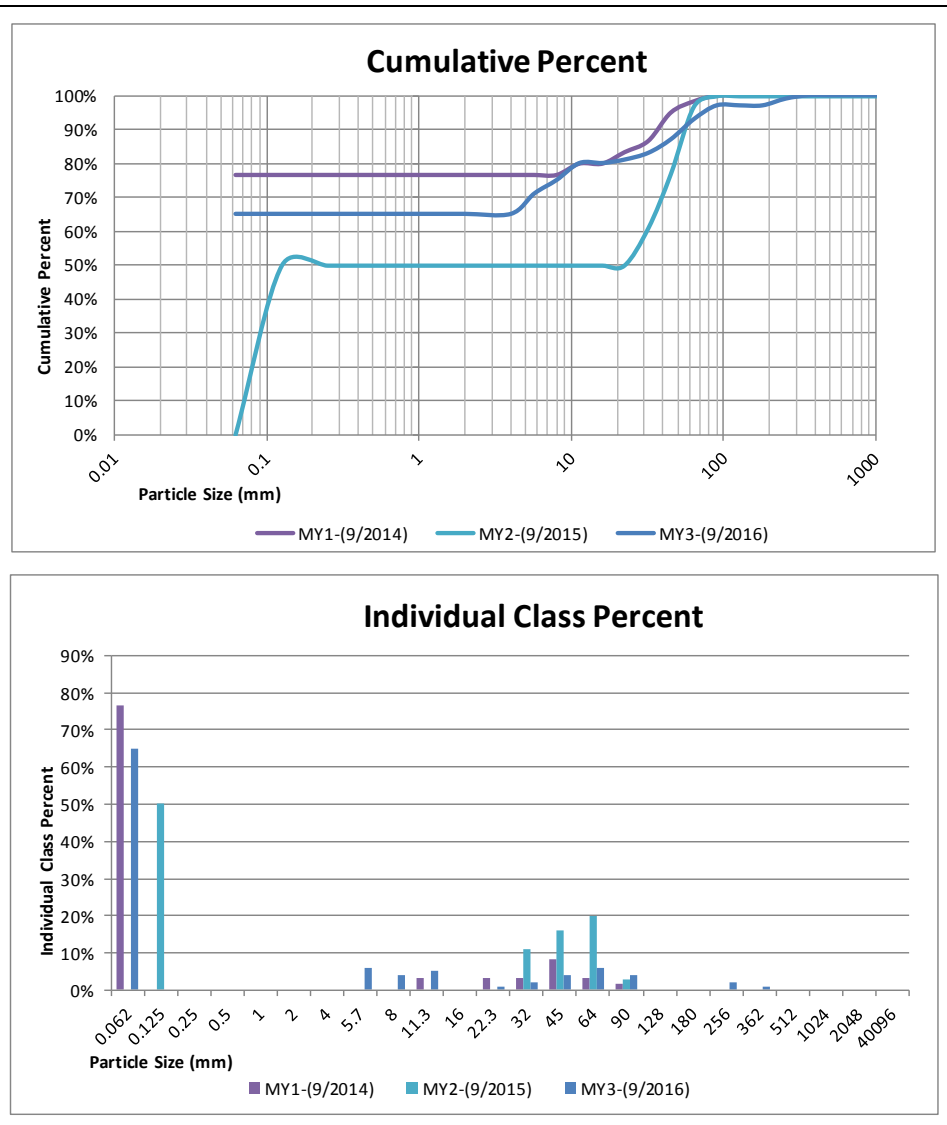


Figure 5.15. Pebble Counts

Project Name: Heath Dairy					
Reach: West Branch to Back Creek					
Feature: Riffle (XS 22)					
			MY3-(9/2016)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	5	5%	5%
Sand	very fine sand	0.125	1	1%	6%
	fine sand	0.250	1	1%	7%
	medium sand	0.50	0	0%	7%
	coarse sand	1.00	0	0%	7%
	very coarse sand	2.0	0	0%	7%
Gravel	very fine gravel	4.0	0	0%	7%
	fine gravel	5.7	0	0%	7%
	fine gravel	8.0	0	0%	7%
	medium gravel	11.3	0	0%	7%
	medium gravel	16.0	0	0%	7%
	course gravel	22.3	0	0%	7%
	course gravel	32.0	1	1%	8%
	very coarse gravel	45	0	0%	8%
	very coarse gravel	64	7	7%	15%
	Cobble	small cobble	90	5	5%
medium cobble		128	18	18%	38%
large cobble		180	20	20%	58%
very large cobble		256	40	40%	98%
Boulder	small boulder	362	0	0%	98%
	small boulder	512	1	1%	99%
	medium boulder	1024	0	0%	99%
	large boulder	2048	1	1%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			-	100	100%
Summary Data					
D50	160.0				
D84	220.0				
D95	240.0				

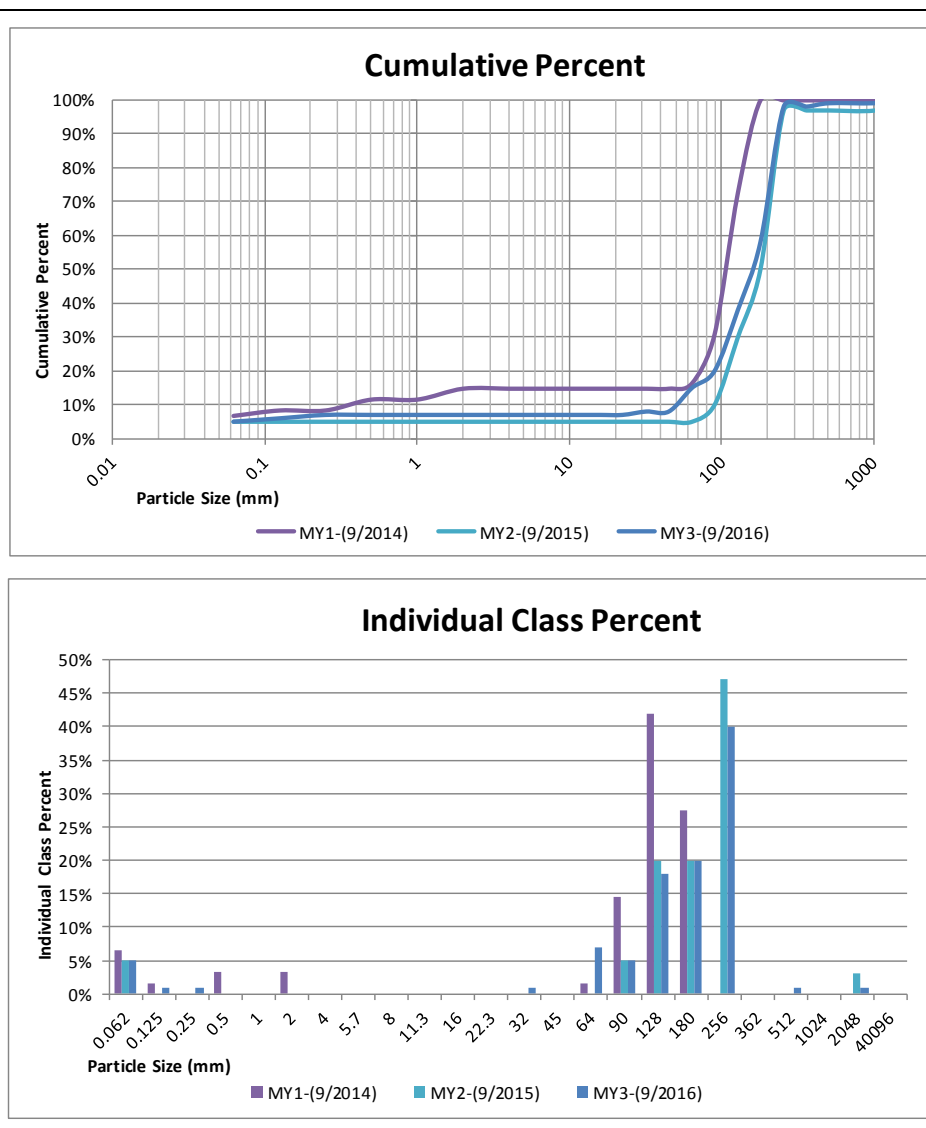


Figure 5.16. Pebble Counts

Project Name: Heath Dairy					
Reach: North Branch to Back Creek					
Feature: Riffle (XS 24)					
			MY3-(9/2016)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	3	3%	3%
Sand	very fine sand	0.125	0	0%	3%
	fine sand	0.250	0	0%	3%
	medium sand	0.50	0	0%	3%
	coarse sand	1.00	0	0%	3%
	very coarse sand	2.0	0	0%	3%
Gravel	very fine gravel	4.0	0	0%	3%
	fine gravel	5.7	11	11%	14%
	fine gravel	8.0	12	12%	26%
	medium gravel	11.3	13	13%	39%
	medium gravel	16.0	16	16%	55%
	course gravel	22.3	11	11%	66%
	course gravel	32.0	14	14%	80%
	very coarse gravel	45	10	10%	90%
	very coarse gravel	64	4	4%	94%
	Cobble	small cobble	90	4	4%
medium cobble		128	2	2%	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%

Summary Data	
D50	15.0
D84	35.0
D95	70.0

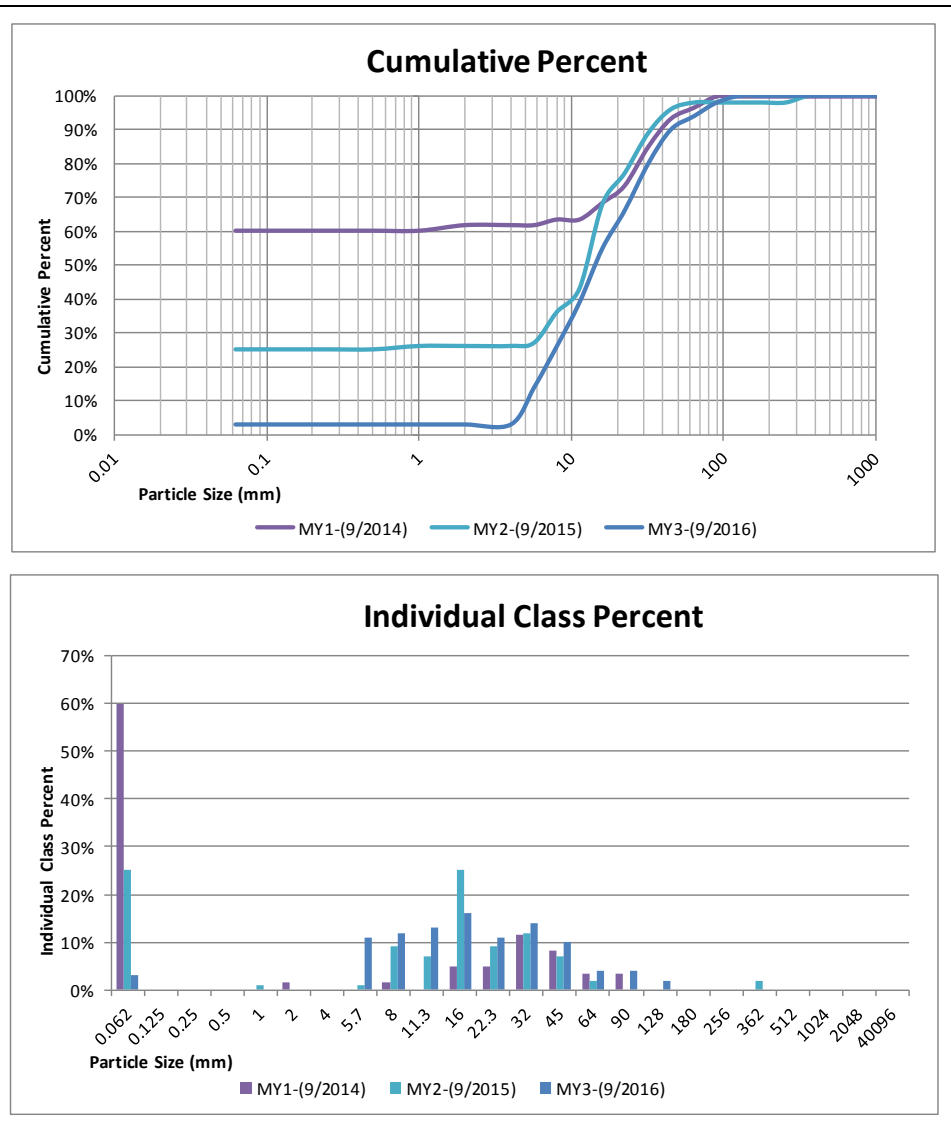


Figure 5.17. Pebble Counts

Project Name: Heath Dairy					
Reach: North Branch to Back Creek					
Feature: Riffle (XS 25)					
			MY3-(9/2016)		
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	0	0%	4%
Gravel	very fine gravel	4.0	0	0%	4%
	fine gravel	5.7	8	8%	12%
	fine gravel	8.0	4	4%	16%
	medium gravel	11.3	8	8%	24%
	medium gravel	16.0	20	20%	44%
	course gravel	22.3	17	17%	61%
	course gravel	32.0	13	13%	74%
	very coarse gravel	45	12	12%	86%
	very coarse gravel	64	10	10%	96%
	Cobble	small cobble	90	4	4%
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%

Summary Data	
D50	18.0
D84	42.0
D95	60.0

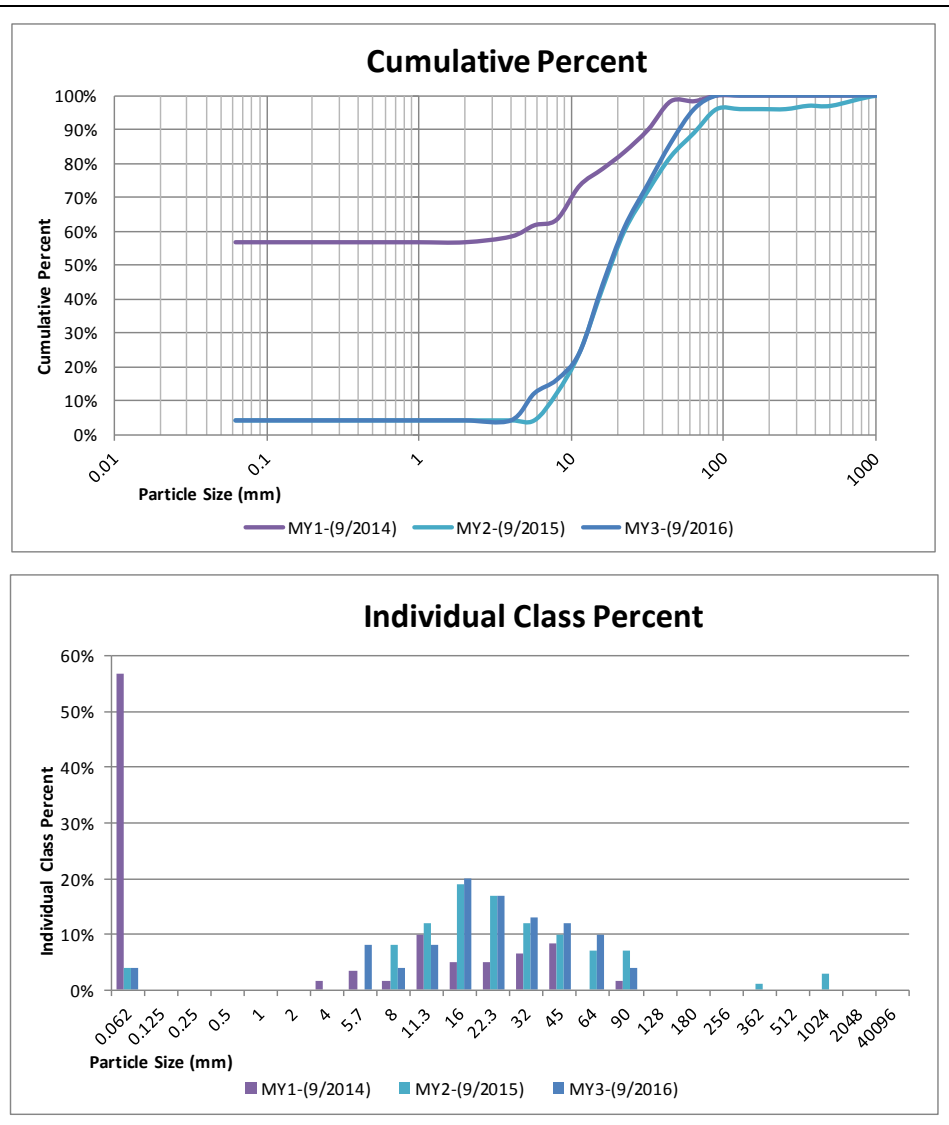


Figure 5.18. Pebble Counts

Project Name: Heath Dairy					
Reach: East Branch to Back Creek					
Feature: Pool (XS 26)					
			MY3-(9/2016)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	68	68%	68%
Sand	very fine sand	0.125	0	0%	68%
	fine sand	0.250	0	0%	68%
	medium sand	0.50	0	0%	68%
	coarse sand	1.00	0	0%	68%
	very coarse sand	2.0	0	0%	68%
Gravel	very fine gravel	4.0	0	0%	68%
	fine gravel	5.7	0	0%	68%
	fine gravel	8.0	0	0%	68%
	medium gravel	11.3	10	10%	78%
	medium gravel	16.0	10	10%	88%
	course gravel	22.3	10	10%	98%
	course gravel	32.0	0	0%	98%
	very coarse gravel	45	0	0%	98%
	very coarse gravel	64	0	0%	98%
	Cobble	small cobble	90	0	0%
medium cobble		128	0	0%	98%
large cobble		180	0	0%	98%
very large cobble		256	2	2%	100%
Boulder		small boulder	362	0	0%
	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		-			

Summary Data	
D50	0.0
D84	15.0
D95	20.0

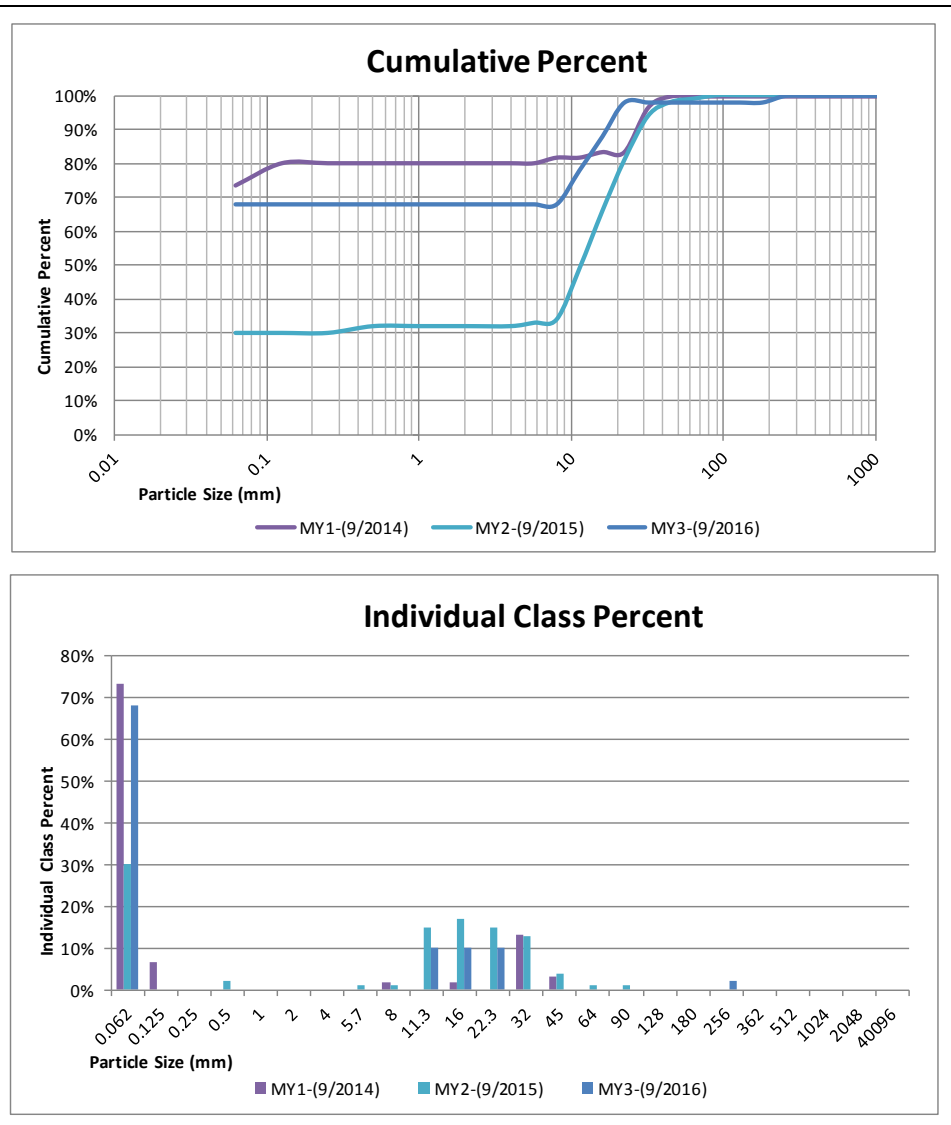


Figure 5.19. Pebble Counts

Project Name: Heath Dairy					
Reach: East Branch to Back Creek					
Feature: Riffle (XS 27)					
			MY3-(9/2016)		
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	0	0%	0%
	very coarse sand	2.0	0	0%	0%
Gravel	very fine gravel	4.0	0	0%	0%
	fine gravel	5.7	0	0%	0%
	fine gravel	8.0	0	0%	0%
	medium gravel	11.3	10	10%	10%
	medium gravel	16.0	18	18%	28%
	course gravel	22.3	20	20%	48%
	course gravel	32.0	20	20%	68%
	very coarse gravel	45	20	20%	88%
	very coarse gravel	64	10	10%	98%
Cobble	small cobble	90	0	0%	98%
	medium cobble	128	0	0%	98%
	large cobble	180	0	0%	98%
	very large cobble	256	2	2%	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		-			
Summary Data					
D50	25.0				
D84	40.0				
D95	58.0				

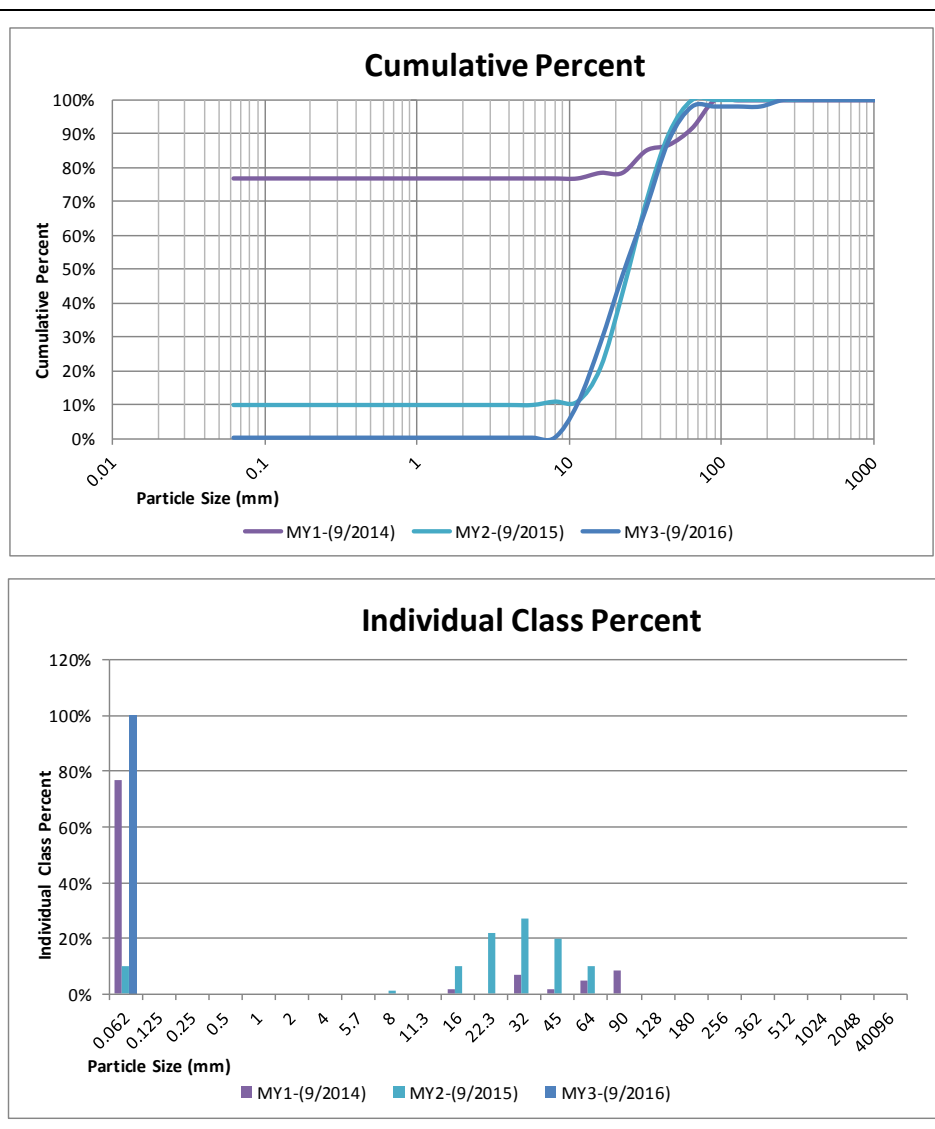


Figure 5.20. Pebble Counts

Project Name: Heath Dairy					
Reach: East Branch to Back Creek					
Feature: Riffle (XS 28)					
			MY3-(9/2016)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	8	8%	8%
Sand	very fine sand	0.125	0	0%	8%
	fine sand	0.250	0	0%	8%
	medium sand	0.50	0	0%	8%
	coarse sand	1.00	0	0%	8%
	very coarse sand	2.0	0	0%	8%
Gravel	very fine gravel	4.0	0	0%	8%
	fine gravel	5.7	0	0%	8%
	fine gravel	8.0	8	8%	16%
	medium gravel	11.3	11	11%	27%
	medium gravel	16.0	24	24%	51%
	course gravel	22.3	20	20%	71%
	course gravel	32.0	8	8%	79%
	very coarse gravel	45	8	8%	87%
	very coarse gravel	64	4	4%	91%
	Cobble	small cobble	90	6	6%
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		-			
Summary Data					
D50	15.0				
D84	40.0				
D95	75.0				

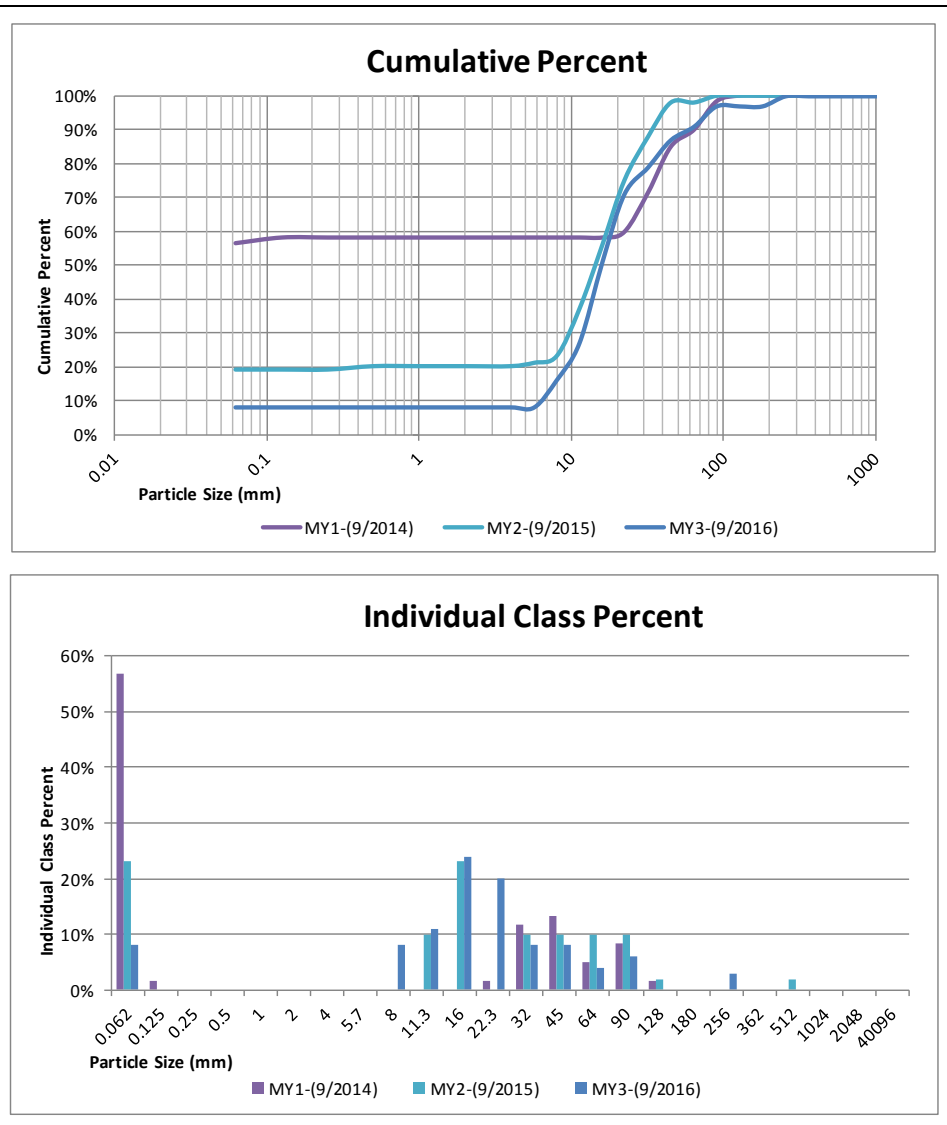


Table 9.1 Baseline Stream Data Summary

Stream Reach	Existing Conditions	Reference Reach	Design			Existing Conditions	Reference Reach	Design	Reference Reach	Design	
	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

*See Restoration Plan dated 2009 for reach designations

Table 9.2 Baseline Stream Data Summary

Stream Reach	Existing Conditions	Reference Reach	Design	Existing Conditions	Reference Reach	Design	Existing Conditions	Reference Reach	Design		
	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

*See Restoration Plan dated 2009 for reach designations

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 - 8																								
	Cross Section 1 (Pool)						Cross Section 2 (Riffle)						Cross Section 3 (Riffle)						Cross Section 4 (Pool)					
Based on fixed baseline bankfull elevation	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	21.75	14.31	17.71	20.27			16.91	13.78	15.64	16.71			15.25	13.57	29.56	34.84			14.97	20.17	17.79	18.95		
Floodprone Width (ft)	32	32	32	32			26	25.3	26	26			100	100	100	100			100	100	100	100		
Bankfull Mean Depth (ft)	1.47	1.13	1.251	1.325			1.01	0.76	0.901	0.955			1.61	1.58	1.111	0.979			1.69	1.87	1.704	1.465		
Bankfull Max Depth (ft)	2.37	1.49	1.572	1.959			1.44	1.01	1.259	1.589			2.39	2.75	2.974	3.293			2.73	2.93	2.929	572.4		
Bankfull Cross Sectional Area (ft ²)	32.01	16.14	22.14	26.86			17	10.42	14.09	15.95			24.56	21.38	32.84	34.11			25.29	37.74	30.31	27.77		
Bankfull Width/Depth Ratio	14.8	12.66	14.16	15.3			16.74	18.13	17.37	17.5			9.47	8.59	26.61	35.59			8.86	10.79	10.44	12.94		
Bankfull Entrenchment Ratio	2.23	2.28	1.807	1.579			2.39	1.84	1.662	1.556			6.55	7.3	3.383	2.87			6.68	4.96	5.622	5.276		
Bankfull Bank Height Ratio			0.667	1.214					0.817	0.848					0.966	0.78					0.991	1.01		
d50 (mm)		0.05	16	30					30.8	16	45				34.5	22	38				0.06	0.06	1	
	Cross Section 5 (Pool)						Cross Section 6 (Riffle)						Cross Section 7 (Pool)						Cross Section 8 (Riffle)					
Based on fixed baseline bankfull elevation	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	18.29	16.17	14.54	14.92			14.27	14.79	15.12	13.78			18.83	19.51	23.08	16.79			26.3	21.33	52.59	41.46		
Floodprone Width (ft)	50	50	50	50			75	75	75	75			100	100	100	100			100	100	100	100		
Bankfull Mean Depth (ft)	1.6	2.16	2.049	2.081			0.87	1.01	0.908	0.833			1.59	1.9	1.533	1.862			0.97	1.23	0.613	0.753		
Bankfull Max Depth (ft)	2.83	3.26	3.315	3.262			1.32	1.66	1.43	1.483			3.07	3.01	3.171	2.597			2.19	1.74	2.003	1.909		
Bankfull Cross Sectional Area (ft ²)	29.28	34.85	29.79	31.05			12.41	14.89	13.73	11.48			29.94	37.15	35.38	31.25			25.6	26.21	32.24	31.2		
Bankfull Width/Depth Ratio	11.43	7.49	7.093	7.169			16.4	14.64	16.65	16.54			11.84	10.27	15.06	9.017			27.3	17.34	85.79	55.08		
Bankfull Entrenchment Ratio	2.73	8.2	3.44	3.351			5.25	5	4.961	5.442			5.31	5.1	4.332	5.957			3.80	4.68	1.902	2.41		
Bankfull Bank Height Ratio			0.997	0.874					0.983	0.91					0.712	1.052					0.952	1.024		
d50 (mm)		NA	NA	NA					0.05	0.1	21				NA	NA	NA				0.05	5	18	

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 XS9 - 16																								
	Cross Section 9 (Pool)						Cross Section 10 (Riffle)						Cross Section 11 (Pool)						Cross Section 12 (Riffle)					
Based on fixed baseline bankfull elevation	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	20.68	22.5	21.34	21.78			22.9	15.71	37.54	35.45			22.55	16.96	18.41	16.81			18.44	17.94	19.55	18.25		
Floodprone Width (ft)	100	100	100	100			100	100	100	100			100	100	100	100			100	100	100	100		
Bankfull Mean Depth (ft)	1.81	2.32	2.094	1.966			1.1	1.06	0.756	0.718			1.51	1.69	1.633	1.864			1.28	1.26	1.185	1.268		
Bankfull Max Depth (ft)	2.83	3.69	3.475	3.279			1.8	1.42	2.013	1.812			2.91	2.94	2.918	3.079			1.78	1.73	1.68	1.724		
Bankfull Cross Sectional Area (ft ²)	37.43	52.17	44.69	42.81			25.14	16.58	28.37	25.46			34.05	28.68	30.07	31.34			23.57	22.69	23.16	23.14		
Bankfull Width/Depth Ratio	11.43	9.7	10.19	11.08			20.82	14.82	49.67	49.36			14.93	10.04	11.27	9.021			14.41	14.24	16.5	14.39		
Bankfull Entrenchment Ratio	4.84	4.4	4.686	4.592			4.36	6.4	2.664	2.821			4.43	5.9	5.431	5.948			5.42	5.6	5.115	5.479		
Bankfull Bank Height Ratio			0.969	0.973					0.902	0.991					0.976	0.99					0.875	0.959		
d50 (mm)		0.06	0.6	7				0.05	9	26				NA	NA	NA				0.06	11	15		
	Cross Section 13 (Pool)						Cross Section 14 (Riffle)						Cross Section 15 (Pool)						Cross Section 16 (Pool)					
Based on fixed baseline bankfull elevation	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	20.02	16.42	18.45	16.42			17.3	15.48	17.89	19.3			16.12	13.76	15.21	11.79			18.22	16.95	17.59	17.93		
Floodprone Width (ft)	100	100	100	100			70	70	70	70			100	100	100	100			57	57	60	60		
Bankfull Mean Depth (ft)	1.43	1.93	1.657	1.897			1.54	1.19	1.146	1.148			1.81	1.99	1.827	2.196			2.34	2.53	2.31	2.499		
Bankfull Max Depth (ft)	2.69	2.81	2.94	2.827			2.39	1.92	1.969	2.092			3.96	3.38	2.984	3.19			3.12	3.22	2.964	3.075		
Bankfull Cross Sectional Area (ft ²)	28.58	31.75	30.56	31.15			26.6	18.37	20.5	22.16			29.14	27.4	27.79	25.9			42.73	42.85	40.64	44.8		
Bankfull Width/Depth Ratio	14	8.51	11.14	8.658			11.23	13.01	15.61	16.81			8.91	6.91	8.321	5.368			7.79	6.7	7.615	7.176		
Bankfull Entrenchment Ratio	4.99	6	5.421	6.089			4	4.5	3.914	3.627			6.20	7.3	6.576	8.481			3.13	3.4	3.411	3.35		
Bankfull Bank Height Ratio			0.663	0.995					0.998	1.065					1.047	1.178					1.082	0.997		
d50 (mm)		NA	NA	NA				0.06	8	18				NA	NA	NA				0.03	3	5		

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 XS17 - 21; UT to West Branch XS22; North Branch XS23-24																								
	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	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	6.65	4.96	7.67	8.511			6.86	5.82	9.961	7.492			6.7	6.23	14.57	6.351			8.79	7.74	22.23	11.66		
Floodprone Width (ft)	20	20	20	20			26	26	30	30			27.7	30	30			29	30	30				
Bankfull Mean Depth (ft)	0.62	0.97	0.966	0.951			0.58	0.6	0.544	0.576			0.59	0.47	0.274	0.503			0.78	0.58	0.317	0.495		
Bankfull Max Depth (ft)	0.99	1.22	1.69	1.53			0.92	1.03	1.09	1.003			0.83	0.62	0.588	0.67			1.01	0.75	0.852	0.965		
Bankfull Cross Sectional Area (ft ²)	4.11	4.82	7.407	8.094			3.97	3.51	5.422	4.317			3.98	2.91	3.998	3.192			6.83	4.53	7.047	5.764		
Bankfull Width/Depth Ratio	10.73	5.1	7.943	8.948			11.83	9.7	18.3	13			11.36	13.26	53.08	12.64			11.27	13.34	70.14	23.57		
Bankfull Entrenchment Ratio	3.69	4.22	2.608	2.35			3.78	4.43	3.012	4.004			6.00	4.45	2.059	4.723			4.53	3.71	1.349	2.574		
Bankfull Bank Height Ratio			0.817	0.614					1	0.98					1.019	1.188					0.771	1.003		
d50 (mm)		NA	NA	NA				NA	NA	NA				113	80	100				45	30	30		
	Cross Section 21 (Pool)						Cross Section 22 (Riffle)						Cross Section 23 (Pool)						Cross Section 24 (Riffle)					
Based on fixed baseline bankfull elevation	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	7.72	10.54	19.27	12.37			8.59	8.52	17.73	22.42			19.17	15.83	18.83	18.59			18.46	18.94	21.93	21.68		
Floodprone Width (ft)	40	40	40	40			75	75	75	75			200	200	200	200			200	200	200	200		
Bankfull Mean Depth (ft)	0.83	0.93	0.589	0.829			0.52	0.51	0.436	0.371			2.68	2.67	2.788	2.697			1.32	1.39	1.32	1.174		
Bankfull Max Depth (ft)	1.31	2.13	1.841	1.846			0.84	0.67	0.794	0.78			4.72	4.83	5.197	5.353			1.93	2.21	1.958	1.945		
Bankfull Cross Sectional Area (ft ²)	6.44	9.83	11.35	10.25			4.46	4.37	7.725	8.326			51.38	42.32	52.52	50.15			24.43	26.37	28.94	25.45		
Bankfull Width/Depth Ratio	9.3	11.33	32.72	14.93			16.52	16.71	40.71	60.39			7.15	5.93	6.755	6.893			13.98	13.63	16.62	18.47		
Bankfull Entrenchment Ratio	5.17	3.74	2.076	3.233			8.5	8.52	4.229	3.345			10.43	12.63	10.62	10.76			10.83	10.56	9.12	9.23		
Bankfull Bank Height Ratio			0.847	0.746					1.05	1.165					0.878	0.902					1.009	0.96		
d50 (mm)		0.04	0.1	0				108	180	160				NA	NA	NA				0.05	14	15		

Table 10.4. Monitoring – Cross Section Morphology

Morphology and Hydraulic Monitoring Summary (Dimensional Parameters – Cross Sections)																								
Heath Dairy Road Stream Restoration/DMS # 170 Segment/Reach: North Branch XS25; East Branch XS26-28																								
	Cross Section 25 (Riffle)						Cross Section 26 (Pool)						Cross Section 27 (Riffle)						Cross Section 28 (Riffle)					
Based on fixed baseline bankfull elevation	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5	Base	MY1	MY2	MY3	MY4	MY5
Bankfull Width (ft)	18.86	17.76	18.37	20.4			8.75	8.78	11.17	9.594			10.23	8.64	18.73	12.91			9.84	9.88	9.538	9.198		
Floodprone Width (ft)	100	100	100	100			50	50	50	50			50	50	50	50			50	50	50	50		
Bankfull Mean Depth (ft)	1.36	1.38	1.253	1.182			0.93	0.82	0.648	0.877			0.62	0.54	0.307	0.436			0.69	0.68	0.547	0.516		
Bankfull Max Depth (ft)	1.82	1.85	1.581	1.792			1.73	1.34	1.404	1.538			1.04	0.83	0.658	0.885			1.11	1.09	0.885	0.923		
Bankfull Cross Sectional Area (ft ²)	25.68	24.46	23.03	24.11			8.1	7.24	7.234	8.411			6.31	4.7	5.759	5.628			6.83	6.74	5.22	4.746		
Bankfull Width/Depth Ratio	13.87	12.87	14.66	17.27			9.41	10.71	17.24	10.94			16.5	16	60.92	29.62			14.26	14.53	17.43	17.83		
Bankfull Entrenchment Ratio	5.30	5.63	5.443	4.901			5.71	5.69	4.477	5.212			4.88	5.78	2.669	3.873			5.08	5.06	5.242	5.436		
Bankfull Bank Height Ratio			1.1	1.003					0.935	1.064					1.027	1.129					1.146	1.196		
d50 (mm)		0.05	18	18				0.04	12	0				0.04	25	25				0.05	15	15		

Table 11.1 Monitoring – As-built Stream Reach Morphology

Stream Reach Data Summary MY0 (2013)												
Parameter	As-built Baseline			As-built Baseline			As-built Baseline			As-built Baseline		
	Back Creek			West Branch			East Branch			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 11.2 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		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Dimension and Substrate - Riffle												
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/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 11.3 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		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Dimension and Substrate - Riffle												
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 11.4 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		
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Dimension and Substrate - Riffle												
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												

Appendix E: Hydrologic Data

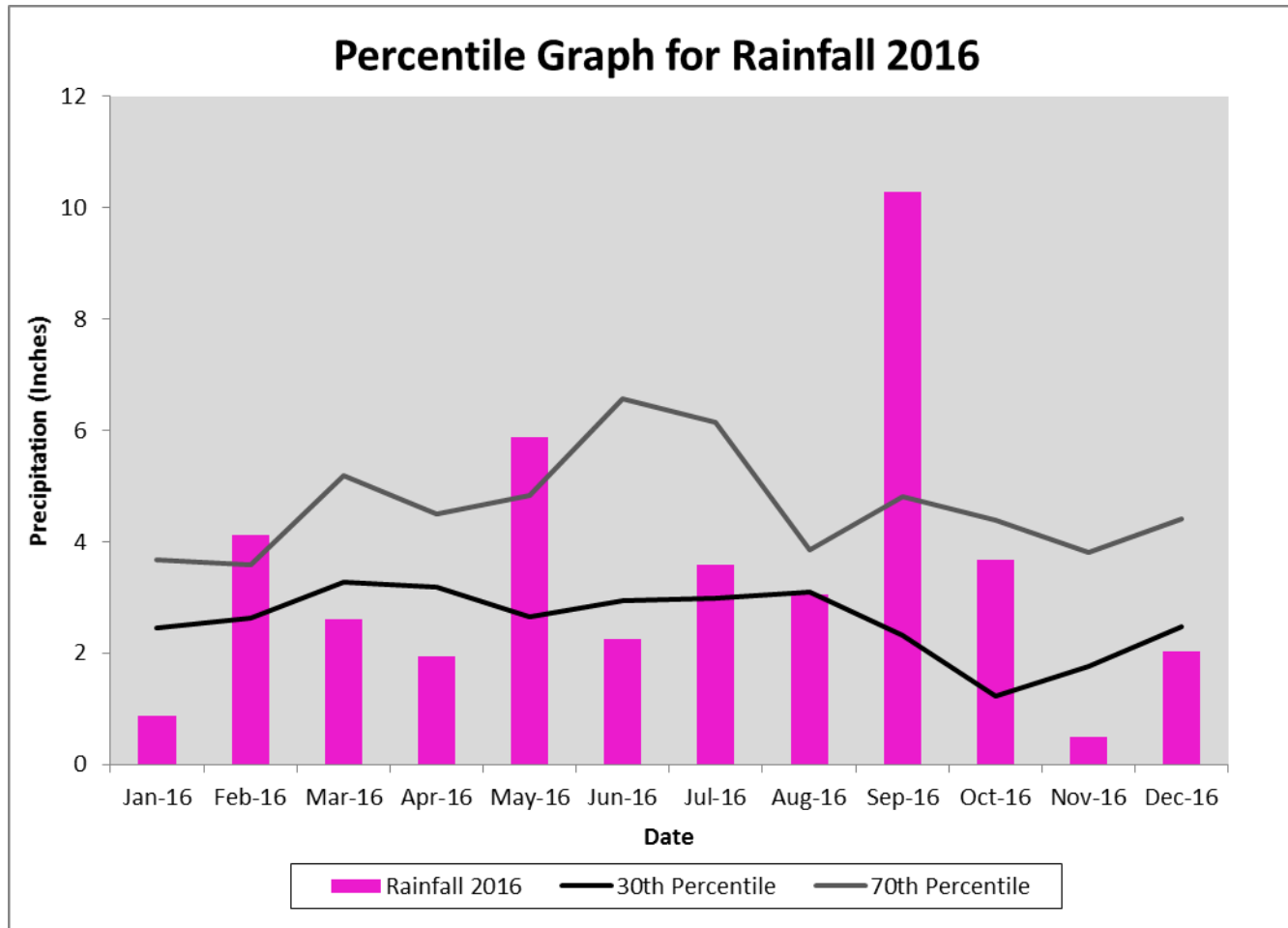
Table 12. Verification of Bankfull Events

Date of Collection	Date of occurrence	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	Below	1.4

Crest Stage Gauge on Main Trib, November 2016

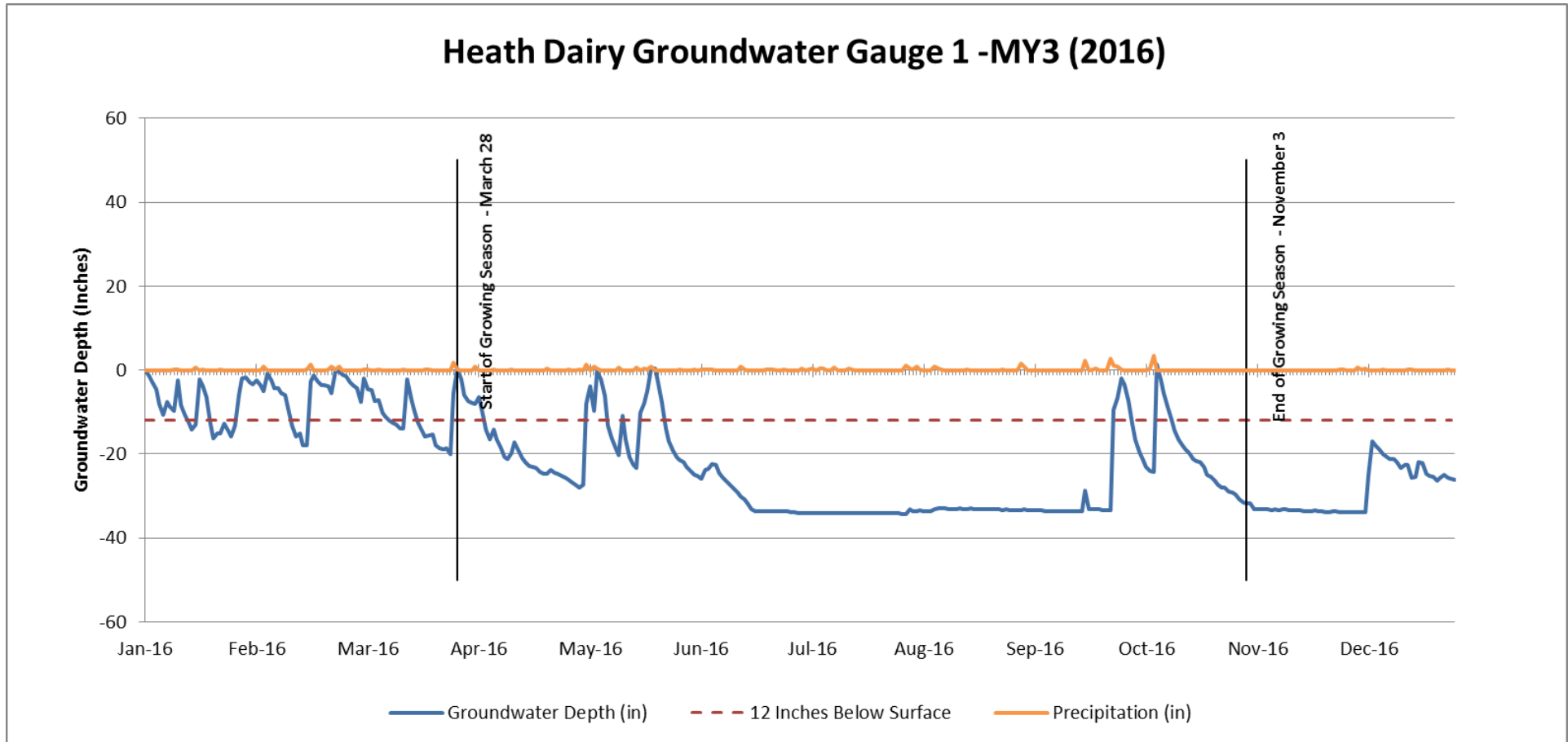


Figure 6. Rainfall Percentile



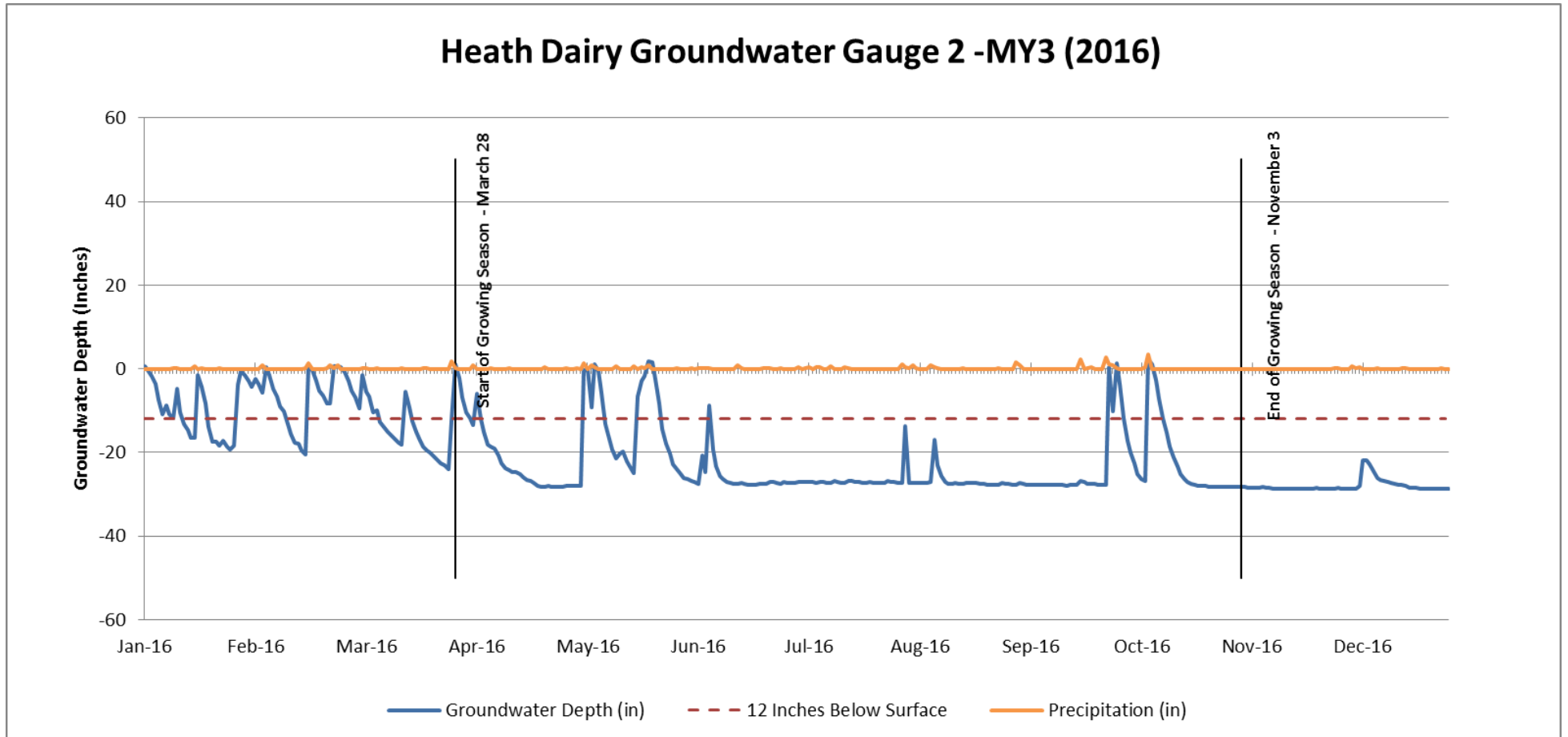
- Monthly rainfall data from CRONOS Station ID: 310286, Asheboro, NC

Figure 7.1. Groundwater Data



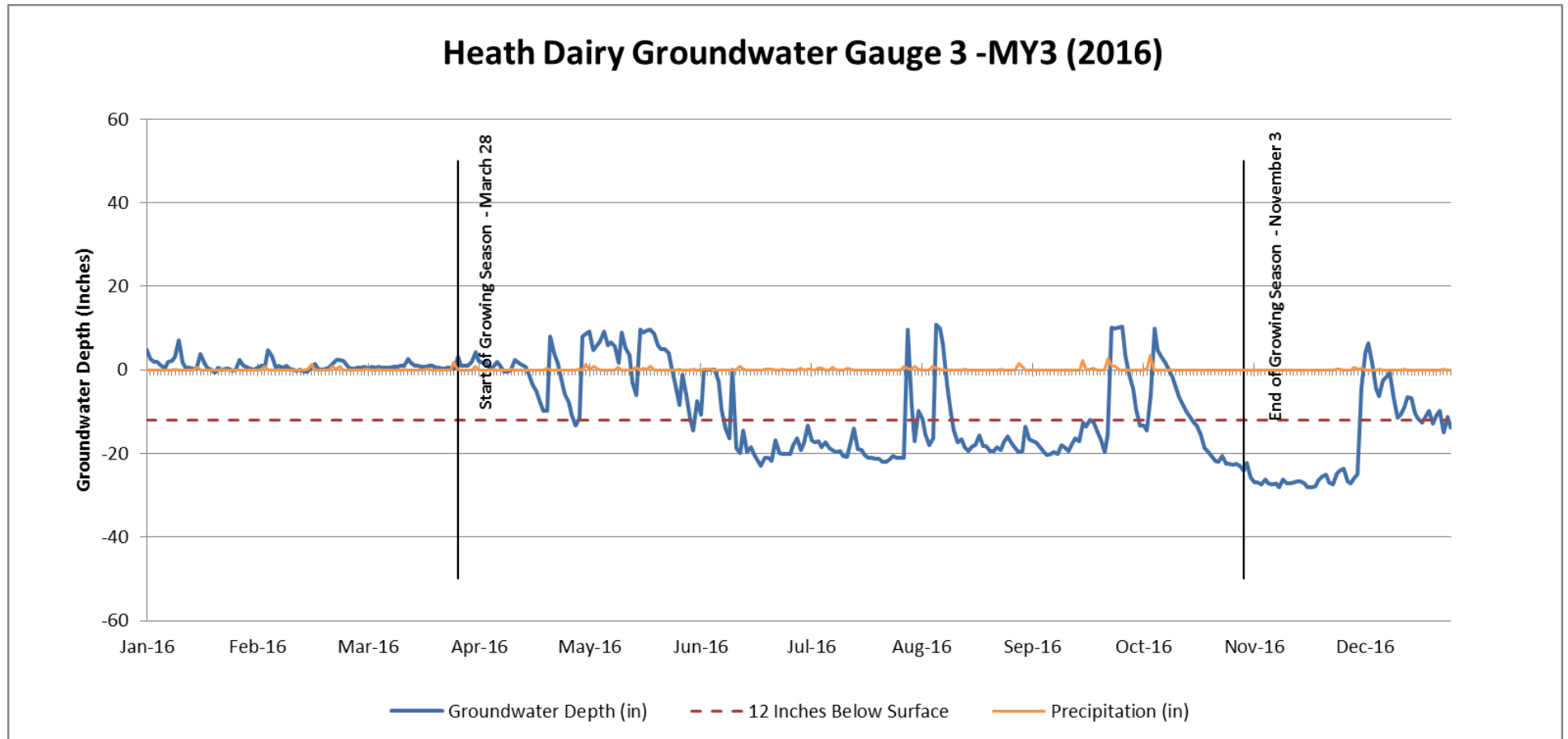
- Daily rainfall data from CRONOS Station ID: 310286, Asheboro, NC

Figure 7.2. Groundwater Data



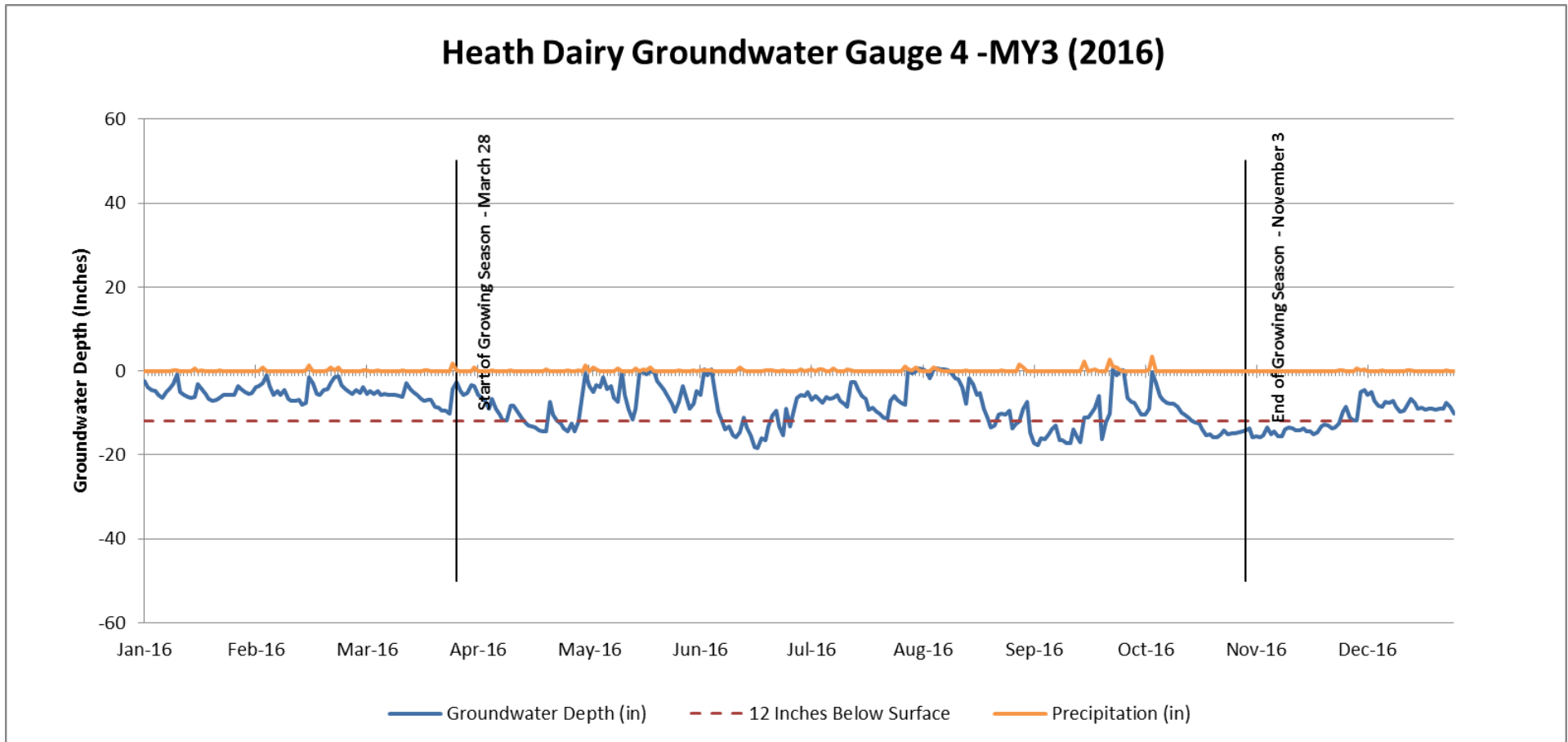
- Daily rainfall data from CRONOS Station ID: 310286, Asheboro, NC

Figure 7.3. Groundwater Data



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

Figure 7.4. Groundwater Data



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

Table 13. Wetland Gauge Attainment

Table 13. Summary of Groundwater Gauge Results Heath Dairy Road Stream Restoration/ DMS No. 170					
Success Criteria Achieved/Max Consecutive Days During Growing Season					
Growing Season 3/21 - 11/13 (237 days): success criterion 12.5%					
Gauge	Year 1 (2014)	Year 2 (2015) *	Year 3 (2016)	Year 4 (2017)	Year 5 (2018)
GW 1 (upstream)	Yes 49 days (20%)	No 8 days (3%)	Yes 33 days (14%)		
GW 2 (mid)	No 13 days (5.5%)	No 3 days (1%)	No 7 days (3%)		
GW 3 (downstream)	No 22 days (9%)	No 4 days (2%)	No 9 days (4%)		
GW 4 (reference)	Yes 87 days (28%)	Yes 41 days (17%)	Yes 55 days (23%)		
*Yr 2 dataset incomplete due to gauge malfunction Growing season from NRCS WETS table; 28 ^d 5/10 years					

* Gage 4 is located within a jurisdictional wetland