Heath Dairy Road Stream Restoration Site
Randolph County, North Carolina

DMS Project #170
USACE Action Item # SAW 2008 02860

MY – 02 Fall Monitoring Report

Data Collected: September 2015
Final Report Submitted: January 2016

Prepared for:
North Carolina Department of Environmental Quality
Division of Mitigation Services
217 West Jones St. Suite 3000A
Raleigh, NC 27603

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Prepared by:
Mogensen Mitigation, Inc.
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APPENDICES

1.0 Project Summary

1.1. Goals & Objectives

The Heath Dairy Road Stream Restoration Site (Heath Dairy Site, DMS # 170) lies along Back Creek and unnamed tributaries in Randolph County NC. 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. The project was initiated by NCDOT in 2004 at which time they secured an option on the Ridge parcel. The project was transferred to DMS in 2005. Following field studies, the Restoration Plan was finalized in 2009 and Design Plans were complete in 2011. Construction on the project was initiated in June 2012 and channel construction was completed in March 2013. Planting of the riparian buffer was completed in March 2014 and Monitoring for MY1 was conducted by AECOM in the fall of 2014. In June 2015, the monitoring contract was awarded to Mogensen Mitigation, Inc. (MMI). Fall monitoring for MY2 was completed by MMI in October 2015.

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 morphologyand proper sediment transport capacity;
- Create and/or improve bed form diversity and improve aquatic and benthic macroinvertabrate 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 (HOBO Readers). The success criteria are described below for each parameter.

- ***Dimension***

Due to the size and 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.

1.2.3 Hydrologic Success

There is no specified hydric criteria for the project wetlands at this time. For the purposes of the MY2 reporting, we considered wetland hydrology to meet successes criteria when saturated soil conditions occurred within 12 inches of the ground's surface for a minimum of 12.5% of the growing season during average climatic 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 mitigation components are summarized in Table 1 of Appendix A.

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. In-stream structures such as rock cross vanes, J-hook vanes, log vanes, and root wads were incorporated into the stream to provide energy dissipation, bank stabilization, grade control, and habitat diversity. Coir fiber matting was used to provide bank stability until vegetation becomes established. 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.

The channel alignments were established to provide maximum conformance to the existing valley form. Where stream channels had been previously moved away from the low point in the valley the alignments repositioned the channel to the proper location. Where the valley width narrowed, channel sinuosity was reduced. Where rock outcrops were present at the surface, the channel alignments were kept near their present locations.

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. Annual monitoring was taken over in 2015 by Mogensen Mitigation, Inc., and will continue through project close-out.

1.6. Current Conditions and Performance Summary

Based on the data collected during the fall of 2015 (MY2), the Heath Dairy Site is trending toward successful restoration with very few minor concerns at this time. Planted woody vegetation throughout the site is struggling with herbaceous weedy competition such as hairy white old field aster (Symphotrichum pilosum), golden rod (solidago spp.), ragweed (ambrosia spp.) and dog fennel (Eupatorium capillifolium). All vegetation plots (temporary and permanent) are achieving about 30% survival rate. Supplementary planting is scheduled for the week of January 4th, 2016 at which time 37 acres will be planted with approximately 9,250 stems per the vegetation contract warranty clause. There was only one problem area that was sparsely vegetated due to poor soils but is very limited in size and will be watched in future monitoring years. It was too small to mention in the report.

All streams appear stable, but some areas of the smaller tributaries (West Branch and East Branch) were observed to be dry during our monitoring visits in late September. These areas have vegetation growing in the channels which may indicate future channel hydrology problems and will continue to be monitored closely. We note that the project site falls within the Carolina Slate Belt physiographic region which may affect channel flow. Differences in cross-sectional metrics between MY2 and previous years likely reflect noise in the data resulting from inherent differences in field conditions and survey teams, rather than environmental patterns. These data will continue to be monitored for trends in the future. At this time, our visual assessment and stream surveys indicate all project reaches are currently performing within established and acceptable threshold criteria ranges. No cattle or other encroachments were observed.

1.6.1. Stream Assessment

Back Creek and North Branch exhibit minor lengthening of the riffles on average compared to the MY1 observations but are otherwise relatively unchanged. The channel banks are undergoing very minor erosion in certain places, but appear relatively stable along most segments. The channel banks are supported by a healthy growth of willow and silky dogwood in most areas. Despite being a relatively dry year, we observed standing water in pools at regular intervals throughout these reaches. Overall, the stream is trending toward an improved ecological condition and no remedial action is proposed at this time

West Branch is exhibiting minor steepening of the riffles, on average, compared to MY1 observations but is otherwise unchanged. We observed that this reach was mostly dry throughout the upper 70% during our September visits yet was holding water occasionally in deeper pools throughout the reach. Limited satellite coverage due to dense overstory foliage and restricted mobility due to an understory overgrown with native bur cucumber (Sicyos angulatus) made survey work difficult along this reach.

East Branch stream features were relatively unchanged compared to previous years, and was observed to be dry along its entire reach during our September visits. Thick herbaceous vegetation has filled the stream channel entirely, making it difficult to distinguish/find all of the steam features. Spring flood events may clear this overgrowth and better define the ordinary high water mark and other channel features.

Pebble count data indicates continued fining of many of the riffle sections across the project site. Heavy vegetation growth (*Murdannia keisak*) was observed in many of the riffles. In some reaches the Murdannia appears to have trapped and held a large amount of silt covering the coarser material below, which are reflected in the corresponding pebble counts.

1.6.2. Wetlands

Project wetlands will be added upon DMS request to USACE since they were added after the restoration plan. No specific monitoring actions were applied to project wetlands for the MY2 monitoring report.

1.6.3. Vegetation Assessment

This year, each of the 26 permanent vegetation plots were monitored in mid-September 2015 by MMI staff, as described in the methods section below. An additional 25 temporary warranty plots were established and sampled to obtain counts of living native stems. All vegetation plots (both permanent and temporary) are achieving an approximate 30% survival rate, with supplementary planting scheduled for January 2016. Several areas across the site were noted as having consistently low density - well below the MY2 success criteria for planted and volunteer stems combined. These areas are noted as polygons on the current plan view and summarized in Table 6.

Only 7 of the 26 permanent vegetation plots met the MY2 success criteria of 320 stems/acre. Across all plots, results show a show an average of 205 planted live stems surviving per acre across the project site. If native volunteers are also included, the project average increases to 300 total stems per acre. These results show that the average stem density across the project decreased by greater than 80% compared to the previous year's observations. Similarly, only 9 of the 25 warranty plots met success criteria, with an average of 255 living stems per acre across all plots. Although species information was not collected for these warranty plot surveys, informal observations suggest no obvious species dominated but rather the species assemblage varied from plot to plot across the project site. Data collected for all the plots are included in Appendix C.

In general, planted woody vegetation throughout the site is struggling with competition by herbaceous weedy species such as hairy white old field aster (Symphotrichum pilosum), golden rod (solidago spp.), ragweed (ambrosia spp.), and dog fennel (Eupatorium capillifolium). We observed scattered occurrences across the site of several of the invasive species listed in the 2014 monitoring guidelines, including multiflora rose (Rosa multiflora), Japanese honeysuckle (Lonicera japonica) and Chinese privet (Ligustrum sinense), with privet being particularly prominent along East Branch. Although each of these species occurred throughout the site, we did not observe any particularly dense occurrences or prominent patches to warrant special inclusion on the current plan view. These species will be monitored closely in future years and be included as polygons should conditions intensify in specific locations.

1.6.4. Hydrology Assessment

Four (4) RDS groundwater gauges have been installed across the site. Prior to 2015, Gauges 1 through 3 were installed and monitored by DMS while Gauge 4 was installed and monitored by AECOM. In September 2015, MMI downloaded all available data from each of the four gauges, and returned in November to download data again at the end of growing season. According to the Mitigation Plan and the MY1 report, hydrologic performance standards will be met in restored wetland areas when saturated soil conditions occur within 12 inches of the ground's surface for a minimum of 12.5% (29 days) of the growing season (March 24 to Nov 13) during average climatic conditions.

None of the gauges met the minimum wetland hydrology criterion of groundwater within 12 inches of the ground surface for a minimum of 12.5% of the growing season (Figure 7, Appendix E).

We estimate at least one flood event accessed the floodplain of Back Creek during 2015 (Table 13, Appendix E). The peak stage reading for the cork crest gage on Back Creek (~ 60 ft. upstream of the confluence with West Branch) was 0.40 ft. above the current bankfull elevation at that location. The design bankfull elevation in the vicinity of the current CSG location is approximately 606 ft. HOBO gage observations show at least two episodes of stream level increase greater than 0.2 feet in the fall, during the time period for which data were available.

2.0. Monitoring Methods

2.1. Vegetation Methodologies

Twenty six (26) permanent vegetation plots were monitored according to the CVS-EEP Level 2 Vegetation Monitoring Protocol Version 4.2 (Lee *et al.* 2008). Additionally, MMI supplemented all permanent plot corners with 3' tall aluminum poles painted blaze orange and took efforts to correct any previous data errors. An additional twenty five (25) warranty plots were established at systematic random locations and surveyed for planted living native woody stems. Each 108'X10' plot was temporarily marked using a measuring tape with end points recorded using a Trimble hand-held GPS.

2.2. Wetland Methodologies

All four (4) RDS groundwater Monitoring Gauges were downloaded most recently in November, 2015, 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, and51+42 to 62+22. Twenty four (24) of the permanent stream cross sections previously established on

the site were surveyed using a Trimble RDK survey-grade GPS unit. Four cross sections (#'s 12, 13, 17, 18) were too overgrown to be surveyed using GPS equipment so they were surveyed with an automatic level and rod and calibrated to known bank pin elevations. Wolman pebble counts were conducted at 20 of the 28 permanent cross-sections and used to calculate the sediment distribution at the cross-sections.

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

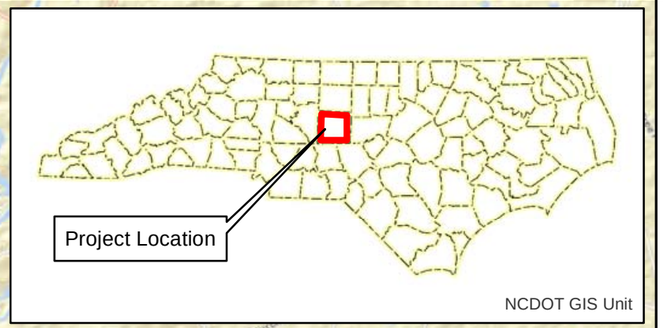
AECOM March 2015. Monitoring Report Year #1

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

Weakly, A.S. (2011) *Flora of the Carolinas, Virginia, Georgia and the Surrounding Areas* University of North Carolina at Chapel Hill
Woman, M. G. 1954. *A Method of Sampling Coarse River-Bed Material,* Transactions of American Geophysical Union 35:951-956

Various NCDMS and NCDEQ DWR Guidance Documents as referenced.

Appendix A: Project Background Data



Project Location

Randleman

Asheboro

Sophia

Project is located at approximately 3112 Heath Dairy Rd, 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.

Legend

Restoration Tributaries

1 0.5 0 1

Miles

Sources: Esri, HERE, DeLorme, USGS, Intermap, increment P Corp., NRCAN, Esri Japan, METI, Esri China (Hong Kong), Esri (Thailand), TomTom, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community

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MOGENSEN MITIGATION, INC

OCTOBER 2015

VICINITY MAP
HEATH DAIRY MONITORING YEAR 2
DMS #170

RANDOLPH COUNTY
NORTH CAROLINA

Environmental Quality

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	P2	Restoration	155 LF	1:1
Back Creek 2	11+55 – 16+25	470 LF	E1	Enhancement	470 LF	1.5:1
Back Creek 3	16+25 – 17+00	75 LF	P1	Restoration	75 LF	1:1
Back Creek 4	17+00 – 20+90	390 LF	E1	Enhancement	390 LF	1.5:1
Back Creek 5	20+90 – 24+60	374 LF	P1	Restoration	370 LF	1:1
Back Creek 6	24+60 – 25+60	100 LF	E1	Enhancement	100 LF	1.5:1
Back Creek 7	25+60 – 63+45	3450 LF	P1, P2	Restoration	3785 LF	1:1
West Preserve	14+58 - 18+75	417 LF	NA	Preservation	417 LF	5:1
West Branch 1	10+00 – 26+12	1523 LF	P1	Restoration	1590 LF*	1:1
North Branch 1	10+30 – 21+97	495 LF	P2	Restoration	1167 LF	1:1
East Preserve	5+01 - 7+20	219 LF	NA	Preservation	219 LF	5:1
East Branch 1	9+96 – 15+93	580 LF	P1	Restoration	547 LF*	1:1
UT to West Br.	10+36 – 11+38	102 LF	P1	Restoration	102 LF	1:1
Wetland A1	*NA*	1.075 AC	*NA*	Preservation	1.075 AC	5:1
Wetland A2	*NA*	0.136AC	*NA*	Enhancement	0.136 AC	2:1
Wetland B	*NA*	0.307 AC	*NA*	Enhancement	0.307 AC	2:1
Wetland C	*NA*	0.104 AC	*NA*	Enhancement	0.104 AC	2:1
Wetland E	*NA*	0.010 AC	*NA*	Enhancement	0.010 AC	2:1
Wetland F	*NA*	0.036 AC	*NA*	Enhancement	0.036 AC	2:1
Wetland I	*NA*	0.007 AC	*NA*	Preservation	0.007 AC	5:1
Wetland J	*NA*	0.090 AC	*NA*	Preservation	0.090 AC	5:1
Wetland K	*NA*	0.010 AC	*NA*	Enhancement	0.010 AC	2:1
Wetland L	*NA*	0.007 AC	*NA*	Preservation	0.007 AC	5:1
Wetland M	*NA*	1.4 AC	*NA*	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
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		

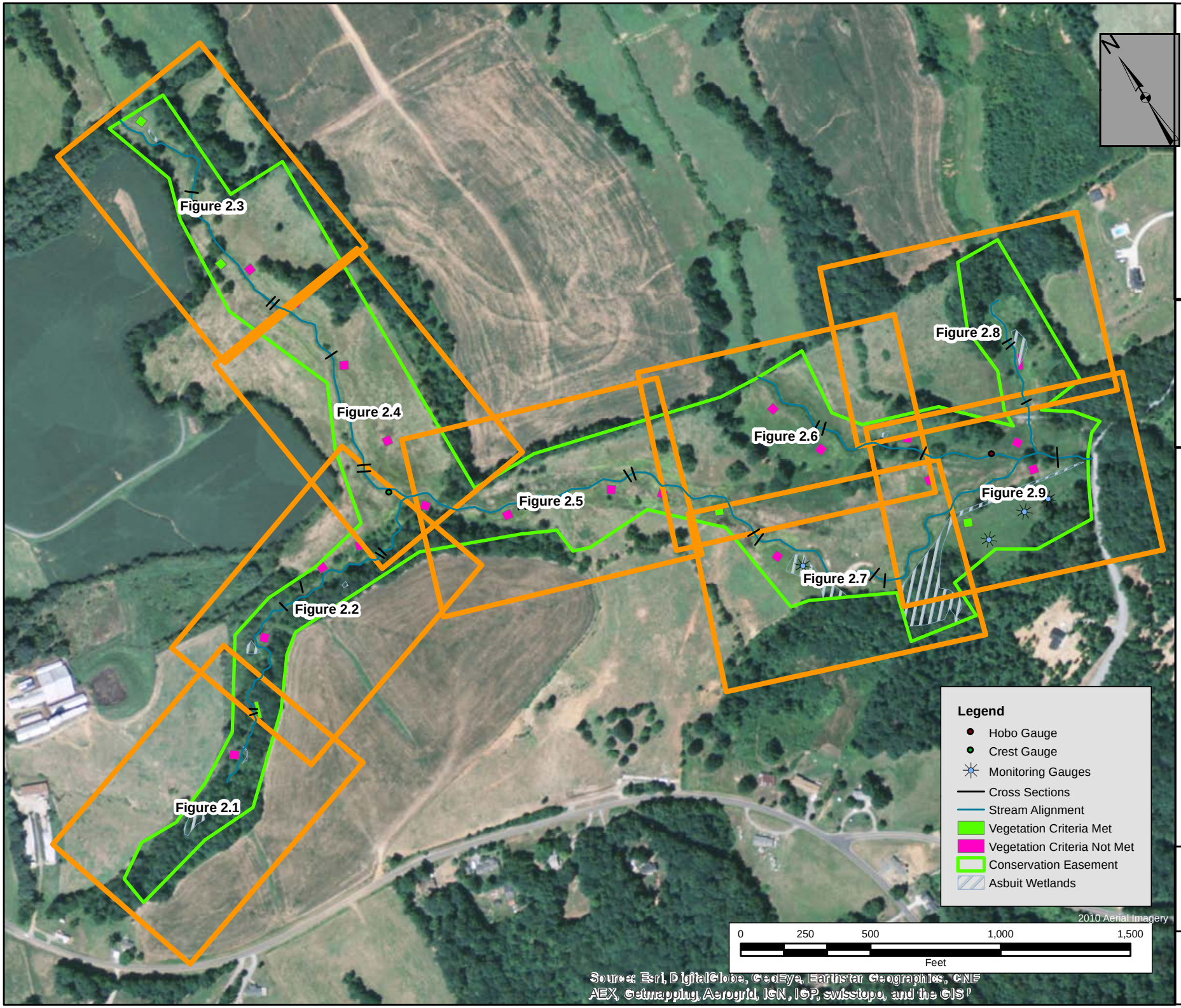
Table 3. Project Contacts

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 Shackleford	 3562 Plainfield Road Sophia, NC 27350 336-861-4555 203 Shannon Road Asheboro, NC 27203 336-625-6222
Construction Contractor	Backwater Environmental 515 S. Kennedy Avenue Eden, NC 27288
Planting Contractor	Carolina Silvics, Inc. 908 Indian Trail Road Edenton, NC 27932
Seeding Contractor	Backwater Environmental 515 S. Kennedy Avenue Eden, NC 27288
Monitoring Performer Mogensen Mitigation, Inc.	Richard K. Mogensen P.O. Box 690429 Charlotte, NC, 28227 704-576-1111

Table 4. Project Attributes

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

Appendix B: Visual Assessment Data



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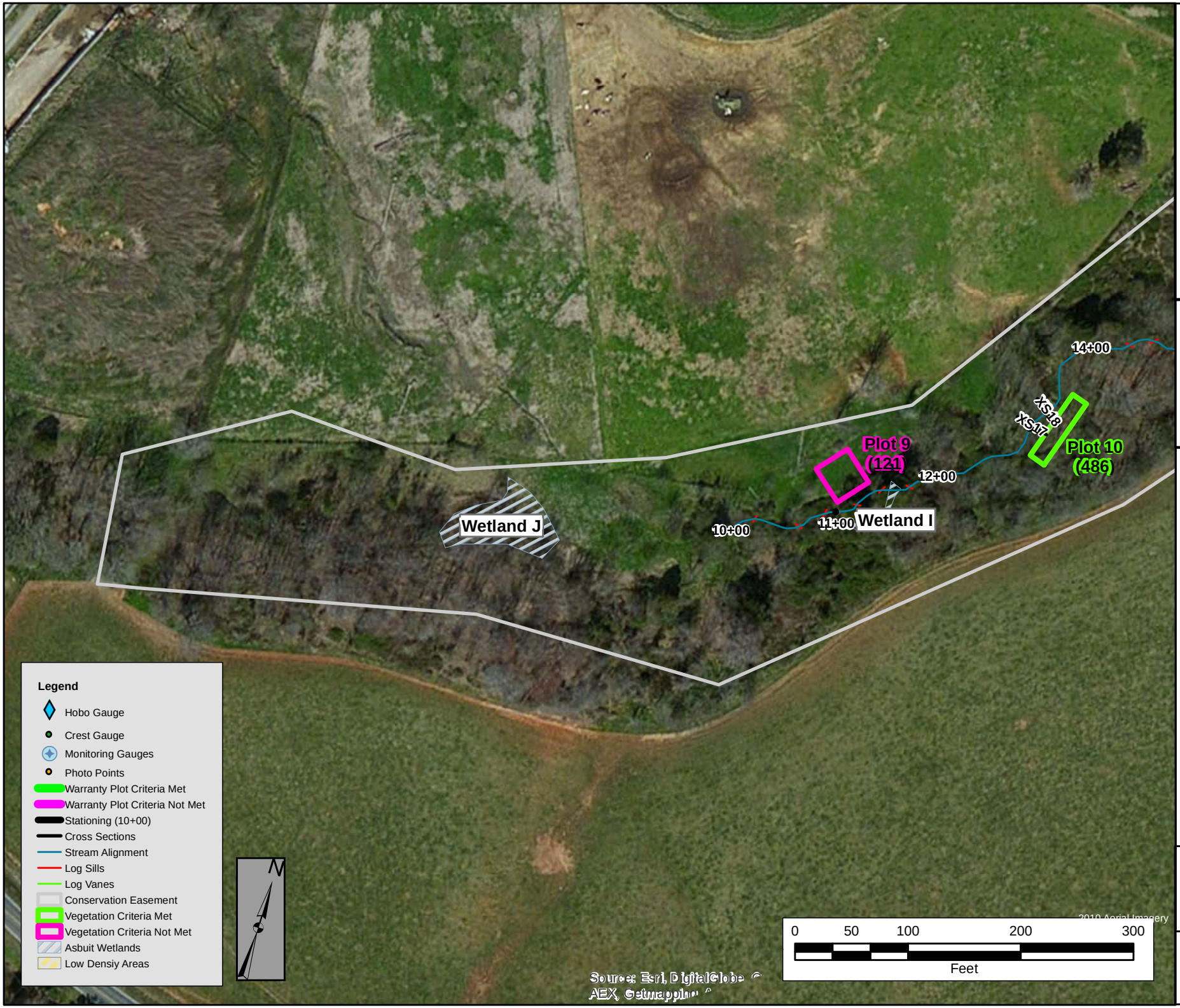
JANUARY 2016

HEATH DAIRY MONITORING YEAR 2
CURRENT CONDITIONS PLAN VIEW OVERWIEW
DMS #170

Randolph County, North Carolina

FIGURE 2



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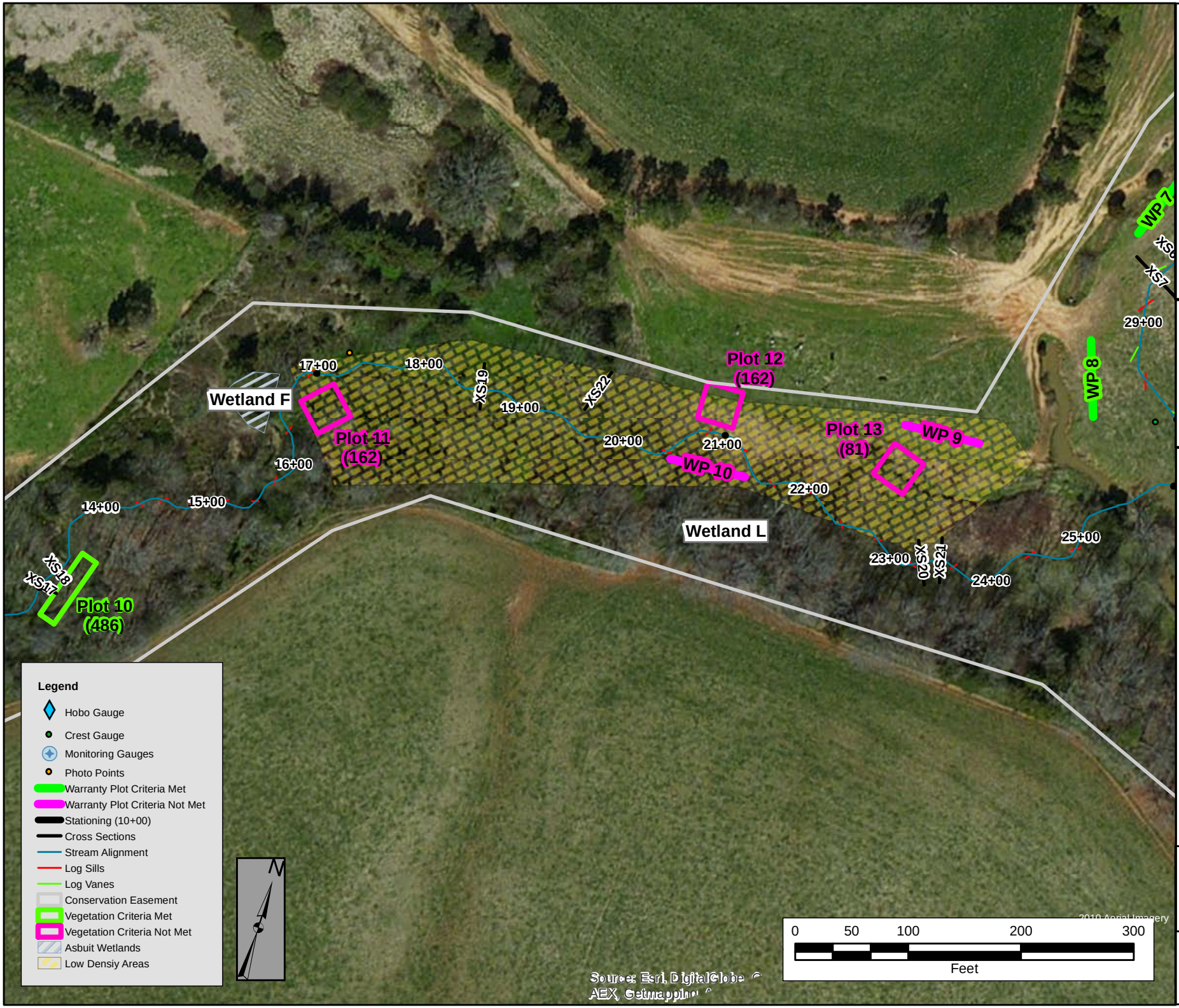
JANUARY 2016

HEATH DAIRY MONITORING YEAR 2
CURRENT CONDITIONS PLAN VIEW OVERWIEW
DMS #170

Randolph County, North Carolina

Figure 2.1



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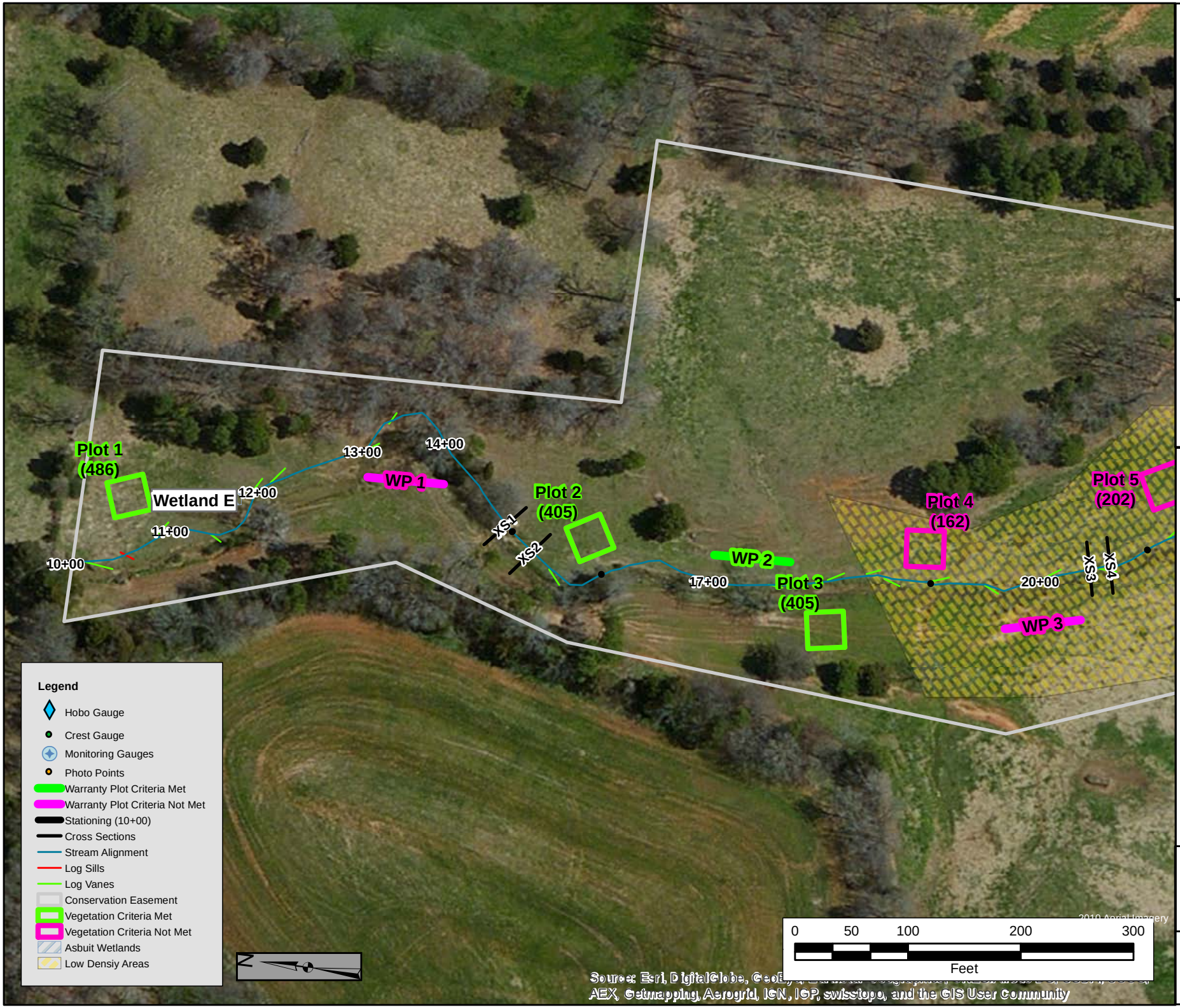
JANUARY 2016

HEATH DAIRY MONITORING YEAR 2
CURRENT CONDITIONS PLAN VIEW OVERWIEW
DMS #170

Randolph County, North Carolina

Figure 2.2



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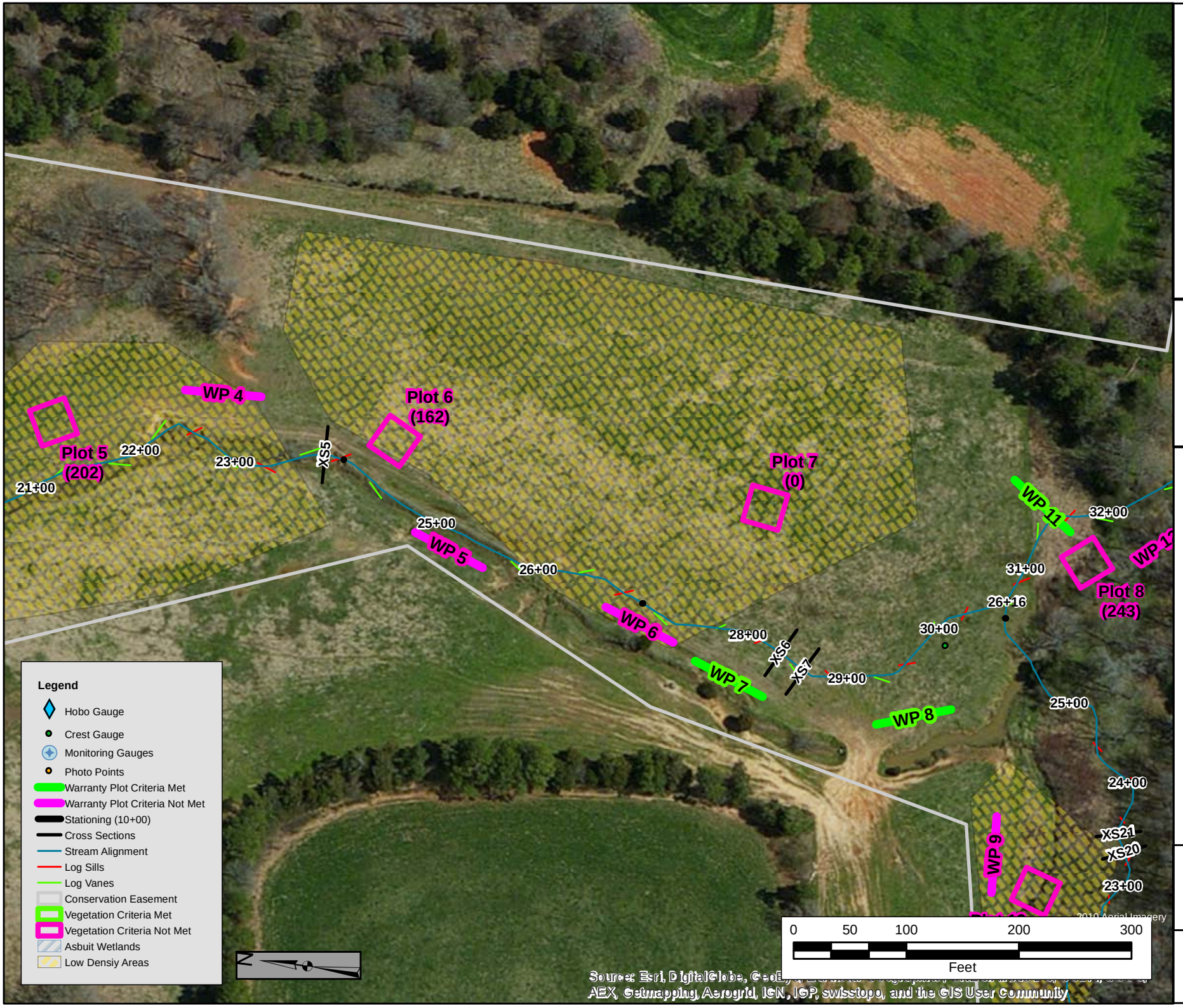
HEATH DAIRY MONITORING YEAR 2
CURRENT CONDITIONS PLAN VIEW OVERWIEW
DMS #170

Randolph County, North Carolina

Figure 2.3



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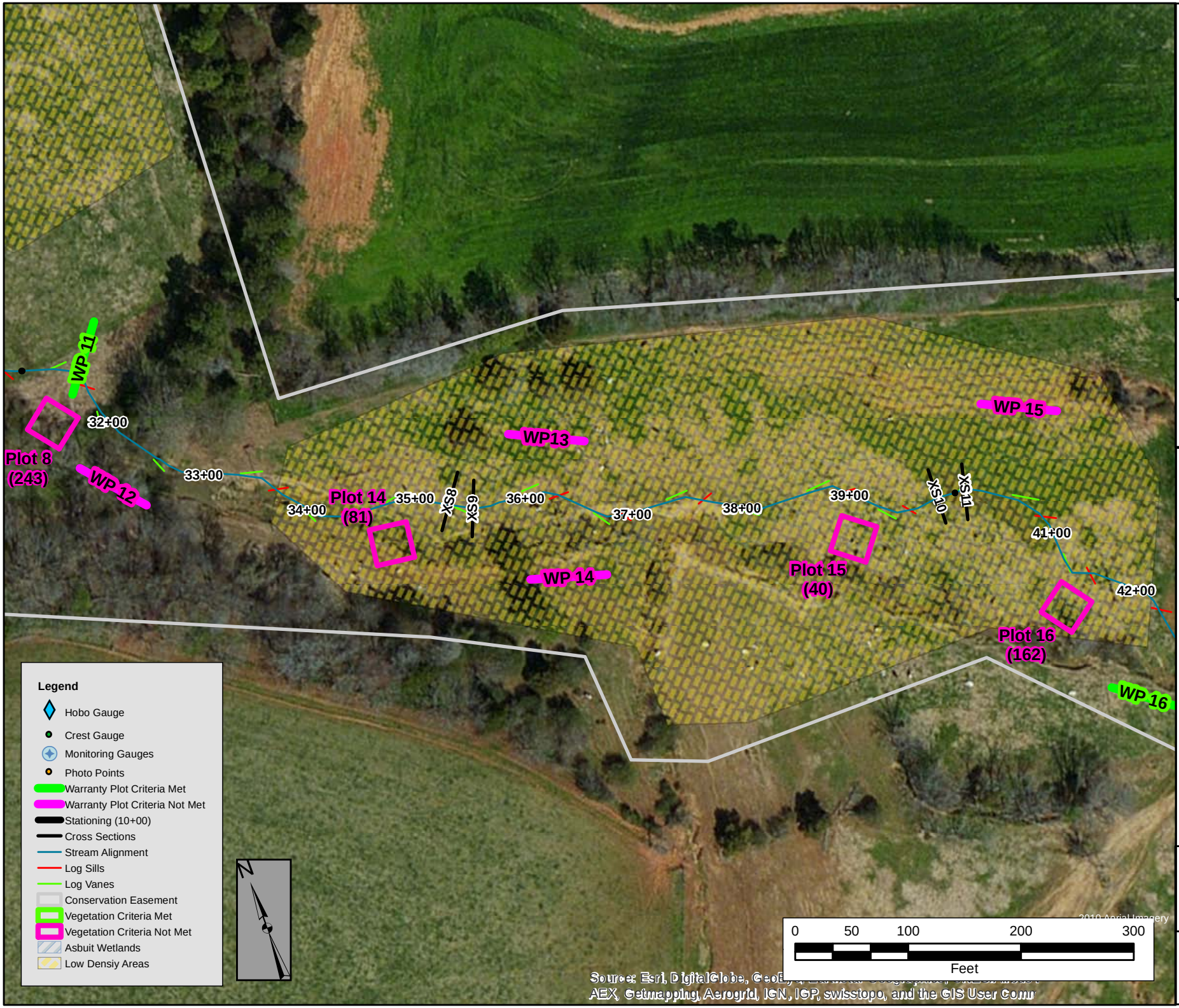
HEATH DAIRY MONITORING YEAR 2
CURRENT CONDITIONS PLAN VIEW OVERWIEW
DMS #170

Randolph County, North Carolina

Figure 2.4



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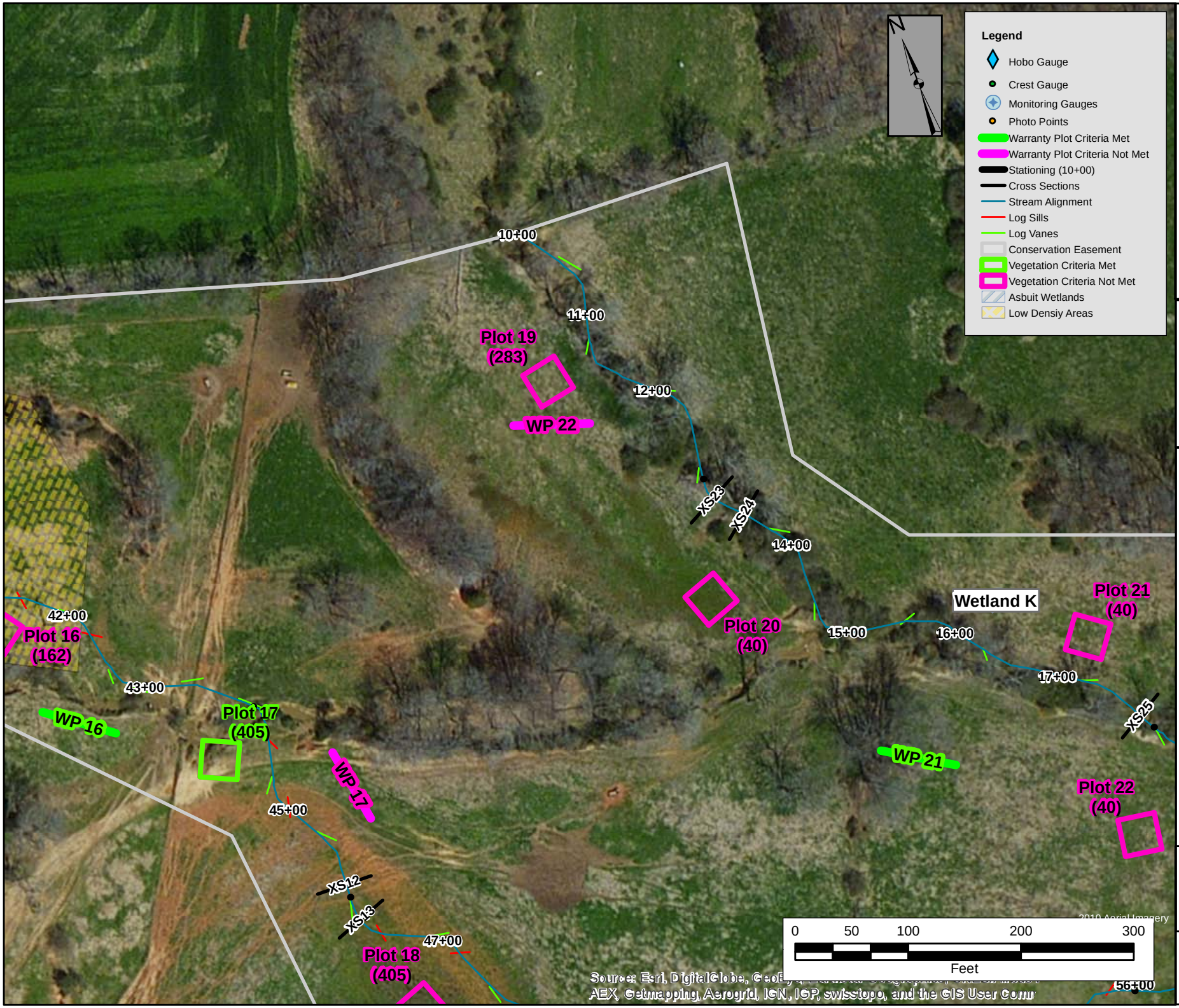
HEATH DAIRY MONITORING YEAR 2
CURRENT CONDITIONS PLAN VIEW OVERWIEW
DMS #170

Randolph County, North Carolina

Figure 2.5



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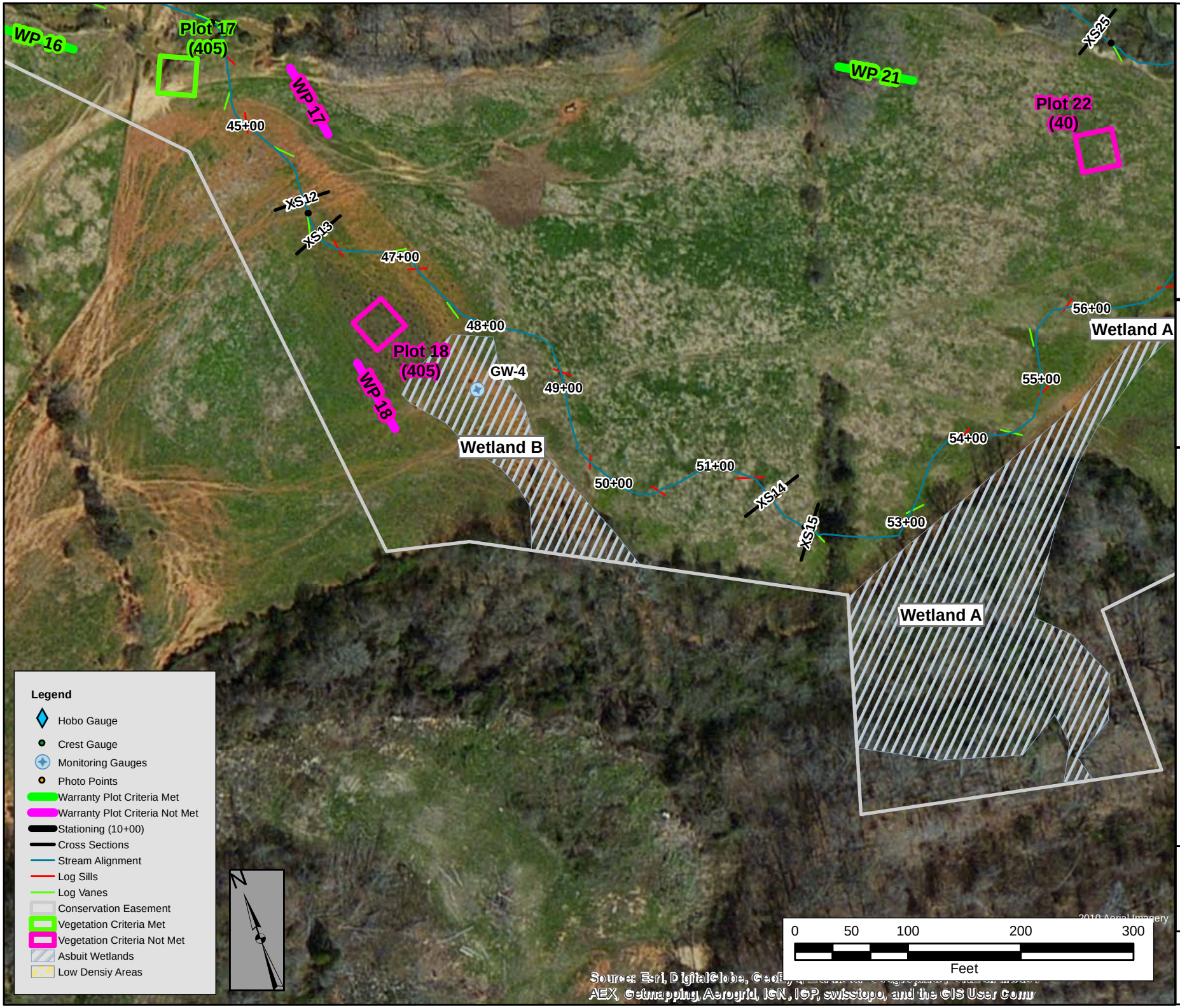
HEATH DAIRY MONITORING YEAR 2
CURRENT CONDITIONS PLAN VIEW OVERWIEW
DMS #170

Randolph County, North Carolina

Figure 2.6



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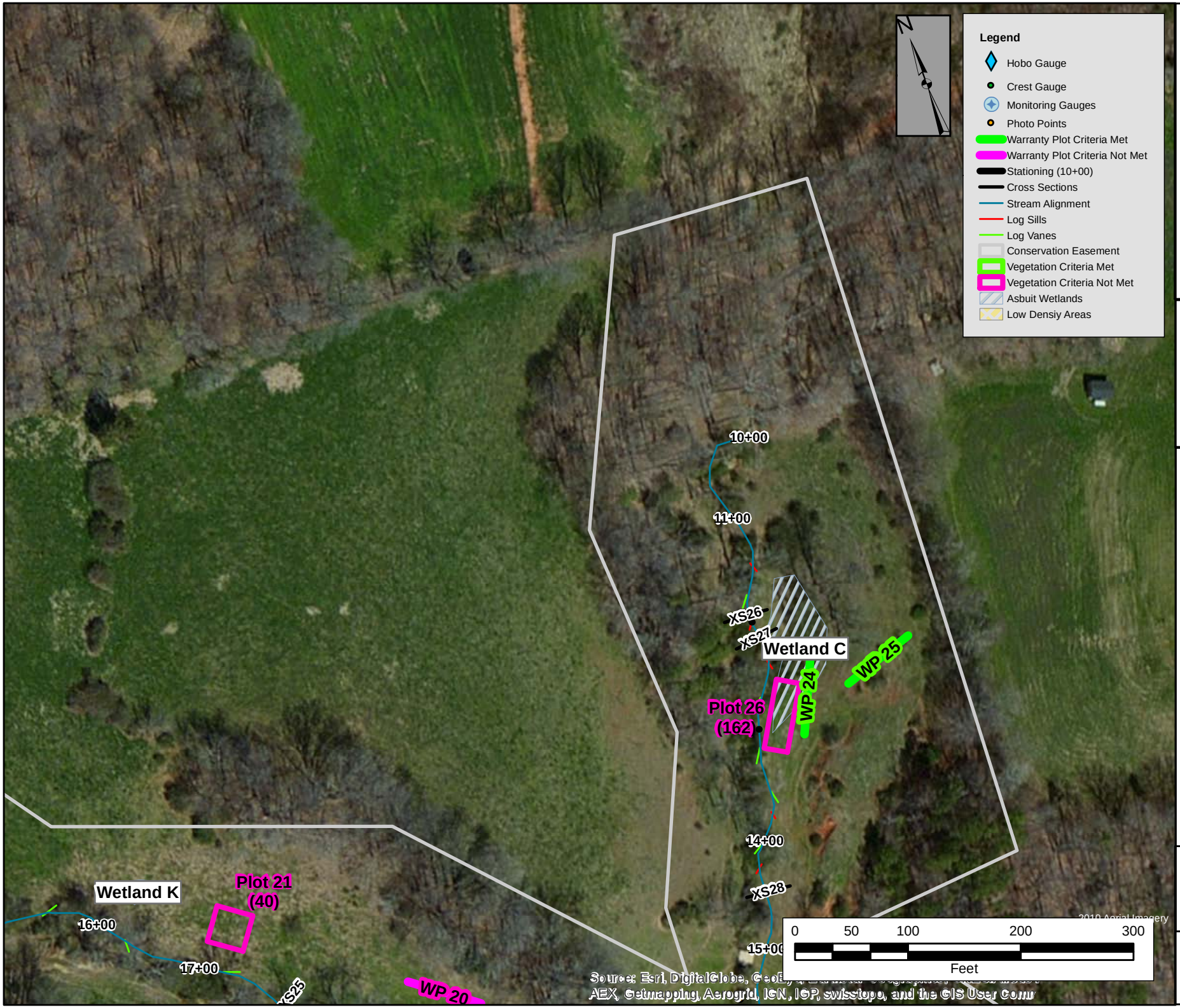
HEATH DAIRY MONITORING YEAR 2
CURRENT CONDITIONS PLAN VIEW OVERWIEW
DMS #170

Randolph County, North Carolina

Figure 2.7



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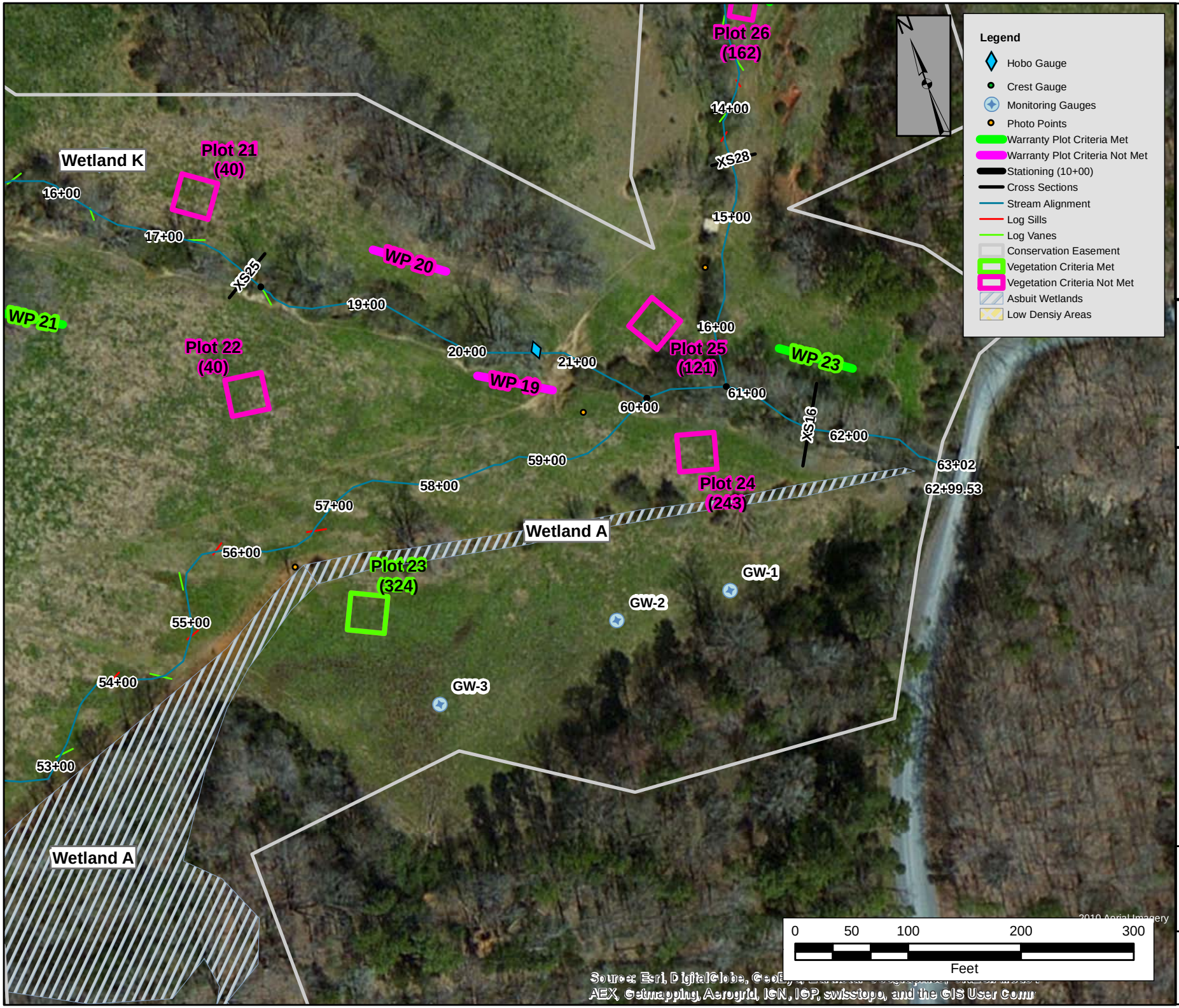
HEATH DAIRY MONITORING YEAR 2
CURRENT CONDITIONS PLAN VIEW OVERWIEW
DMS #170

Randolph County, North Carolina

Figure 2.8



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HEATH DAIRY MONITORING YEAR 2
CURRENT CONDITIONS PLAN VIEW OVERWIEW
DMS #170

Randolph County, North Carolina

Figure 2.9

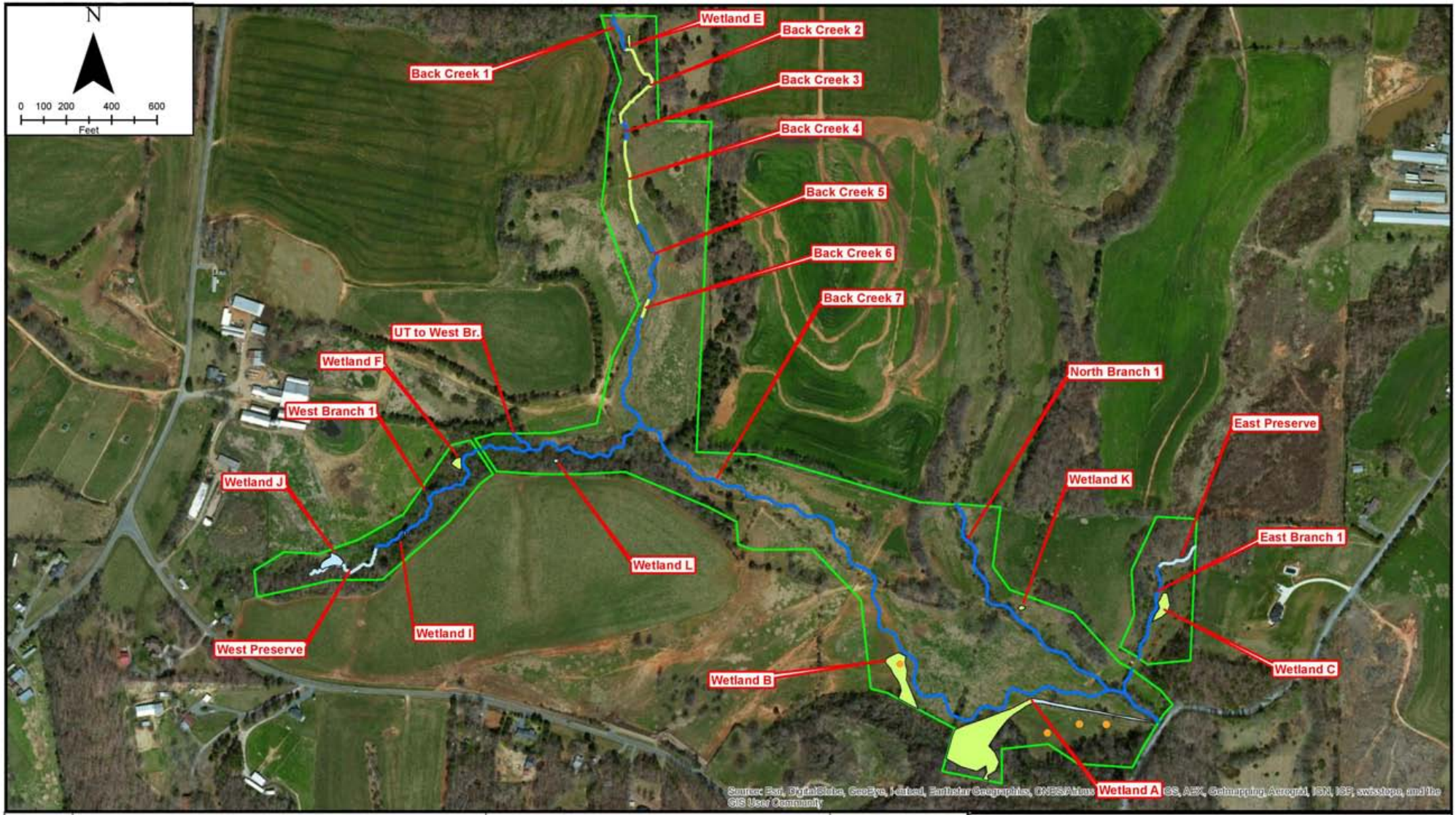

Figure 2.10

COMPONENT ASSESSMENT MAP
HEATH DAIRY ROAD
STREAM RESTORATION SITE
RANDOLF COUNTY, NORTH CAROLINA
MONITORING YEAR 2
DMS # 170

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

DATE: January 2016

Legend

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

Wetland Type

- Wetland Enhancemen
- Wetland Preservation

Table 5.1. Visual Stream Assessment

Visual Stream Assement - 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. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	50	76			66%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	76	76			100%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	60	76			79%
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	70	76			92%
		2. Thalweg centering at downstream of meander (Glide)	76	76			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	102	104			98%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	42	43			98%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	40	43			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	43	43			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	104	104			100%

Table 5.2. Visual Stream Assessment

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

Table

5.3. Visual Stream Assessment

Visual Stream Assement - North Branch to Back Creek							
Major Channel Category	**Channel Sub-Category**	**Metric**	**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. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	7	14			50%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	14	14			100%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	14	14			100%
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	14	14			100%
		2. Thalweg centering at downstream of meander (Glide)	14	14			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	15	15			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	15	15			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	15	15			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	15	15			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	15	15			100%

Table 5.4. Visual Stream Assessment

Visual Stream Assement - East Branch to Back Creek							
Major Channel Category	**Channel Sub-Category**	**Metric**	**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. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%
		2. Degradation - Evidence of downcutting			0	0	100%
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate	8	14			57%
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6)	14	14			100%
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstrem riffle)	14	14			100%
	4.**Thalweg Position**	1. Thalweg centering at upstream of meander bend (Run)	14	14			100%
		2. Thalweg centering at downstream of meander (Glide)	14	14			100%
2. Bank	**1. Scoured/Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	17	17			100%
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	17	17			100%
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	17	17			100%
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in EEP monitoring guidance document)	17	17			100%
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth ratio ≥ 1.6 Rootwads/logs providing some cover at base-flow.	17	17			100%

Table 6. Vegetation Condition Assessment

Planted Acreage **32**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	N/A	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY2 criteria.	0.1 acres	orange cross-hatch polygon	4	11.07	34.6%
			Total	0	11.07	34.6%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	N/A	0	0.00	0.0%
			Cumulative Total	4	11.07	34.6%

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	N/A	0	0.00	0.0%
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%

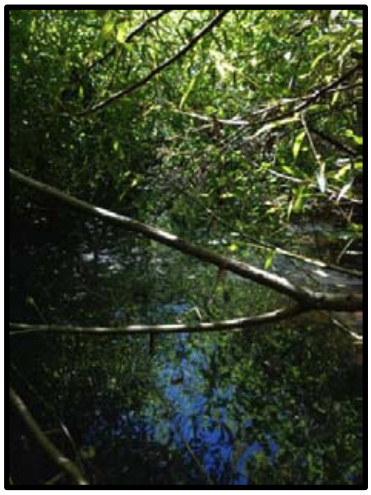
Cross Section 1 (upstream) MY2

Cross Section 1 (downstream) MY2

Cross Section 2 (upstream) MY2

Cross Section 2 (downstream) MY2

Cross Section 3 (upstream) MY2

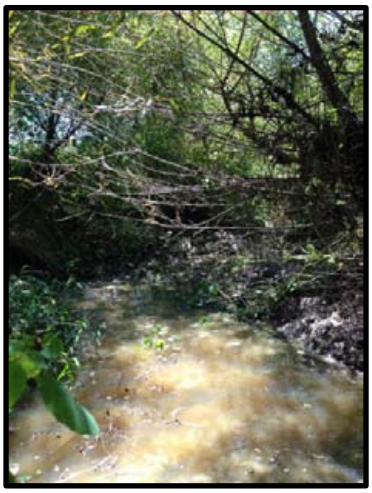


Cross Section 3 (downstream) MY2

Cross Section 4 (upstream) MY2

Cross Section 4 (downstream) MY2

Cross Section 5 (upstream) MY2

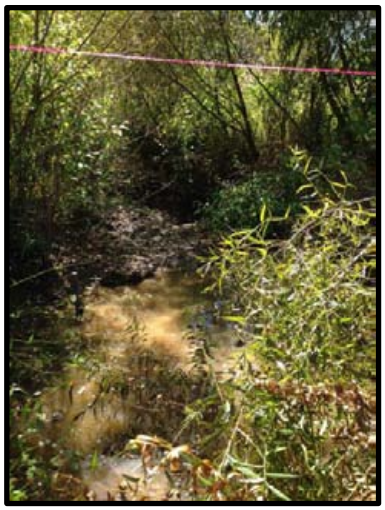


Cross Section 5 (downstream) MY2

Cross Section 6 (upstream) MY2

Cross Section 6 (downstream) MY2

Cross Section 7 (upstream) MY2



Cross Section 7 (downstream) MY2

Cross Section 8 (upstream) MY2

Cross Section 8 (downstream) MY2

Cross Section 9 (upstream) MY2

Cross Section 9 (downstream) MY2

Cross Section 10 (upstream) MY2

Cross Section 10 (downstream) MY2

Cross Section 11 (upstream) MY2

Cross Section 11 (downstream) MY2

Cross Section 12 (upstream) MY2

Cross Section 12 (downstream) MY2

Cross Section 13 (upstream) MY2

Cross Section 13 (downstream) MY2

Cross Section 14 (upstream) MY2

Cross Section 14 (downstream) MY2

Cross Section 15 (upstream) MY2

Cross Section 15 (downstream) MY2

Cross Section 16 (upstream) MY2

Cross Section 16 (downstream) MY2

Cross Section 17 (upstream) MY2

Cross Section 17 (downstream) MY2

Cross Section 18 (upstream) MY2

Cross Section 18 (downstream) MY2

Cross Section 19 (upstream) MY2

Cross Section 19 (downstream) MY2

Cross Section 20 (upstream) MY2

Cross Section 20 (downstream) MY2

Cross Section 21 (upstream) MY2

Cross Section 21 (downstream) MY2

Cross Section 22 (upstream) MY2

Cross Section 22 (downstream) MY2

Cross Section 23 (upstream) MY2

Cross Section 23 (downstream) MY2

Cross Section 24 (upstream) MY2

Cross Section 24 (downstream) MY2

Cross Section 25 (upstream) MY2

Cross Section 25 (downstream) MY2

Cross Section 26 (upstream) MY2

Cross Section 26 (downstream) MY2

Cross Section 27 (upstream) MY2

Cross Section 27 (downstream) MY2

Cross Section 28 (upstream) MY2

Cross Section 28 (downstream) MY2

Vegetation Monitoring Plot 1 MY-2, 2015

Vegetation Monitoring Plot 2 MY-2, 2015

Vegetation Monitoring Plot 3 MY-2, 2015

Vegetation Monitoring Plot 4 MY-2, 2015

Vegetation Monitoring Plot 5 MY-2, 2015

Vegetation Monitoring Plot 6 MY-2, 2015

Vegetation Monitoring Plot 7 MY-2, 2015

Vegetation Monitoring Plot 8 MY-2, 2015

Vegetation Monitoring Plot 9 MY-2, 2015

Vegetation Monitoring Plot 10 MY-2, 2015

Vegetation Monitoring Plot 11 MY-2, 2015

Vegetation Monitoring Plot 12 MY-2, 2015

Vegetation Monitoring Plot 13 MY-2, 2015

Vegetation Monitoring Plot 14 MY-2, 2015

Vegetation Monitoring Plot 15 MY-2, 2015

Vegetation Monitoring Plot 16 MY-2, 2015

Vegetation Monitoring Plot 17 MY-2, 2015

Vegetation Monitoring Plot 18 MY-2, 2015

Vegetation Monitoring Plot 19 MY-2, 2015

Vegetation Monitoring Plot 20 MY-2, 2015

Vegetation Monitoring Plot 21 MY-2, 2015

Vegetation Monitoring Plot 22 MY-2, 2015

Vegetation Monitoring Plot 23 MY-2, 2015

Vegetation Monitoring Plot 24 MY-2, 2015

Vegetation Monitoring Plot 25 MY-2, 2015

Vegetation Monitoring Plot 26 MY-2, 2015

Photo Point #1

Photo Point #2

Photo Point #3

Photo Point #4

Appendix C: Vegetation Plot Data

Table 7. Vegetation Warranty Plot Attainment Summary

Plot	Latitude /Longitude Starting Point	Latitude /Longitude Ending Point	Counted Stems	Stems per Acre	Success Criteria Met?
1	35.787100, -79.852417	35.786850, -79.852400	7	283	No
2	35.786150, -79.852383	35.786400, -79.852417	13	526	Yes
3	35.785467, -79.852483	35.785750, -79.852600	4	162	No
4	35.784973, -79.851883	35.784860, -79.851891	5	202	No
5	35.784508, -79.852310	35.784447, -79.852318	4	162	No
6	35.783806, -79.852463	35.783702, -79.852479	4	162	No
7	35.783470, -79.852600	35.783394, -79.852617	8	324	Yes
8	35.783180, -79.852570	35.783077, -79.852417	11	445	Yes
9	35.782967, -79.852850	35.782900, -79.853217	0	0	No
10	35.782650, -79.853550	35.782650, -79.853817	2	81	No
11	35.782963, -79.851872	35.783020, -79.851824	10	405	Yes
12	35.782692, -79.852066	35.782637, -79.851966	5	202	No
13	35.782413, -79.850802	35.782378, -79.850614	4	162	No
14	35.782097, -79.850861	35.782038, -79.850722	6	243	No
15	35.782091, -79.849497	35.782047, -79.849347	4	162	No
16	35.781376, -79.849327	35.781290, -79.849232	8	324	Yes
17	35.780955, -79.848427	35.780816, -79.848395	6	243	No
18	35.780235, -79.848663	35.780146, -79.848583	7	283	No
19	35.780027, -79.845930	35.779970, -79.845721	3	121	No
20	35.780458, -79.846010	35.780414, -79.845892	5	202	No
21	35.780480, -79.846987	35.780414, -79.846869	8	324	Yes
22	35.781597, -79.847633	35.781537, -79.847472	7	283	No
23	35.779816, -79.844849	35.779757, -79.844753	8	324	Yes
24	35.780655, -79.844498	35.780586, -79.844518	8	324	Yes
25	35.780693, -79.844170	35.780712, -79.844086	11	445	Yes
Project Average			6	255	No

Table 8. Vegetation Plot Success Criteria Attainment Summary

Plot #	Stream/ Wetland Stems[1]	Volunteer Stems[2]	Total Stems[3]	Success Criteria Met?
1	405	0	405	Yes
2	405	243	647	Yes
3	405	243	647	Yes
4	162	0	162	No
5	202	0	202	No
6	162	0	162	No
7	0	0	0	No
8	243	364	607	No
9	121	445	567	No
10	486	0	486	Yes
11	162	0	162	No
12	162	0	162	No
13	81	81	162	No
14	81	202	283	No
15	40	40	81	No
16	162	0	162	No
17	405	40	445	Yes
18	405	0	405	Yes
19	283	81	364	No
20	40	0	40	No
21	40	40	81	No
22	40	0	40	No
23	324	81	405	Yes
24	243	324	567	No
25	121	40	162	No
26	162	243	405	No
Project Avg	**205**	**95**	**300**	**No**

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

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

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

Table 9.1. 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
Betula nigra	river birch	Tree																		
Carya glabra	pignut hickory	Tree				2	2	2	1	1	1									
Celtis laevigata	sugarberry	Tree																		
Diospyros virginiana	common persimmon	Tree	5	5	5	1	1	1	1	1	1							1	1	1
Fraxinus pennsylvanica	green ash	Tree							3	3	3							1	1	1
Juglans nigra	black walnut	Tree						2			3									
Liquidambar styraciflua	sweetgum	Tree	1	1	1			1												
Liriodendron tulipifera	tuliptree	Tree	2	2	2	1	1	4	1	1	1				1	1	1			
Nyssa sylvatica	blackgum	Tree				2	2	2												
Platanus occidentalis	American sycamore	Tree										3	3	3	2	2	2	2	2	2
Quercus	oak	Tree							1	1	1									
Quercus falcata	southern red oak	Tree				1	1	1							1	1	1			
Quercus michauxii	swamp chestnut oak	Tree																		
Quercus nigra	water oak	Tree																		
Quercus phellos	willow oak	Tree				3	3	3							1	1	1			
Quercus rubra	northern red oak	Tree	2	2	2				3	3	3	1	1	1						
Salix nigra	black willow	Tree																		
Ulmus alata	winged elm	Tree									3									
Ulmus americana	American elm	Tree																		
	Stem count		10	10	10	10	10	16	10	10	16	4	4	4	5	5	5	4	4	4
	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	4	6	6	8	6	6	8	2	2	2	4	4	4	3	3	3
	Stems per ACRE		405	405	405	405	405	648	405	405	648	162	162	162	202	202	202	162	162	162

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 9.2. 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
Betula nigra	river birch	Tree										2	2	2						
Carya glabra	pignut hickory	Tree													1	1	1			
Celtis laevigata	sugarberry	Tree																		
Diospyros virginiana	common persimmon	Tree										3	3	3						
Fraxinus pennsylvanica	green ash	Tree				1	1	1										3	3	3
Juglans nigra	black walnut	Tree									11									
Liquidambar styraciflua	sweetgum	Tree						2												
Liriodendron tulipifera	tuliptree	Tree				2	2	5	2	2	2	2	2	2	2	2	2	1	1	1
Nyssa sylvatica	blackgum	Tree																		
Platanus occidentalis	American sycamore	Tree				1	1	1												
Quercus	oak	Tree										1	1	1	1	1	1			
Quercus falcata	southern red oak	Tree										1	1	1						
Quercus michauxii	swamp chestnut oak	Tree																		
Quercus nigra	water oak	Tree				1	1	1	1	1	1									
Quercus phellos	willow oak	Tree				1	1	1				1	1	1						
Quercus rubra	northern red oak	Tree										2	2	2						
Salix nigra	black willow	Tree						3												
Ulmus alata	winged elm	Tree																		
Ulmus americana	American elm	Tree						1												
	Stem count		0	0	0	6	6	15	3	3	14	12	12	12	4	4	4	4	4	4
	size (ares)		1			1			1			1			1			1		
	size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.02		
	Species count		0	0	0	5	5	8	2	2	3	7	7	7	3	3	3	2	2	2
	Stems per ACRE		0	0	0	243	243	607	121	121	567	486	486	486	162	162	162	162	162	162

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 9.3. 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
Betula nigra	river birch	Tree																1	1	1
Carya glabra	pignut hickory	Tree																		
Celtis laevigata	sugarberry	Tree			1															
Diospyros virginiana	common persimmon	Tree				1	1	1	1	1	1				3	3	3			
Fraxinus pennsylvanica	green ash	Tree										2	2	2				9	9	9
Juglans nigra	black walnut	Tree			1			3									1			
Liquidambar styraciflua	sweetgum	Tree						1			1									
Liriodendron tulipifera	tuliptree	Tree	1	1	1	1	1	1							1	1	1			
Nyssa sylvatica	blackgum	Tree																		
Platanus occidentalis	American sycamore	Tree																		
Quercus	oak	Tree										2	2	2	1	1	1			
Quercus falcata	southern red oak	Tree	1	1	1															
Quercus michauxii	swamp chestnut oak	Tree																		
Quercus nigra	water oak	Tree																		
Quercus phellos	willow oak	Tree													2	2	2			
Quercus rubra	northern red oak	Tree													3	3	3			
Salix nigra	black willow	Tree																		
Ulmus alata	winged elm	Tree																		
Ulmus americana	American elm	Tree						1												
		Stem count	2	2	4	2	2	7	1	1	2	4	4	4	10	10	11	10	10	10
		size (ares)	1			1			1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.02		
		Species count	2	2	4	2	2	5	1	1	2	2	2	2	5	5	6	2	2	2
		Stems per ACRE	81	81	162	81	81	283	40	40	81	162	162	162	405	405	445	405	405	405

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 9.4. 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
Betula nigra	river birch	Tree																		
Carya glabra	pignut hickory	Tree																		
Celtis laevigata	sugarberry	Tree																		
Diospyros virginiana	common persimmon	Tree													2	2	4			
Fraxinus pennsylvanica	green ash	Tree	1	1	1				1	1	1	1	1	1	2	2	2	1	1	7
Juglans nigra	black walnut	Tree			1						1									1
Liquidambar styraciflua	sweetgum	Tree																		
Liriodendron tulipifera	tuliptree	Tree																		
Nyssa sylvatica	blackgum	Tree													1	1	1			1
Platanus occidentalis	American sycamore	Tree				1	1	1							1	1	1			
Quercus	oak	Tree													1	1	1			
Quercus falcata	southern red oak	Tree	3	3	3															
Quercus michauxii	swamp chestnut oak	Tree																		
Quercus nigra	water oak	Tree																2	2	2
Quercus phellos	willow oak	Tree	1	1	1										1	1	1	2	2	2
Quercus rubra	northern red oak	Tree	2	2	2													1	1	1
Salix nigra	black willow	Tree																		
Ulmus alata	winged elm	Tree																		
Ulmus americana	American elm	Tree			1															
	Stem count		7	7	9	1	1	1	1	1	2	1	1	1	8	8	10	6	6	14
	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	1	1	1	1	1	2	1	1	1	6	6	6	4	4	6
	Stems per ACRE		283	283	364	40	40	40	40	40	81	40	40	40	324	324	405	243	243	567

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 9.5. Vegetation Plot Summary

			Plot Data 2015						Project Total Stem Counts & Annual Mean Density														
			170-01-0025			170-01-0026			MY5 (***)			MY4 (***)			MY3 (***)			MY2 (2015)			MY1 (2014)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T										PnoLS	P-all	T	PnoLS	P-all	T
Betula nigra	river birch	Tree							-	-	-	-	-	-	-	-	-	3	3	3	2	2	2
Carya glabra	pignut hickory	Tree							-	-	-	-	-	-	-	-	-	4	4	4	6	6	6
Celtis laevigata	sugarberry	Tree							-	-	-	-	-	-	-	-	-			1			
Diospyros virginiana	common persimmon	Tree							-	-	-	-	-	-	-	-	-	18	18	20	12	12	12
Fraxinus pennsylvanica	green ash	Tree	2	2	2	1	1	1	-	-	-	-	-	-	-	-	-	28	28	34	19	19	19
Juglans nigra	black walnut	Tree			1				-	-	-	-	-	-	-	-	-			25			
Liquidambar styraciflua	sweetgum	Tree							-	-	-	-	-	-	-	-	-	1	1	6			
Liriodendron tulipifera	tuliptree	Tree							-	-	-	-	-	-	-	-	-	17	17	23	7	7	7
Nyssa sylvatica	blackgum	Tree							-	-	-	-	-	-	-	-	-	3	3	4			
Platanus occidentalis	American sycamore	Tree							-	-	-	-	-	-	-	-	-	10	10	10	3	3	3
Quercus	oak	Tree							-	-	-	-	-	-	-	-	-	7	7	7	18	18	18
Quercus falcata	southern red oak	Tree				2	2	2	-	-	-	-	-	-	-	-	-	9	9	9	3	3	3
Quercus michauxii	swamp chestnut oak	Tree							-	-	-	-	-	-	-	-	-				1	1	1
Quercus nigra	water oak	Tree							-	-	-	-	-	-	-	-	-	4	4	4	3	3	3
Quercus phellos	willow oak	Tree							-	-	-	-	-	-	-	-	-	12	12	12	15	15	15
Quercus rubra	northern red oak	Tree	1	1	1	1	1	1	-	-	-	-	-	-	-	-	-	16	16	16	1	1	1
Salix nigra	black willow	Tree						6	-	-	-	-	-	-	-	-	-			9			
Ulmus alata	winged elm	Tree							-	-	-	-	-	-	-	-	-			3			
Ulmus americana	American elm	Tree							-	-	-	-	-	-	-	-	-			3			
	Stem count		3	3	4	4	4	10	-	-	-	-	-	-	-	-	-	132	132	193	90	90	90
	size (ares)		1			1			1			1			1			1			1		
	size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.02			0.02		
	Species count		2	2	3	3	3	4	-	-	-	-	-	-	-	-	-	13	13	18	12	12	12
	Stems per ACRE		121	121	162	162	162	405	-	-	-	-	-	-	-	-	-	205	205	300	1821	1821	1821

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 Geomorpology Data

Figure 3.1 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-1, Pool
Survey Date	9/2015
SUMMARY DATA	
Bankfull Elevation (ft)	613.16
Bankfull Cross-Sectional Area (ft^2)	13.80
Bankfull Width (ft)	19.57
Flood Prone Area Elevation (ft)	614.20
Flood Prone Width (ft)	32.00
Bankfull Mean Depth (ft)	0.96
Bankfull Max Depth (ft)	1.05
W/D Ratio	20.38
Entrenchment Ratio	1.64
Bank Height Ratio	1.00

XS-1: Upstream

XS-1: Downstream

Station	Elevation	Notes
0.00	616.34	LPIN
0.23	616.37	
2.39	615.94	
5.16	615.88	
8.03	615.34	
11.64	614.13	TLB
13.77	614.26	
15.81	613.88	
17.38	612.80	
18.19	612.32	LEW
20.41	611.96	
21.78	611.98	
23.41	612.11	THW
24.54	611.97	
26.12	612.02	
27.38	612.07	
29.37	612.16	
30.28	612.65	REW
31.21	613.16	TRB
33.04	613.55	
35.69	614.01	
37.60	614.34	
41.62	614.72	
44.31	615.59	
47.46	616.05	
50.67	616.07	RPIN

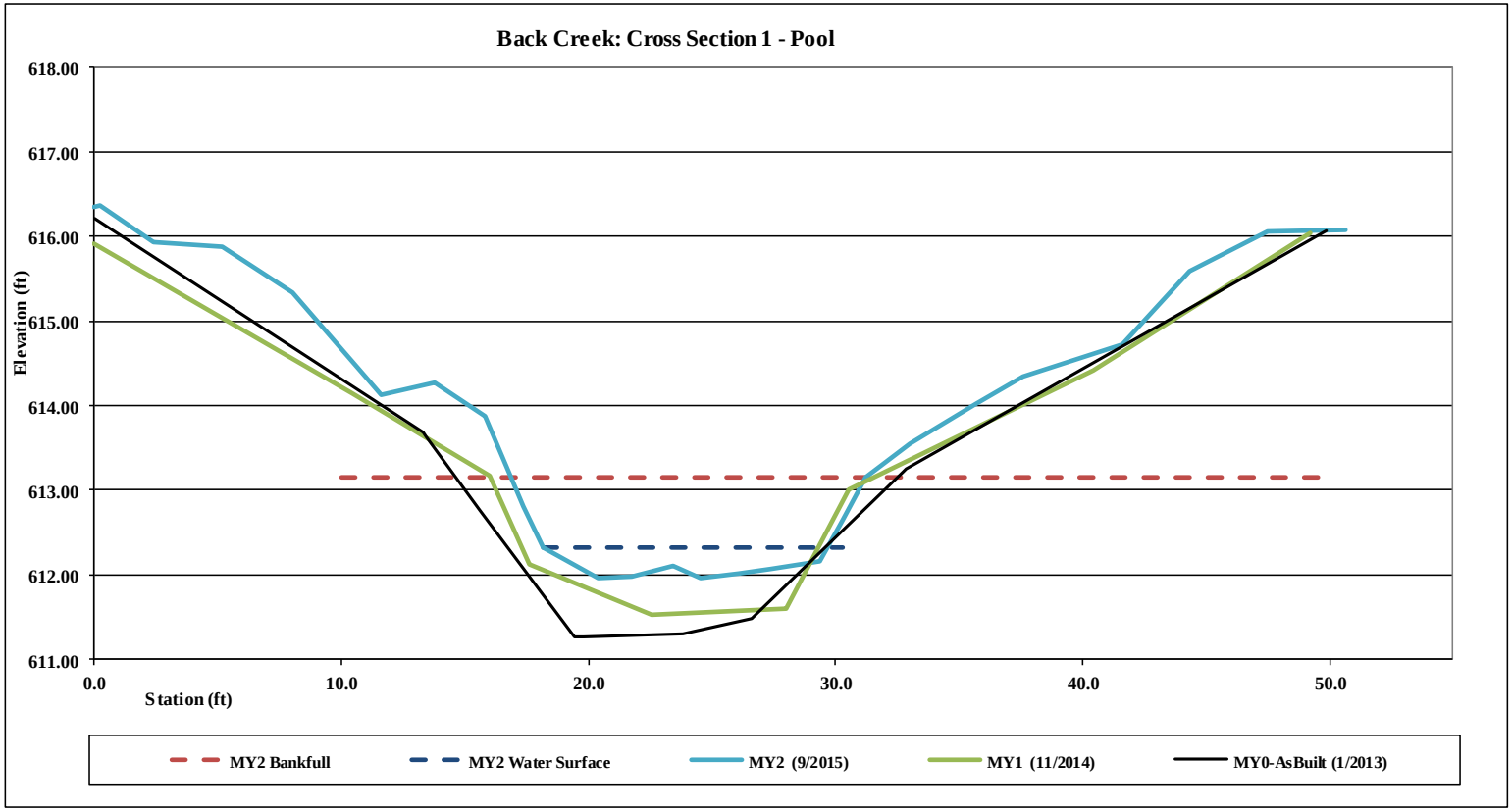


Figure 3.2 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-2, Riffle
Survey Date	9/2015
SUMMARY DATA	
Bankfull Elevation (ft)	613.43
Bankfull Cross-Sectional Area (ft^2)	10.70
Bankfull Width (ft)	15.87
Flood Prone Area Elevation (ft)	614.46
Flood Prone Width (ft)	25.30
Bankfull Mean Depth (ft)	0.75
Bankfull Max Depth (ft)	1.03
W/D Ratio	21.16
Entrenchment Ratio	1.59
Bank Height Ratio	1.00

XS-2: Upstream

XS-2: Downstream

Station	Elevation	Notes
0.00	615.13	LPIN
4.33	615.00	
7.95	614.63	
8.00	614.71	
10.45	614.25	
11.76	614.12	
14.84	613.86	TLB
16.57	613.41	
17.91	613.03	
19.56	612.51	
21.29	612.42	
22.85	612.40	THW
24.17	612.44	
26.14	612.43	
28.72	612.81	
30.71	613.43	TRB
32.90	614.38	
35.12	614.80	
37.59	615.22	
39.74	615.16	
41.90	614.97	
44.29	615.41	
46.24	616.10	
49.28	616.54	RPIN

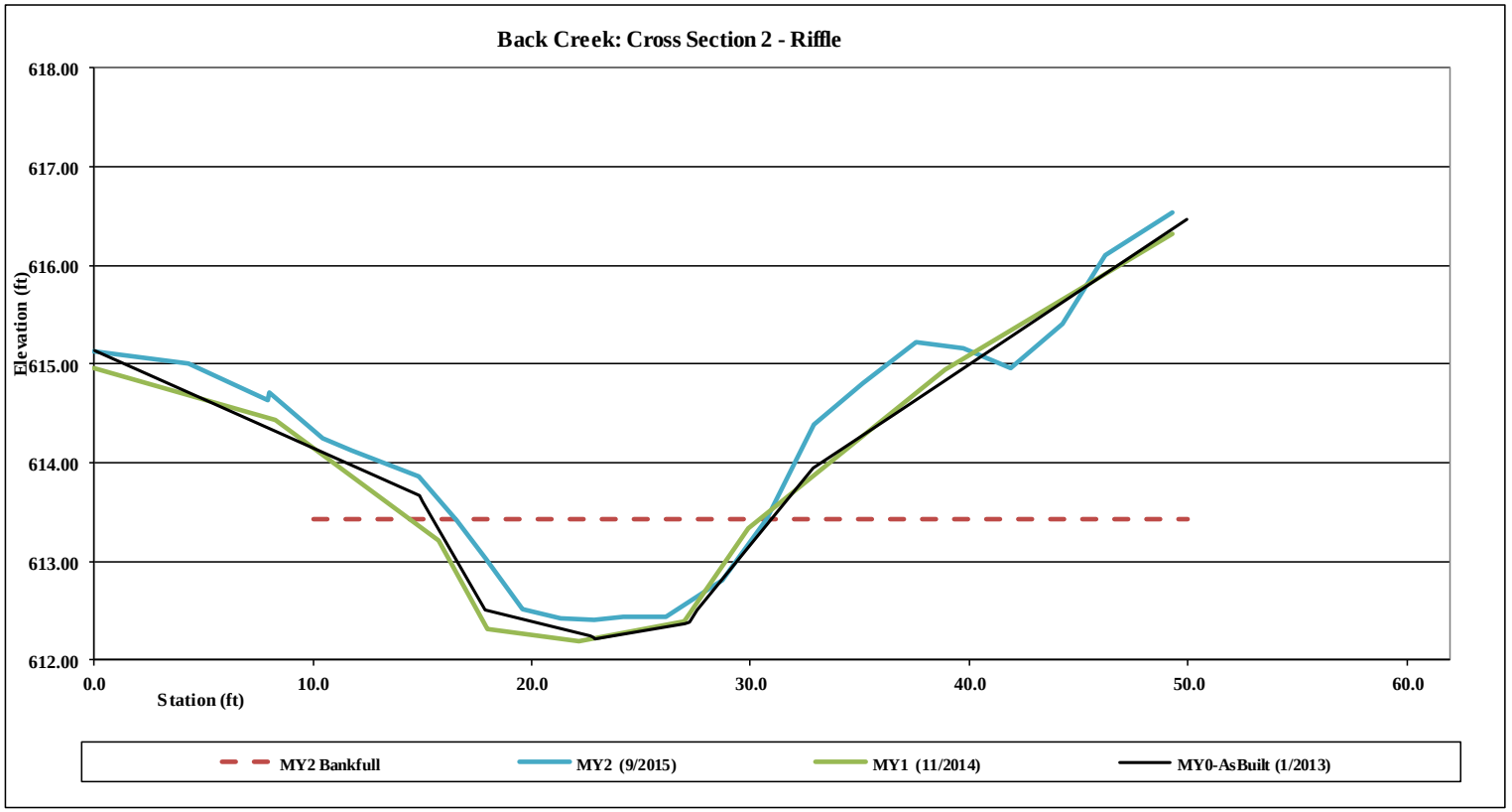


Figure 3.3 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-3, Riffle
Survey Date	9/2015
SUMMARY DATA	
Bankfull Elevation (ft)	611.33
Bankfull Cross-Sectional Area (ft^2)	30.10
Bankfull Width (ft)	15.79
Flood Prone Area Elevation (ft)	615.70
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.21
Bankfull Max Depth (ft)	2.87
W/D Ratio	13.05
Entrenchment Ratio	6.33
Bank Height Ratio	1.00

XS-3: Upstream

XS-3: Downstream

Station	Elevation	Notes
0.00	611.51	LPIN
0.23	611.00	
2.48	611.03	
5.34	611.17	
8.32	611.28	
12.43	611.48	
15.00	611.45	
17.90	611.47	TLB
18.94	611.00	
19.77	610.34	
20.70	609.96	
21.41	608.87	
24.22	608.34	
26.36	608.46	THW
27.15	608.57	
28.69	608.69	
29.21	609.04	
29.74	609.86	
31.44	610.64	
33.70	611.33	TRB
35.86	611.39	
37.85	611.70	
41.21	612.32	
45.93	612.72	
47.83	612.67	
48.21	613.19	RPIN

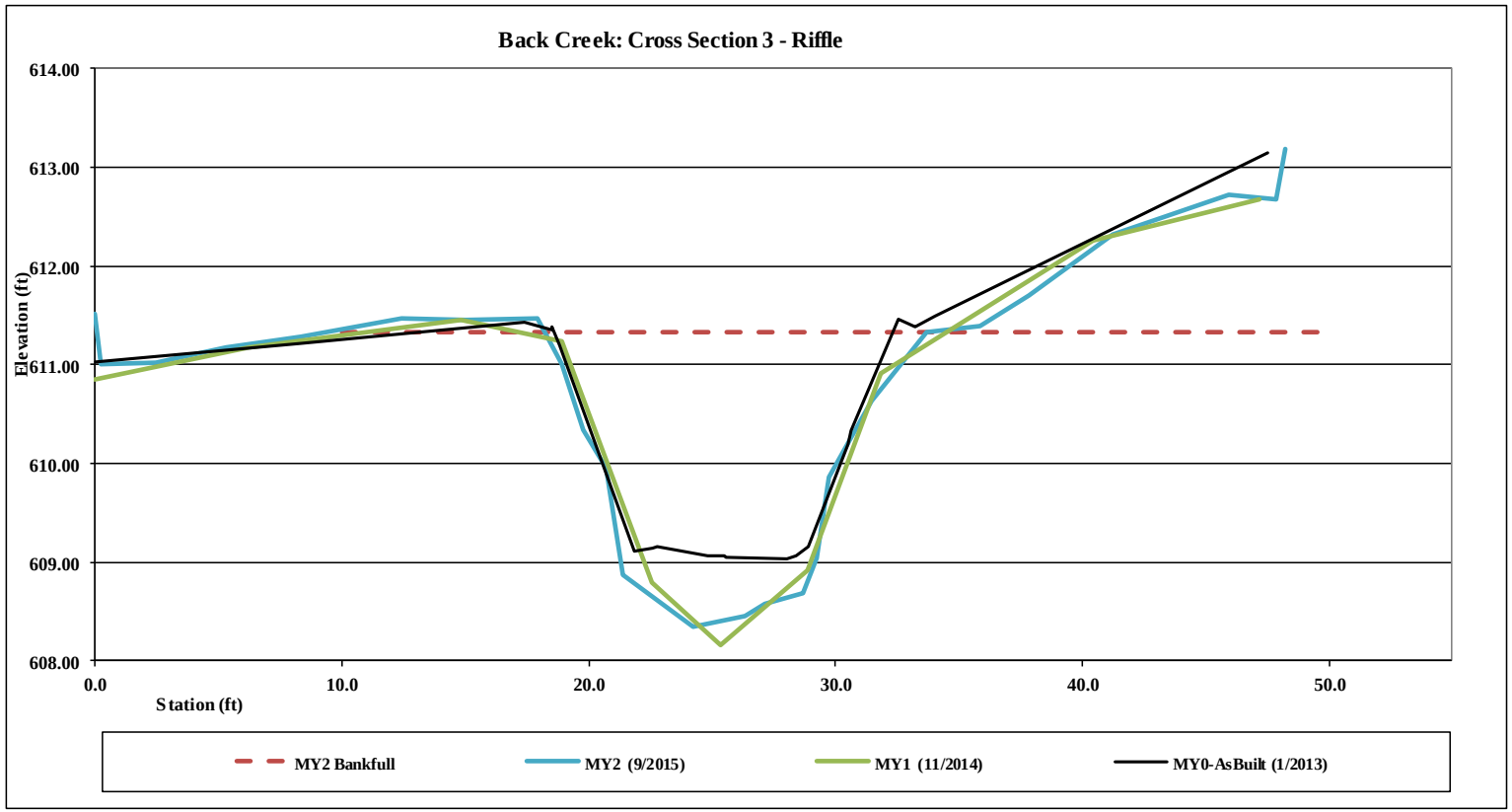


Figure 3.4 Cross Section Data

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-4, Pool	
Survey Date	9/2015	
SUMMARY DATA		
Bankfull Elevation (ft)		610.38
Bankfull Cross-Sectional Area (ft^2)		30.00
Bankfull Width (ft)		18.56
Flood Prone Area Elevation (ft)		613.29
Flood Prone Width (ft)		100.00
Bankfull Mean Depth (ft)		1.70
Bankfull Max Depth (ft)		2.91
W/D Ratio		10.92
Entrenchment Ratio		5.39
Bank Height Ratio		1.00

XS-4: Upstream

XS-4: Downstream

Station	Elevation	Notes
0.00	610.88	LPIN
3.89	610.82	
8.29	611.07	
11.80	611.05	
15.04	610.58	TLB
16.44	610.29	
18.08	609.96	
19.20	609.48	LEW
20.47	608.81	
21.73	608.05	
23.11	607.84	
24.04	607.65	
25.69	607.59	
27.03	607.47	THW
29.01	607.66	
30.59	609.05	REW
31.34	609.48	
32.29	609.93	
33.60	610.38	TRB
35.98	611.01	
43.10	611.92	
51.42	612.37	RPIN

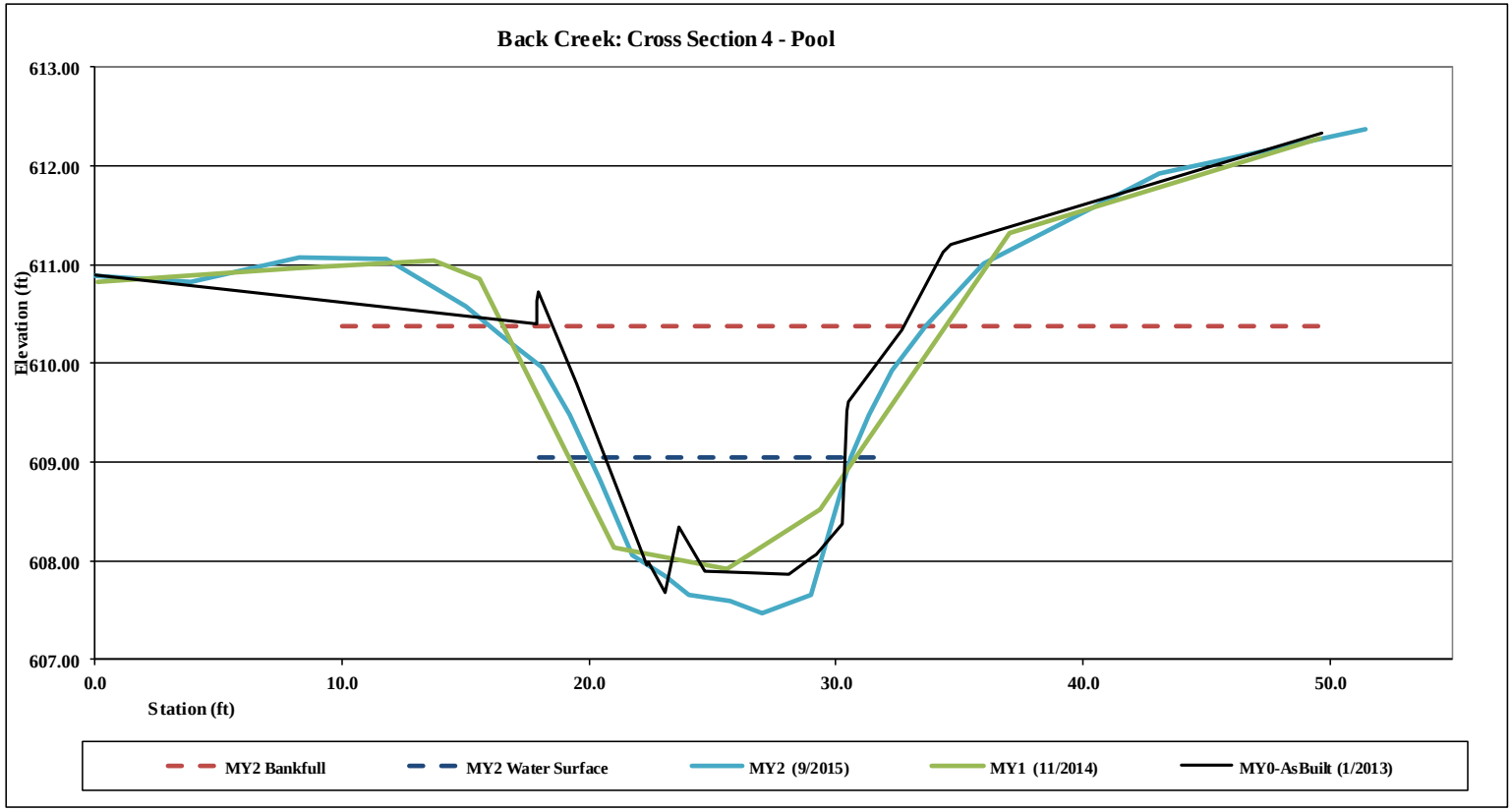


Figure 3.5 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-5, Pool
Survey Date	9/2015
SUMMARY DATA	
Bankfull Elevation (ft)	608.92
Bankfull Cross-Sectional Area (ft^2)	29.60
Bankfull Width (ft)	17.33
Flood Prone Area Elevation (ft)	612.23
Flood Prone Width (ft)	50.00
Bankfull Mean Depth (ft)	2.06
Bankfull Max Depth (ft)	3.30
W/D Ratio	8.41
Entrenchment Ratio	2.89
Bank Height Ratio	1.00

XS-5: Upstream

XS-5: Downstream

Station	Elevation	Notes
0.00	610.20	LPIN
0.19	609.79	
2.27	609.92	
6.28	609.76	
11.28	609.58	
14.52	609.22	
16.07	609.45	TLB
16.94	609.04	
17.60	608.52	
18.27	607.91	
19.47	607.02	
20.64	606.45	
21.73	606.39	LEW
22.58	606.18	
24.04	605.62	THW
24.73	605.58	
26.28	605.86	
27.25	606.35	REW
28.12	606.71	
28.88	607.10	
29.69	608.11	
31.50	608.92	
33.41	609.10	TRB
35.46	609.12	
37.71	609.12	
41.24	609.68	
45.24	610.16	
49.61	610.13	
50.34	610.48	RPIN

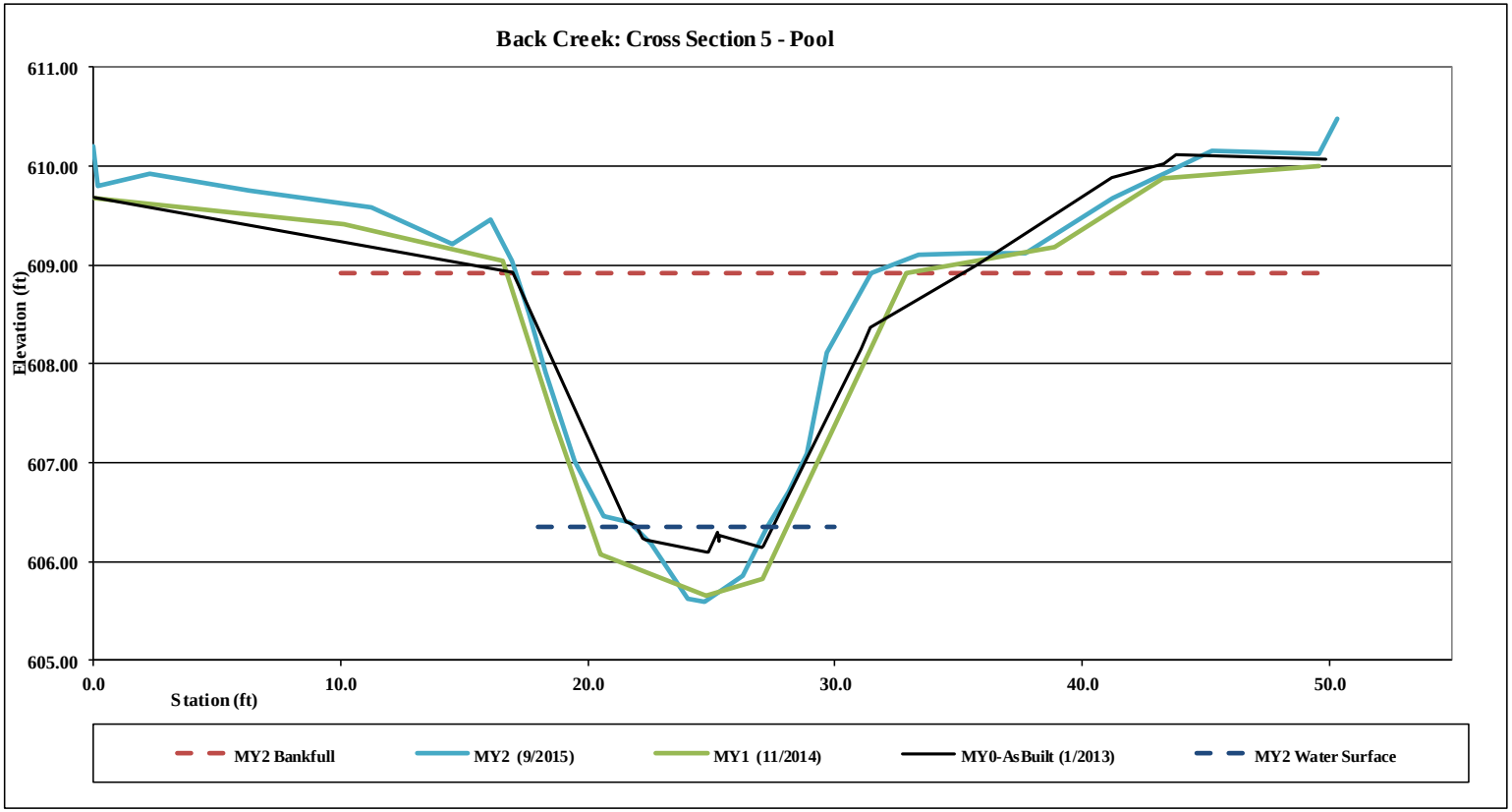


Figure 3.6 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-6, Riffle
Survey Date	9/2015
SUMMARY DATA	
Bankfull Elevation (ft)	606.466
Bankfull Cross-Sectional Area (ft^2)	13.30
Bankfull Width (ft)	16.04
Flood Prone Area Elevation (ft)	607.87
Flood Prone Width (ft)	75.00
Bankfull Mean Depth (ft)	0.91
Bankfull Max Depth (ft)	1.41
W/D Ratio	17.63
Entrenchment Ratio	4.68
Bank Height Ratio	1.00

XS-6: Upstream

XS-6: Downstream

Station	Elevation	Notes
0.00	607.95	LPIN
3.38	607.92	
6.95	607.60	
10.85	607.06	
15.61	606.76	
19.33	606.47	TLB
20.32	606.29	
21.32	605.86	
22.57	605.50	
24.31	605.06	THW
25.86	604.88	
27.69	605.04	
28.88	605.37	
30.69	605.73	
31.86	605.74	
33.52	606.35	
35.37	606.78	TRB
37.59	606.81	
41.25	606.77	
44.40	607.21	
47.52	607.49	
49.93	607.53	
50.43	607.93	RPIN

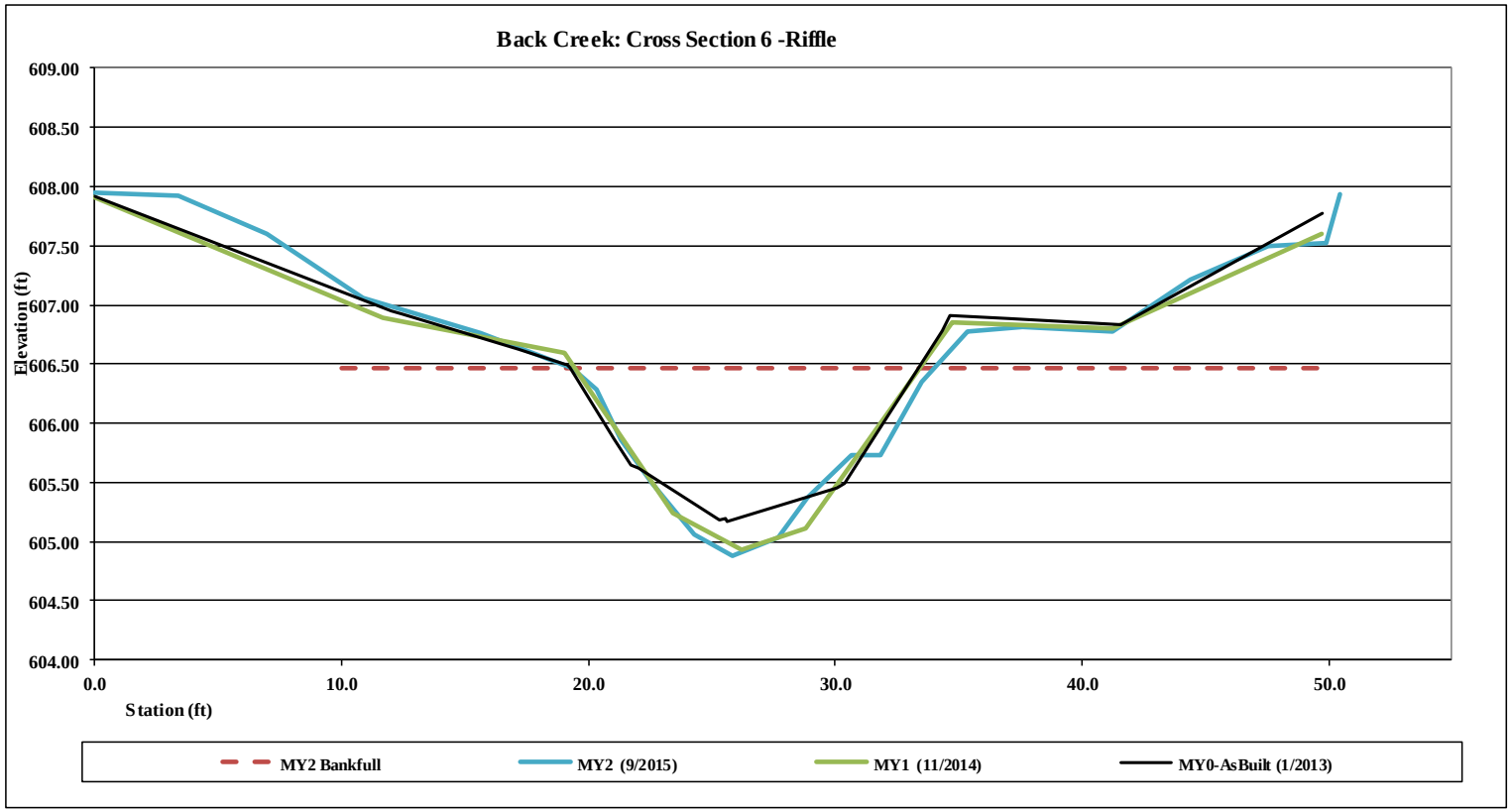


Figure 3.7 Cross Section Data

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-7, Pool	
Survey Date	9/2015	
SUMMARY DATA		
Bankfull Elevation (ft)		606.16
Bankfull Cross-Sectional Area (ft^2)		34.10
Bankfull Width (ft)		15.35
Flood Prone Area Elevation (ft)		609.28
Flood Prone Width (ft)		100.00
Bankfull Mean Depth (ft)		1.80
Bankfull Max Depth (ft)		3.12
W/D Ratio		8.53
Entrenchment Ratio		6.52
Bank Height Ratio		1.00

XS-7: Upstream

XS-7: Downstream

Station	Elevation	Notes
0.00	607.90	LPIN
0.37	607.56	
3.16	607.68	
5.90	607.83	
8.46	606.93	
10.37	606.86	
13.62	606.39	
15.69	605.43	
17.76	605.31	TLB
19.10	604.32	
20.23	603.79	
20.91	603.84	LEW
21.95	603.33	
22.65	603.24	
23.71	603.05	THW
26.41	603.33	
27.33	603.85	REW
30.06	604.06	
31.02	605.30	
31.55	606.00	
33.11	606.16	TRB
37.05	606.22	
40.14	606.63	
43.44	607.16	
47.33	607.52	
50.47	607.21	RPIN

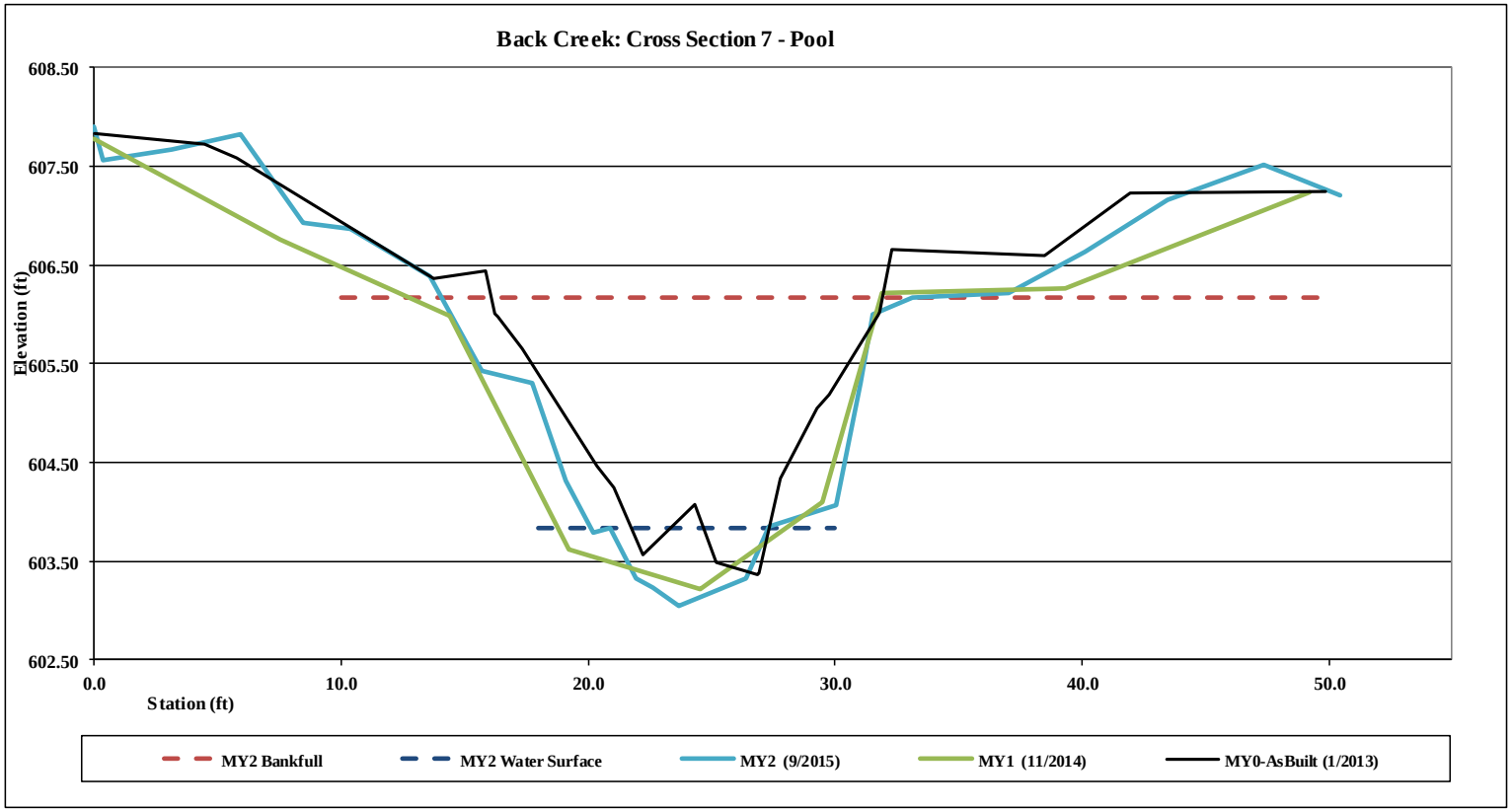


Figure 3.8 Cross Section Data

Project Name	**Heath Dairy**
DMS Project Number	**170**
Cross-Section ID	**XS-8 - Riffle**
Survey Date	**9/2015**
SUMMARY DATA	
Bankfull Elevation (ft)	602.42
Bankfull Cross-Sectional Area (ft^2)	28.10
Bankfull Width (ft)	23.26
Flood Prone Area Elevation (ft)	604.32
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.10
Bankfull Max Depth (ft)	1.90
W/D Ratio	21.15
Entrenchment Ratio	4.30
Bank Height Ratio	1.00

XS-8: Upstream

XS-8: Downstream

Station	Elevation	Notes
0.00	602.44	LPIN
6.29	602.49	
8.76	602.46	
12.32	602.45	
15.53	602.43	
18.31	602.42	TLB
20.94	601.75	
22.97	601.42	
25.40	600.97	
26.81	600.74	
28.36	600.57	
29.34	600.52	THW
31.01	600.53	
32.60	600.60	
34.31	600.72	
35.65	600.85	
37.12	601.09	
38.36	601.57	
39.59	602.13	
41.57	602.54	TRB
44.09	602.48	
47.44	602.50	
50.77	602.42	
53.58	602.41	RPIN

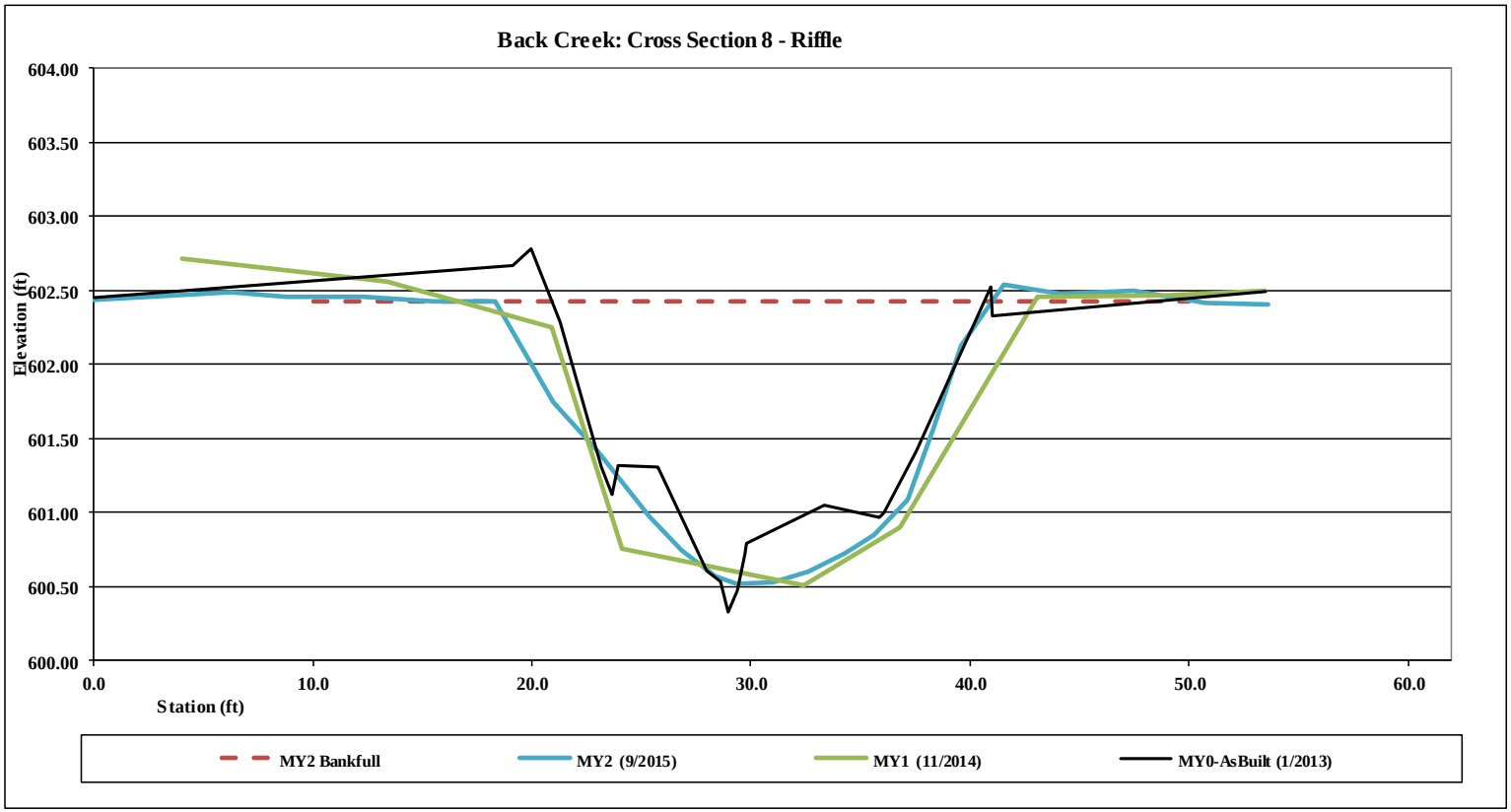


Figure 3.9 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-9, Pool
Survey Date	9/2015
SUMMARY DATA	
Bankfull Elevation (ft)	602.77
Bankfull Cross-Sectional Area (ft^2)	52.00
Bankfull Width (ft)	21.64
Flood Prone Area Elevation (ft)	606.52
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.33
Bankfull Max Depth (ft)	3.75
W/D Ratio	16.27
Entrenchment Ratio	4.62
Bank Height Ratio	1.00

XS-9: Upstream

XS-9: Downstream

Station	Elevation	Notes
0.00	603.36	LPIN
0.19	602.98	
2.38	602.91	
5.11	602.87	
8.64	602.74	
12.32	602.77	TLB
13.54	602.37	
15.13	601.65	
16.19	600.19	
18.42	600.15	
20.29	600.44	LEW
23.35	599.49	
24.96	599.03	THW
25.74	599.17	
26.77	599.28	
27.60	599.62	
29.17	599.77	
30.46	599.97	
31.46	600.90	REW
31.60	601.51	
32.32	601.81	
33.96	602.39	TRB
35.93	602.80	
38.36	602.73	
41.62	602.68	
45.92	602.56	
51.44	603.02	RPIN

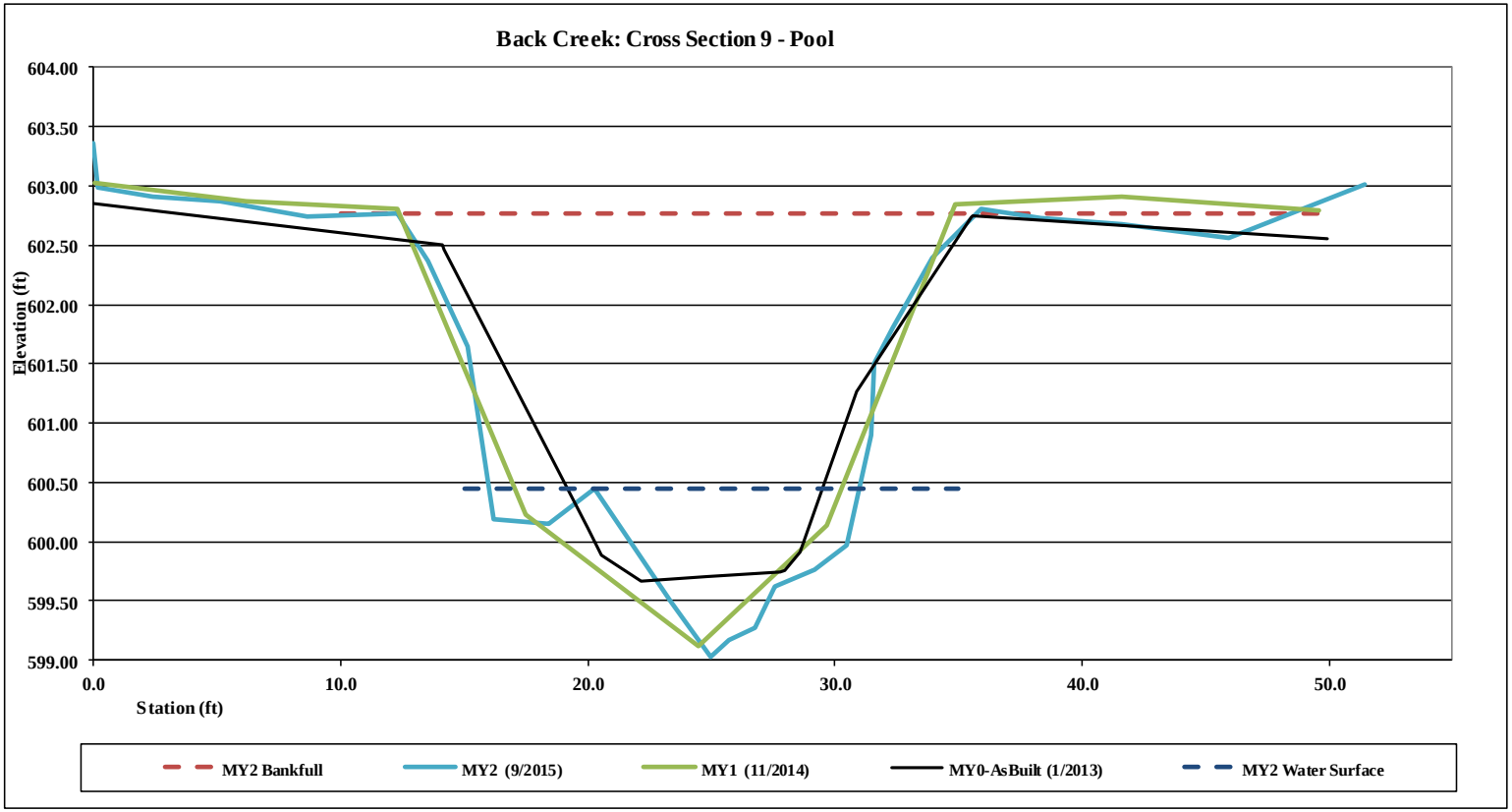


Figure 3.10 Cross Section Data

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-10, Riffle	
Survey Date	9/2015	
SUMMARY DATA		
Bankfull Elevation (ft)		599.9
Bankfull Cross-Sectional Area (ft^2)		21.90
Bankfull Width (ft)		24.41
Flood Prone Area Elevation (ft)		601.71
Flood Prone Width (ft)		100.00
Bankfull Mean Depth (ft)		0.92
Bankfull Max Depth (ft)		1.81
W/D Ratio		26.54
Entrenchment Ratio		4.10
Bank Height Ratio		1.00

XS-10: Upstream

XS-10: Downstream

Station	Elevation	Notes
0.00	600.12	LPIN
0.57	599.71	
4.65	599.88	
8.77	599.92	
12.20	600.16	
15.27	600.12	
17.81	599.90	TLB
19.36	599.46	
20.28	599.09	
21.21	598.75	
22.33	598.27	
23.64	598.09	THW
24.73	598.12	
26.49	598.26	
28.25	598.45	
30.03	598.34	
31.51	598.37	
33.19	598.92	
34.43	599.52	
35.62	599.93	
38.11	599.93	
42.23	600.12	TRB
46.94	600.17	
49.93	600.23	
50.14	600.65	RPIN

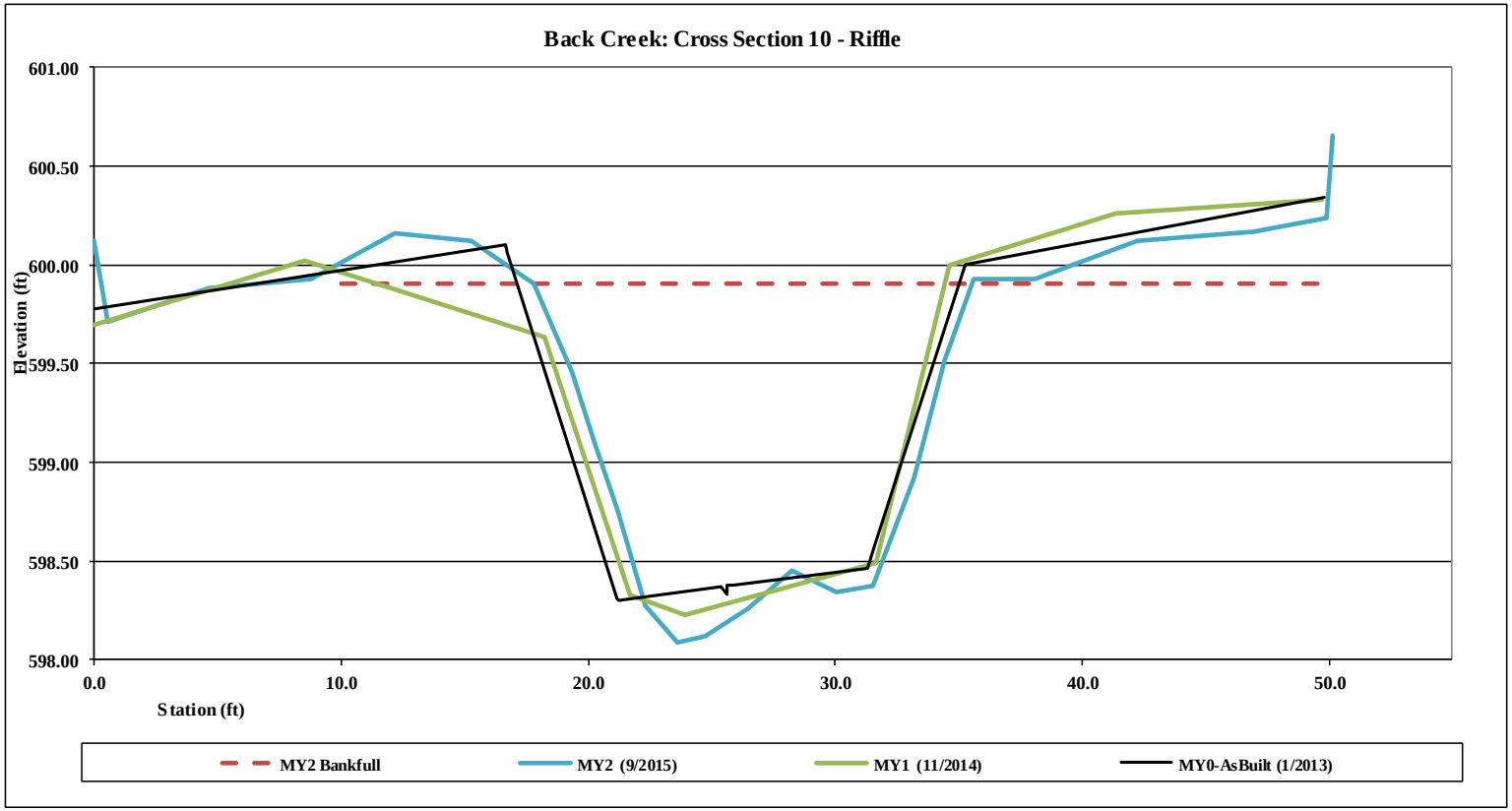


Figure 3.11 Cross Section Data

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-11, Pool	
Survey Date	9/2015	
SUMMARY DATA		
Bankfull Elevation (ft)		599.55
Bankfull Cross-Sectional Area (ft^2)		28.80
Bankfull Width (ft)		19.04
Flood Prone Area Elevation (ft)		602.40
Flood Prone Width (ft)		100.00
Bankfull Mean Depth (ft)		1.64
Bankfull Max Depth (ft)		2.85
W/D Ratio		11.61
Entrenchment Ratio		5.25
Bank Height Ratio		1.00

XS-11: Upstream

XS-11: Downstream

Station	Elevation	Notes
0.00	600.00	LPIN
0.21	599.99	
0.35	600.04	
3.53	600.08	
5.91	600.03	
8.91	600.05	
11.70	599.97	
13.87	599.91	TLB
16.97	599.15	
17.80	598.79	
18.63	597.89	
19.28	597.46	
20.22	597.12	
20.46	597.19	LEW
21.18	596.74	
22.61	596.70	THW
23.53	596.61	
25.02	596.73	
25.86	596.74	
26.37	597.10	REW
27.13	597.46	
28.09	597.95	
29.26	598.59	
30.72	599.10	
32.91	599.55	TRB
35.30	599.85	
38.94	600.17	
42.30	600.28	
46.10	600.29	
49.72	600.25	
50.43	600.72	RPIN

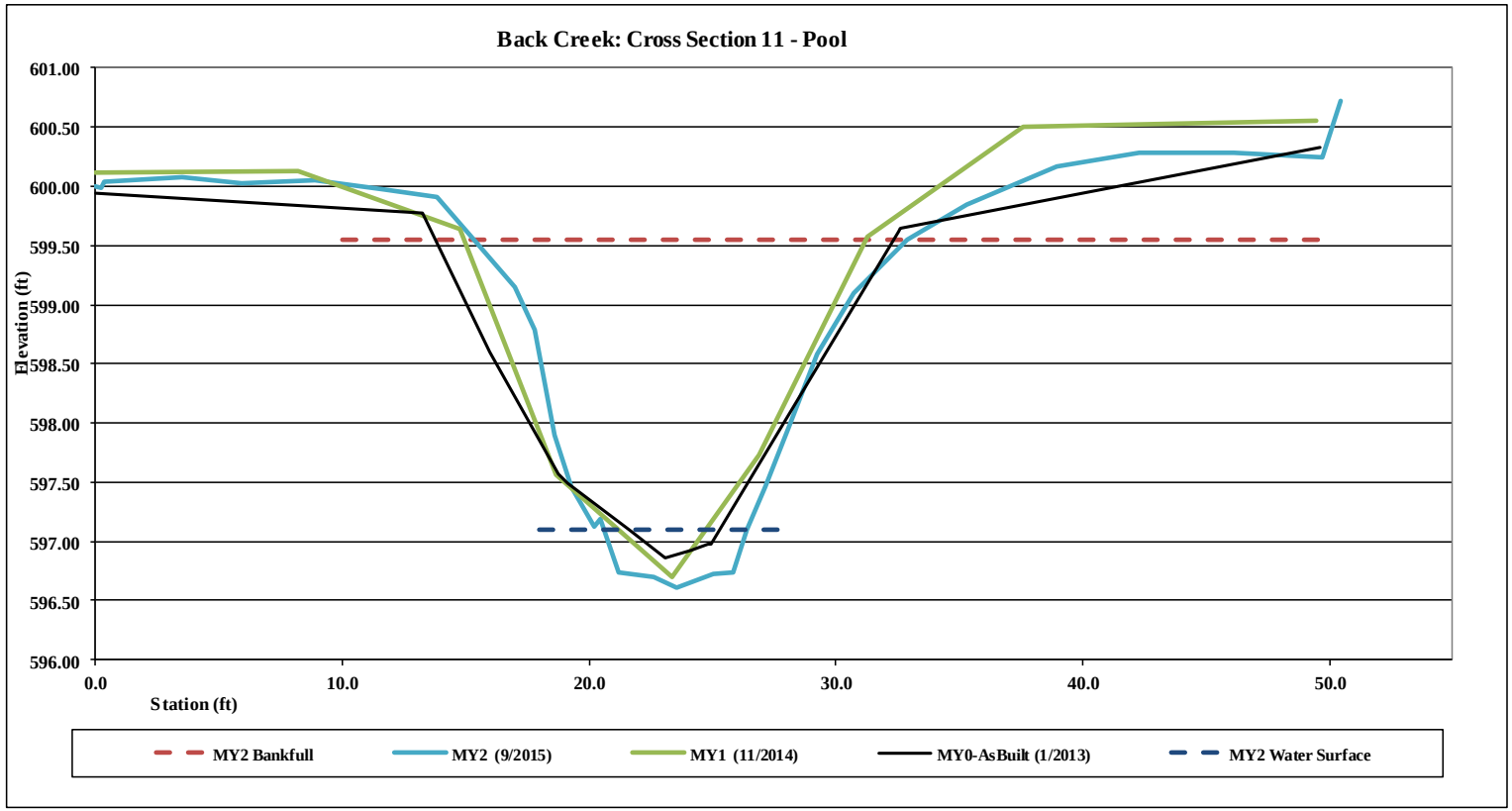


Figure 3.12 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-12, Riffle
Survey Date	9/2015
SUMMARY DATA	
Bankfull Elevation (ft)	595.97
Bankfull Cross-Sectional Area (ft^2)	20.40
Bankfull Width (ft)	17.50
Flood Prone Area Elevation (ft)	597.50
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.14
Bankfull Max Depth (ft)	1.53
W/D Ratio	15.35
Entrenchment Ratio	5.71
Bank Height Ratio	1.00

XS-12: Upstream

XS-12: Downstream

Station	Elevation	Notes
0.50	596.62	TLP
1.00	596.57	BLP
4.00	596.55	
7.00	596.57	
10.00	596.48	
13.00	596.26	
14.50	596.20	
16.00	595.97	TLB
17.00	595.49	
17.50	595.15	
19.00	594.47	BLB
22.50	594.58	
25.00	594.44	THW
28.00	594.54	
29.50	594.62	BRB
30.50	595.03	
32.00	595.36	
33.50	595.91	TRB
36.00	596.40	
39.00	596.60	
42.00	596.77	
45.00	597.14	
48.00	597.25	
49.50	597.33	BRP
50.40	597.85	TRP

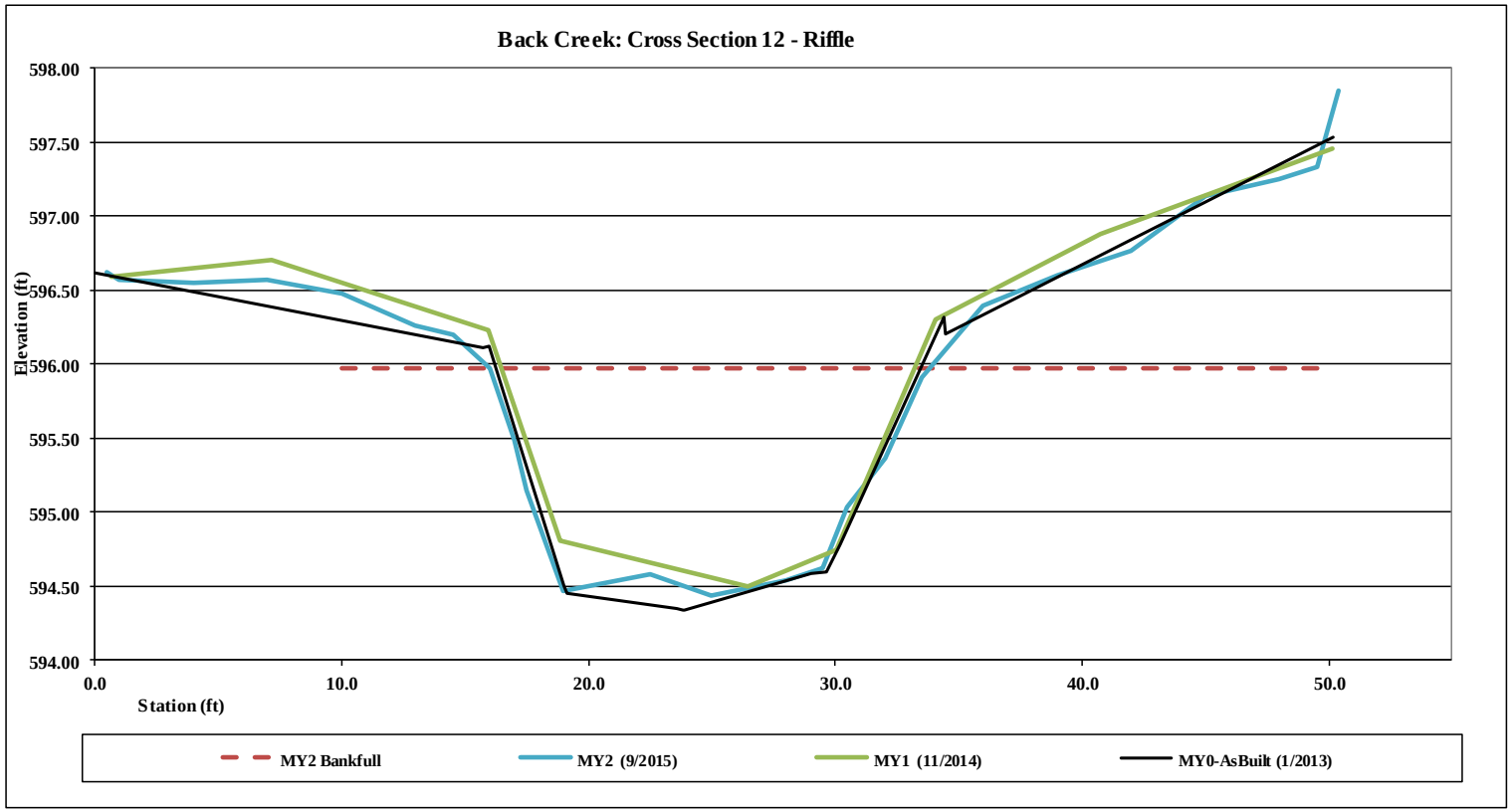


Figure 3.13 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-13, Pool
Survey Date	9/2015
SUMMARY DATA	
Bankfull Elevation (ft)	595.31
Bankfull Cross-Sectional Area (ft^2)	21.10
Bankfull Width (ft)	11.00
Flood Prone Area Elevation (ft)	597.62
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.74
Bankfull Max Depth (ft)	2.31
W/D Ratio	6.32
Entrenchment Ratio	9.09
Bank Height Ratio	1.00

XS-13: Upstream

XS-13: Downstream

Station	Elevation	Notes
0.40	596.87	TLP
0.90	596.62	BLP
4.00	596.56	
7.00	596.58	
10.00	596.52	
13.00	596.49	
16.00	596.30	
19.00	595.85	
21.50	595.44	
23.00	594.95	TLB
24.00	593.75	LEW-WS
24.00	593.24	BLB
26.00	593.00	THW
28.00	593.04	
30.00	593.18	
33.00	593.66	BRB
33.20	593.75	REW-WS
34.00	595.31	TRB
36.00	595.81	
39.00	596.27	
42.00	596.34	
45.00	596.57	
48.00	596.86	
51.00	597.19	BRP
51.40	597.51	TRP

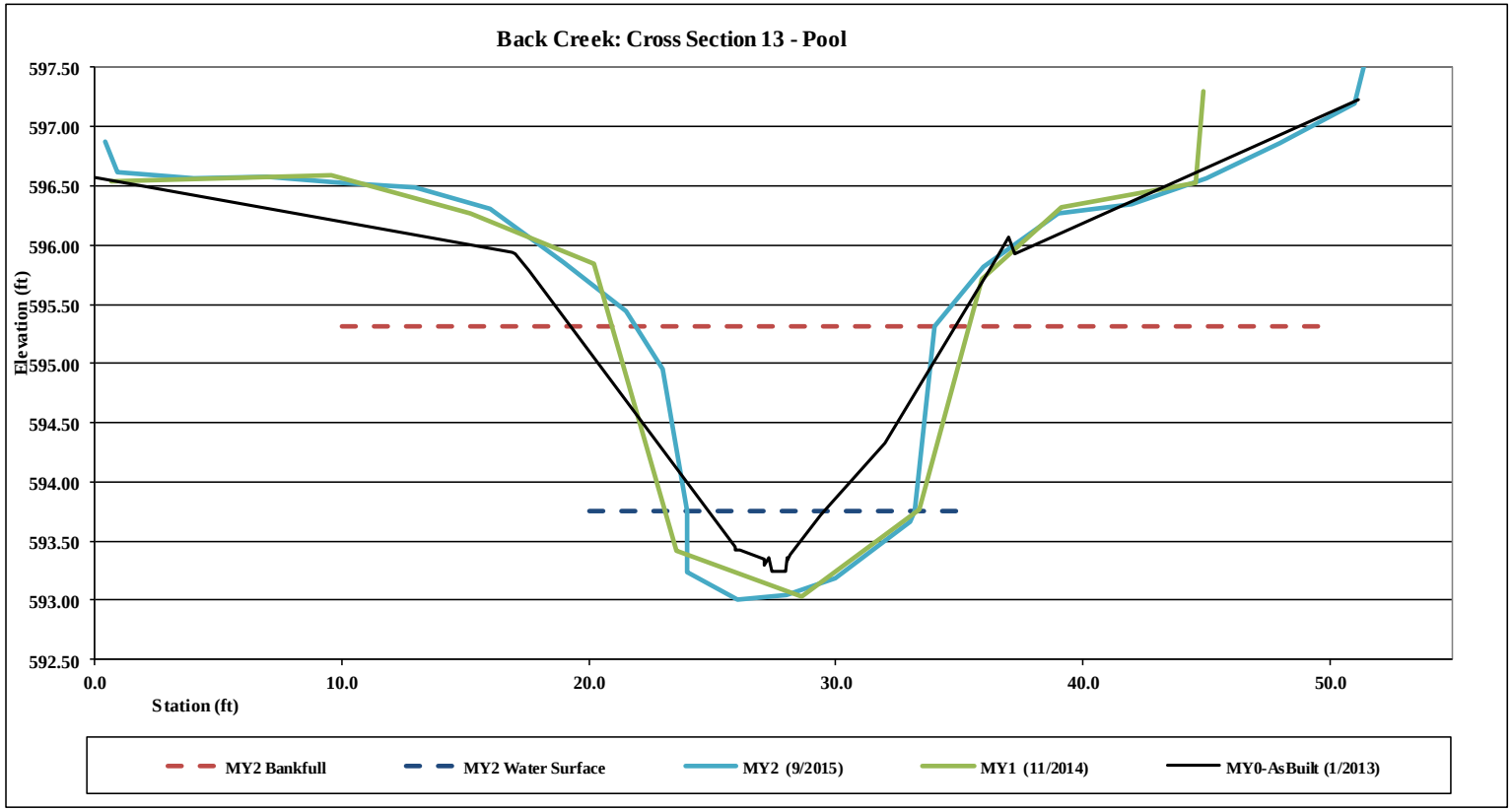


Figure 3.14 Cross Section Data

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-14, Riffle	
Survey Date	9/2015	
SUMMARY DATA		
Bankfull Elevation (ft)		594.65
Bankfull Cross-Sectional Area (ft^2)		22.30
Bankfull Width (ft)		18.42
Flood Prone Area Elevation (ft)		596.71
Flood Prone Width (ft)		70.00
Bankfull Mean Depth (ft)		1.01
Bankfull Max Depth (ft)		2.06
W/D Ratio		18.24
Entrenchment Ratio		3.80
Bank Height Ratio		1.00

XS-14: Upstream

XS-14: Downstream

Station	Elevation	Notes
0.00	596.30	LPIN
0.13	595.99	
2.29	595.38	
4.78	594.83	
7.93	594.59	
12.02	594.78	
16.65	594.66	
20.35	594.71	
22.18	594.56	TLB
24.38	594.00	
26.53	593.19	
28.22	592.77	
30.21	592.63	
32.10	592.59	THW
34.00	592.87	
35.82	593.58	
38.63	594.35	
40.60	594.65	TRB
43.19	594.69	
47.71	594.69	
53.08	594.77	
55.93	595.14	
58.51	595.71	
59.04	595.97	RPIN

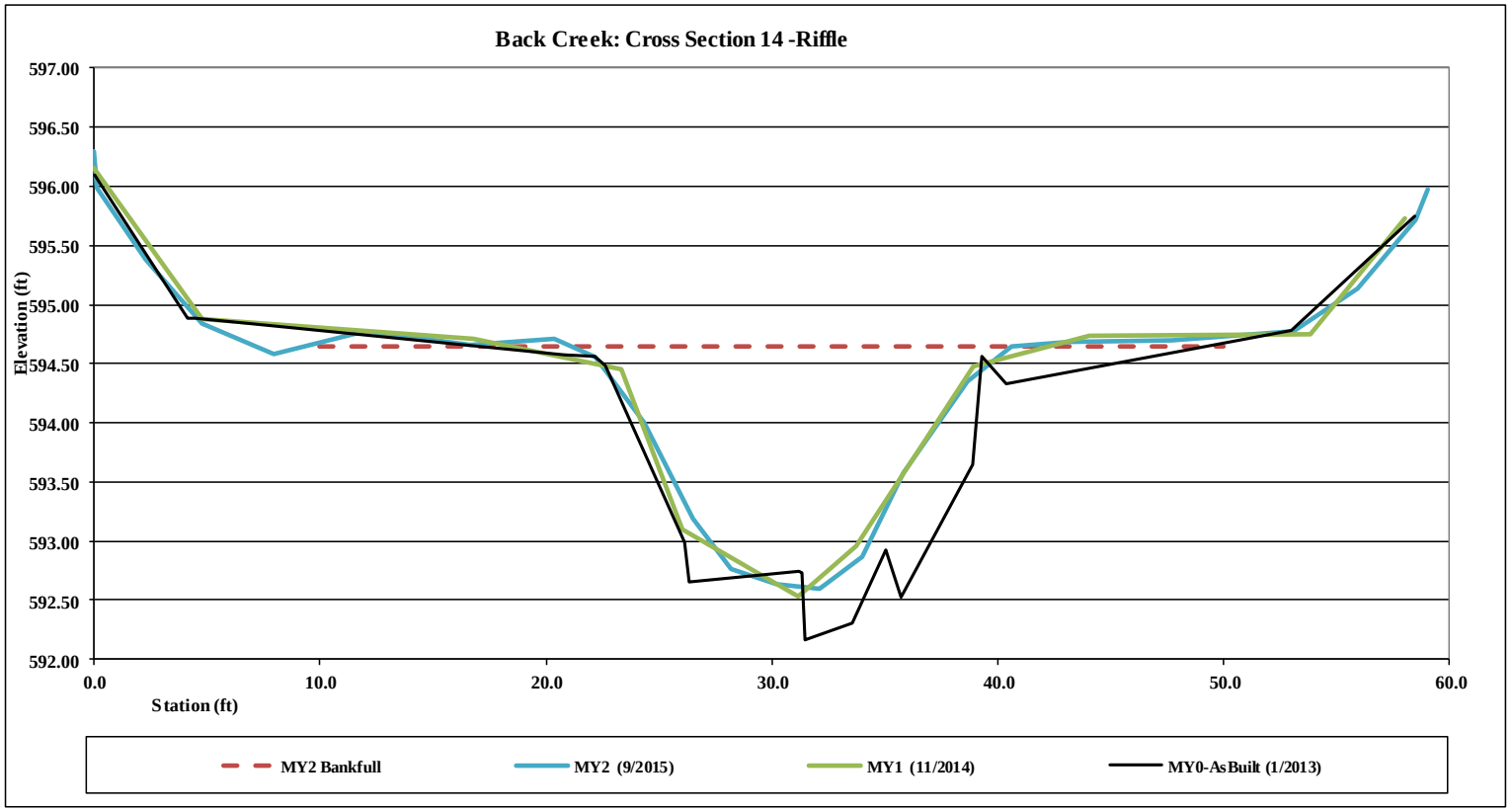


Figure 3.15 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-15, Pool
Survey Date	9/2015
SUMMARY DATA	
Bankfull Elevation (ft)	593.84
Bankfull Cross-Sectional Area (ft^2)	30.00
Bankfull Width (ft)	18.64
Flood Prone Area Elevation (ft)	596.96
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.84
Bankfull Max Depth (ft)	3.12
W/D Ratio	10.13
Entrenchment Ratio	5.37
Bank Height Ratio	1.00

XS-15: Upstream

XS-15: Downstream

Station	Elevation	Notes
0.00	595.40	LPIN
0.19	595.12	
1.38	595.11	
4.95	594.53	
9.28	594.64	
13.30	594.64	
16.08	594.41	
18.11	593.84	TLB
20.29	593.46	
21.94	592.53	
23.57	591.85	LEW
26.11	590.85	
29.23	590.72	THW
31.93	591.54	REW
33.34	593.30	
34.92	594.11	
36.74	594.57	TRB
38.73	594.45	
41.72	594.25	
44.73	594.29	
48.85	594.68	
52.34	594.97	
52.99	595.31	RPIN

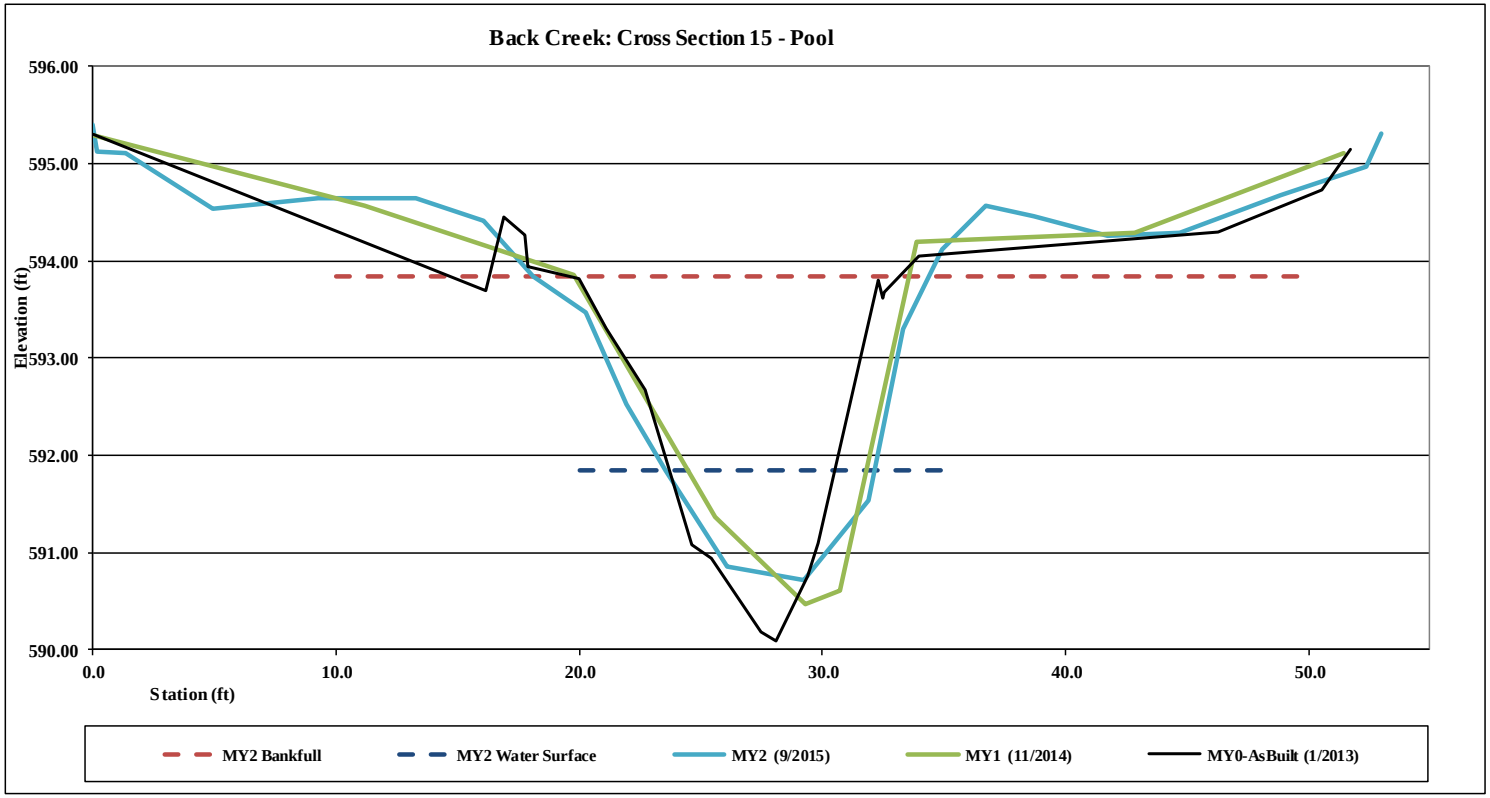


Figure 3.16 Cross Section Data

Project Name	**Heath Dairy**
DMS Project Number	**170**
Cross-Section ID	**XS-16, Pool**
Survey Date	**9/2015**
SUMMARY DATA	
Bankfull Elevation (ft)	588.16
Bankfull Cross-Sectional Area (ft^2)	45.00
Bankfull Width (ft)	21.29
Flood Prone Area Elevation (ft)	591.36
Flood Prone Width (ft)	60.00
Bankfull Mean Depth (ft)	2.45
Bankfull Max Depth (ft)	3.20
W/D Ratio	8.69
Entrenchment Ratio	2.82
Bank Height Ratio	1.00

XS-16: Upstream

XS-16: Downstream

Station	Elevation	Notes
0.00	592.11	LPIN
0.27	591.91	
4.50	592.18	
8.19	591.97	
11.69	591.53	
15.52	590.46	
19.47	589.94	
23.86	588.78	
27.55	589.05	
29.57	588.46	TLB
31.99	588.37	
33.31	587.85	
34.50	586.41	
36.53	586.37	LEW
37.54	585.23	
39.28	585.28	
40.26	585.11	
42.02	584.96	THW
43.57	584.91	
45.35	585.20	
47.09	585.18	
48.87	585.41	
49.56	585.74	REW
50.86	588.16	TRB
57.05	588.70	
57.35	588.30	
63.56	589.67	
65.78	589.74	
69.12	590.55	
71.50	591.76	
73.30	592.24	
72.38	592.53	RPIN

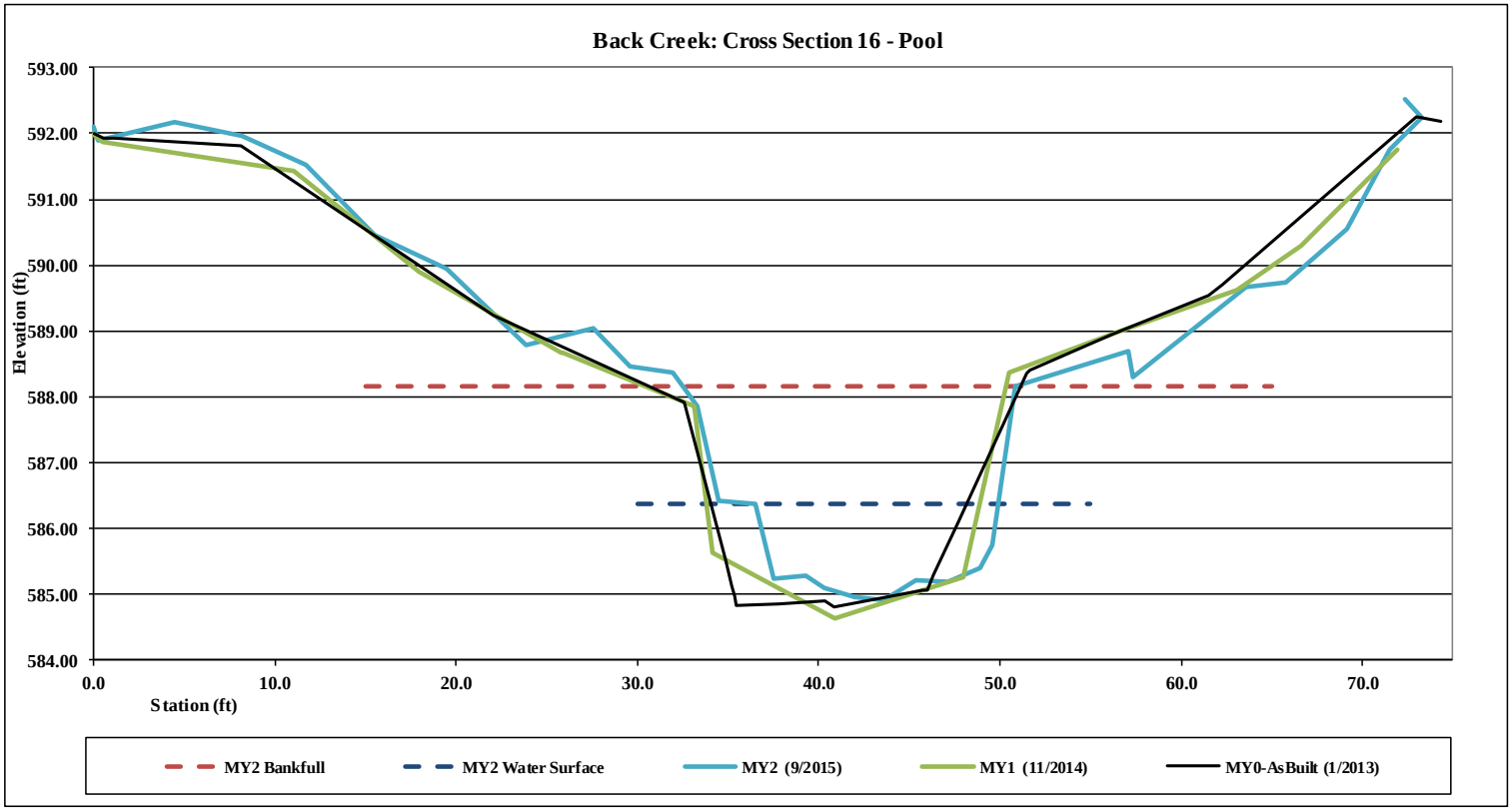


Figure 3.17 Cross Section Data

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-17, Pool	
Survey Date	9/2015	
SUMMARY DATA		
Bankfull Elevation (ft)		626.54
Bankfull Cross-Sectional Area (ft^2)		5.46
Bankfull Width (ft)		4.90
Flood Prone Area Elevation (ft)		627.92
Flood Prone Width (ft)		20.00
Bankfull Mean Depth (ft)		1.11
Bankfull Max Depth (ft)		1.38
W/D Ratio		4.41
Entrenchment Ratio		4.08
Bank Height Ratio		1.00

XS-17: Upstream

XS-17: Downstream

Station	Elevation	Notes
0.00	629.03	TLP
0.40	628.46	BLP
3.00	628.13	
6.00	627.48	
9.00	627.14	
11.90	626.54	TLB
12.70	625.27	BLB
14.00	625.16	THW
16.00	625.22	BRB
16.80	626.54	TRB
20.00	627.32	
23.00	627.65	
26.00	627.81	
29.60	627.96	BRP
30.20	628.46	TRP

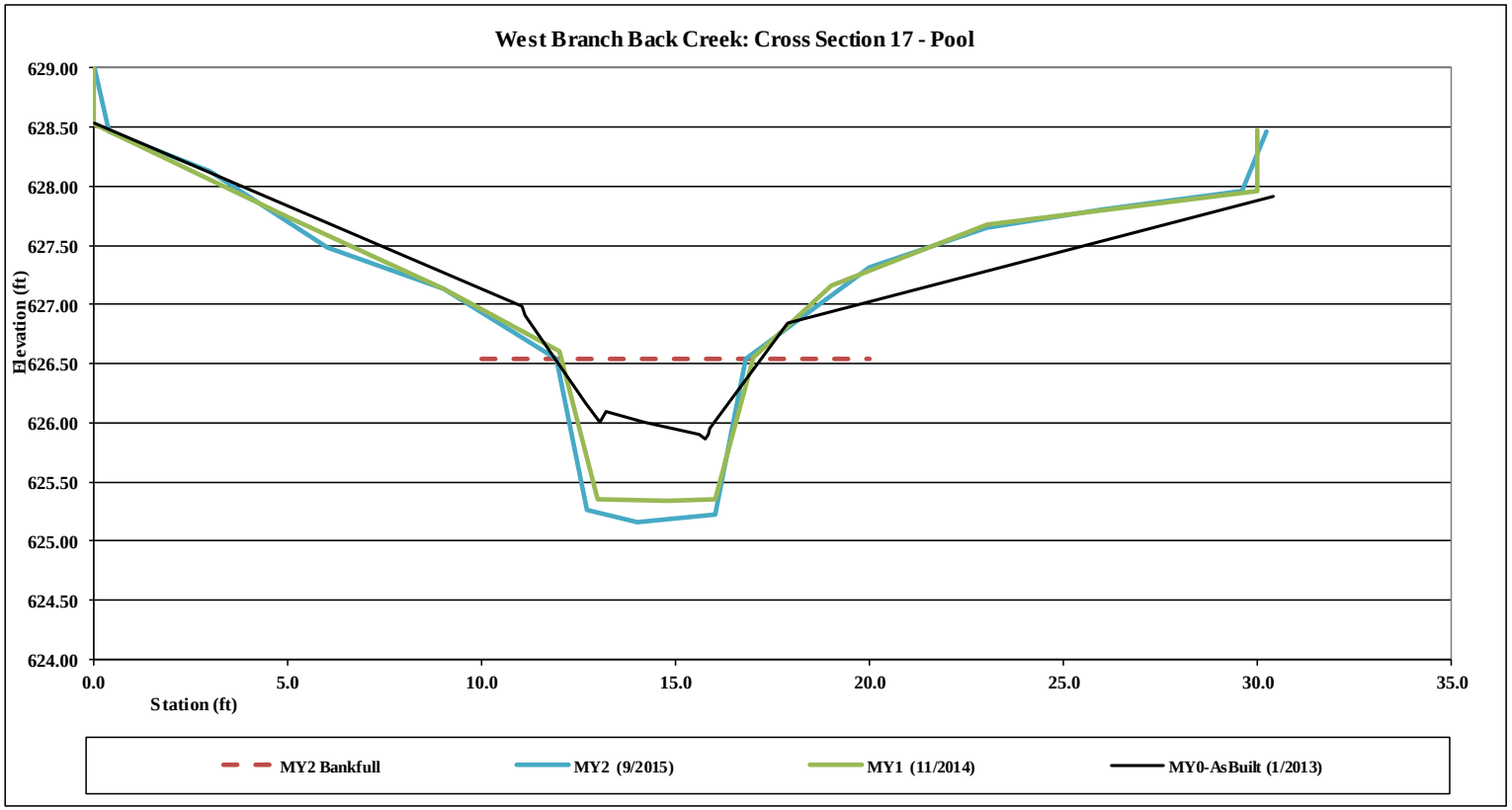


Figure 3.18 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-18, Riffle
Survey Date	9/2015
SUMMARY DATA	
Bankfull Elevation (ft)	626.62
Bankfull Cross-Sectional Area (ft^2)	5.42
Bankfull Width (ft)	6.30
Flood Prone Area Elevation (ft)	627.71
Flood Prone Width (ft)	30.00
Bankfull Mean Depth (ft)	0.54
Bankfull Max Depth (ft)	1.09
W/D Ratio	11.67
Entrenchment Ratio	4.76
Bank Height Ratio	1.00

Station	Elevation	Notes
0.00	628.23	TLP
0.40	627.87	BLP
3.10	627.40	
6.10	626.86	
9.10	626.45	
11.60	626.62	TLB
13.10	625.51	BLB
14.60	625.53	THW
16.40	625.60	BRB
17.90	626.68	TRB
21.10	626.92	
24.10	627.09	
27.10	627.20	
29.30	627.27	BRP
29.50	627.60	TRP

XS-18: Upstream

XS-18: Downstream

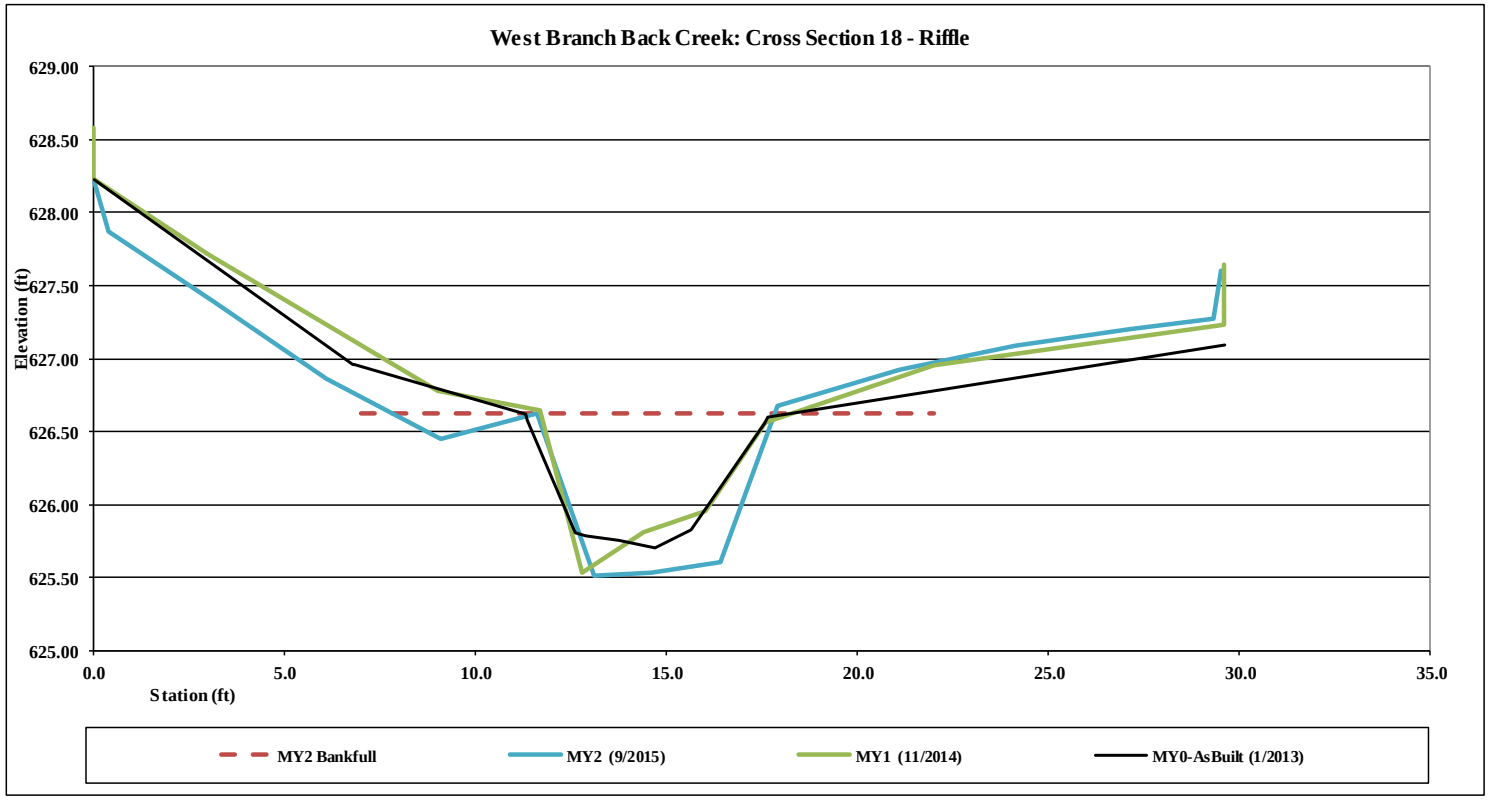


Figure 3.19 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-19, Riffle
Survey Date	9/2015
SUMMARY DATA	
Bankfull Elevation (ft)	616.16
Bankfull Cross-Sectional Area (ft^2)	4.15
Bankfull Width (ft)	8.72
Flood Prone Area Elevation (ft)	616.76
Flood Prone Width (ft)	30.00
Bankfull Mean Depth (ft)	0.27
Bankfull Max Depth (ft)	0.60
W/D Ratio	32.29
Entrenchment Ratio	3.44
Bank Height Ratio	1.00

Station	Elevation	Notes
0.00	617.31	LPIN
0.34	616.81	
3.19	616.68	
7.34	616.95	
11.44	616.72	
13.91	616.43	
16.70	616.12	
18.42	616.16	TLB
20.20	615.54	
21.52	615.76	
22.88	615.56	THW
24.06	615.65	
24.48	615.25	
25.32	615.66	
27.14	616.43	TRB
30.54	616.05	
34.34	616.11	
37.47	616.54	
39.83	616.67	
40.35	617.15	RPIN

XS-19: Upstream

XS-19: Downstream

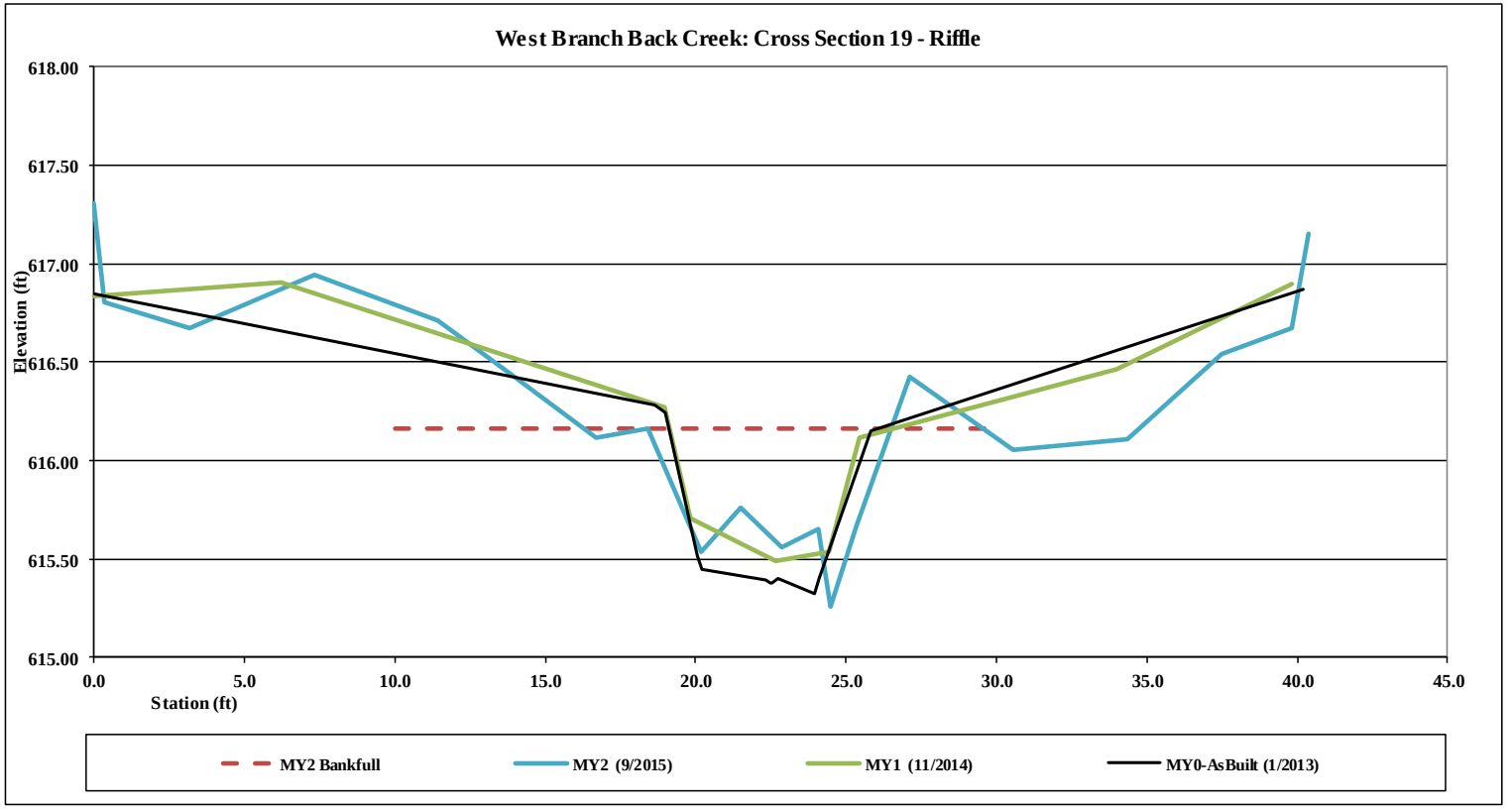


Figure 3.20 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-20, Riffle
Survey Date	9/2015
SUMMARY DATA	
Bankfull Elevation (ft)	608.78
Bankfull Cross-Sectional Area (ft^2)	4.37
Bankfull Width (ft)	12.01
Flood Prone Area Elevation (ft)	609.44
Flood Prone Width (ft)	30.00
Bankfull Mean Depth (ft)	0.44
Bankfull Max Depth (ft)	0.66
W/D Ratio	27.29
Entrenchment Ratio	2.50
Bank Height Ratio	1.00

XS-20: Upstream

XS-20: Downstream

Station	Elevation	Notes
0.00	609.79	LPIN
8.46	609.75	
10.68	609.70	
12.57	608.78	TLB
14.25	608.59	
15.45	608.83	
16.25	608.22	
17.23	608.15	
18.69	608.03	
19.87	608.12	THW
21.25	608.05	
22.03	608.44	
22.86	608.88	
23.63	609.25	
24.57	609.03	TRB
26.03	608.98	
29.44	608.91	
33.29	608.95	
36.69	608.79	
37.55	608.95	
39.97	609.40	
40.42	609.72	RPIN

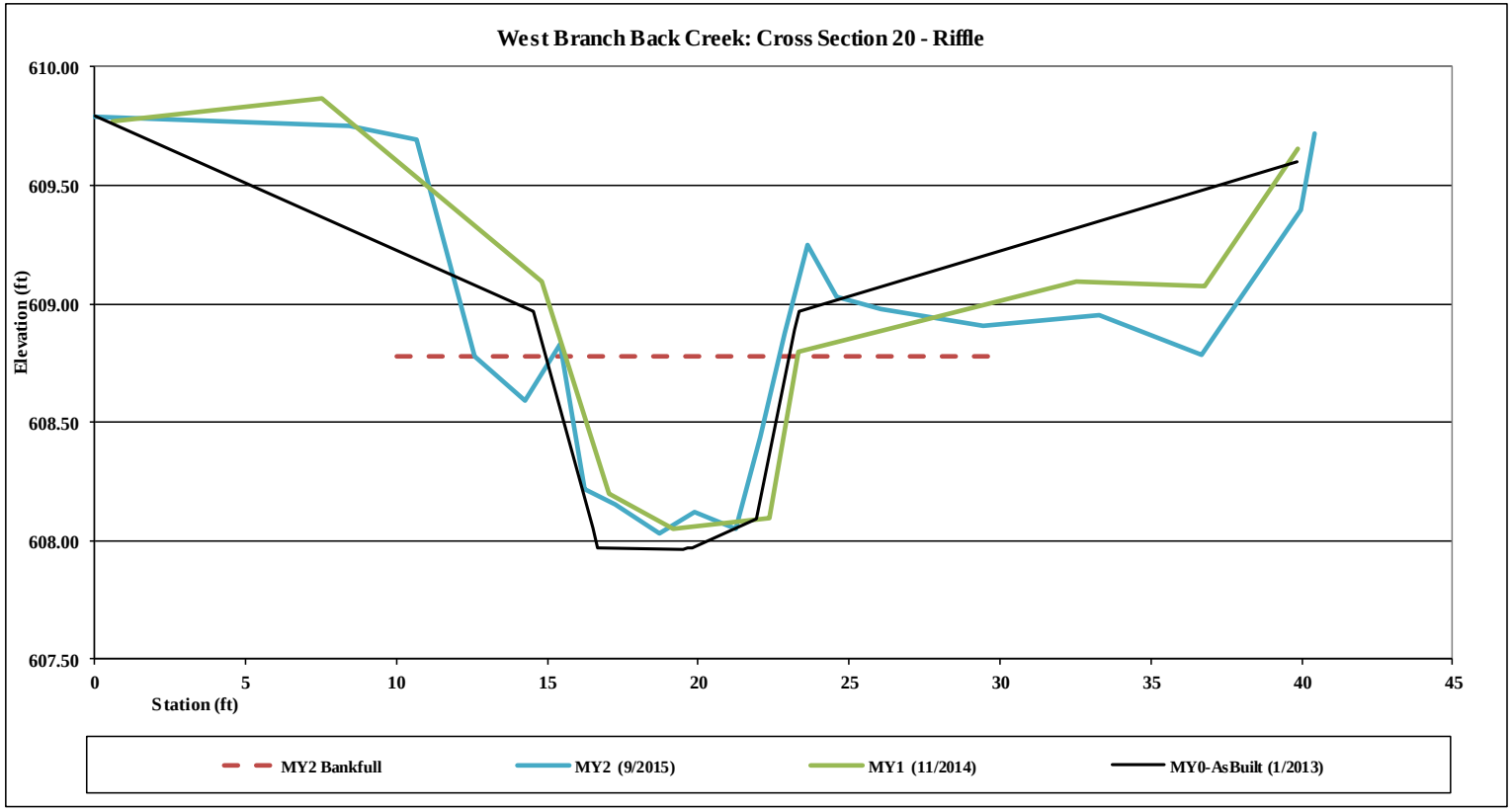
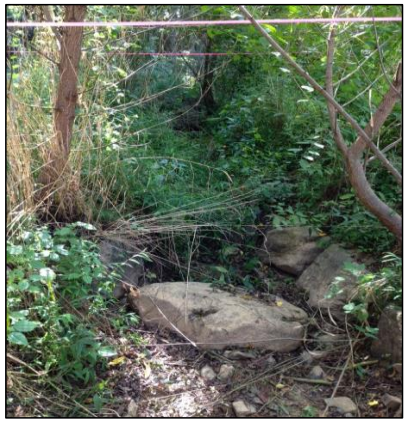


Figure 3.21 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-21, Pool
Survey Date	9/2015
SUMMARY DATA	
Bankfull Elevation (ft)	608.23
Bankfull Cross-Sectional Area (ft^2)	7.61
Bankfull Width (ft)	6.75
Flood Prone Area Elevation (ft)	609.79
Flood Prone Width (ft)	40.00
Bankfull Mean Depth (ft)	0.97
Bankfull Max Depth (ft)	1.56
W/D Ratio	6.96
Entrenchment Ratio	5.92
Bank Height Ratio	1.00



XS-21: Upstream

XS-21: Downstream

Station	Elevation	Notes
0.00	609.63	LPIN
0.16	609.27	
2.72	609.43	
5.99	609.08	
9.47	609.17	
13.09	609.04	
14.53	608.47	
15.46	608.79	
16.13	608.30	
17.14	607.18	
18.21	606.65	
19.32	606.67	THW
20.52	606.87	
21.04	607.24	
22.33	607.57	
23.90	608.23	TRB
26.44	608.27	
29.43	608.53	
32.44	608.32	
35.76	608.53	
37.84	608.95	
40.21	608.86	
40.52	609.50	RPIN

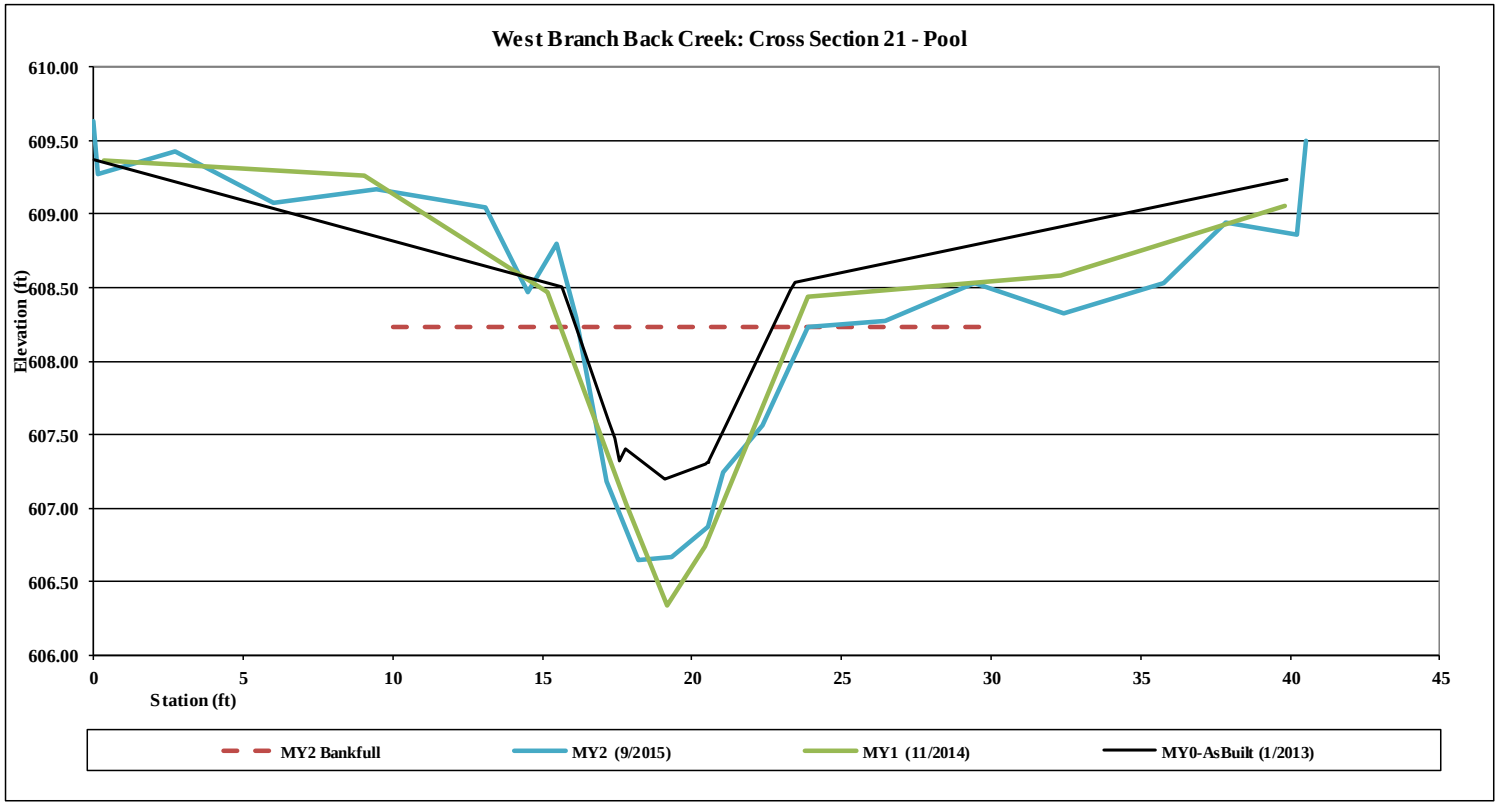


Figure 3.22 Cross Section Data

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-22, Riffle	
Survey Date	9/2015	
SUMMARY DATA		
Bankfull Elevation (ft)		613.89
Bankfull Cross-Sectional Area (ft^2)		8.45
Bankfull Width (ft)		7.15
Flood Prone Area Elevation (ft)		614.72
Flood Prone Width (ft)		75.00
Bankfull Mean Depth (ft)		0.46
Bankfull Max Depth (ft)		0.83
W/D Ratio		15.54
Entrenchment Ratio		10.49
Bank Height Ratio		1.00

XS-22: Upstream

XS-22: Downstream

Station	Elevation	Notes
0.00	614.37	LPIN
0.23	614.23	
3.65	613.99	
12.69	614.08	
16.70	613.97	TLB
17.41	613.30	
18.62	613.06	THW
19.98	613.19	
21.65	612.92	
22.72	613.33	
23.85	613.89	TRB
26.49	613.97	
27.67	613.87	
29.53	613.75	
31.29	613.36	
33.63	613.50	
36.23	613.43	
38.74	613.64	RPIN

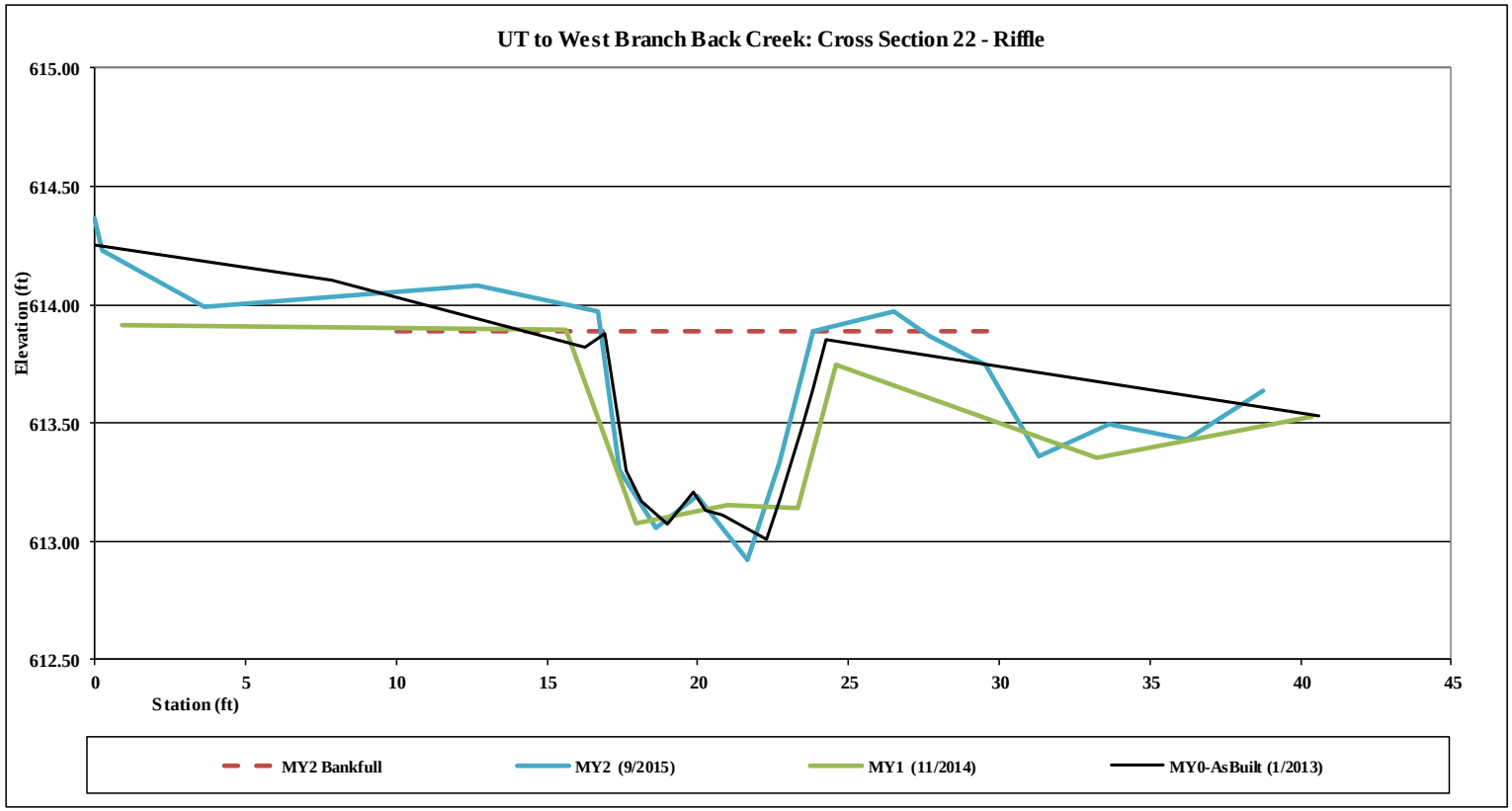


Figure 3.23 Cross Section Data

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-23, Pool	
Survey Date	9/2015	
SUMMARY DATA		
Bankfull Elevation (ft)		594.25
Bankfull Cross-Sectional Area (ft^2)		42.10
Bankfull Width (ft)		17.18
Flood Prone Area Elevation (ft)		598.82
Flood Prone Width (ft)		200.00
Bankfull Mean Depth (ft)		2.88
Bankfull Max Depth (ft)		4.57
W/D Ratio		5.96
Entrenchment Ratio		11.64
Bank Height Ratio		1.00

XS-23: Upstream

XS-23: Downstream

Station	Elevation	Notes
0.00	596.16	LPIN
0.35	595.83	
2.78	595.73	
7.01	595.56	
10.47	595.48	
14.24	594.94	
16.39	594.85	
19.57	594.25	TLB
20.82	592.69	
22.00	591.81	
23.24	591.27	
23.48	590.80	LEW
25.30	590.42	
26.58	589.82	
27.52	590.03	
28.65	589.68	THW
29.95	589.82	
31.10	592.12	
32.50	592.80	
33.63	593.30	
34.61	595.02	
36.74	595.24	TRB
38.96	595.44	
41.80	595.63	
45.72	595.76	
49.34	595.80	
54.46	595.56	
55.51	595.76	RPIN

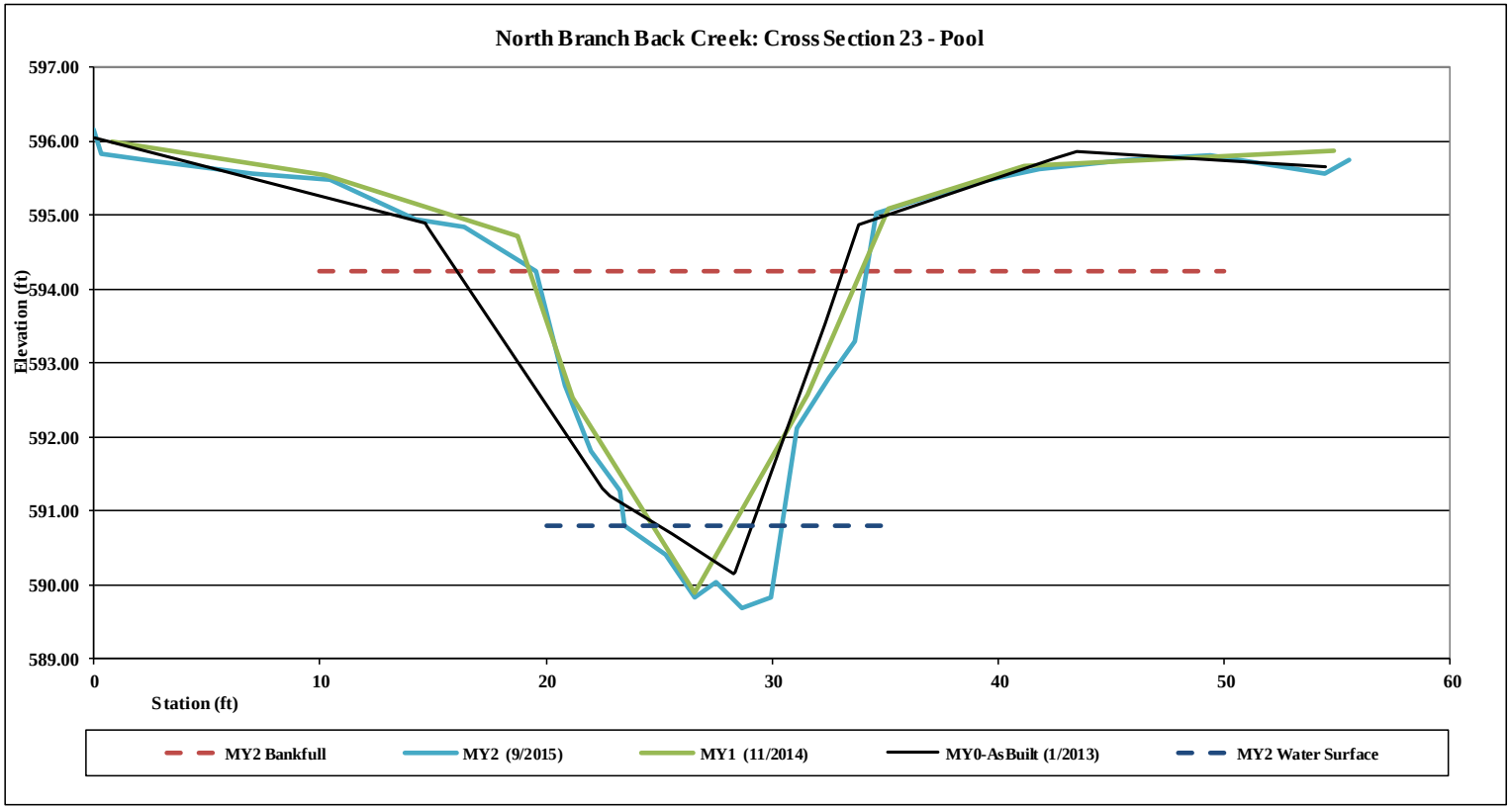


Figure 3.24 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-24, Riffle
Survey Date	9/2015
SUMMARY DATA	
Bankfull Elevation (ft)	594.83
Bankfull Cross-Sectional Area (ft^2)	29.40
Bankfull Width (ft)	22.41
Flood Prone Area Elevation (ft)	596.81
Flood Prone Width (ft)	200.00
Bankfull Mean Depth (ft)	1.33
Bankfull Max Depth (ft)	1.98
W/D Ratio	16.85
Entrenchment Ratio	8.92
Bank Height Ratio	1.00

XS-24: Upstream

XS-24: Downstream

Station	Elevation	Notes
0.00	596.22	LPIN
0.12	596.07	
2.88	595.97	
6.53	595.51	
10.76	595.02	
13.77	594.83	TLB
17.26	593.50	
19.01	593.23	
20.29	593.39	
21.74	593.16	
23.81	592.91	
26.21	592.85	THW
26.95	592.98	
30.59	592.78	
31.44	593.72	
33.77	594.50	
36.18	594.88	TRB
38.86	595.21	
41.97	595.34	
45.68	595.61	
49.46	595.83	
51.63	595.97	
51.92	596.31	RPIN

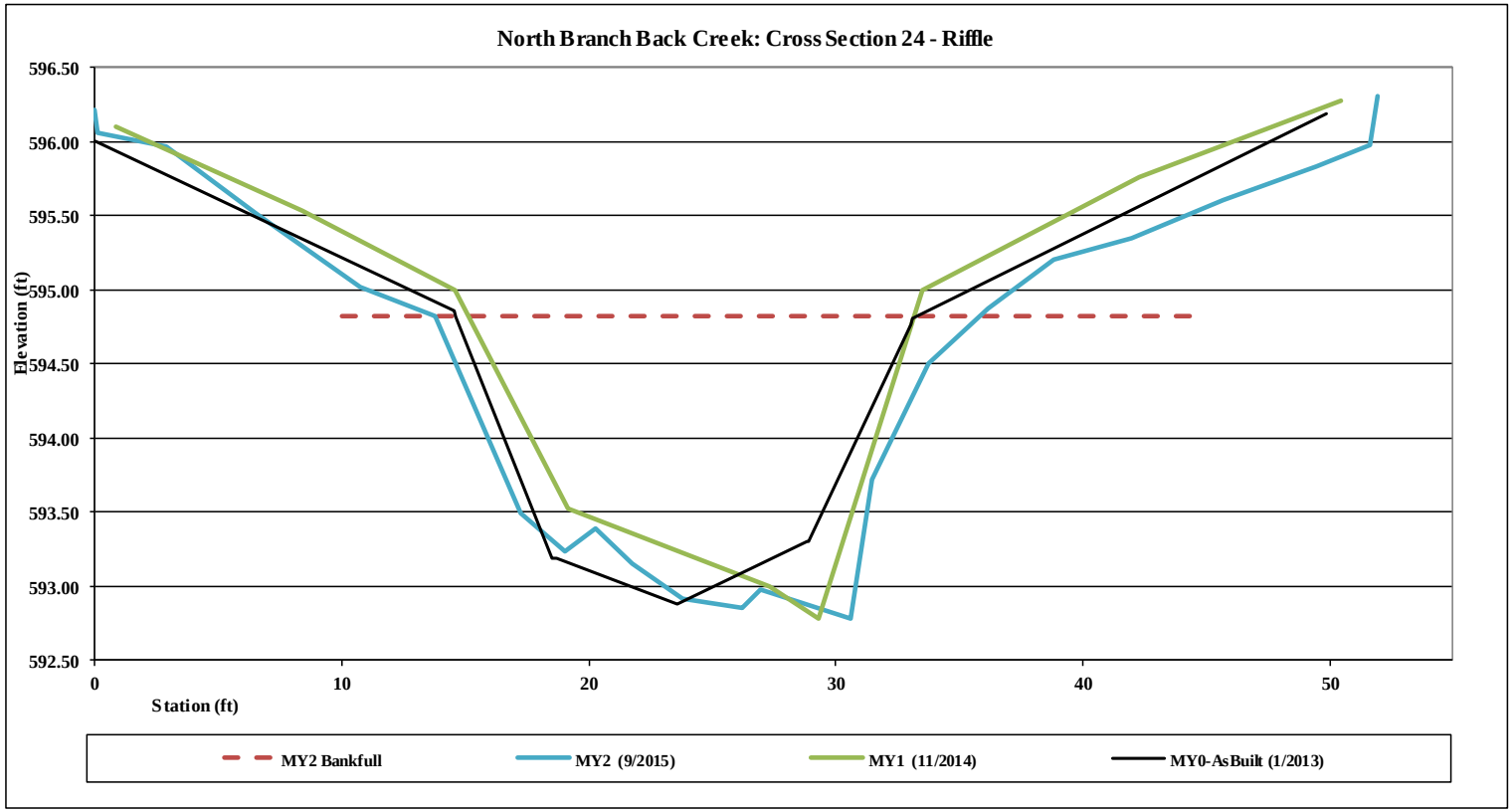


Figure 3.25 Cross Section Data

Project Name	Heath Dairy
DMS Project Number	170
Cross-Section ID	XS-25, Riffle
Survey Date	9/2015
SUMMARY DATA	
Bankfull Elevation (ft)	593.34
Bankfull Cross-Sectional Area (ft^2)	26.00
Bankfull Width (ft)	20.68
Flood Prone Area Elevation (ft)	595.08
Flood Prone Width (ft)	100.00
Bankfull Mean Depth (ft)	1.35
Bankfull Max Depth (ft)	1.74
W/D Ratio	15.32
Entrenchment Ratio	4.84
Bank Height Ratio	1.00

XS-25: Upstream

XS-25: Downstream

Station	Elevation	Notes
0.00	594.78	LPIN
0.43	594.63	
3.02	594.56	
7.13	594.24	
10.42	593.96	
13.80	593.56	
15.33	593.34	TLB
17.07	592.46	
18.52	591.90	
20.09	591.50	
21.97	591.21	
23.60	591.60	THW
25.60	591.58	
27.13	591.67	
29.19	591.57	
30.63	592.19	
32.37	592.65	
34.12	593.21	
36.01	593.66	TRB
39.69	593.92	
44.62	593.95	
50.42	594.23	
50.86	594.46	RPIN

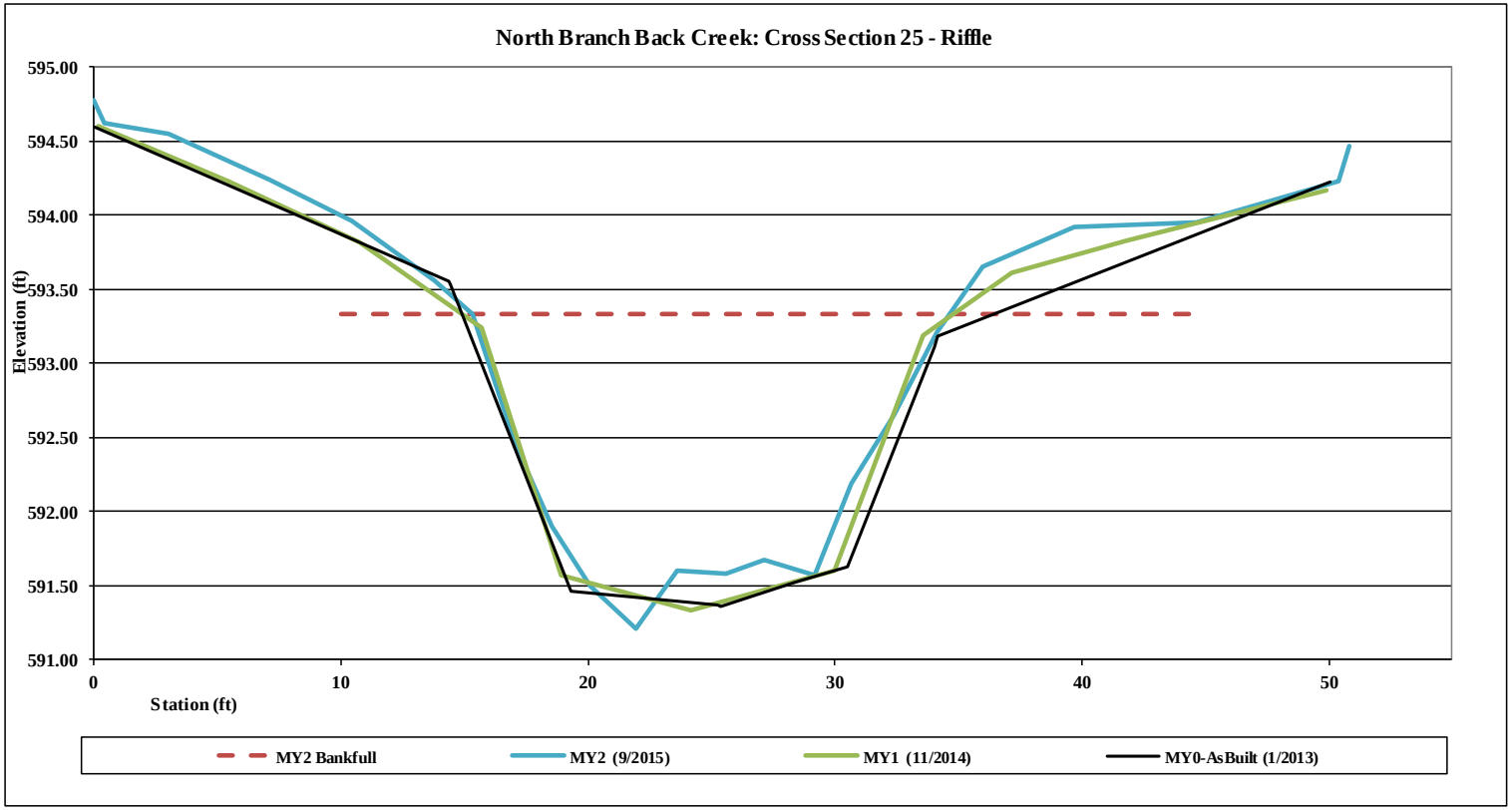


Figure 3.26 Cross Section Data

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-26, Pool	
Survey Date	9/2015	
SUMMARY DATA		
Bankfull Elevation (ft)		596.27
Bankfull Cross-Sectional Area (ft^2)		6.32
Bankfull Width (ft)		11.80
Flood Prone Area Elevation (ft)		597.58
Flood Prone Width (ft)		50.00
Bankfull Mean Depth (ft)		0.68
Bankfull Max Depth (ft)		1.31
W/D Ratio		17.36
Entrenchment Ratio		4.24
Bank Height Ratio		1.00

XS-26: Upstream

XS-26: Downstream

Station	Elevation	Notes
0.00	596.55	LPIN
0.18	596.42	
3.82	596.73	
6.63	596.72	
9.33	596.52	
11.44	596.94	TLB
13.25	596.67	
14.64	595.95	
16.04	596.03	
17.42	595.38	
19.11	594.96	THW
20.44	594.99	
21.21	595.59	
23.24	596.27	TRB
26.11	596.42	
30.40	596.79	
34.27	597.28	
39.94	597.93	RPIN

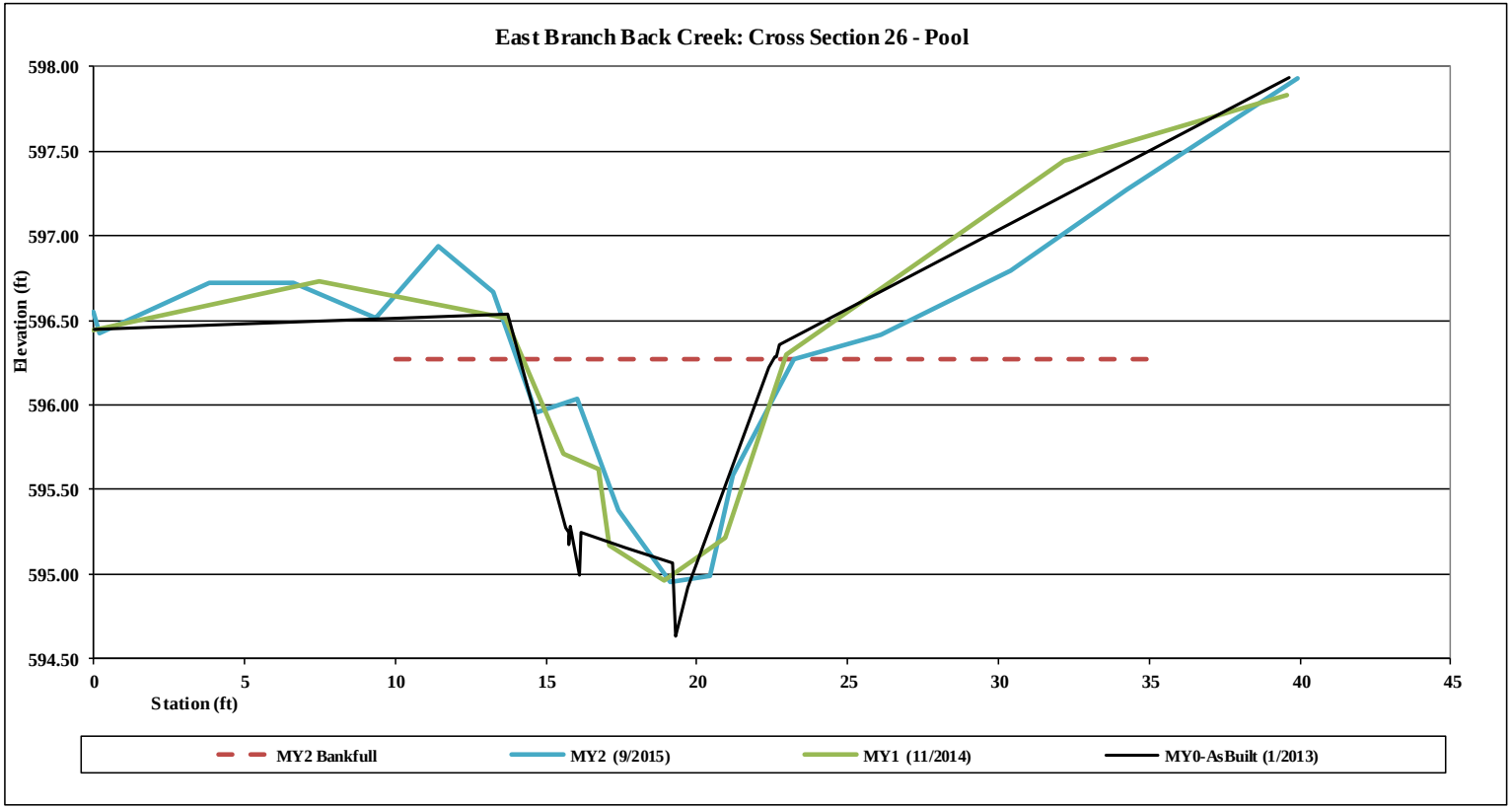


Figure 3.27 Cross Section Data

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-27, Riffle	
Survey Date	9/2015	
SUMMARY DATA		
Bankfull Elevation (ft)		596.26
Bankfull Cross-Sectional Area (ft^2)		6.15
Bankfull Width (ft)		10.94
Flood Prone Area Elevation (ft)		596.94
Flood Prone Width (ft)		50.00
Bankfull Mean Depth (ft)		0.30
Bankfull Max Depth (ft)		0.68
W/D Ratio		36.48
Entrenchment Ratio		4.57
Bank Height Ratio		1.00

XS-27: Upstream

XS-27: Downstream

Station	Elevation	Notes
0.00	596.33	LPIN
0.02	596.19	
1.95	596.19	
6.03	596.27	
9.55	596.12	
11.55	596.35	TLB
13.23	596.04	
15.52	595.39	
17.11	595.58	THW
18.91	595.33	
20.90	595.94	
22.49	596.26	TRB
24.62	596.31	
25.95	596.37	
31.94	596.62	
36.15	596.74	
39.71	597.28	
39.94	597.61	RPIN

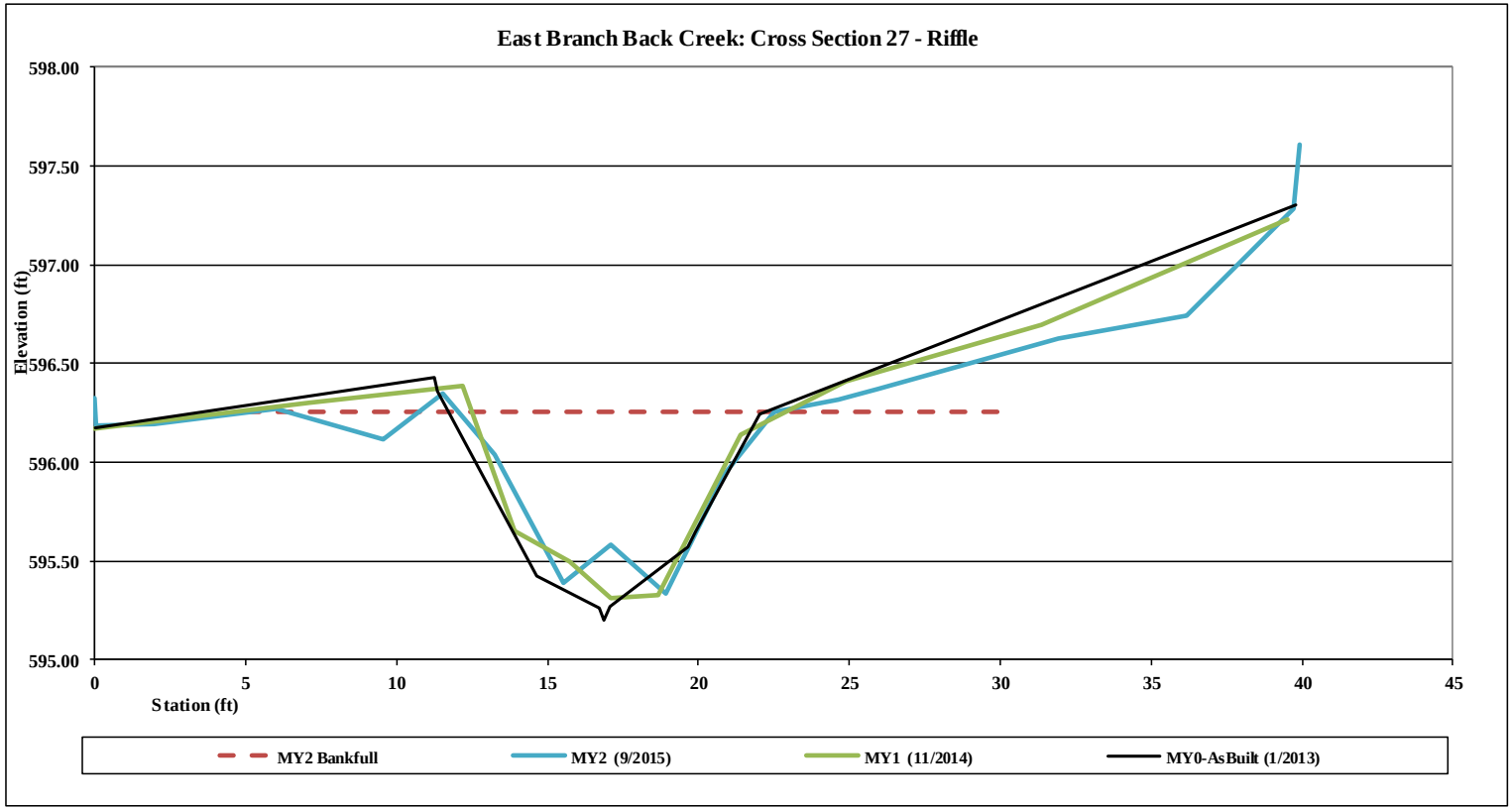


Figure 3.28 Cross Section Data

Project Name	Heath Dairy	
DMS Project Number	170	
Cross-Section ID	XS-28,Riffle	
Survey Date	9/2015	
SUMMARY DATA		
Bankfull Elevation (ft)		594.31
Bankfull Cross-Sectional Area (ft^2)		7.38
Bankfull Width (ft)		12.68
Flood Prone Area Elevation (ft)		595.33
Flood Prone Width (ft)		50.00
Bankfull Mean Depth (ft)		0.35
Bankfull Max Depth (ft)		1.01
W/D Ratio		36.24
Entrenchment Ratio		3.94
Bank Height Ratio		1.00

XS-28: Upstream

XS-28: Downstream

Station	Elevation	Notes
0.00	595.71	LPIN
0.57	595.64	
4.08	595.44	
9.85	594.82	
13.02	594.74	
16.30	594.60	TLB
18.66	594.28	
19.99	593.91	
21.30	593.68	
22.68	593.30	THW
23.95	593.22	
25.17	593.51	
26.76	593.63	
28.98	594.31	TRB
32.29	594.20	
36.71	594.19	
40.10	594.34	
40.64	594.60	RPIN

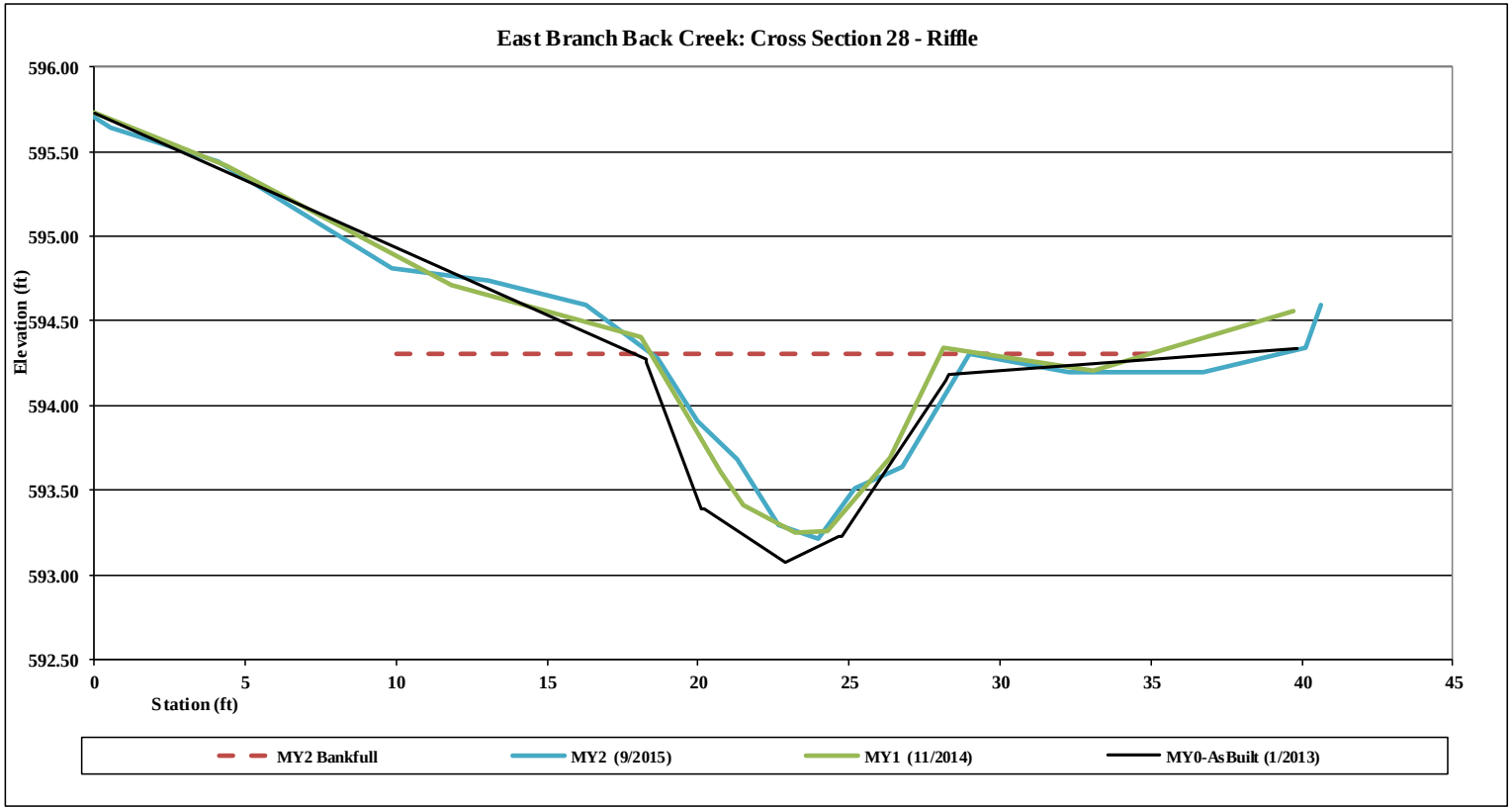
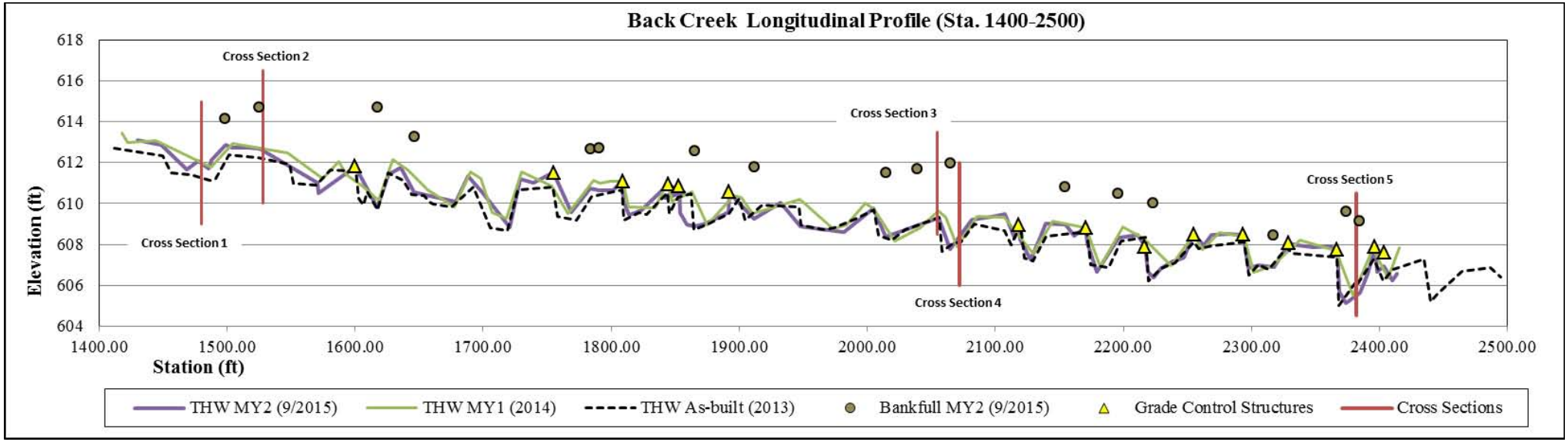
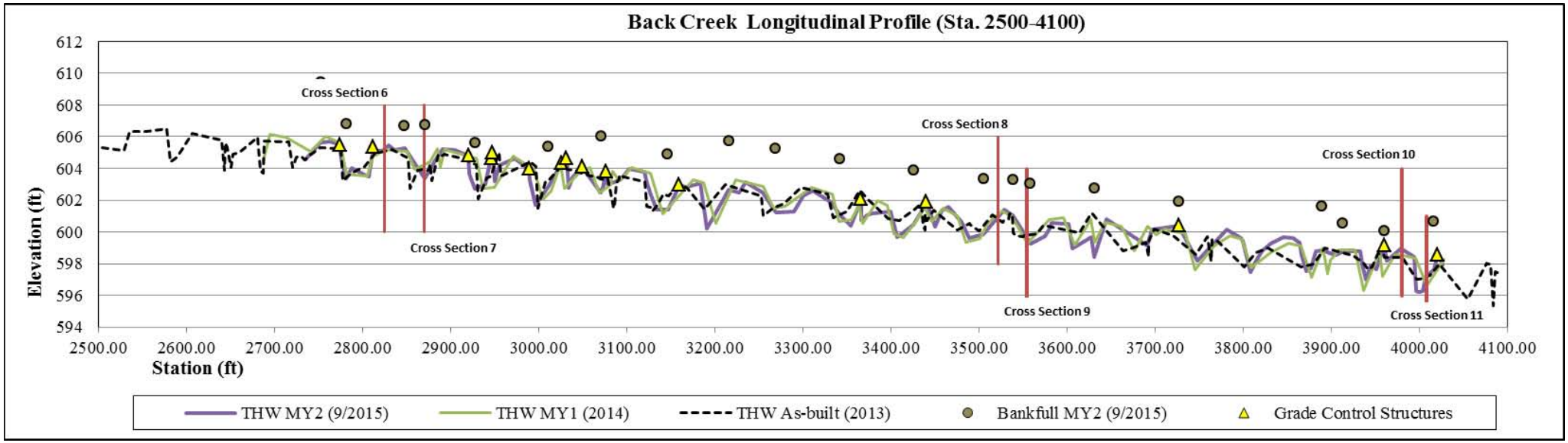


Figure 4.1. Longitudinal Profile





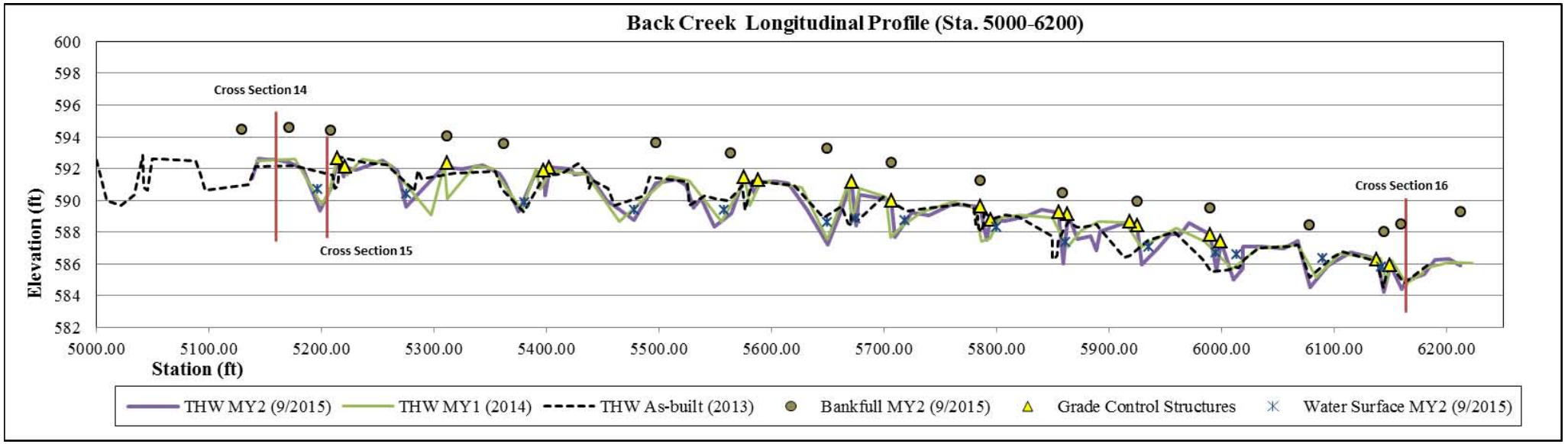
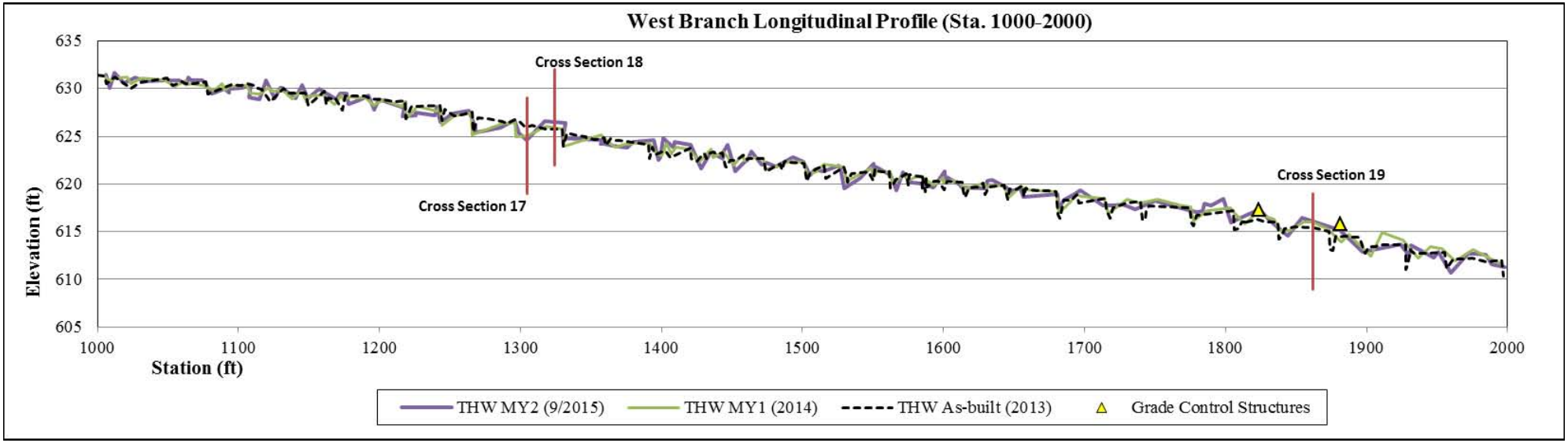

Back Creek Longitudinal Profile (Sta. 5000-6200)
Elevation (ft)
600
598
596
594
592
590
588
586
584
582
Cross Section 14
Cross Section 15
Cross Section 16
5000.00
5100.00
5200.00
5300.00
5400.00
5500.00
5600.00
5700.00
5800.00
5900.00
6000.00
6100.00
6200.00
Station (ft)
THW MY2 (9/2015)
THW MY1 (2014)
THW As-built (2013)
Bankfull MY2 (9/2015)
Grade Control Structures
Water Surface MY2 (9/2015)

Figure 4.2. Longitudinal Profile



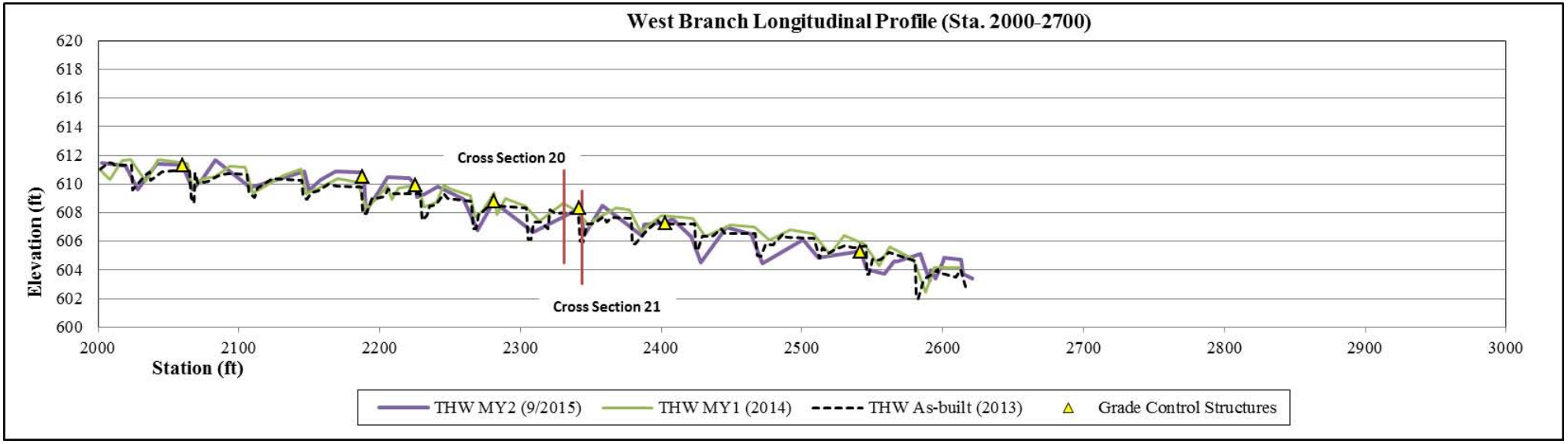


Figure 4.3. Longitudinal Profile

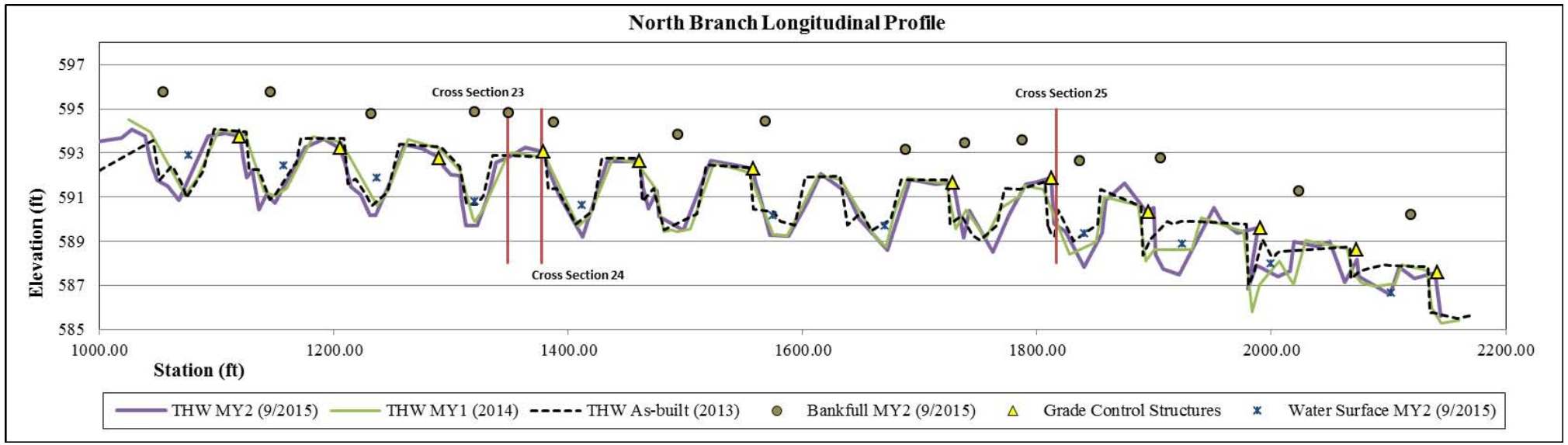


Figure 4.4. Longitudinal Profile

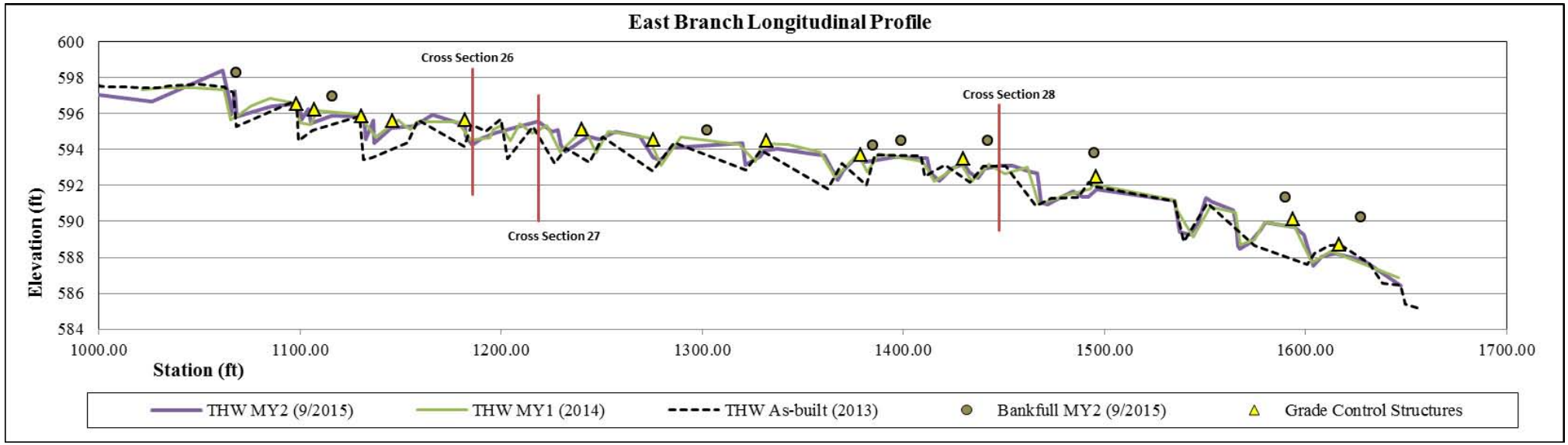
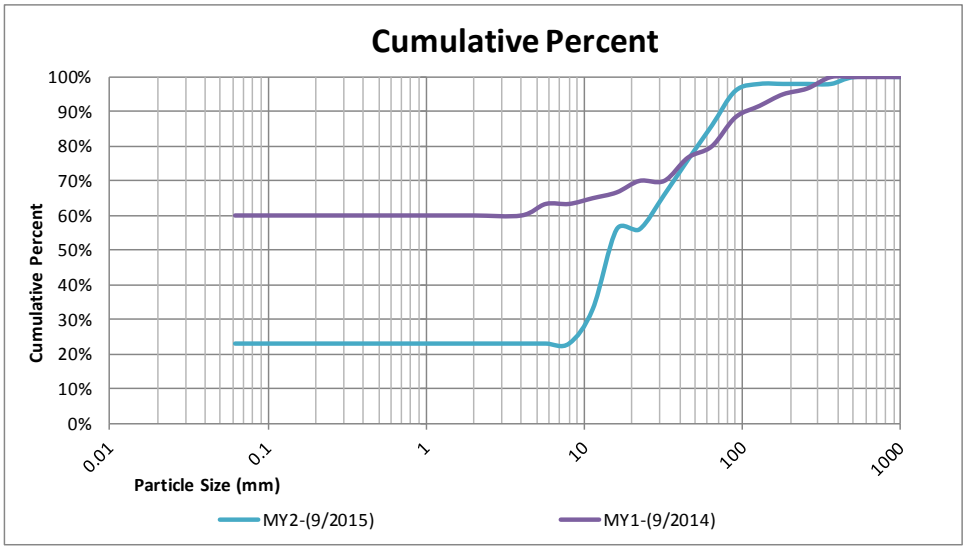


Figure 5.1. Pebble Counts

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Pool (XS 1)					
			MY2-(9/2015)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	23	23%	23%
Sand	very fine sand	0.125	0	0%	23%
	fine sand	0.250	0	0%	23%
	medium sand	0.50	0	0%	23%
	coarse sand	1.00	0	0%	23%
	very coarse sand	2.0	0	0%	23%
Gravel	very fine gravel	4.0	0	0%	23%
	fine gravel	5.7	0	0%	23%
	fine gravel	8.0	0	0%	23%
	medium gravel	11.3	10	10%	33%
	medium gravel	16.0	23	23%	56%
	course gravel	22.3	0	0%	56%
	course gravel	32.0	10	10%	66%
	very coarse gravel	45	10	10%	76%
	very coarse gravel	64	10	10%	86%
Cobble	small cobble	90	10	10%	96%
	medium cobble	128	2	2%	98%
	large cobble	180	0	0%	98%
	very large cobble	256	0	0%	98%
Boulder	small boulder	362	0	0%	98%
	small boulder	512	2	2%	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	16.0
D84	64.0
D95	90.0



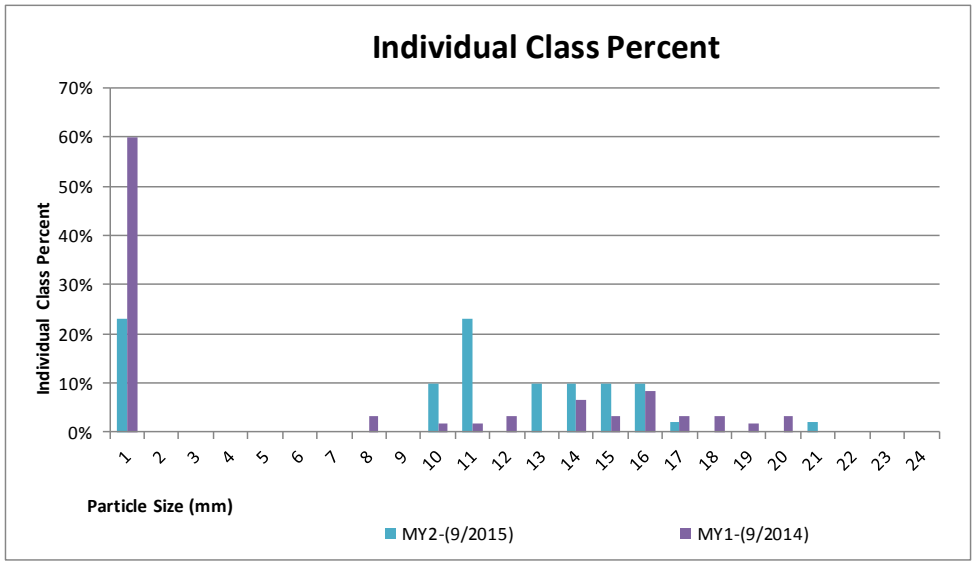
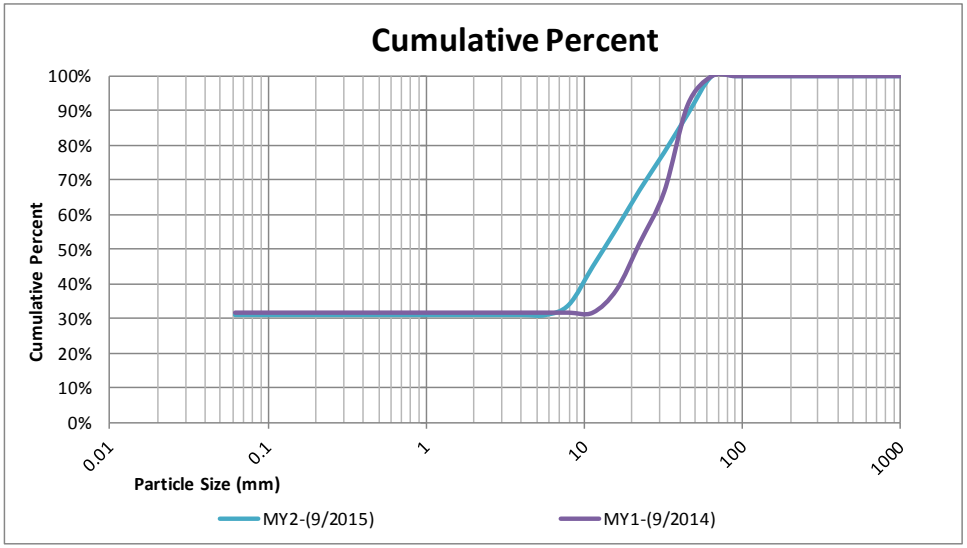


Figure 5.2. Pebble Counts

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 2)					
			MY2-(9/2015)		
Description	**Material**	**Size (mm)**	**Total #**	**Item %**	**Cum %**
Silt/Clay	silt/clay	0.062	31	31%	31%
Sand	very fine sand	0.125	0	0%	31%
	fine sand	0.250	0	0%	31%
	medium sand	0.50	0	0%	31%
	coarse sand	1.00	0	0%	31%
	very coarse sand	2.0	0	0%	31%
Gravel	very fine gravel	4.0	0	0%	31%
	fine gravel	5.7	0	0%	31%
	fine gravel	8.0	3	3%	34%
	medium gravel	11.3	11	11%	45%
	medium gravel	16.0	11	11%	56%
	course gravel	22.3	11	11%	67%
	course gravel	32.0	11	11%	78%
	very coarse gravel	45	11	11%	89%
	very coarse gravel	64	11	11%	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	16.0
D84	45.0
D95	64.0



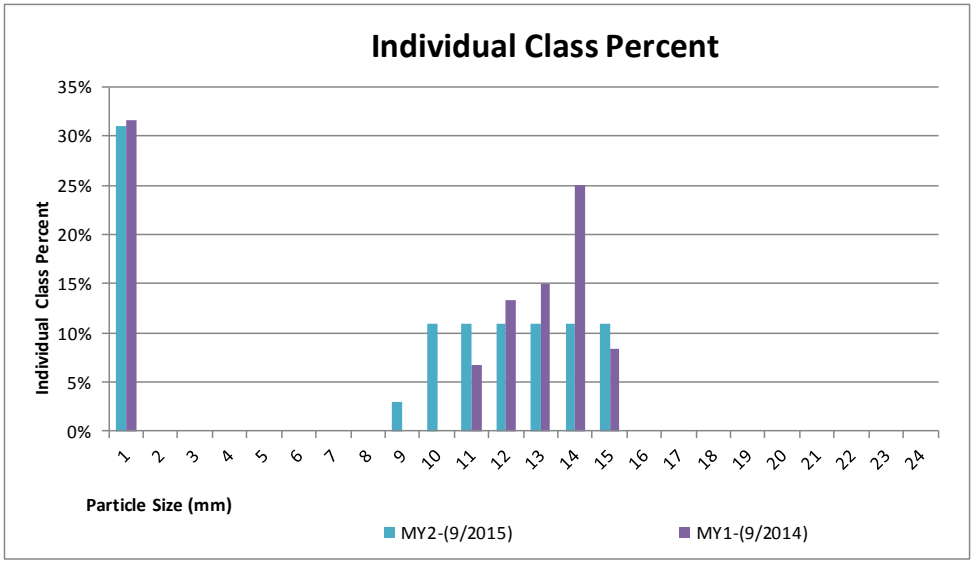
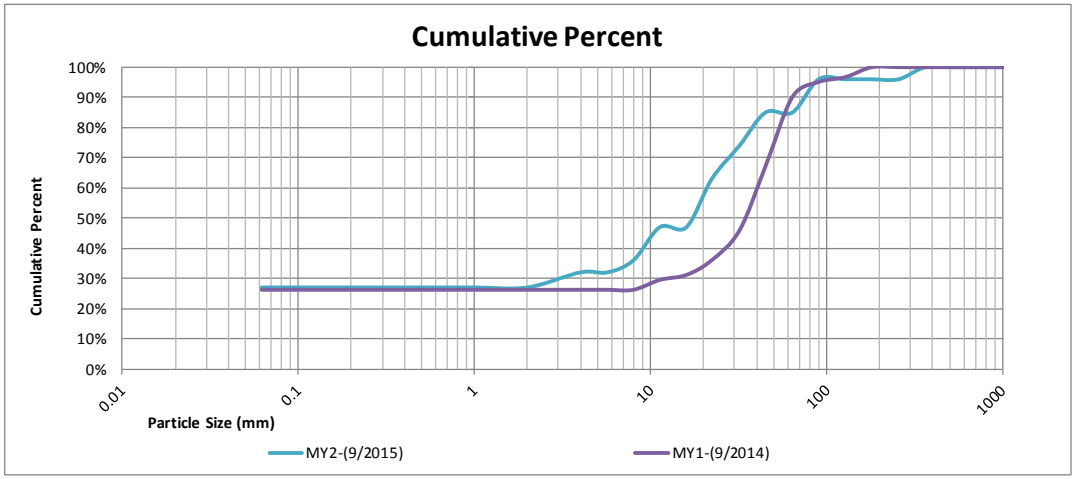


Figure 5.3. Pebble Counts

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 3)					
			MY2-(9/2015)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	27	27%	27%
Sand	very fine sand	0.125	0	0%	27%
	fine sand	0.250	0	0%	27%
	medium sand	0.50	0	0%	27%
	coarse sand	1.00	0	0%	27%
	ery coarse san	2.0	0	0%	27%
Gravel	very fine grave	4.0	5	5%	32%
	fine gravel	5.7	0	0%	32%
	fine gravel	8.0	4	4%	36%
	medium gravel	11.3	11	11%	47%
	medium gravel	16.0	0	0%	47%
	course gravel	22.3	16	16%	63%
	course gravel	32.0	11	11%	74%
	ery coarse grav	45	11	11%	85%
	ery coarse grav	64	0	0%	85%
Cobble	small cobble	90	11	11%	96%
	medium cobble	128	0	0%	96%
	large cobble	180	0	0%	96%
	ery large cobbl	256	0	0%	96%
Boulder	small boulder	362	4	4%	100%
	small boulder	512	0	0%	100%
	medium boulde	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole coun		-	100	100%	100%

Summary Data	
D50	22.0
D84	45.0
D95	90.0



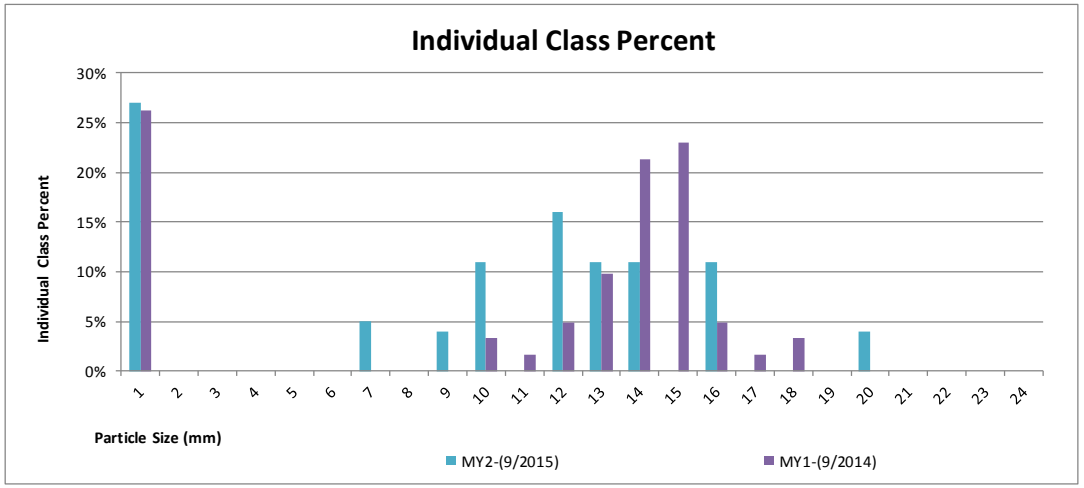
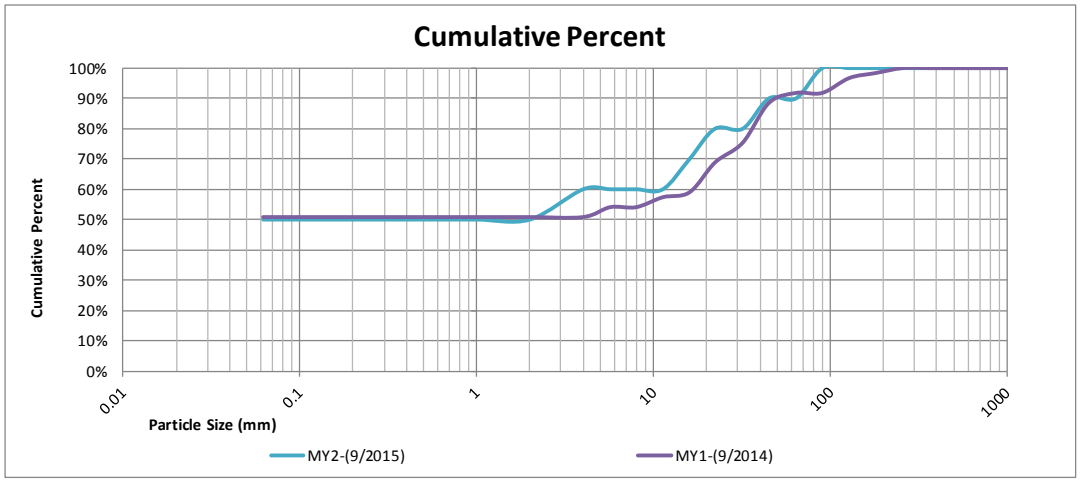


Figure 5.4. Pebble Counts

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Pool (XS 4)					
			MY2-(9/2015)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	50	50%	50%
Sand	very fine sand	0.125	0	0%	50%
	fine sand	0.250	0	0%	50%
	medium sand	0.50	0	0%	50%
	coarse sand	1.00	0	0%	50%
	ery coarse san	2.0	0	0%	50%
Gravel	very fine grave	4.0	10	10%	60%
	fine gravel	5.7	0	0%	60%
	fine gravel	8.0	0	0%	60%
	medium gravel	11.3	0	0%	60%
	medium gravel	16.0	10	10%	70%
	course gravel	22.3	10	10%	80%
	course gravel	32.0	0	0%	80%
	ery coarse grav	45	10	10%	90%
	ery coarse grav	64	0	0%	90%
Cobble	small cobble	90	10	10%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	ery large cobb	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulde	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole coun		-	100	100%	100%

Summary Data	
D50	0.6
D84	42.0
D95	75.0



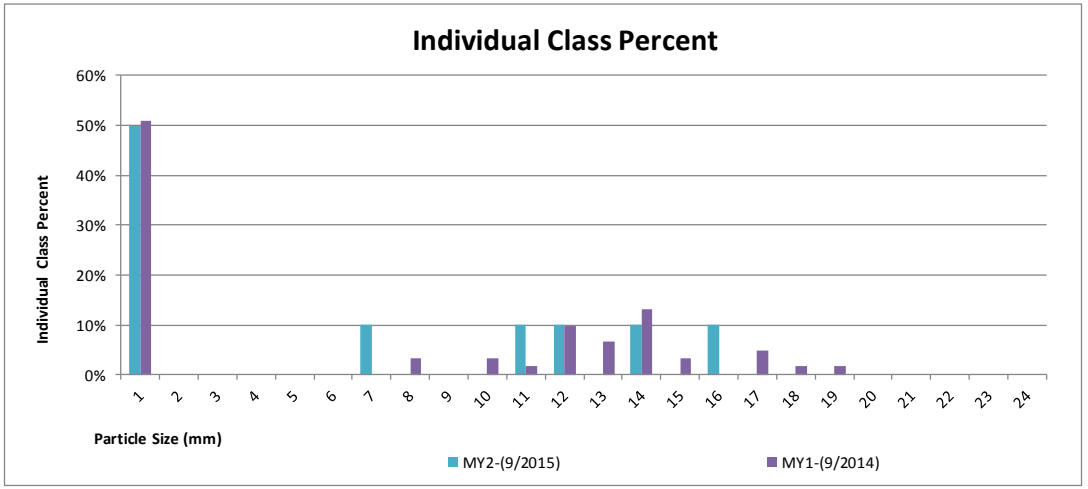
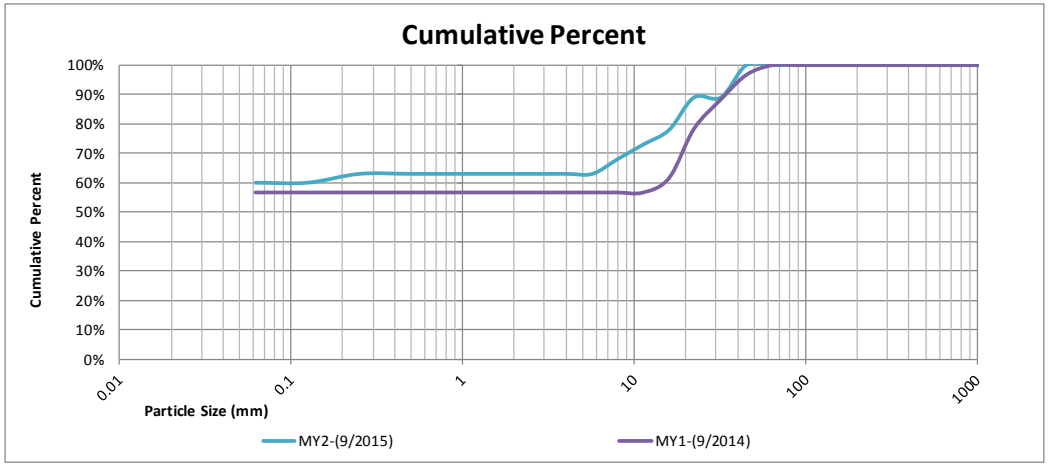


Figure 5.5. Pebble Counts

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 6)					
			MY2-(9/2015)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	60	60%	60%
Sand	very fine sand	0.125	0	0%	60%
	fine sand	0.250	3	3%	63%
	medium sand	0.50	0	0%	63%
	coarse sand	1.00	0	0%	63%
	ery coarse san	2.0	0	0%	63%
Gravel	very fine grave	4.0	0	0%	63%
	fine gravel	5.7	0	0%	63%
	fine gravel	8.0	5	5%	68%
	medium gravel	11.3	5	5%	73%
	medium gravel	16.0	5	5%	78%
	course gravel	22.3	11	11%	89%
	course gravel	32.0	0	0%	89%
	ery coarse grav	45	11	11%	100%
	ery coarse grav	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	ery large cobb	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulde	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole coun		-	100	100%	100%

Summary Data	
D50	0.1
D84	22.0
D95	45.0



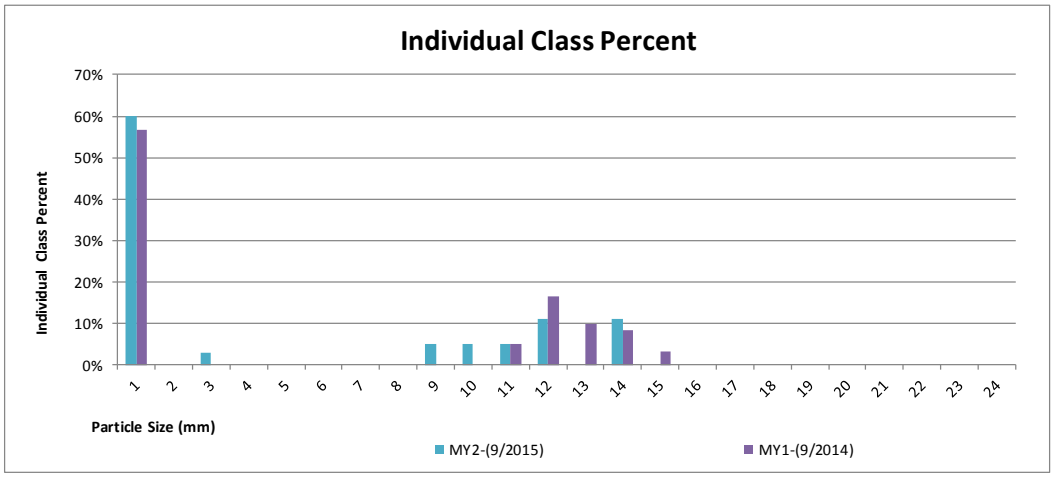
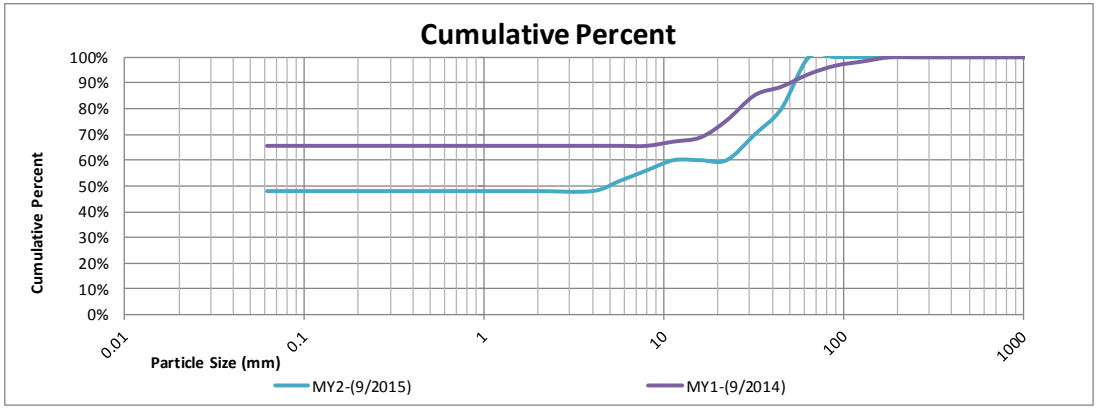


Figure 5.6. Pebble Counts

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 8)					
			MY2-(9/2015)		
Descriptio	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	48	48%	48%
Sand	very fine sand	0.125	0	0%	48%
	fine sand	0.250	0	0%	48%
	medium sand	0.50	0	0%	48%
	coarse sand	1.00	0	0%	48%
	ery coarse san	2.0	0	0%	48%
Gravel	very fine grave	4.0	0	0%	48%
	fine gravel	5.7	4	4%	52%
	fine gravel	8.0	4	4%	56%
	medium gravel	11.3	4	4%	60%
	medium gravel	16.0	0	0%	60%
	course gravel	22.3	0	0%	60%
	course gravel	32.0	10	10%	70%
	ery coarse grav	45	10	10%	80%
	ery coarse grav	64	20	20%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	ery large cobbl	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	nedium boulde	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole coun		-	100	100%	100%

Summary Data	
D50	5.0
D84	50.0
D95	60.0



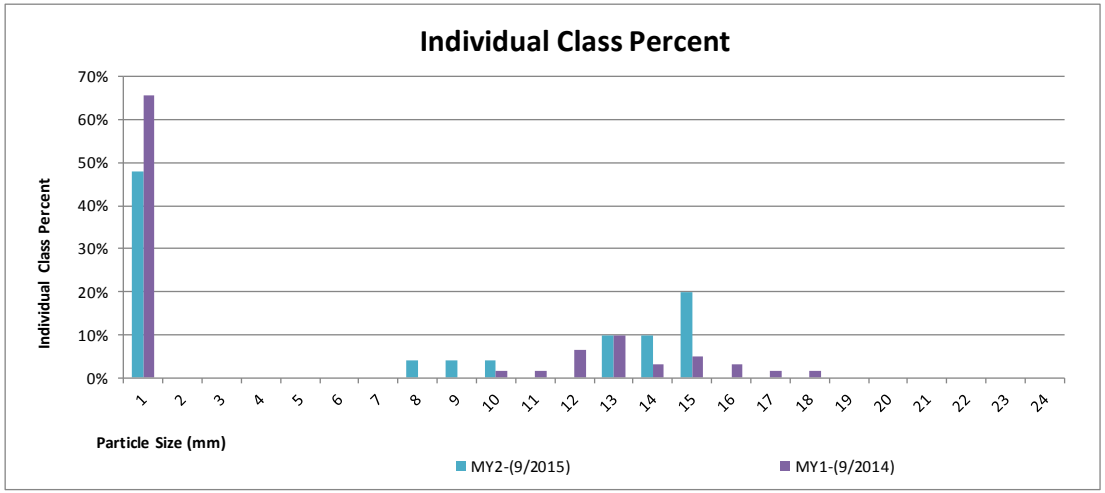
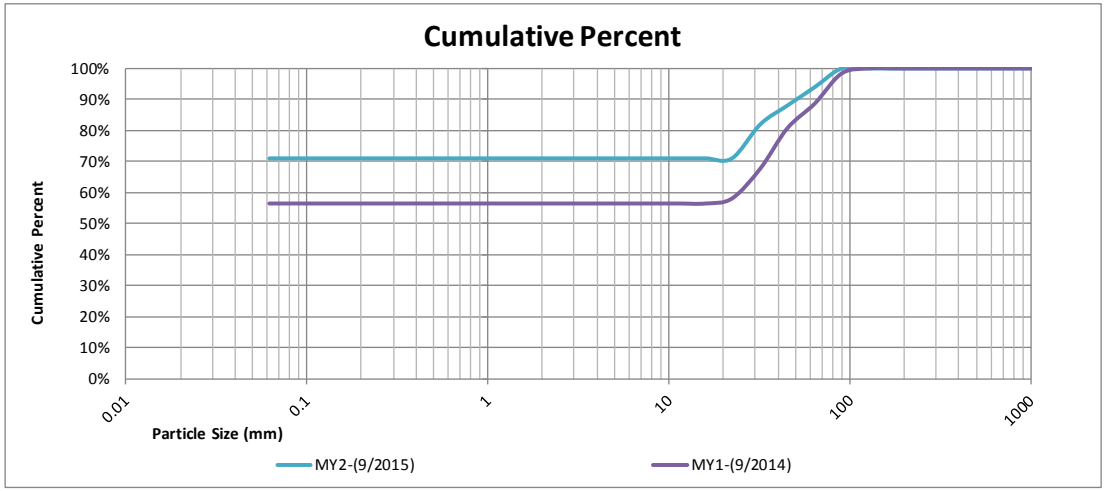


Figure 5.7. Pebble Counts

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Pool (XS 9)					
			MY2-(9/2015)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	71	71%	71%
Sand	very fine sand	0.125	0	0%	71%
	fine sand	0.250	0	0%	71%
	medium sand	0.50	0	0%	71%
	coarse sand	1.00	0	0%	71%
	very coarse san	2.0	0	0%	71%
Gravel	very fine grave	4.0	0	0%	71%
	fine gravel	5.7	0	0%	71%
	fine gravel	8.0	0	0%	71%
	medium gravel	11.3	0	0%	71%
	medium gravel	16.0	0	0%	71%
	course gravel	22.3	0	0%	71%
	course gravel	32.0	11	11%	82%
	very coarse grav	45	6	6%	88%
	very coarse grav	64	6	6%	94%
Cobble	small cobble	90	6	6%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobbl	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulde	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole coun		-	100	100%	100%

Summary Data	
D50	0.6
D84	42.0
D95	65.0



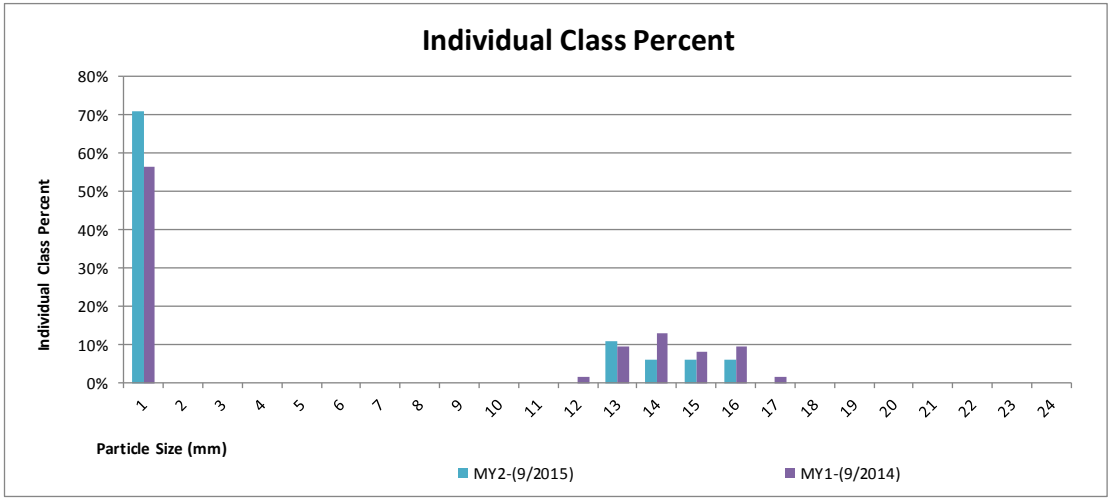
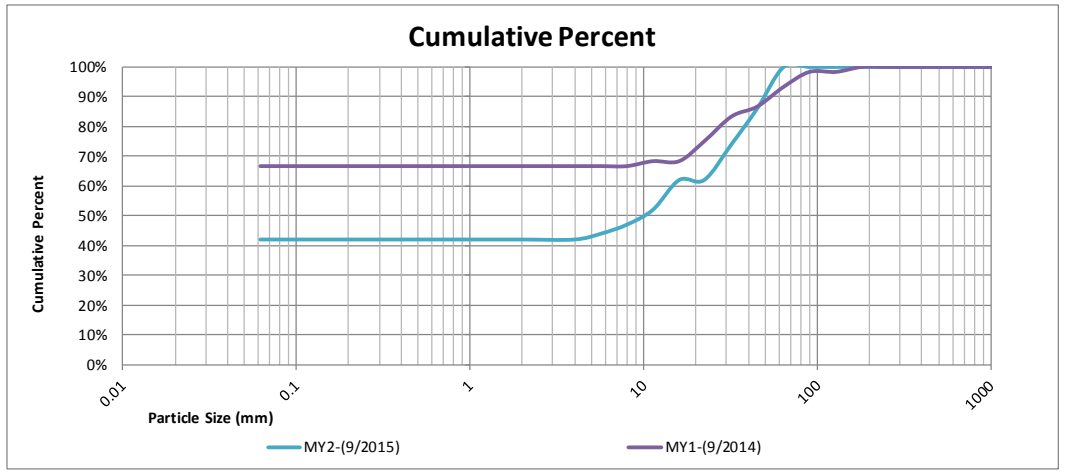


Figure 5.8. Pebble Counts

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 10)					
			MY2-(9/2015)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	42	42%	42%
Sand	very fine sand	0.125	0	0%	42%
	fine sand	0.250	0	0%	42%
	medium sand	0.50	0	0%	42%
	coarse sand	1.00	0	0%	42%
	very coarse sand	2.0	0	0%	42%
Gravel	very fine gravel	4.0	0	0%	42%
	fine gravel	5.7	2	2%	44%
	fine gravel	8.0	3	3%	47%
	medium gravel	11.3	5	5%	52%
	medium gravel	16.0	10	10%	62%
	course gravel	22.3	0	0%	62%
	course gravel	32.0	12	12%	74%
	very coarse grav	45	12	12%	86%
	very coarse grav	64	14	14%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	very large cobbl	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulde	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole coun		-	100	100%	100%

Summary Data	
D50	9.0
D84	42.0
D95	60.0



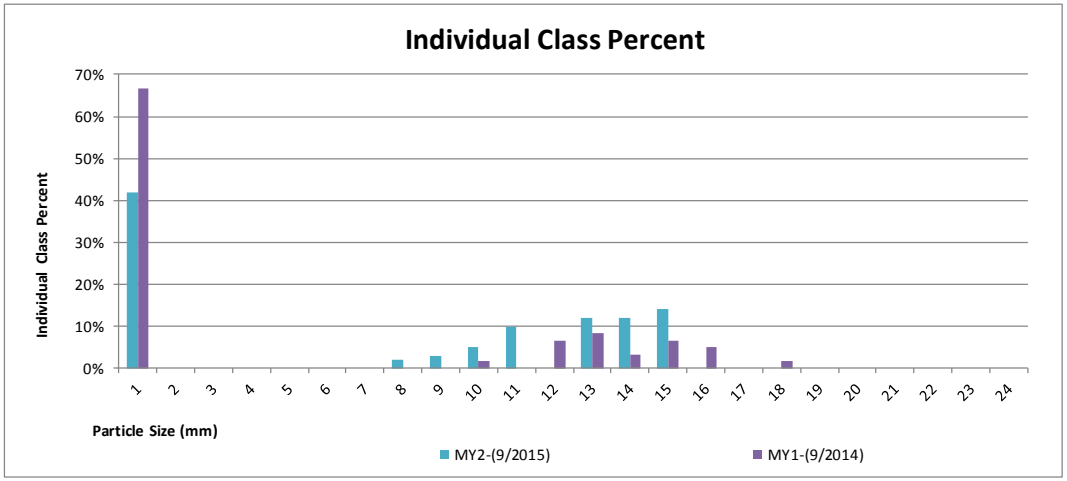
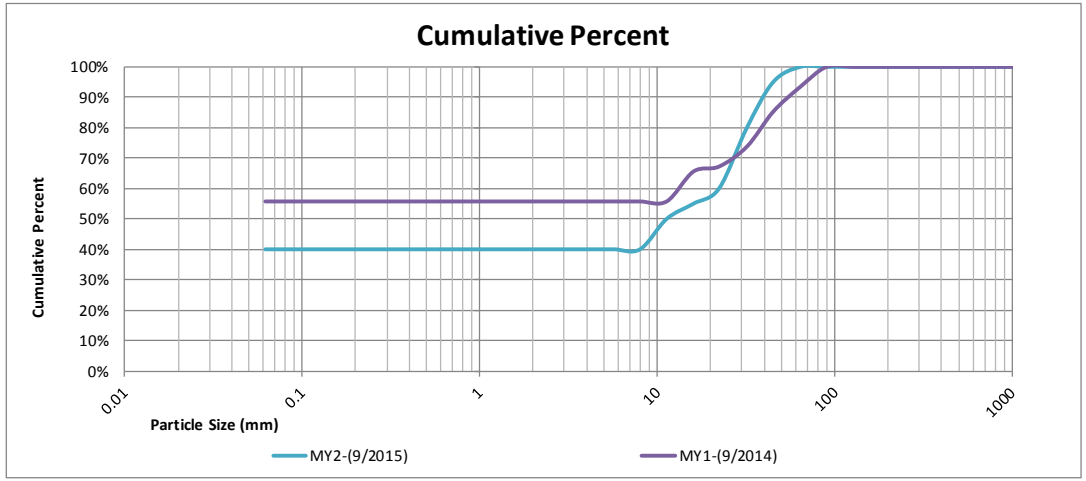


Figure 5.9. Pebble Counts

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 12)					
			MY2-(9/2015)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	40	40%	40%
Sand	very fine sand	0.125	0	0%	40%
	fine sand	0.250	0	0%	40%
	medium sand	0.50	0	0%	40%
	coarse sand	1.00	0	0%	40%
	ery coarse san	2.0	0	0%	40%
Gravel	very fine grave	4.0	0	0%	40%
	fine gravel	5.7	0	0%	40%
	fine gravel	8.0	0	0%	40%
	medium gravel	11.3	10	10%	50%
	medium gravel	16.0	5	5%	55%
	course gravel	22.3	5	5%	60%
	course gravel	32.0	20	20%	80%
	ery coarse grav	45	15	15%	95%
	ery coarse grav	64	5	5%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	ery large cobb	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulde	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole coun		-	100	100%	100%

Summary Data	
D50	11.0
D84	35.0
D95	45.0



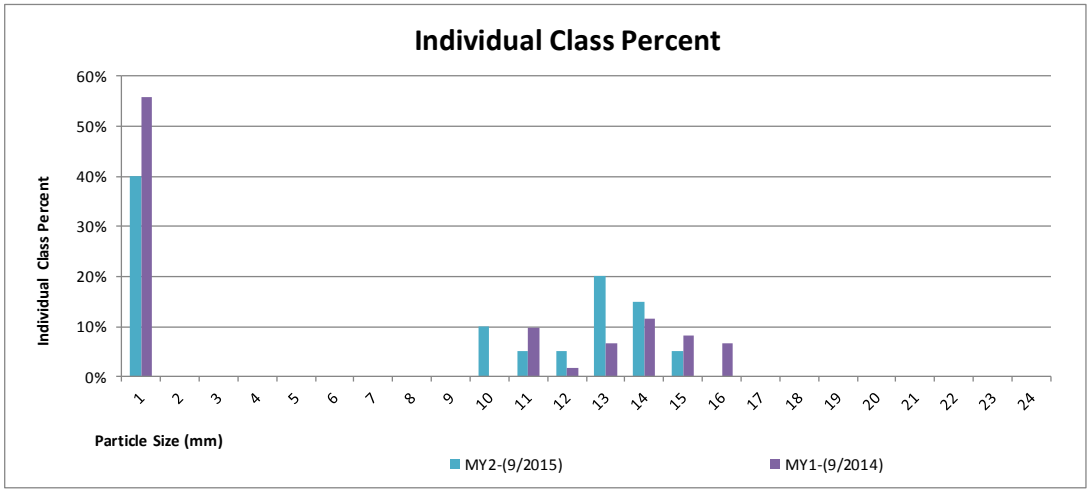
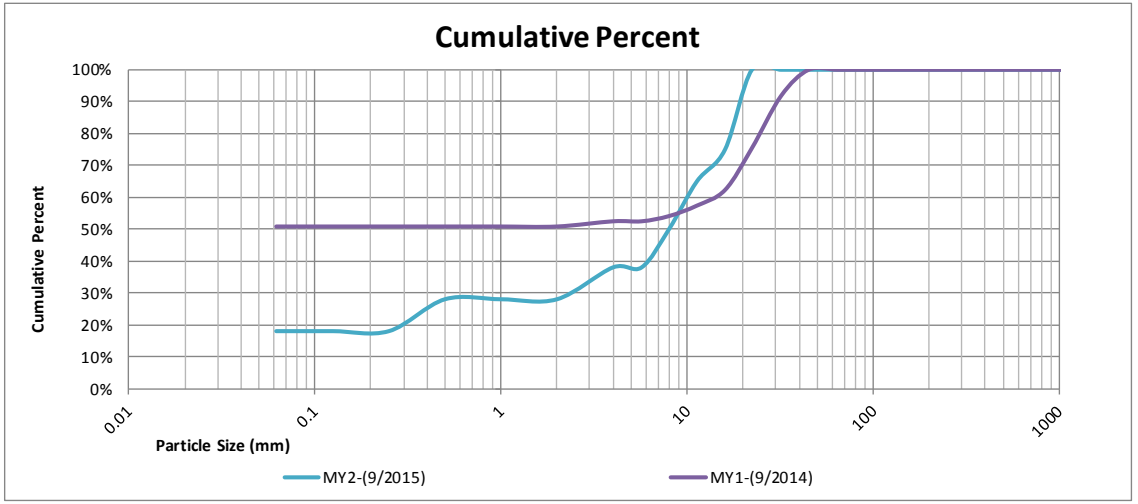


Figure 5.10. Pebble Counts

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 14)					
			MY2-(9/2015)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	18	18%	18%
Sand	very fine sand	0.125	0	0%	18%
	fine sand	0.250	0	0%	18%
	medium sand	0.50	10	10%	28%
	coarse sand	1.00	0	0%	28%
	ery coarse san	2.0	0	0%	28%
Gravel	very fine grave	4.0	10	10%	38%
	fine gravel	5.7	0	0%	38%
	fine gravel	8.0	12	12%	50%
	medium gravel	11.3	15	15%	65%
	medium gravel	16.0	10	10%	75%
	course gravel	22.3	25	25%	100%
	course gravel	32.0	0	0%	100%
	ery coarse grav	45	0	0%	100%
	ery coarse grav	64	0	0%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	ery large cobb	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulde	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole cour		-	100	100%	100%

Summary Data	
D50	8.0
D84	18.0
D95	22.0



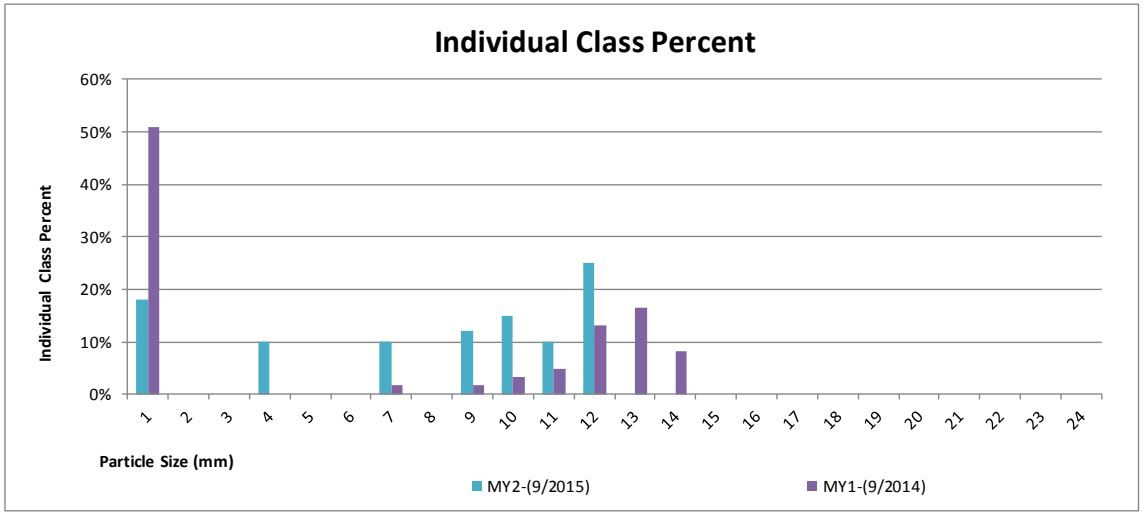
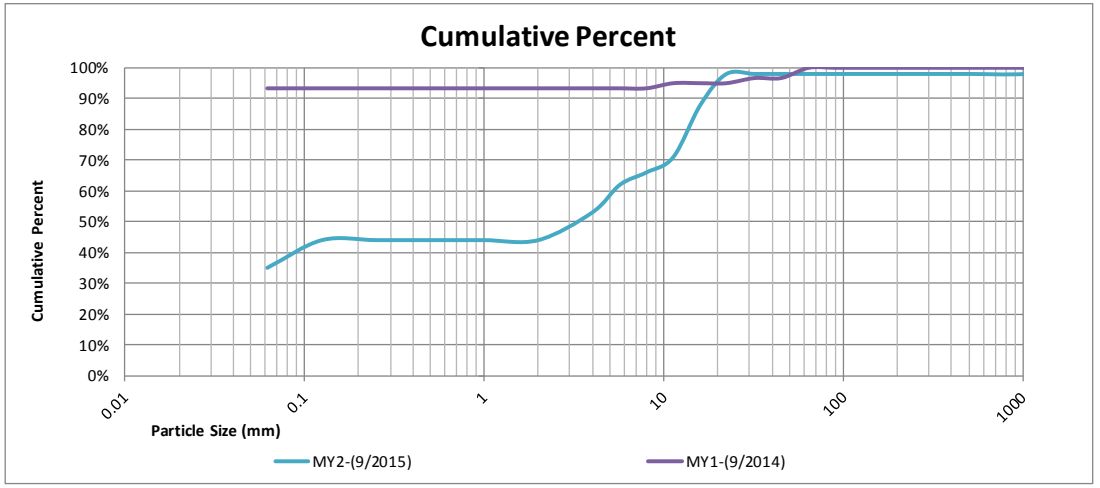


Figure 5.11. Pebble Counts

Project Name: Heath Dairy					
Reach: Back Creek					
Feature: Riffle (XS 16)					
			MY2-(9/2015)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	35	35%	35%
Sand	very fine sand	0.125	9	9%	44%
	fine sand	0.250	0	0%	44%
	medium sand	0.50	0	0%	44%
	coarse sand	1.00	0	0%	44%
	ery coarse sand	2.0	0	0%	44%
Gravel	very fine grave	4.0	9	9%	53%
	fine gravel	5.7	9	9%	62%
	fine gravel	8.0	4	4%	66%
	medium gravel	11.3	5	5%	71%
	medium gravel	16.0	17	17%	88%
	course gravel	22.3	10	10%	98%
	course gravel	32.0	0	0%	98%
	ery coarse grav	45	0	0%	98%
	ery coarse grav	64	0	0%	98%
Cobble	small cobble	90	0	0%	98%
	medium cobble	128	0	0%	98%
	large cobble	180	0	0%	98%
	ery large cobbl	256	0	0%	98%
Boulder	small boulder	362	0	0%	98%
	small boulder	512	0	0%	98%
	medium boulde	1024	0	0%	98%
	large boulder	2048	2	2%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole coun		-	100	100%	100%

Summary Data	
D50	3.0
D84	15.0
D95	21.0



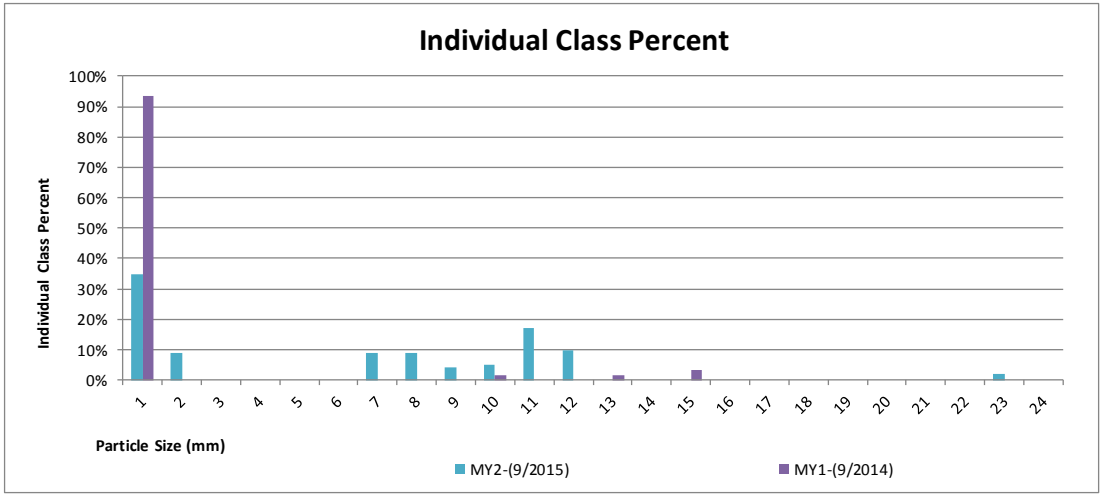
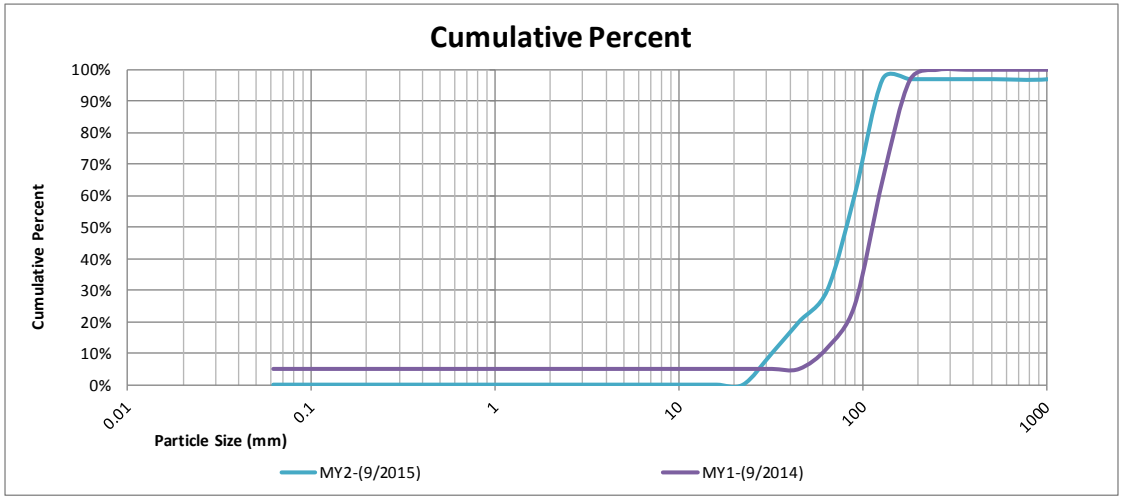


Figure 5.12. Pebble Counts

Project Name: Heath Dairy					
Reach: West Branch to Back Creek					
Feature: Riffle (XS 19)					
			MY2-(9/2015)		
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%
	ery coarse san	2.0	0	0%	0%
Gravel	very fine grave	4.0	0	0%	0%
	fine gravel	5.7	0	0%	0%
	fine gravel	8.0	0	0%	0%
	medium gravel	11.3	0	0%	0%
	medium gravel	16.0	0	0%	0%
	course gravel	22.3	0	0%	0%
	course gravel	32.0	10	10%	10%
	ery coarse grav	45	10	10%	20%
	ery coarse grav	64	10	10%	30%
Cobble	small cobble	90	30	30%	60%
	medium cobble	128	37	37%	97%
	large cobble	180	0	0%	97%
	ery large cobbl	256	0	0%	97%
Boulder	small boulder	362	0	0%	97%
	small boulder	512	0	0%	97%
	medium boulde	1024	0	0%	97%
	large boulder	2048	3	3%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole coun		-	100	100%	100%

Summary Data	
D50	80.0
D84	104.0
D95	120.0



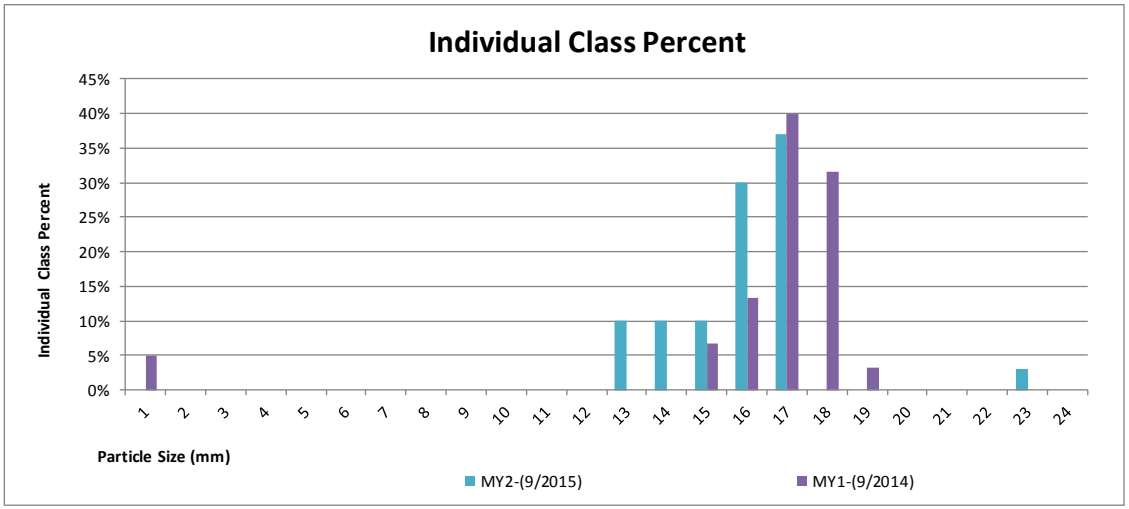
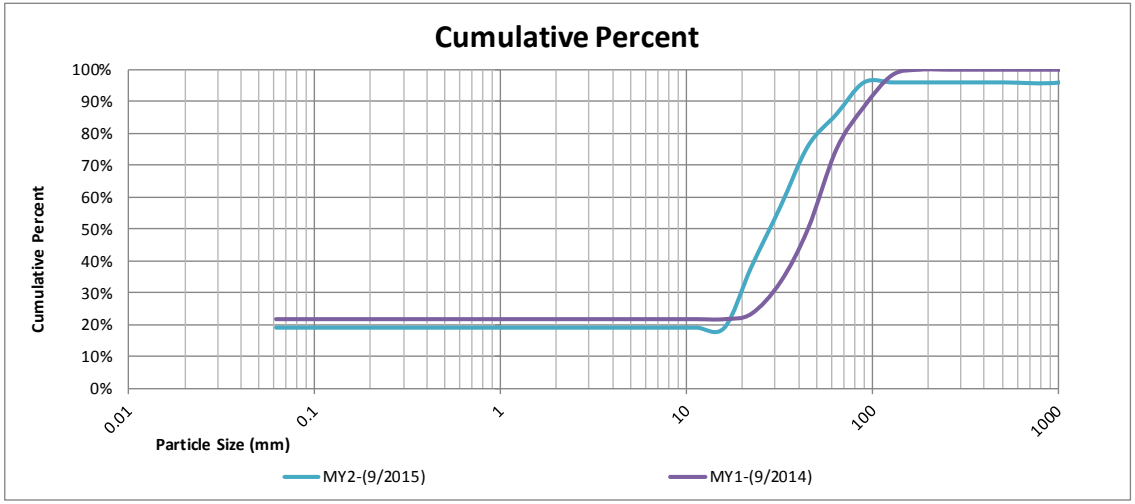


Figure 5.13. Pebble Counts

Project Name: Heath Dairy					
Reach: West Branch to Back Creek					
Feature: Riffle (XS 20)					
			MY2-(9/2015)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	19	19%	19%
Sand	very fine sand	0.125	0	0%	19%
	fine sand	0.250	0	0%	19%
	medium sand	0.50	0	0%	19%
	coarse sand	1.00	0	0%	19%
	ery coarse san	2.0	0	0%	19%
Gravel	very fine grave	4.0	0	0%	19%
	fine gravel	5.7	0	0%	19%
	fine gravel	8.0	0	0%	19%
	medium gravel	11.3	0	0%	19%
	medium gravel	16.0	0	0%	19%
	course gravel	22.3	19	19%	38%
	course gravel	32.0	19	19%	57%
	ery coarse grav	45	19	19%	76%
	ery coarse grav	64	10	10%	86%
Cobble	small cobble	90	10	10%	96%
	medium cobble	128	0	0%	96%
	large cobble	180	0	0%	96%
	ery large cobbl	256	0	0%	96%
Boulder	small boulder	362	0	0%	96%
	small boulder	512	0	0%	96%
	medium boulde	1024	0	0%	96%
	large boulder	2048	4	4%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole coun		-	100	100%	100%

Summary Data	
D50	30.0
D84	58.0
D95	88.0



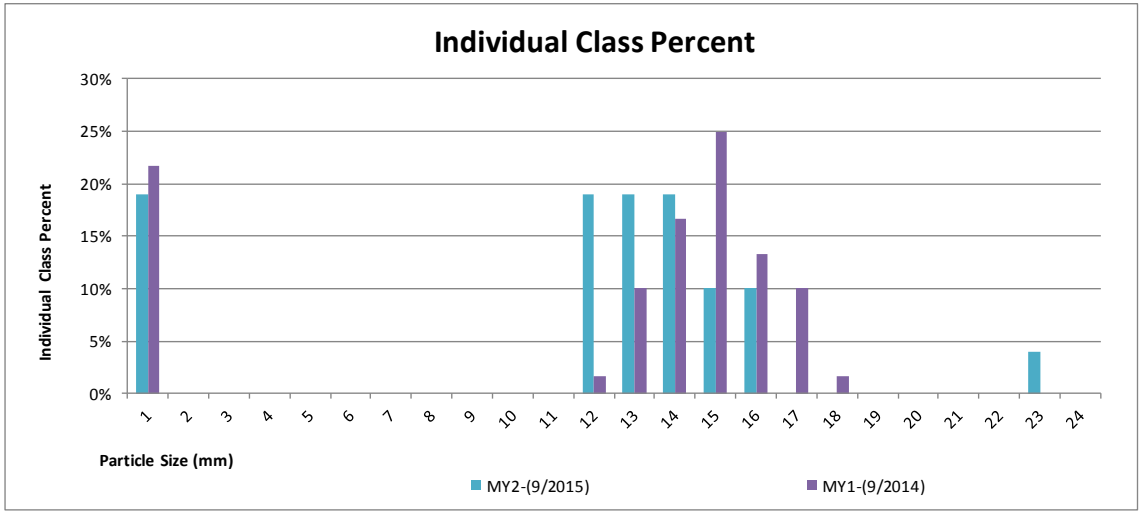
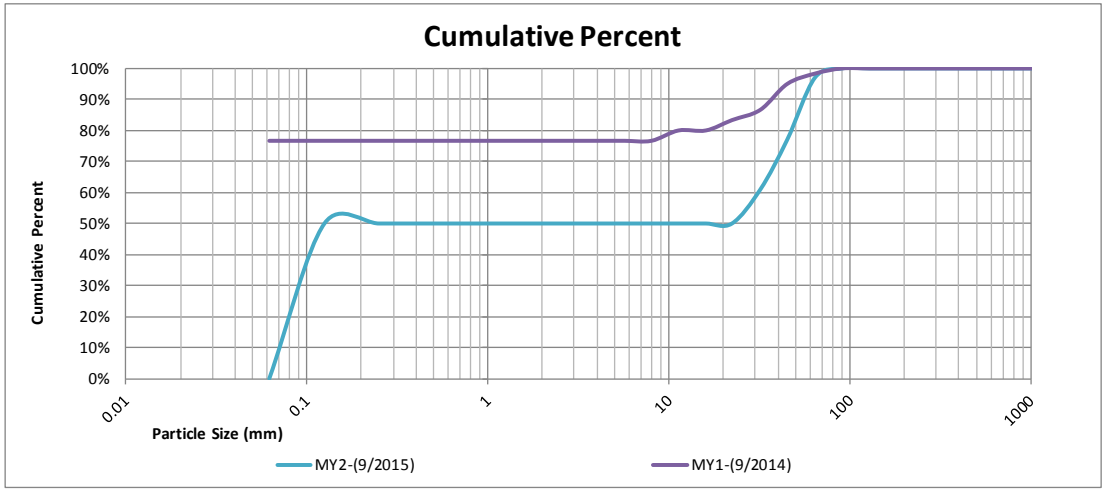


Figure 5.14. Pebble Counts

Project Name: Heath Dairy					
Reach: West Branch to Back Creek					
Feature: Pool (XS 21)					
			MY2-(9/2015)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	0	0%	0%
Sand	very fine sand	0.125	50	51%	51%
	fine sand	0.250	0	0%	51%
	medium sand	0.50	0	0%	51%
	coarse sand	1.00	0	0%	51%
	ery coarse san	2.0	0	0%	51%
Gravel	very fine grave	4.0	0	0%	51%
	fine gravel	5.7	0	0%	51%
	fine gravel	8.0	0	0%	51%
	medium gravel	11.3	0	0%	51%
	medium gravel	16.0	0	0%	51%
	course gravel	22.3	0	0%	51%
	course gravel	32.0	11	11%	61%
	ery coarse grav	45	16	16%	77%
	ery coarse grav	64	20	20%	97%
Cobble	small cobble	90	3	3%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	ery large cobb	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulde	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole coun		-	100	100%	100%

Summary Data	
D50	0.1
D84	50.0
D95	60.0



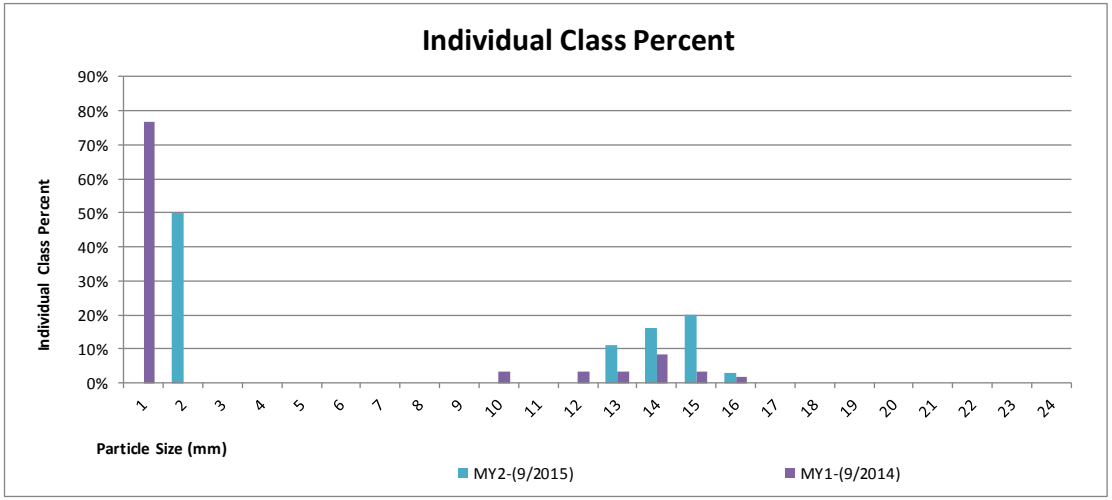
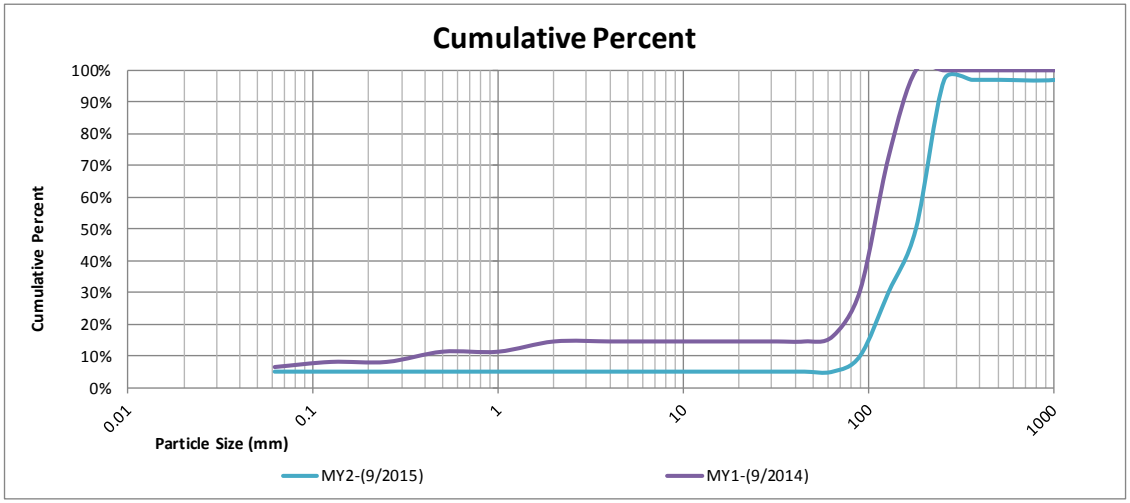


Figure 5.15. Pebble Counts

Project Name: Heath Dairy					
Reach: West Branch to Back Creek					
Feature: Riffle (XS 22)					
			MY2-(9/2015)		
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%
	ery coarse san	2.0	0	0%	5%
Gravel	very fine grave	4.0	0	0%	5%
	fine gravel	5.7	0	0%	5%
	fine gravel	8.0	0	0%	5%
	medium gravel	11.3	0	0%	5%
	medium gravel	16.0	0	0%	5%
	course gravel	22.3	0	0%	5%
	course gravel	32.0	0	0%	5%
	ery coarse grav	45	0	0%	5%
	ery coarse grav	64	0	0%	5%
Cobble	small cobble	90	5	5%	10%
	medium cobble	128	20	20%	30%
	large cobble	180	20	20%	50%
	ery large cobbl	256	47	47%	97%
Boulder	small boulder	362	0	0%	97%
	small boulder	512	0	0%	97%
	medium boulde	1024	0	0%	97%
	large boulder	2048	3	3%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole coun		-	100	100%	100%

Summary Data	
D50	180.0
D84	225.0
D95	250.0



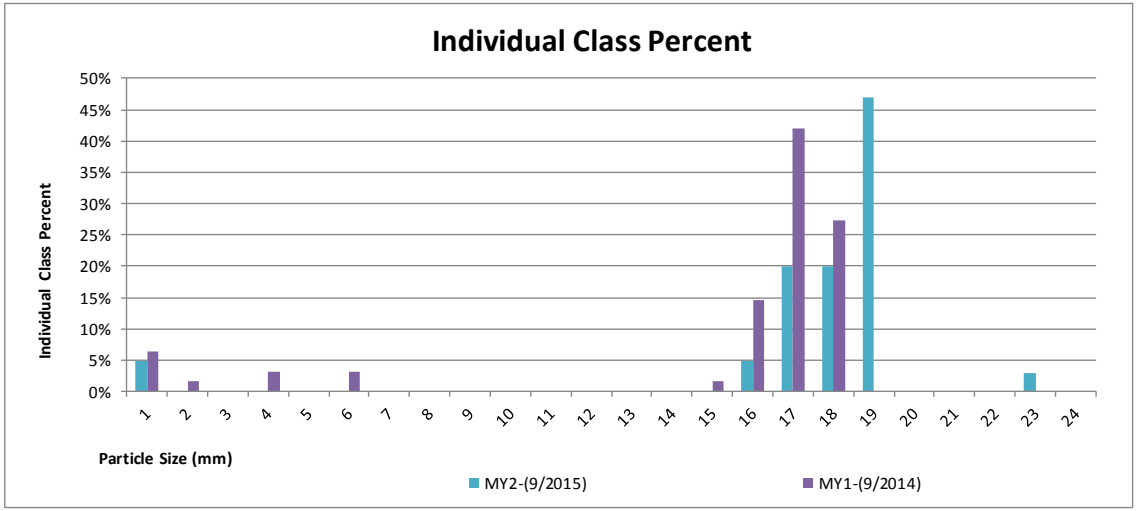
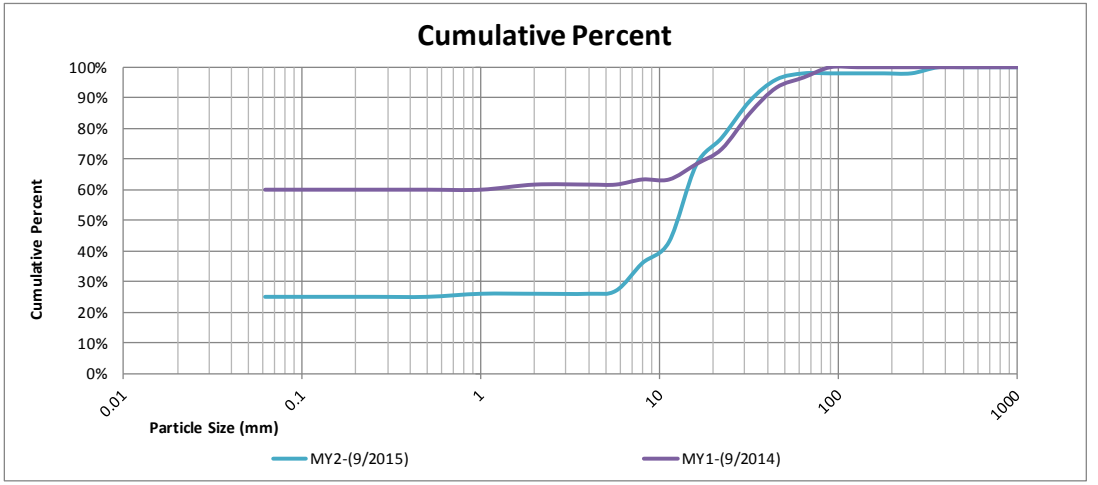


Figure 5.16. Pebble Counts

Project Name: Heath Dairy					
Reach: North Branch to Back Creek					
Feature: Riffle (XS 24)					
			MY2-(9/2015)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	25	25%	25%
Sand	very fine sand	0.125	0	0%	25%
	fine sand	0.250	0	0%	25%
	medium sand	0.50	0	0%	25%
	coarse sand	1.00	1	1%	26%
	ery coarse sand	2.0	0	0%	26%
Gravel	very fine grave	4.0	0	0%	26%
	fine gravel	5.7	1	1%	27%
	fine gravel	8.0	9	9%	36%
	medium gravel	11.3	7	7%	43%
	medium gravel	16.0	25	25%	68%
	course gravel	22.3	9	9%	77%
	course gravel	32.0	12	12%	89%
	ery coarse grav	45	7	7%	96%
	ery coarse grav	64	2	2%	98%
Cobble	small cobble	90	0	0%	98%
	medium cobble	128	0	0%	98%
	large cobble	180	0	0%	98%
	ery large cobbl	256	0	0%	98%
Boulder	small boulder	362	2	2%	100%
	small boulder	512	0	0%	100%
	medium boulde	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole coun		-	100	100%	100%

Summary Data	
D50	14.0
D84	30.0
D95	42.0



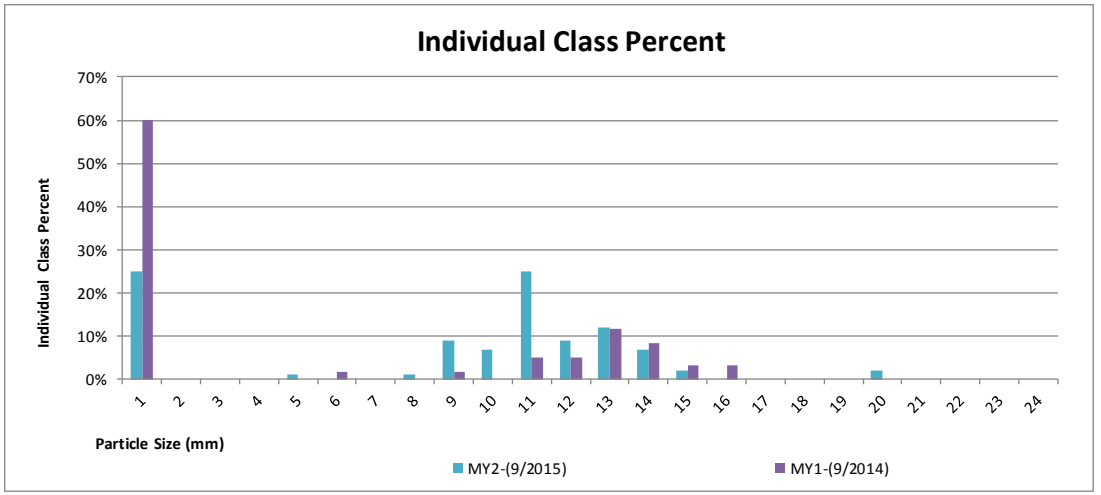
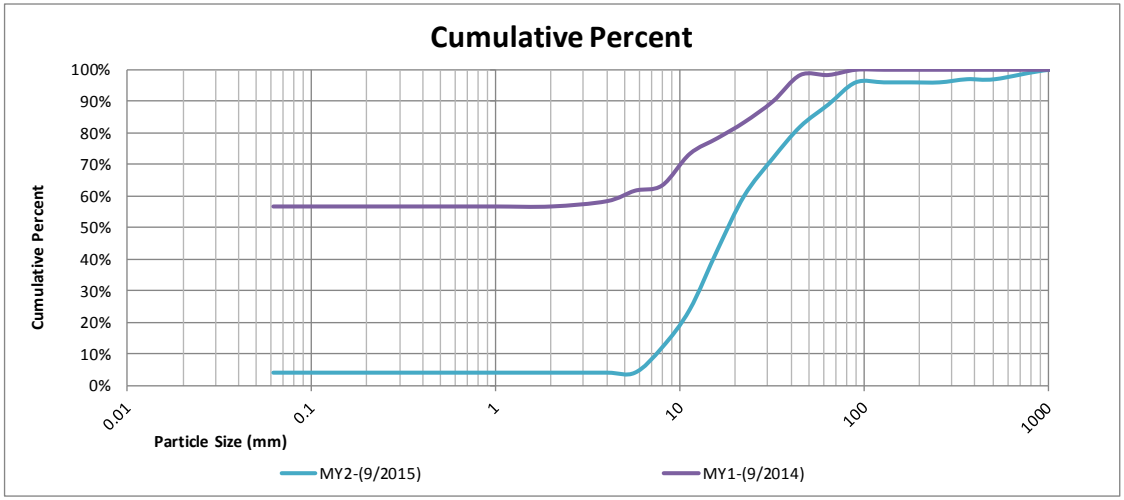


Figure 5.17. Pebble Counts

Project Name: Heath Dairy					
Reach: North Branch to Back Creek					
Feature: Riffle (XS 25)					
			MY2-(9/2015)		
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%
	ery coarse san	2.0	0	0%	4%
Gravel	very fine grave	4.0	0	0%	4%
	fine gravel	5.7	0	0%	4%
	fine gravel	8.0	8	8%	12%
	medium gravel	11.3	12	12%	24%
	medium gravel	16.0	19	19%	43%
	course gravel	22.3	17	17%	60%
	course gravel	32.0	12	12%	72%
	ery coarse grav	45	10	10%	82%
	ery coarse grav	64	7	7%	89%
Cobble	small cobble	90	7	7%	96%
	medium cobble	128	0	0%	96%
	large cobble	180	0	0%	96%
	ery large cobbl	256	0	0%	96%
Boulder	small boulder	362	1	1%	97%
	small boulder	512	0	0%	97%
	medium boulde	1024	3	3%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole coun		-	100	100%	100%

Summary Data	
D50	18.0
D84	50.0
D95	85.0



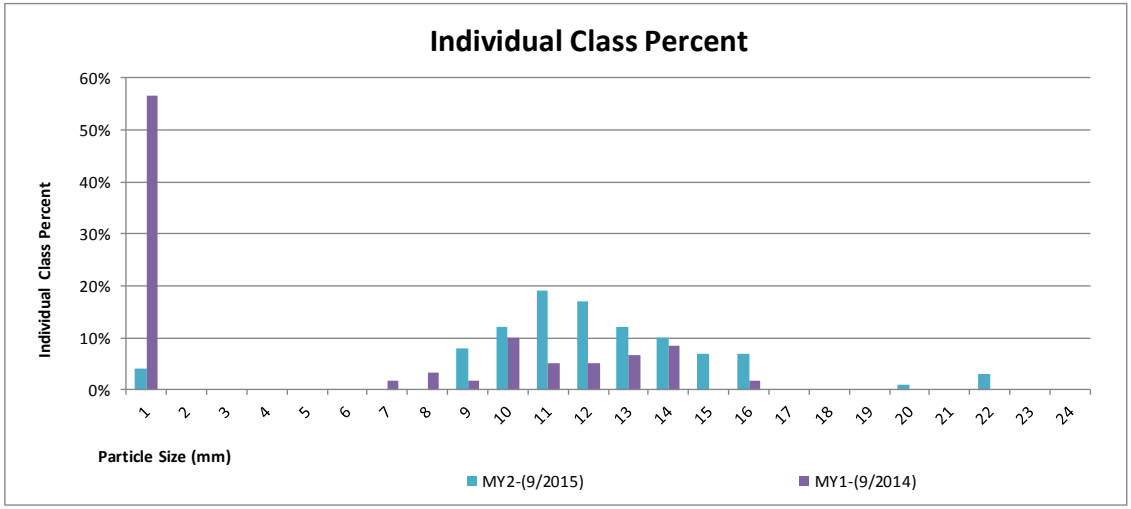
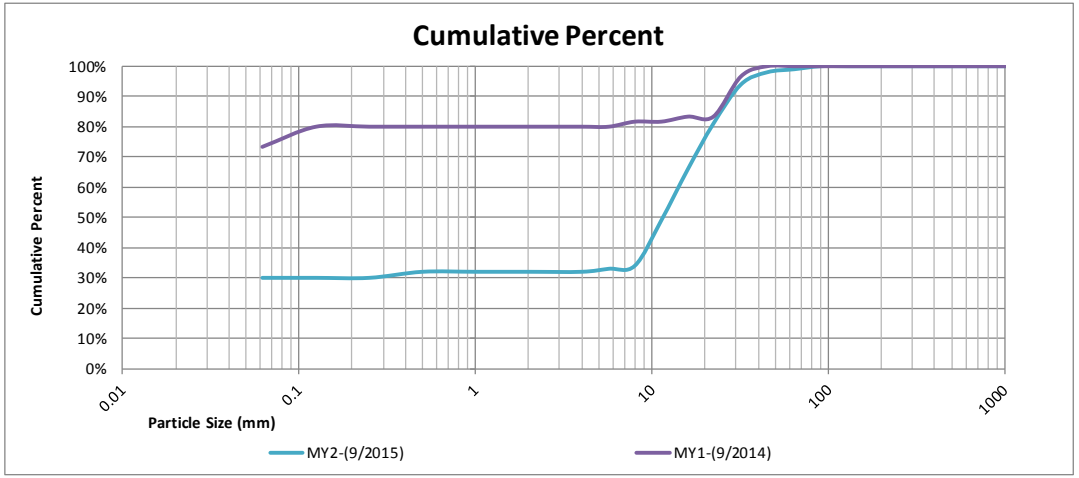


Figure 5.18. Pebble Counts

Project Name: Heath Dairy					
Reach: East Branch to Back Creek					
Feature: Pool (XS 26)					
			MY2-(9/2015)		
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	2	2%	32%
	coarse sand	1.00	0	0%	32%
	ery coarse san	2.0	0	0%	32%
Gravel	very fine grave	4.0	0	0%	32%
	fine gravel	5.7	1	1%	33%
	fine gravel	8.0	1	1%	34%
	medium gravel	11.3	15	15%	49%
	medium gravel	16.0	17	17%	66%
	course gravel	22.3	15	15%	81%
	course gravel	32.0	13	13%	94%
	ery coarse grav	45	4	4%	98%
	ery coarse grav	64	1	1%	99%
Cobble	small cobble	90	1	1%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	ery large cobbl	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulde	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole coun		-	100	100%	100%

Summary Data	
D50	12.0
D84	25.0
D95	33.0



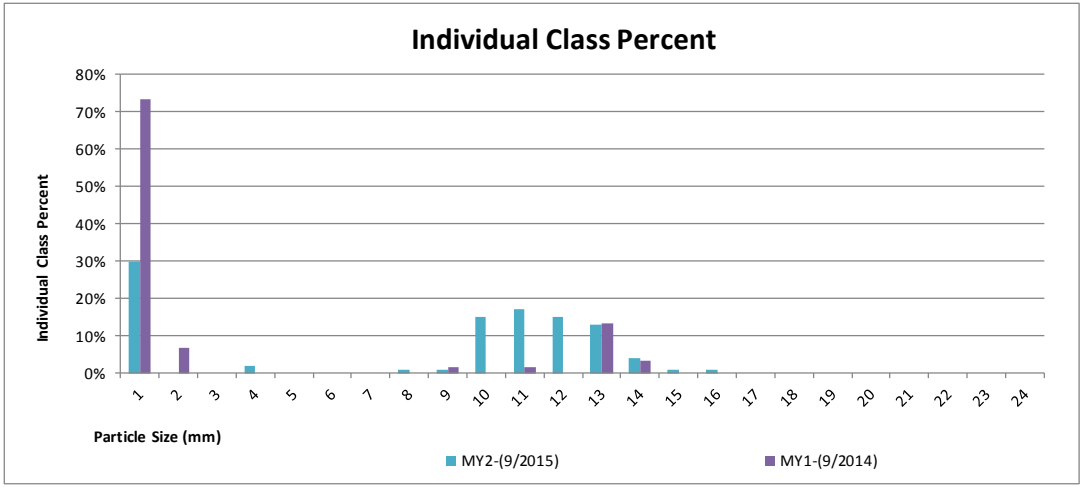
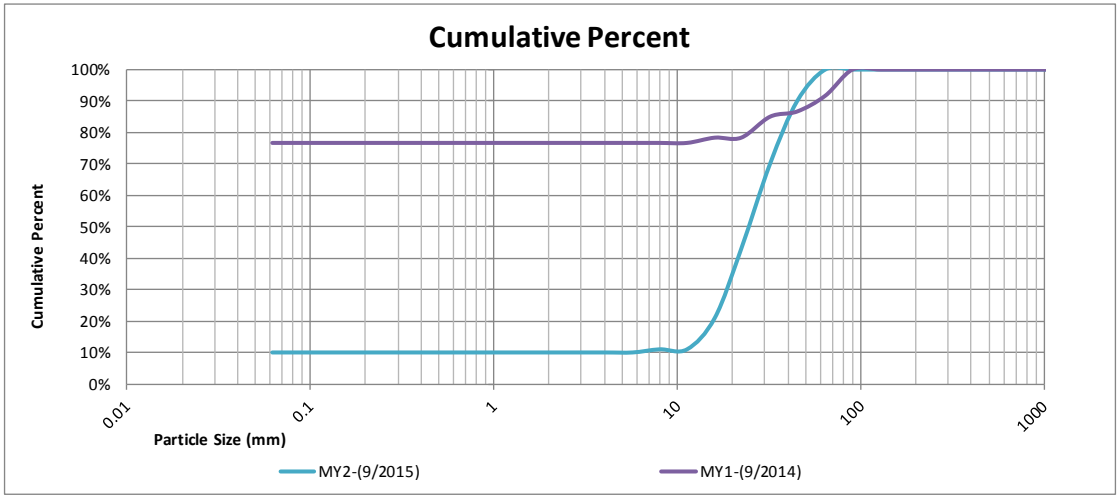


Figure 5.19. Pebble Counts

Project Name: Heath Dairy					
Reach: East Branch to Back Creek					
Feature: Riffle (XS 27)					
			MY2-(9/2015)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	10	10%	10%
Sand	very fine sand	0.125	0	0%	10%
	fine sand	0.250	0	0%	10%
	medium sand	0.50	0	0%	10%
	coarse sand	1.00	0	0%	10%
	ery coarse san	2.0	0	0%	10%
Gravel	very fine grave	4.0	0	0%	10%
	fine gravel	5.7	0	0%	10%
	fine gravel	8.0	1	1%	11%
	medium gravel	11.3	0	0%	11%
	medium gravel	16.0	10	10%	21%
	course gravel	22.3	22	22%	43%
	course gravel	32.0	27	27%	70%
	ery coarse grav	45	20	20%	90%
	ery coarse grav	64	10	10%	100%
Cobble	small cobble	90	0	0%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	ery large cobbl	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulde	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole cour		-	100	100%	100%

Summary Data	
D50	25.0
D84	40.0
D95	55.0



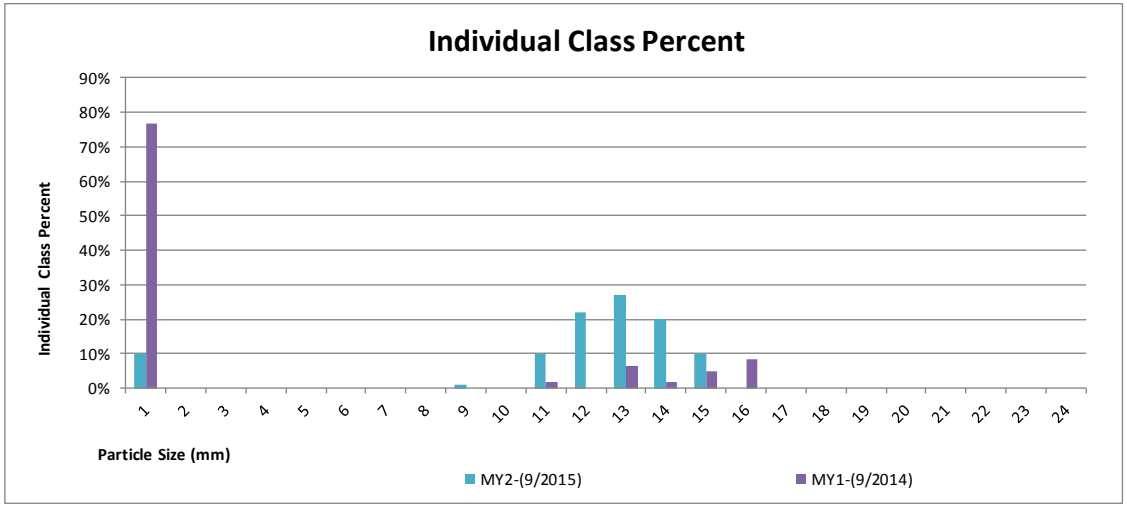
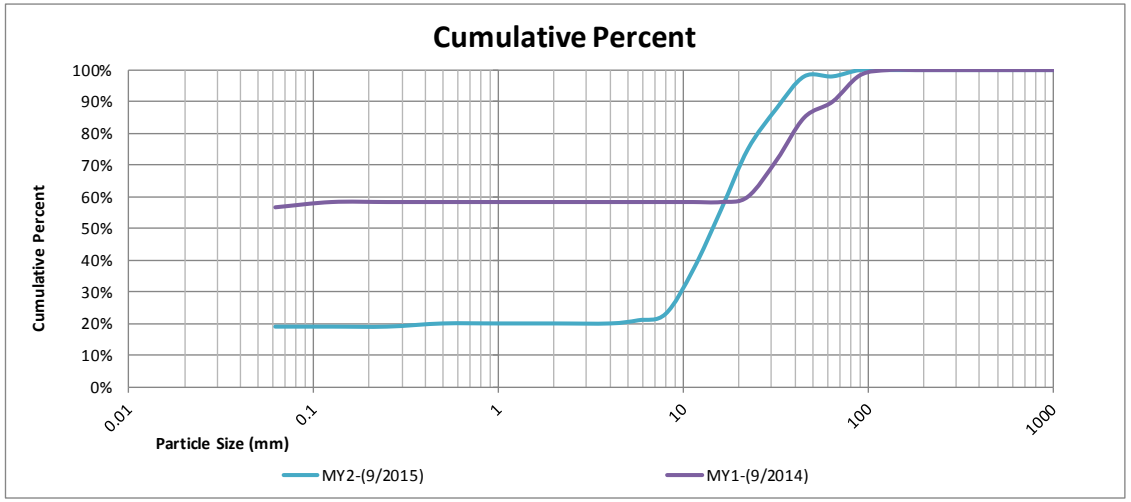


Figure 5.20. Pebble Counts

Project Name: Heath Dairy					
Reach: East Branch to Back Creek					
Feature: Riffle (XS 28)					
			MY2-(9/2015)		
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	19	19%	19%
Sand	very fine sand	0.125	0	0%	19%
	fine sand	0.250	0	0%	19%
	medium sand	0.50	1	1%	20%
	coarse sand	1.00	0	0%	20%
	ery coarse san	2.0	0	0%	20%
Gravel	very fine grave	4.0	0	0%	20%
	fine gravel	5.7	1	1%	21%
	fine gravel	8.0	2	2%	23%
	medium gravel	11.3	14	14%	37%
	medium gravel	16.0	19	19%	56%
	course gravel	22.3	19	19%	75%
	course gravel	32.0	13	13%	88%
	ery coarse grav	45	10	10%	98%
	ery coarse grav	64	0	0%	98%
Cobble	small cobble	90	2	2%	100%
	medium cobble	128	0	0%	100%
	large cobble	180	0	0%	100%
	ery large cobbl	256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulde	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole coun		-	100	100%	100%

Summary Data	
D50	15.0
D84	30.0
D95	41.0



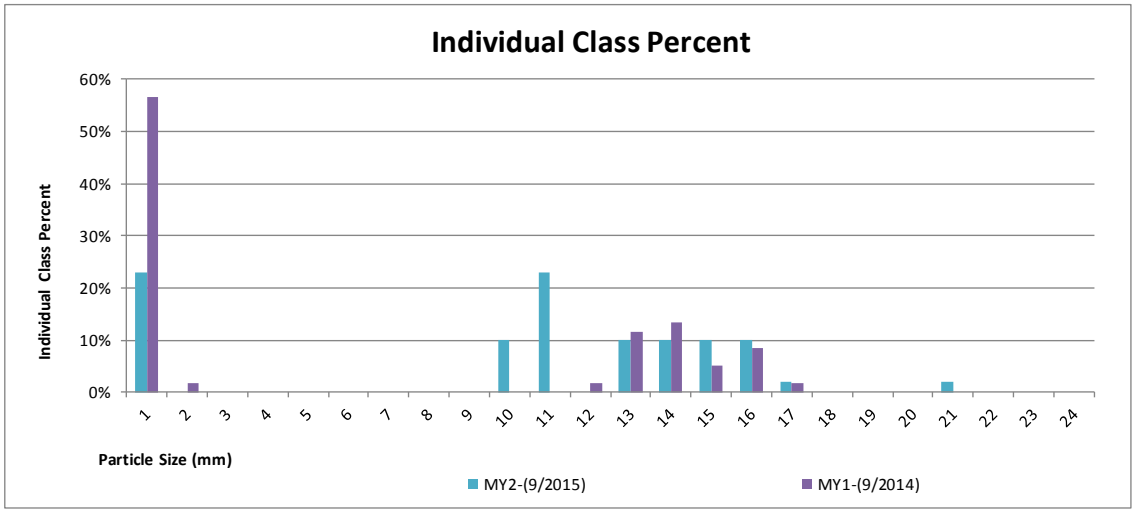


Table 10.1 Baseline Stream Data Summary

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

*See Restoration Plan dated 2009 for reach designations

Table 10.2 Baseline Stream Data Summary

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

*See Restoration Plan dated 2009 for reach designations

Table 11.1. Monitoring – Cross Section Morphology

Morphology and Hydraulic Monitoring Summary (Dimensional Parameters – Cross Sections)																																			
Heath Dairy Road Stream Restoration/DMS # 170 Segment/Reach: Back Creek XS1 - 10																																			
	Cross Section 1 (Pool)							Cross Section 2 (Riffle)							Cross Section 3 (Riffle)							Cross Section 4 (Pool)							Cross Section 5 (Pool)						
Based on fixed baseline bankfull elevation	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	21.75	14.31	19.57					16.91	13.78	15.87					15.25	13.57	15.79					14.97	20.17	18.56					18.29	16.17	17.33				
Floodprone Width (ft)	32	32	32					26	25.3	25.3					100	100	100					100	100	100					50	50	50				
Bankfull Mean Depth (ft)	1.47	1.13	0.96					1.01	0.76	0.75					1.61	1.58	1.21					1.69	1.87	1.7					1.6	2.16	2.06				
Bankfull Max Depth (ft)	2.37	1.49	1.048					1.44	1.01	1.029					2.39	2.75	2.874					2.73	2.93	2.909					2.83	3.26	3.305				
Bankfull Cross Sectional Area (ft^2)	32.01	16.14	20.38					17	10.42	21.16					24.56	21.38	13.05					25.29	37.74	10.92					29.28	34.85	8.413				
Bankfull Width/Depth Ratio	14.8	12.66	13.8					16.74	18.13	10.7					9.47	8.59	30.1					8.86	10.79	30					11.43	7.49	29.6				
Bankfull Entrenchment Ratio	2.23	2.28	1.635					2.39	1.84	1.594					6.55	7.3	6.332					6.68	4.96	5.388					2.73	8.2	2.885				
Bankfull Bank Height Ratio			1.002							1.001							1							1							1.001				
Based on current/developing bankfull feature																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft^2)																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft^2)																																			
d50 (mm)		0.05	16						30.8	16						34.5	22						0.06	0.06						NA	NA				
	Cross Section 6 (Riffle)							Cross Section 7 (Pool)							Cross Section 8 (Riffle)							Cross Section 9 (Pool)							Cross Section 10 (Riffle)						
Based on fixed baseline bankfull elevation	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	14.27	14.79	16.04					18.83	19.51	15.35					26.3	21.33	23.26					20.68	22.5	21.64					22.9	15.71	24.41				
Floodprone Width (ft)	75	75	75					100	100	100					100	100	100					100	100	100					100	100	100				
Bankfull Mean Depth (ft)	0.87	1.01	0.91					1.59	1.9	1.8					0.97	1.23	1.1					1.81	2.32	1.33					1.1	1.06	0.92				
Bankfull Max Depth (ft)	1.32	1.66	1.406					3.07	3.01	3.117					2.19	1.74	1.903					2.83	3.69	3.745					1.8	1.42	1.813				
Bankfull Cross Sectional Area (ft^2)	12.41	14.89	17.63					29.94	37.15	8.526					25.6	26.21	21.15					37.43	52.17	16.27					25.14	16.58	26.54				
Bankfull Width/Depth Ratio	16.4	14.64	13.3					11.84	10.27	34.1					27.3	17.34	28.1					11.43	9.7	52					20.82	14.82	21.9				
Bankfull Entrenchment Ratio	5.25	5	4.675					5.31	5.1	6.516					3.80	4.68	4.299					4.84	4.4	4.621					4.36	6.4	4.096				
Bankfull Bank Height Ratio			1.001							1							1							0.999							1				
Based on current/developing bankfull feature																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft^2)																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft^2)																																			
d50 (mm)		0.05	0.1						NA	NA						0.05	5						0.06	0.6						0.05	9				

Table 11.2. Monitoring – Cross Section Morphology

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

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

	Cross Section 11 (Pool)							Cross Section 12 (Riffle)							Cross Section 13 (Pool)							Cross Section 14 (Riffle)							Cross Section 15 (Pool)						
Based on fixed baseline bankfull elevation	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	22.55	16.96	19.04					18.44	17.94	17.5					20.02	16.42	11					17.3	15.48	18.42					16.12	13.76	18.64				
Floodprone Width (ft)	100	100	100					100	100	100					100	100	100					70	70	70					100	100	100				
Bankfull Mean Depth (ft)	1.51	1.69	1.64					1.28	1.26	1.14					1.43	1.93	1.74					1.54	1.19	1.01					1.81	1.99	1.84				
Bankfull Max Depth (ft)	2.91	2.94	2.848					1.78	1.73	1.53					2.69	2.81	2.31					2.39	1.92	2.059					3.96	3.38	3.124				
Bankfull Cross Sectional Area (ft^2)	34.05	28.68	11.61					23.57	22.69	15.35					28.58	31.75	6.322					26.6	18.37	18.24					29.14	27.4	10.13				
Bankfull Width/Depth Ratio	14.93	10.04	28.8					14.41	14.24	20.4					14	8.51	21.1					11.23	13.01	22.3					8.91	6.91	30				
Bankfull Entrenchment Ratio	4.43	5.9	5.253					5.42	5.6	5.714					4.99	6	9.091					4.00	4.5	3.8					6.20	7.3	5.366				
Bankfull Bank Height Ratio			0.999							1							0.999							1							1.001				
Based on current/developing bankfull feature																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft^2)																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft^2)																																			
d50 (mm)		NA	NA						0.06	11						NA	NA						0.06	8						NA	NA				
	Cross Section 16 (Pool)							**Cross Section 17 (Riffle)**							**Cross Section 18 (Pool)**							**Cross Section 19 (Riffle)**							**Cross Section 20 (Riffle)**						
Based on fixed baseline bankfull elevation	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	18.22	16.95	21.29					6.65	4.96	4.9					6.86	5.82	6.3					6.7	6.23	8.719					8.79	7.74	12.01				
Floodprone Width (ft)	57	57	60					20	20	20					26	26	30						27.7	30						29	30				
Bankfull Mean Depth (ft)	2.34	2.53	2.45					0.62	0.97	1.11					0.58	0.6	0.54					0.59	0.47	0.27					0.78	0.58	0.44				
Bankfull Max Depth (ft)	3.12	3.22	3.204					0.99	1.22	1.38					0.92	1.03	1.09					0.83	0.62	0.598					1.01	0.75	0.662				
Bankfull Cross Sectional Area (ft^2)	42.73	42.85	8.69					4.11	4.82	4.414					3.97	3.51	11.67					3.98	2.91	32.29					6.83	4.53	27.29				
Bankfull Width/Depth Ratio	7.79	6.7	45					10.73	5.1	5.46					11.83	9.7	5.42					11.36	13.26	4.15					11.27	13.34	4.37				
Bankfull Entrenchment Ratio	3.13	3.4	2.818					3.69	4.22	4.082					3.78	4.43	4.762					6.00	4.45	3.441					4.53	3.71	2.499				
Bankfull Bank Height Ratio			1.001							1							1							1.001							1				
Based on current/developing bankfull feature																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft^2)																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft^2)																																			
d50 (mm)		0.03	3						NA	NA						NA	NA						113	80						45	30				

Table 11.3. Monitoring – Cross Section Morphology

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

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

	Cross Section 21 (Pool)							Cross Section 22 (Riffle)							Cross Section 23 (Pool)							Cross Section 24 (Riffle)							Cross Section 25 (Riffle)						
Based on fixed baseline bankfull elevation	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	7.72	10.54	6.754					8.59	8.52	7.146					19.17	15.83	17.18					18.46	18.94	22.41					18.86	17.76	20.68				
Floodprone Width (ft)	40	40	40					75	75	75					200	200	200					200	200	200					100	100	100				
Bankfull Mean Depth (ft)	0.83	0.93	0.97					0.52	0.51	0.46					2.68	2.67	2.88					1.32	1.39	1.33					1.36	1.38	1.35				
Bankfull Max Depth (ft)	1.31	2.13	1.561					0.84	0.67	0.834					4.72	4.83	4.567					1.93	2.21	1.978					1.82	1.85	1.741				
Bankfull Cross Sectional Area (ft^2)	6.44	9.83	6.963					4.46	4.37	15.54					51.38	42.32	5.964					24.43	26.37	16.85					25.68	24.46	15.32				
Bankfull Width/Depth Ratio	9.3	11.33	7.61					16.52	16.71	8.45					7.15	5.93	42.1					13.98	13.63	29.4					13.87	12.87	26				
Bankfull Entrenchment Ratio	5.17	3.74	5.922					8.50	8.52	10.49					10.43	12.63	11.64					10.83	10.56	8.924					5.30	5.63	4.836				
Bankfull Bank Height Ratio			1.001							1							0.998							1.001							0.999				
Based on current/developing bankfull feature																																			
Bankfull Width (ft)																																			
Floodprone Width (ft)																																			
Bankfull Mean Depth (ft)																																			
Bankfull Max Depth (ft)																																			
Bankfull Cross Sectional Area (ft^2)																																			
Bankfull Width/Depth Ratio																																			
Bankfull Entrenchment Ratio																																			
Bankfull Bank Height Ratio																																			
Cross Sectional Area between end pins (ft^2)																																			
d50 (mm)		0.04	0.1						108	180						NA	NA						0.05	14						0.05	18				

	Cross Section 26 (Pool)							Cross Section 27 (Riffle)							Cross Section 28 (Riffle)						
Based on fixed baseline bankfull elevation	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+	Base	MY1	MY2	MY3	MY4	MY5	MY+
Bankfull Width (ft)	8.75	8.78	11.8					10.23	8.64	10.94					9.84	9.88	12.68				
Floodprone Width (ft)	50	50	50					50	50	50					50	50	50				
Bankfull Mean Depth (ft)	0.93	0.82	0.68					0.62	0.54	0.3					0.69	0.68	0.35				
Bankfull Max Depth (ft)	1.73	1.34	1.314					1.04	0.83	0.678					1.11	1.09	1.015				
Bankfull Cross Sectional Area (ft^2)	8.1	7.24	17.36					6.31	4.7	36.48					6.83	6.74	36.24				
Bankfull Width/Depth Ratio	9.41	10.71	6.32					16.5	16	6.15					14.26	14.53	7.38				
Bankfull Entrenchment Ratio	5.71	5.69	4.236					4.88	5.78	4.57					5.08	5.06	3.94				
Bankfull Bank Height Ratio			1.001							1							1				
Based on current/developing bankfull feature																					
Bankfull Width (ft)																					
Floodprone Width (ft)																					
Bankfull Mean Depth (ft)																					
Bankfull Max Depth (ft)																					
Bankfull Cross Sectional Area (ft^2)																					
Bankfull Width/Depth Ratio																					
Bankfull Entrenchment Ratio																					
Bankfull Bank Height Ratio																					
Cross Sectional Area between end pins (ft^2)																					
d50 (mm)		0.04	12						0.04	25						0.05	15				

Table 12.1 Monitoring – As-built Stream Reach Morphology

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

Table 12.2 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		
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 12.3 Monitoring – MY2 (2015) Stream Reach Morphology

	Stream Reach Data Summary MY2 (2015)											
Parameter	**MY 1 Back Creek**			**MY 1 West Branch**			**MY 1 East Branch**			**MY 1 North Branch**		
Dimension and Substrate - Riffle	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg
Bankfull Width (ft)	18.36	24.41	11.00	7.74	12.01	4.90	17.18	22.41	20.09	10.94	12.68	11.81
Floodprone Width (ft)	82.02	100.00	25.30	30.00	40.00	20.00	100.00	200.00	166.67	50	50	50.00
Bankfull Mean Depth (ft)	1.41	2.45	0.75	0.67	1.11	0.27	1.33	2.88	1.85	0.3	0.68	0.44
[1]Bankfull Max Depth (ft)	2.39	3.75	1.03	1.06	1.56	0.60	1.74	4.57	2.76	0.678	1.314	1.00
Bankfull Cross Sectional Area (ft^2)	14.65	26.54	6.32	16.53	32.29	4.41	5.96	16.85	12.71	17.36	36.48	30.03
Width/Depth Ratio	26.95	52.00	10.70	5.40	7.61	4.15	26.00	42.10	32.50	6.15	7.38	6.62
Entrenchment Ratio	4.63	9.09	1.59	4.14	5.92	2.50	4.84	11.64	8.47	3.942	4.568	4.25
Bank Height Ratio			1.00			1.00			1.00			1.00
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												
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Additional Reach Parameters												
Rosgen Classification	B4c/E4			B4c			B4c			B4c		
Bankfull Velocity (fps)												
Bankfull Discharge (cfs)												
Valley length (ft)	4400			927			612			1082		
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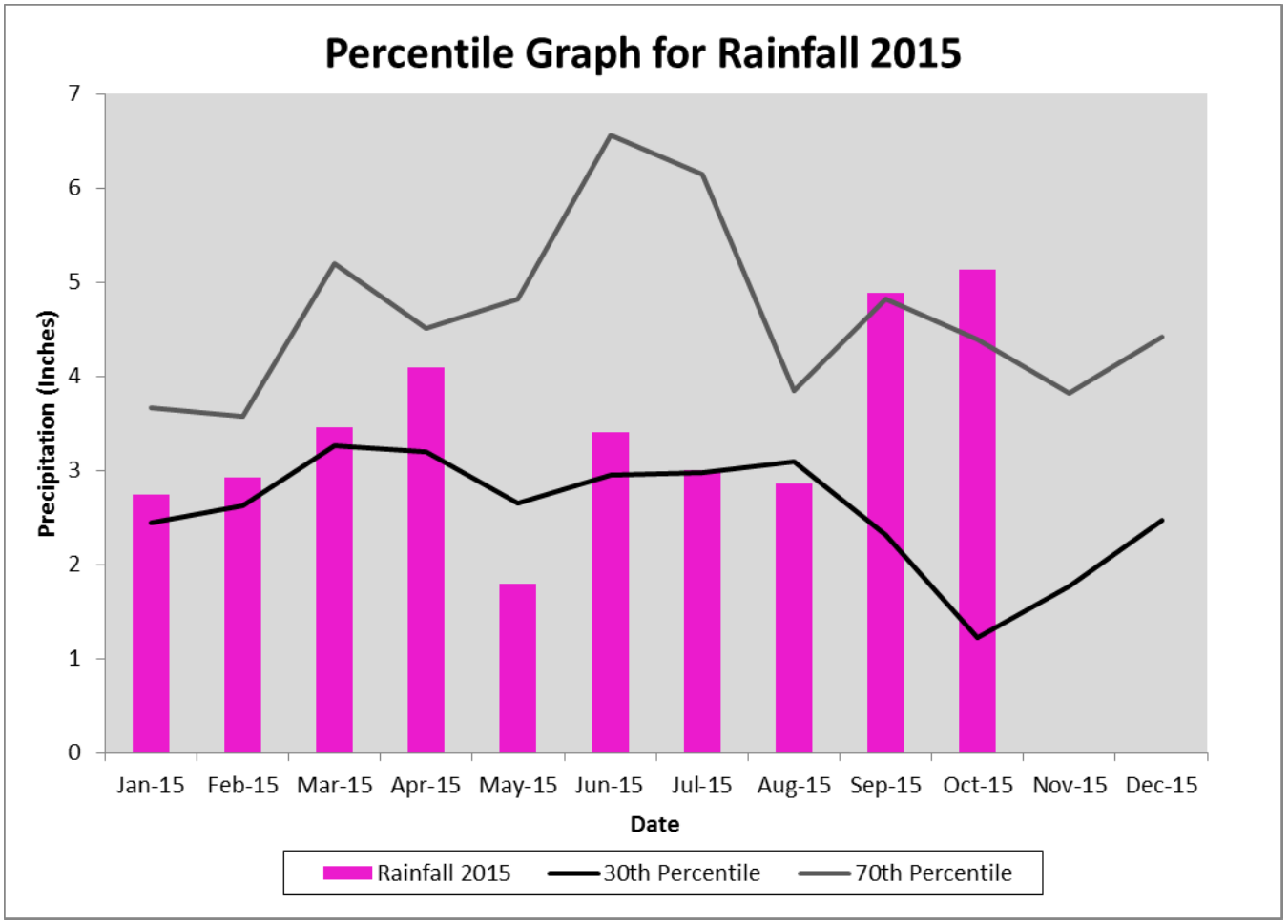
Sinuosity (ft)	1.2			1.7			1.1			1.1		
Water Surface Slope (Channel) (ft/ft)	0.0056			0.018			0.009			0.0061		
BF slope (ft/ft)	0.005			0.019			0.014			0.0054		
Bankfull Floodplain Area (acres)												
Proportion over wide (%)												
Channel Stability or Habitat Metric												
Biological or Other												

Appendix E: Hydrologic Data

Table 13. Verification of Bankfull Events

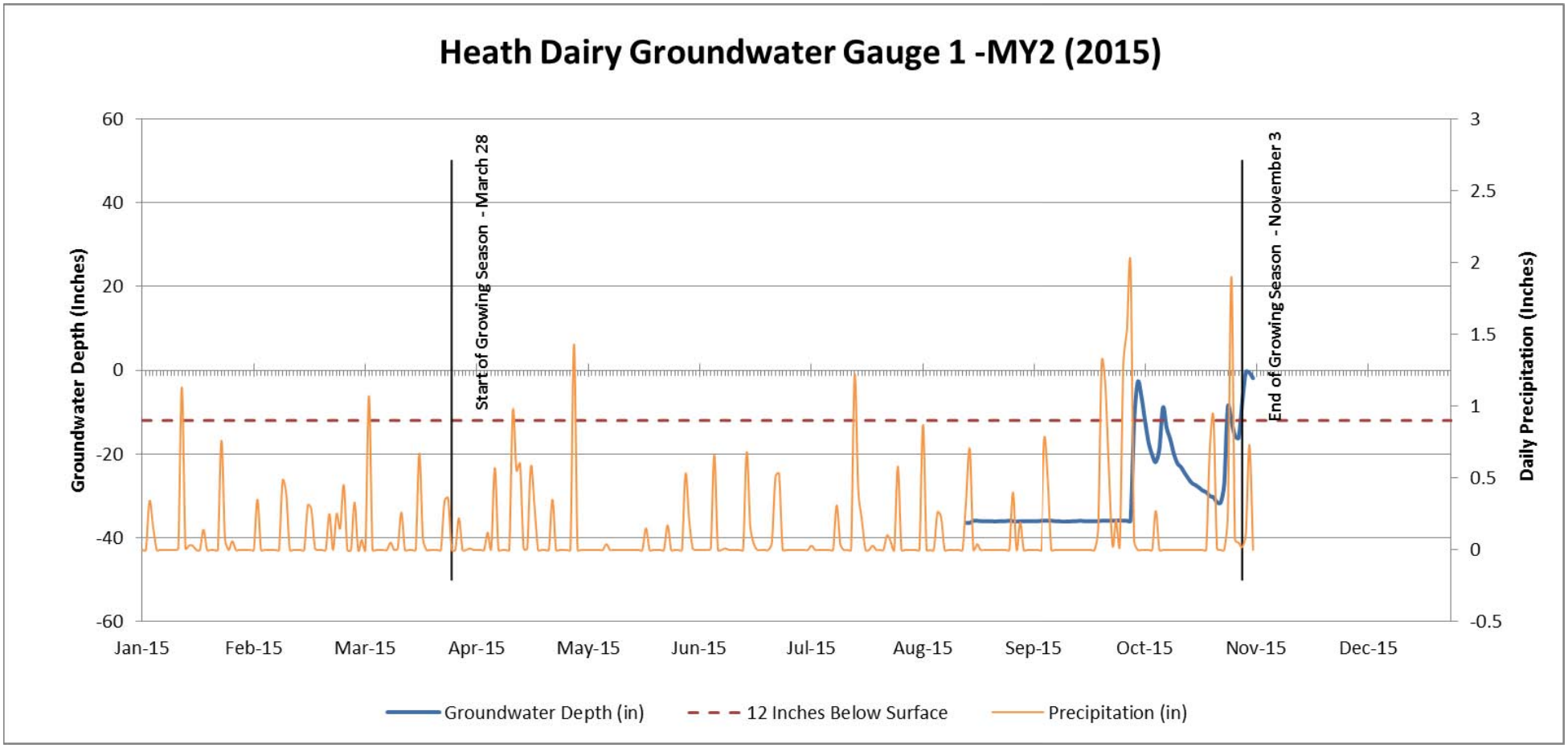
Date of Collection	Date of occurance	Method	Photo (If Available)	Feet Above average Bankful Elevation
Sep-15	Unknown	CSG; HOBO	NA	0.4

Figure 6. Rainfall Percentile



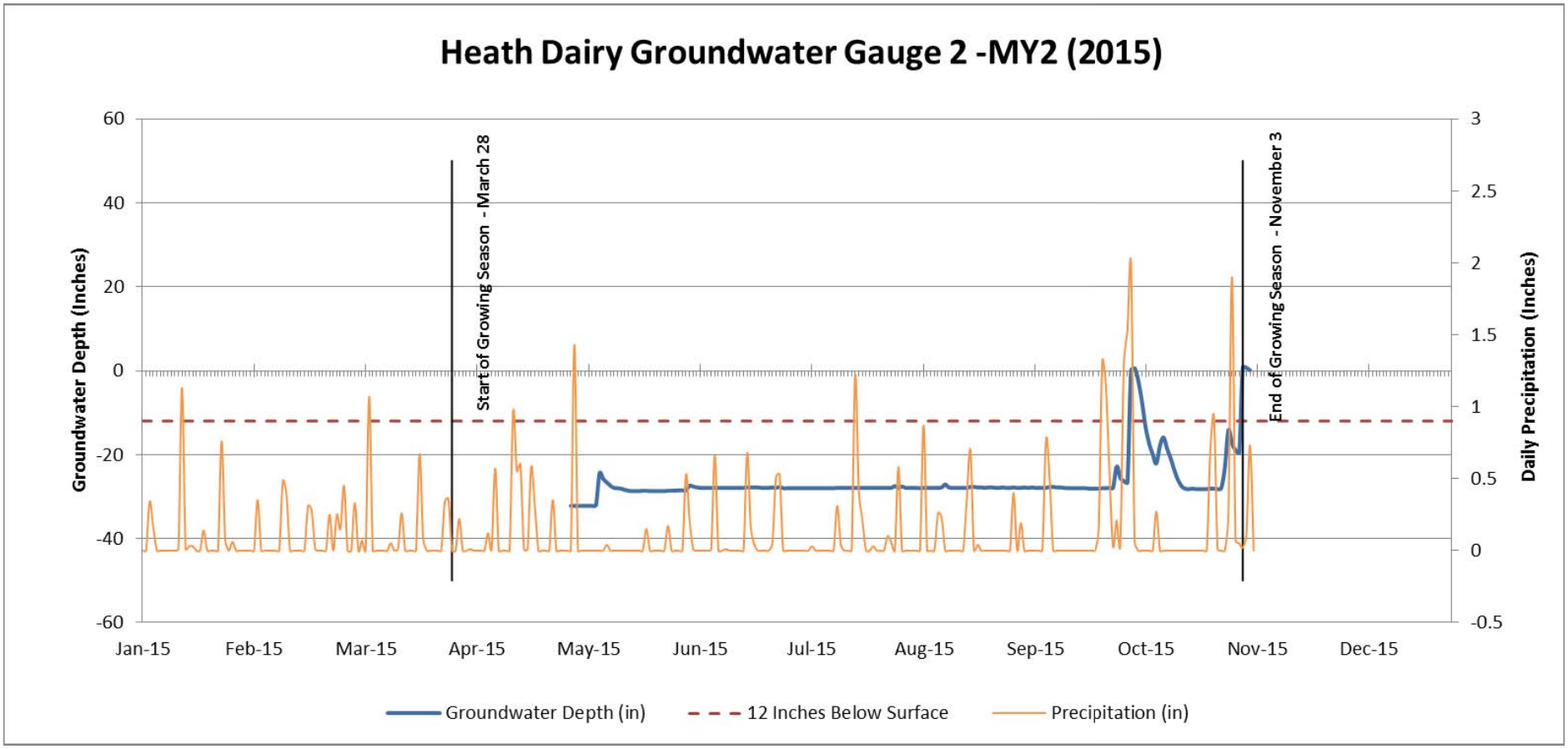
- Monthly rainfall data from CRONOS Station ID: 310286, Asheboro, NC

Figure 7.1. Groundwater Data



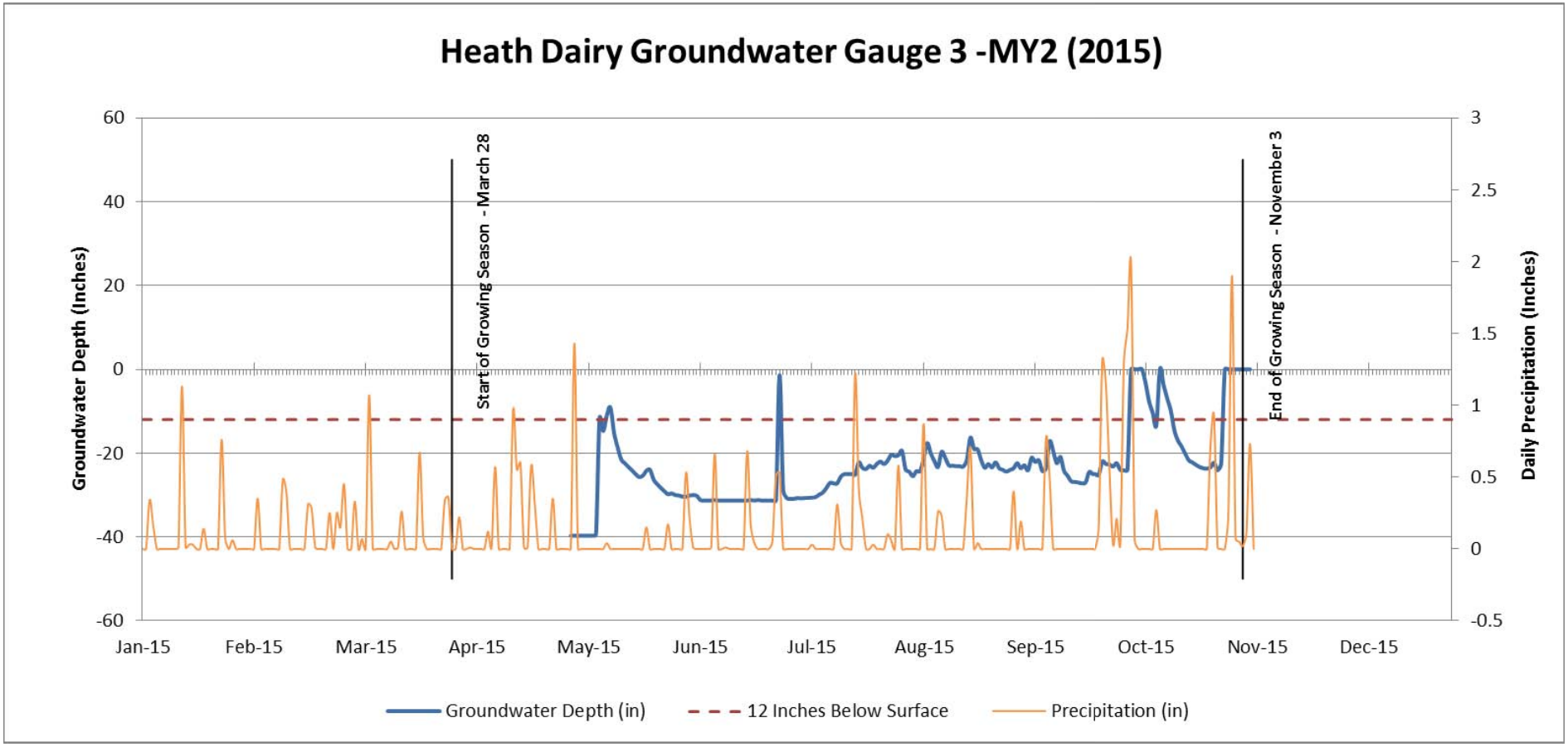
- Daily rainfall data from CRONOS Station ID: 310286, Asheboro, NC

Figure 7.2. Groundwater Data



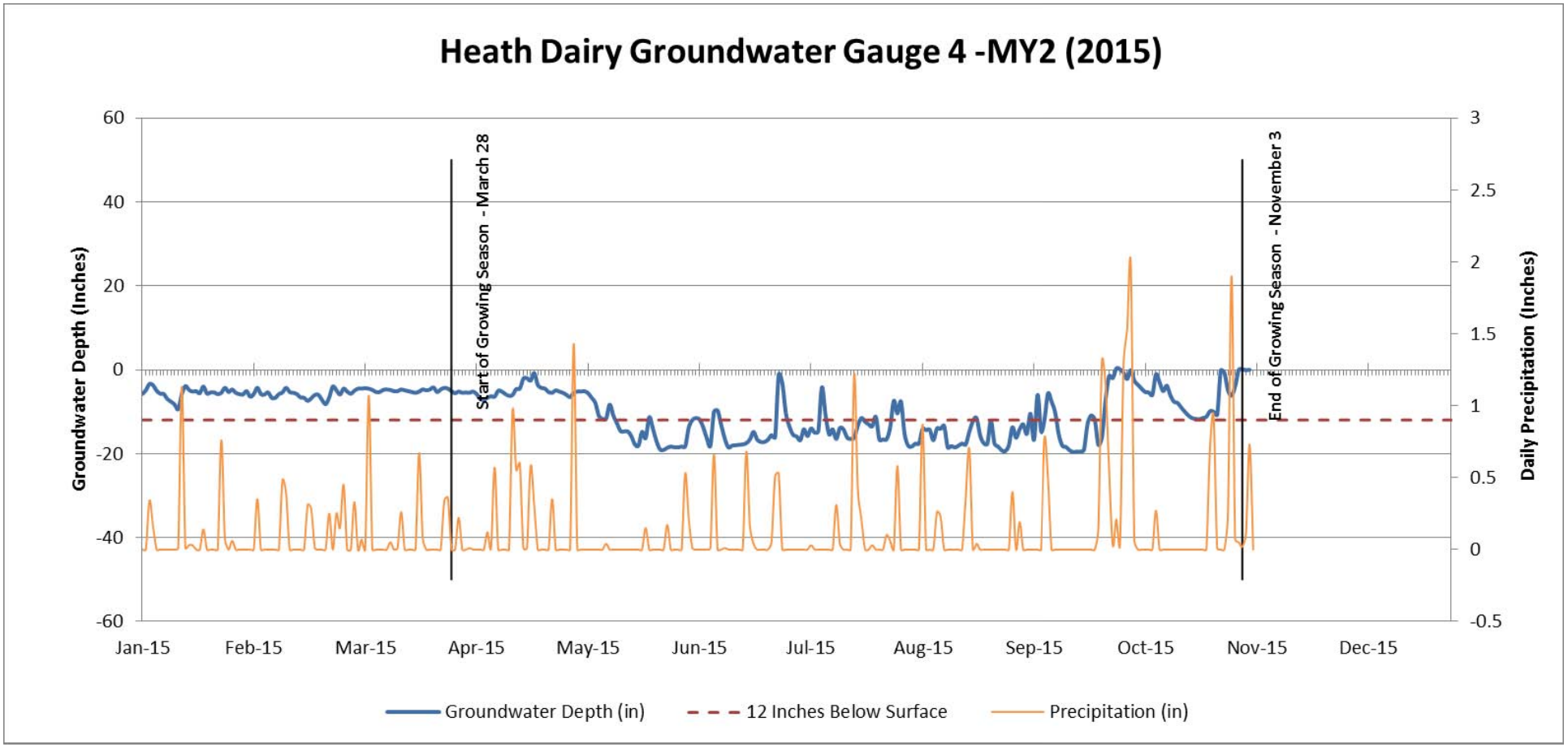
- Daily rainfall data from CRONOS Station ID: 310286, Asheboro, NC

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 14. Wetland Gauge Attainment

	MY2 2015			
Gage #	% of Growing Season Monitored	Max # Consec. Days	% of Growing Season	Success Critera Attained?
1	35%	4	2	*NA*
2	85%	3	1	*NA*
3	85%	8	4	*NA*
4	100%	41	19	***YES*** *

* Gage 4 is located within a jurisdictional wetland