

Lewis Creek Stream Restoration Henderson County, North Carolina

DMS Project #733
NCDEQ Contract #5631



MY – 05 Monitoring Report

Data Collected: September-November 2015
Submitted: December 2015

Prepared for:
North Carolina Department of Environmental Quality
Division of Mitigation Services
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1.0 EXECUTIVE SUMMARY

Based on our field observations and review of the data collected in during the fall of 2015, we conclude that the Lewis Creek project is trending toward a successful restoration project.

1.1 Project Goals & Objectives

The Lewis Creek Stream Restoration Site (Lewis Creek Site) is located in an active agricultural community and many of the forest lands in the area are being converted to orchards or residential development. The Lewis Creek Site is protected in perpetuity and is located immediately adjacent to a preserved mountain bog. The segment of Lewis Creek that underwent active restoration is classified by the North Carolina Department of Environmental Quality (NCDEQ) Division of Water Resources (DWR) as Class C, trout waters (NCDDWR, 2007). The following is a list of Goals & Objectives to be gained from this project:

Goals

1. Reestablishing stream stability and capacity to transport watershed flows and sediment load by restoring 1,750 linear feet of stable channel morphology;
2. Re-introduce a more frequent hydrologic connection between the stream and the floodplain;
3. Establish native riparian bottomland hardwood tree and shrub community;
4. Reduce nonpoint source sediment pollution and excessive nutrient inputs;
5. Enhance the flood storage capacity of the Site by adjusting channel and/or flood plain elevations while improving the hydrologic connection of the stream to its floodplain.

Objectives

1. Utilize natural channel design principles to create a more stable pattern, profile and dimension morphology and improve stream habitat using grade/bank stabilization structures;
2. Lower floodplain berms along Lewis Creek to allow more access by flood events;
3. Successfully plant riparian and flood plain areas with native woody trees and shrubs conforming to the density requirements specified below;
4. Eliminate accelerated bank erosion, exclude livestock, and reestablish native riparian buffers substantially greater than 50 feet in width;
5. Reestablish floodplain connectivity;
6. Preserve the entire Site with a Conservation Easement in perpetuity.

1.2 Background

The Lewis Creek Site is located in Henderson County, North Carolina, northeast of the City of Hendersonville. The Site is located within the French Broad River Watershed (USGS HUC

06010105) and is a third order tributary to Clear Creek. A Vicinity Map is included in Appendix A. The land use is dominated by agriculture (primarily fruit orchards and row crops) and forest. Much of the surrounding forested land is being converted to orchards and sod farms. New residential development is also encroaching toward the Lewis Creek Site. The project area consists of 1,750 linear feet of stream restoration on the main channel of Lewis Creek. The Site begins at North Ridge Road culvert crossing and continues downstream for 1,750 lf to the end of the project. Approximately 10 acres of forested wetlands are located along the south side of Lewis Creek, most of which extends beyond the conservation easement. This area is owned by the Carolina Mountain Land Conservancy (CMLC). CMLC is actively involved in the management of this site and we have coordinated closely with them during the monitoring field work. Prior to restoration activities Lewis Creek had been impacted by straightening and berm construction. The design was done by Jordan, Jones & Goulding, Inc. (JJG) and constructed by Carolina Environmental Contracting for the North Carolina Ecosystem Enhancement Program (EEP), now Division of Mitigation Services (DMS). The fifth year monitoring field work was completed in September 2015 by Mogensen Mitigation, Inc. (MMI). The monitoring was done in conformance with the NC DMS Monitoring Report Template dated February 2014.

The Lewis Creek Site was constructed in April 2011 and MY-01 was completed in 2012 by JJG. No monitoring occurred for MY-02. Mogensen Mitigation, Inc. (MMI) conducted the monitoring for MY-03 in October of 2013, the monitoring for MY-04 in September of 2014 and MY-05 in September 2015. The Lewis Creek Site includes 1,750 lf of stream restoration and a small area of riparian wetlands (approximately 0.18 ac.) on the Lewis Creek floodplain. During this fall monitoring season (September, 2015, MY-05), in addition to the usual monitoring tasks, MMI has delineated the wetlands and mapped the extent using GPS survey equipment. Wetland Data Forms are included in Appendix E.

The existing stream reach that was available for restoration was 1,663 lf of Lewis Creek. The stream restoration consisted of Priority Level 2 restoration along the main channel of Lewis Creek resulting in 1,750 lf of restored stream. The restoration plan also included planting the stream banks and riparian zones with native tree and shrub species. The designed channel dimension was based on a combination of dimensionless ratios from the reference reach along Raccoon Branch, NC Regional Curve for Rural mountain streams, Rosgen stable reach data ranges (Rosgen 2004a) and existing conditions. Appendix A includes more details on the Site's location, history and watershed background information.

1.3 Vegetative Conditions

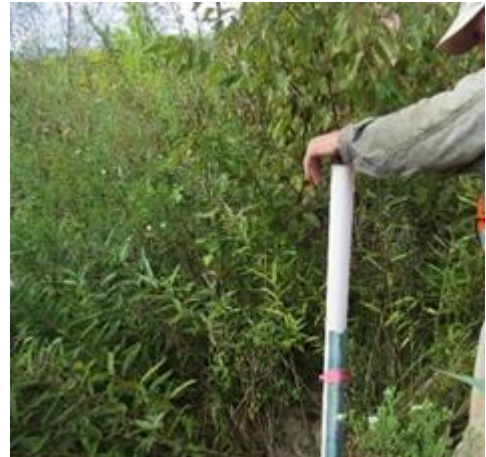
In September 2015, each of the five pre-established 10 x 10 meter vegetation plots were re-located, flagged and surveyed by MMI staff using Version 4.2 of the CVS-EEP Level 2 Vegetation Monitoring Protocol (Lee *et al.*, 2008). According to this protocol, both planted and

volunteer stems were resampled. For this monitoring year (MY-05 2015), the success criterion specified in the mitigation plan requires a minimum survival rate of 260 live stems/per acre.

In 2015 the five CVS monitoring plots had surviving planted stem densities of 81 to 364 stems per acre (average 210 per acre), and three plots did not meet the MY-05 success criterion (260 stems per acre) based on planted stem survival. However, the total density of planted plus native volunteer woody stems ranges from 931 to 7729, and all plots have densities far exceeding the success criterion when volunteer stems are included (Appendix C, Table 8). Predominant volunteer species include *Salix nigra*, *Salix cinerea*, *Alnus serrulata*, *Betula nigra*, and *Cornus amomum*.

1.4 Significant Flood Events

Observations of the crest stage gauge (CSG) in September, 2015 suggest that at least one storm event did reach overbank flooding during the winter/spring of 2015 (Table 11). This most likely occurred during June 2015 when the NC mountains experienced two weeks of rain. MMI noted the height of the flooding (8") and removed the existing CSG during the site visit field work. Each monitoring year for the last three years the site experienced a bankfull event, therefore, this criteria has been achieved.



1.5 Stream Assessment

Observations from this year's fall monitoring field work indicate that the stream banks and the present stream dimensions along the restored reach appear to be stable and within acceptable parameters. The entire 1,750 lf reach of Lewis Creek was surveyed and assessed from the project origin at North Ridge Road bridge to the project terminus. This assessment included five surveyed cross-sections (Figure 4), a longitudinal-profile survey (Figure 5) visual stability (Table 5) and field verifying the Current Condition Plan View (Figure 2).



During our fall site visit in September, MMI observed evidence of an active beaver dam at approximately station 7+75 just upstream from VP-03 that was backing up water for roughly half

the project. MMI staff manually removed this dam to facilitate the longitudinal survey, and informed DMS about the presence of beaver at that time. A DMS contractor was subsequently notified in September 2015 and is conducting monthly site visits to trap beaver and remove dams as necessary.

Several center bars persist in the stream channel and have been closely watched in all monitoring years. Larger bars occur at approximately Stations 8+50 and 11+50. Smaller center bars that had been observed downstream in past years were flooded this year due to the beaver activity. In general, these center bars are not a cause for concern as the streambank vegetation along these reaches is preventing lateral migration of the stream. The stream flows continue to be adequate to keep most in-stream vegetation from overtaking the stream channel even in summer months.



The sediment and substrate loads were a mix of sand in slower moving stream reaches and cobble & gravel in the riffles (see Pebble Count data below). Based on the recent monitoring data and our visual inspection the restored stream channel appears to be functioning as designed, maintaining stability, and adequately passing bedload sediment. Stream bank erosion was not observed anywhere along the restored reach. All structures appear to be functioning as designed and are not showing any signs of erosion or piping. Cross-section survey data indicates that channel geometry remains stable with only slight changes in channel morphology evident.

1.6 Wetland Conditions

Data from groundwater monitoring gages 1, 2, 4, 5 & 6 supported by field observations suggest that these areas are not close to meeting jurisdictional wetland hydrology (see Appendix E). It is important to note, however, that between the fall monitoring periods of 2014 & 2015 several of the gauges have malfunctioned at times resulting in data gaps, despite routine checks, maintenance, recalibration, and even replacement of Gauges 1 & 6 in May 2015. We have supplemented the incomplete gauge data with field measurements of saturation depth (manual readings taken with a tape measure) during each site visit. We recognize these occasional data points cannot document the duration of shallow saturation, but the limited evidence they provide does support our opinion that the wells are probably not meeting wetland hydrology success criteria in these areas.

Water tables at gauges 2 through 6 remained far below 12" from January through March prior to the growing season, except for brief spikes. Thus it is unlikely that they achieved saturation for

extended periods during the growing season. For gauge 1 we do not have any January to March data for 2015, but during Jan to Mar of the previous year there were only a few intermittent days when it rose above the 12” depth threshold. Field observations further indicate that these areas did not exhibit wetland indicators such as dominant wetland vegetation and/or hydric soils. Observed trends in vegetation, surface water, and groundwater data suggest that the only jurisdictional wetland area is in the vicinity of Gauge 3, as described below.

Field observations indicate that any wetland hydrology in the vicinity of Gauge 3 is based on surface flows from the adjacent mountain bog. On numerous occasions during the last three years of monitoring, we have observed standing water in this area during periods when the gauge readings clearly showed the water table more than 12 inches below the surface. MMI staff have repeatedly used manual measurements with a tape measure to insure that the gauge was working correctly in these incidences. The manual measurements have confirmed that there was a disconnect between the surface flows and the groundwater in the wetland area.

Although the jurisdictional wetland area found on the Lewis Creek site is relatively small (~0.18 acres), it contains a high diversity of native wetland shrubs and forbs. According to the Cowardin Classification System it is considered a Palustrine Scrub-Shrub Broad-Leaved Deciduous with Saturated Water Regime (PSS1B). The wetlands are dominated by river birch, black willow and silky dogwood in the canopy layer and alder and grey willow in the shrub layer. The herbaceous vegetation includes sedges, rushes, jewelweed, woolgrass, Joe-Pye weed, boneset, seedbox and cardinal flower. The soils are mapped Codorus silt loam with inclusions of Hatboro silt loam which is a Hydric A soil. The soils are saturated and mucky in the wetter areas. As noted in the Methodology Section, the wetland boundaries were delineated using the latest state and federal rules for determining jurisdictional waters of the United States. Routine Wetland Determination Data Forms were completed for this wetland area and included in Appendix E.

1.7 Problem Areas

One new, active, beaver dam was found to be backing up water for >700 linear feet of the project. This dam was removed by hand to the best of our abilities during the site visit and DMS was notified at that time. A DMS contractor was subsequently notified in September 2015 and is conducting monthly site visits to trap beaver and remove dams as necessary.

With respect to planted vegetation, the only minor problem we observed in 2015 is the continuing sand deposition in isolated flood plain areas, as noted in previous years. Cumulatively, these areas represent a relatively small amount of the site area below the mapping threshold (~0.1 acres), as noted on table 6. These



areas of sand deposition tend to support annual herbaceous vegetation that can root quickly in the new sand piles.

No other problems were observed to exist at this time.

2.0 METHODOLOGY

Monitoring methodologies follow the CVS-EEP Level 2 Vegetation Monitoring Protocol for Recording Vegetation (Lee *et al.* 2008). All photos were taken with a Cannon digital camera and are available electronically. A Trimble Hand Held GPS unit was used to locate veg. plot corners, groundwater gauges and problem areas.

For gauges 1 & 6 a laptop equipped with PC TRANSFER and ODYSSEY software was used to download the data from the groundwater gauges. For gauges 2, 3, 4, 5 an HP calculator and Dell Laptop computer were used to download the data. All graphics have been done using ArcGIS and are available electronically.

2.1 Vegetation Methodologies

Five 10 x 10 square meter veg. plots were installed and monitored according to the CVS-EEP Level 2 Vegetation Monitoring Protocol Version 4.2 (Lee *et al.* 2008). The plot corners are marked with 1" Aluminum or PVC pipe and flagged with bright red flagging tape. Data collected from each plot is included in Appendix C. Monitoring plot locations are shown on the maps in Appendix B. Plant identification was aided by the publication *Flora of the Southern and Mid-Atlantic States* (Weakley 2012).

2.2 Wetland Methodologies

Six (6) Infinities Continuous-Read Groundwater gauges were installed by MMI in 2013 according to the Technical Note HY-1A-3.1 (USACE 1993). Three gauges (1, 2, 3) are located on the south side of Lewis Creek and three (4, 5, 6) are located along the north side of Lewis Creek (per directions from Mike McDonald NCDMS PM). The gauges are set to record data every 24 hours and are downloaded at regular intervals through the year. All six (6) groundwater Monitoring Gauges were downloaded most recently in November, 2015, and were checked regularly throughout the growing season. Data is provided in an Excel spreadsheet and may be supplemented with data from the NC CRONOS database, Station ID NC-HN-15 and field observations. This year, project wetland boundaries were delineated (figure 2) using the Routine Wetland Determination method (Level 2-Onsite Inspection; field sheets available in Appendix E) as defined in the 1987 USACE Wetland Delineation Manual, as required by our contract.

2.3 Stream Methodologies

Five cross-sections and 1,750 linear feet of stream long-pro were surveyed in September 2015 using a Trimble RDK survey-grade GPS unit. The survey data locations were plotted using ARC GIS 10.0 and Excel. Cross-sectional data was based on a linear alignment between end points marked by metal pins. Measurements at each cross-section include points at point of origin, bankfull, top of bank, toe of slope and thalweg for each stream side supplemented with photos. Long-pro measurements include thalweg, and water surface taken at the head of feature (i.e. riffle, run, pool glide) in addition to pool depths. It should be noted that due to the change in water levels resulting from beaver activity it was difficult to establish the exact location of some features, particularly the pools. For this reason, only one pool was measured in 2015. In addition, visual and photographic assessment of in-stream structures was conducted to determine overall project success. Structure failures include collapse of structure, undermining, abandonment of channel, piping around the structure. Stream assessment data are included in Appendix D with cross-sections and monitored stream reaches indicated on maps in Appendix B. In addition, MMI used manual crest stage gauges to verify bankfull events.

All raw data supporting the tables, figures and graphs in the appendices are available to NCDMS upon request.

3.0 References

Doll, B. A., Grabow, G.L., Hall, K. A., Halley, J., Harman, W. A. Jennings, G.D., Wise, D.E., (2003). Stream Restoration: A Natural Channel Design Handbook. *NC Stream Restoration Institute, NC State University.*

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JJG March 2013. Monitoring Report Year #1

Rosgen, D. L. (1996). Applied River Morphology. *Wildland Hydrology Books*, Pagosa Springs, CO.

Weakley, A. S. (2012). Flora of the Southeastern and Mid-Atlantic States. *Working draft of November 2012. University of North Carolina Herbarium (NCU), NC Botanical Garden, University of North Carolina, Chapel Hill, North Carolina.*

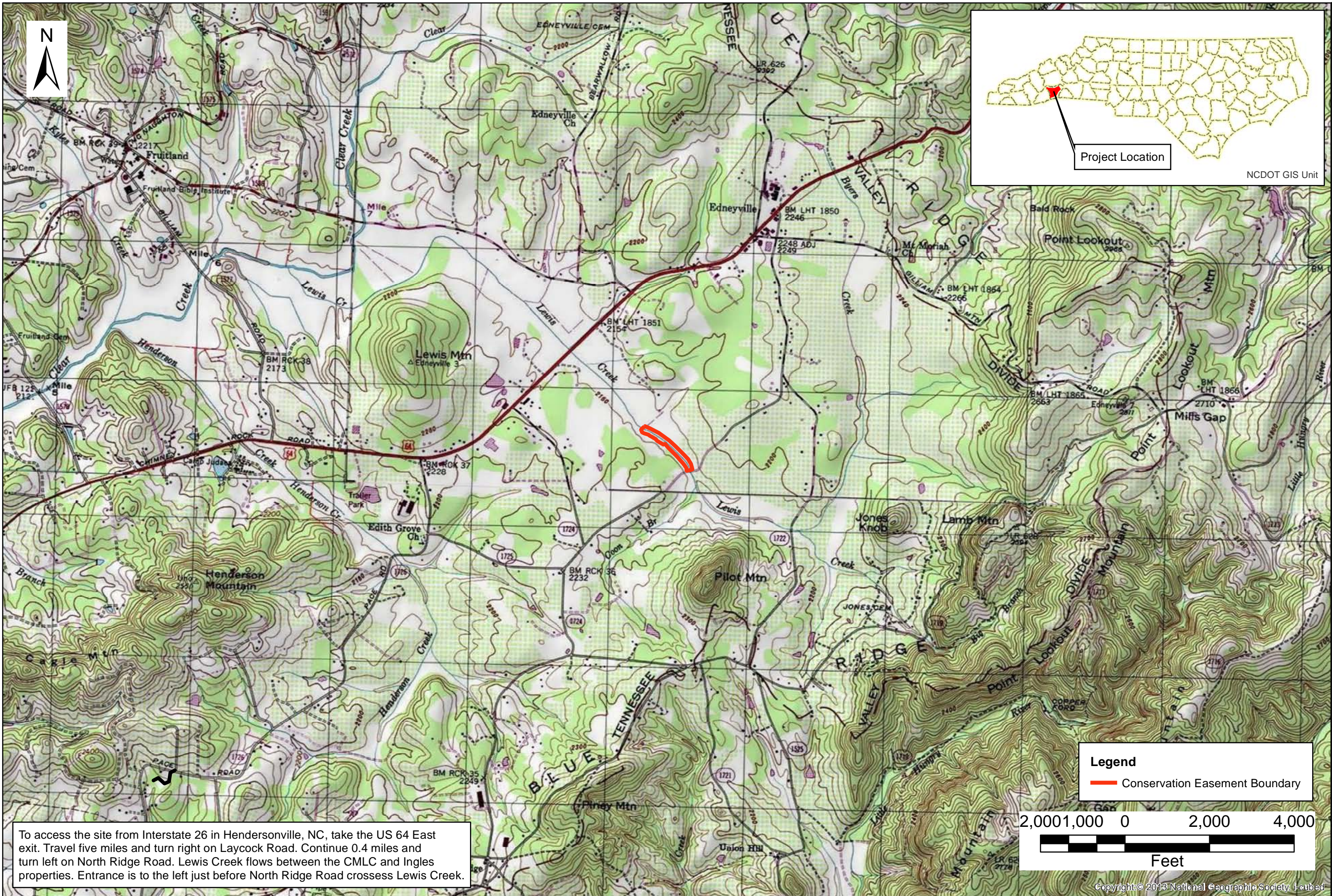
Miller, James H. (2003). Invasive Plants of Southern Forests. A field guide for identification and Control. *USDA Forest Service Southern Research station General Technical Report SRS-62.*

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

Dept. of the Army, Corps of Engineers (33 CFR Part 328) & US Environmental Protection Agency (40 CFR Parts 110, 112, 116 et al). Clean Water Rule: Definition of “Waters of the United States”: Final Rule.

Various NCDMS Guideline Documents as noted.

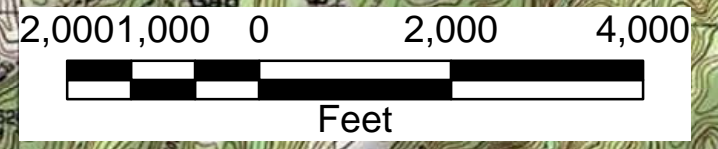
**Appendix A: Project Vicinity Map
and Background Tables**



Project Location

NCDOT GIS Unit

Legend
 — Conservation Easement Boundary



To access the site from Interstate 26 in Hendersonville, NC, take the US 64 East exit. Travel five miles and turn right on Laycock Road. Continue 0.4 miles and turn left on North Ridge Road. Lewis Creek flows between the CMLC and Ingles properties. Entrance is to the left just before North Ridge Road crosses Lewis Creek.

Table 1. Project Components and Mitigation Credits

Mitigation Credits									
	Stream		Riparian Wetland		Non-Riparian Wetland		Buffer	Nitrogen Nutrient Offset	Phosphorus Nutrient Offset
Type	R	RE	R	RE	R	RE	N/A	N/A	N/A
Totals	1,750	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Project Components									
Project Component	Stationing/Location		Existing Feet/Acres		Approach		Restoration or-Restoration Equivalent	Restoration Footage or Acres	Mitigation Ratio
Lewis Creek	0+00 – 17+50		1,663 lf		P II		Restoration	1,750 lf	1:1
Component Summation									
Restoration Level	Stream (lf)		Riparian Wetland (ac)		Non-Riparian Wetland (ac)	Buffer (sq ft)	Upland (ac)		
			Riverine	Non-Riverine					
Restoration (R)	1,750		N/A		N/A		N/A	N/A	N/A
Totals	1,750		N/A		N/A		N/A	N/A	N/A
BMP Elements									
Element	Location		Purpose/Function			Notes			
N/A	N/A		N/A			N/A			
BMP Elements									
BR = Bioretention Cell; SF = Sand Filter; SW = Stormwater Wetland; WDP = Wet Detention Pond; DDP= Dry Detention Pond; FS = Filter Strip; S= Grass Swale; LS = Level Spreader; NI = Natural Infiltration Area; FB = Forested Buffer									
SMU = Stream Mitigation Unit; WMU = Wetland Mitigation Mitigation Unit									

Table 2. Project Activity and Reporting History

Activity or Report	Data Collection Completed	Actual Completion or Delivery
Mitigation Plan	September-07	December-07
Final Design - Construction Plans	August-09	August-09
Construction	September-10	April-11
Temporary S&E mix applied to entire project area	April-11	April-11
Permanent seed mix applied to reach/segments	April-11	April-11
B&B plantings for reach/segments	April-11	April-11
Bare root and livestake plantings for reach/segments	April-11	April-11
Baseline Monitoring Document (Year 0 Monitoring - baseline)	July-11	December-11
Section 404 Permit	September-07	February-08
Year 1 Monitoring	June-12	November-12
Year 2 Monitoring	NA	NA
Year 3 Monitoring	October-13	February-13
Year 4 Monitoring	September-14	November-14
Year 5 Monitoring	September-15	December-15

Table 3. Project Contacts Table

Designer Matthew Clabaugh, PE	Jordan, Jones and Goulding, Inc. 309 E. Morehead Street, Suite 110 Charlotte, NC 28202 704-527-4106
Construction Contractor Stephen James	Carolina Environmental Contracting, Inc. P.O. Box 1905 Mt. Airy, NC 27030 336-320-3849
Planting Contractor Stephen James	Carolina Environmental Contracting, Inc. P.O. Box 1905 Mt. Airy, NC 27030 336-320-3849
Seeding Contractor Stephen James	Carolina Environmental Contracting, Inc. P.O. Box 1905 Mt. Airy, NC 27030 336-320-3849
Seed Mix Sources	Green Resources Rodney Montgomery 336-215-3458
Nursery Stock Suppliers	Mellow Marsh Farm, Inc. 919-742-1200
Monitoring Performers: Baseline-Year 1	Jordan, Jones and Goulding, Inc. 309 E. Morehead Street, Suite 110 Charlotte, NC 28202 704-527-4106
Monitoring Performers: Year 3-5	Mogensen Mitigation, Inc. PO Box 690429 Charlotte, NC 28202
Stream Monitoring, POC	Rich Mogensen, 704-576-1111
Vegetation Monitoring, POC	

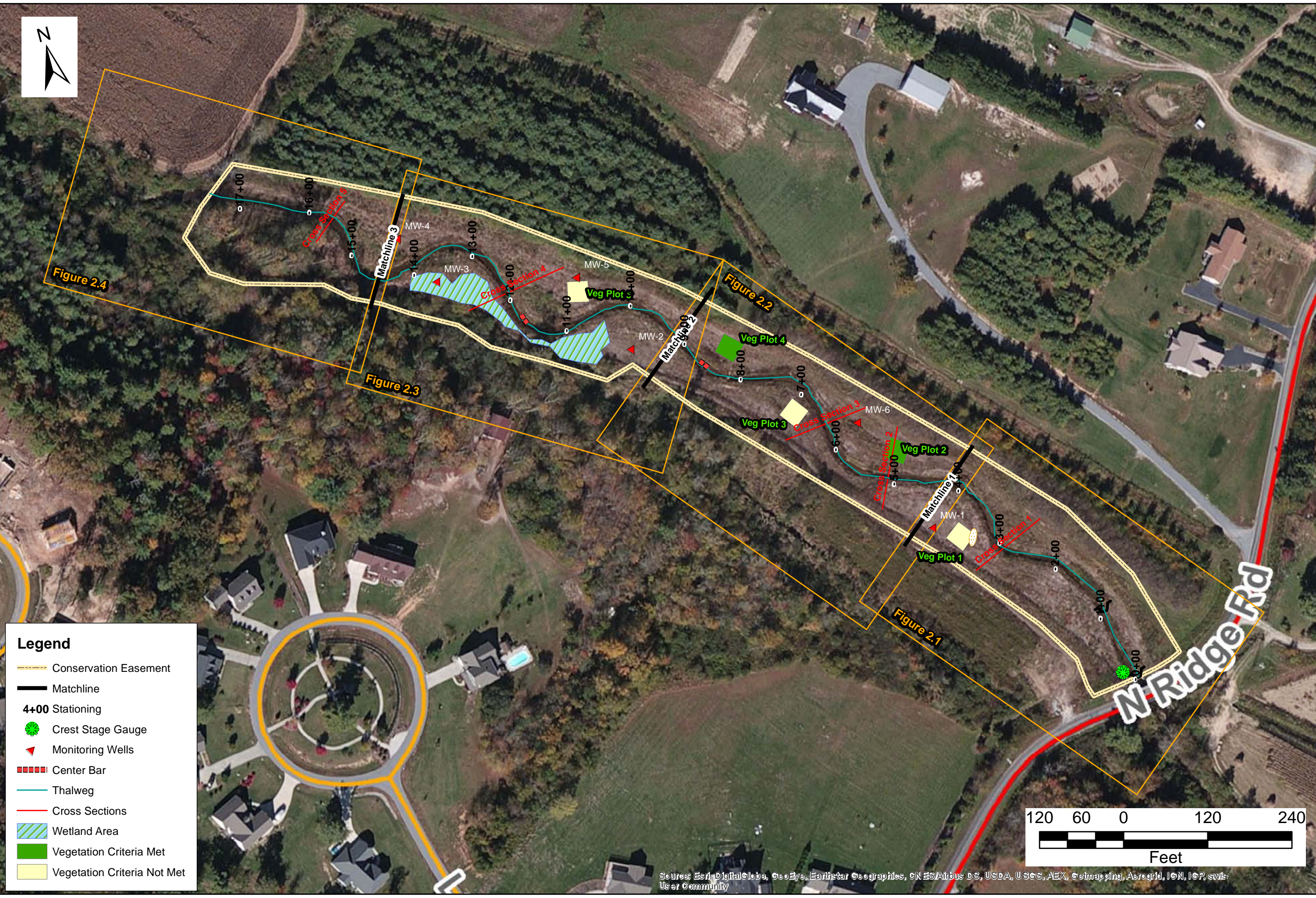
Table 4. Project Baseline Information and Attributes

Project Information			
Project Name	Lewis Creek Stream Restoration		
Project County	Henderson County, NC		
Project Area (acres)	2.53		
Project Coordinates	35°22'40.5"N 82°20'56.1"W		
Project Watershed Summary Information			
Physiographic Region	Blue Ridge		
Project River Basin	French Broad		
USGS HUC for Project (8 digit)	06010105		
NCDWQ Sub-basin for Project and Reference	04-03-02		
Project Drainage Area (acres)	2,560		
Project Drainage Area Percentage of Impervious Area	0		
CGIA Land Use Classification	2.01		
Reach Summary Information*			
Parameters			
Length of reach (linear feet)	1,750		
Valley classification	VIII		
Drainage area (acres)	1,856		
NCDWQ stream identification score	N/A		
NCDWQ Water Quality Classification	N/A		
Morphological Description (stream type)	Perennial		
Evolutionally trend	Agricultural		
Underlying mapped soils	Codorus and Hatboro loam		
Drainage Class	moderate to poor		
Soil Hydric status	Hatboro - hydric		
Slope	0.0030		
FEMA classification	100 year floodplain		
Native vegetation community	Montane Alluvial Forest and Piedmont/Mountain Alluvial Forest intermediate community type		
Percent composition of exotic invasive vegetation	U		
Regulatory Considerations			
Regulation	Applicable?	Resolved?	Supporting Documentation
Waters of the United States - Section 404	Yes	Yes	DWR #08-00008
Waters of the United States - Section 401	Yes	Yes	SAW-2008-0072
Endangered Species Act	Yes	Yes	SAW-2008-0072
Historic Preservation Act	N/A	N/A	N/A
Costal Zone Managemetn Act (CZMA)/Costal Area Management Act (CAMA)	N/A	N/A	N/A
FEMA Floodplain Compliance	Yes	No	Henderson County Floodplain Development Permit Issued 5/20/08; LOMR Approved 11/23/11
Essential Fisheries Habitat	N/A	N/A	N/A











*This site is within the Mud Creek LWP and is in a Targeted Local Watershed

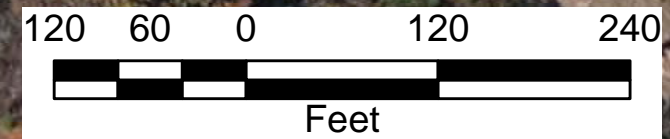
"N/A": items do not apply / "-": items are unavailable / "U": items are unknown

Appendix B: Visual Assessment Data



Legend

-  Conservation Easement
-  Matchline
- 4+00** Stationing
-  Crest Stage Gauge
-  Monitoring Wells
-  Center Bar
-  Thalweg
-  Cross Sections
-  Wetland Area
-  Vegetation Criteria Met
-  Vegetation Criteria Not Met



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swis, User Community

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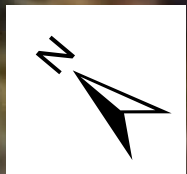


NOVEMBER
2015

LEWIS CREEK (DMS #733)
FALL REPORT
CURRENT CONDITIONS PLAN VIEW
HENDERSON COUNTY
NORTH CAROLINA



Figure 2
Overall



Legend

- Conservation Easement
- Monitoring Wells
- 4+00 Stationing
- Crest Stage Gauge
- Vegetation Criteria Met (Planted Stems/Total Stems)
- Vegetation Criteria Not Met (Planted Stems/Total Stems)
- Cross Sections
- Wetland Area
- Center Bar
- Trail
- Rock Structure
- Rootwad/Logvane
- Rockvane
- Matchline
- Thalweg



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, User Community

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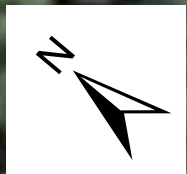


NOVEMBER
2015

LEWIS CREEK (DMS #733)
FALL REPORT
CURRENT CONDITIONS PLAN VIEW
HENDERSON COUNTY
NORTH CAROLINA



Figure 2.1



Legend

Conservation Easement	Center Bar
Monitoring Wells	Trail
Stationing	Rock Structure
Crest Stage Gauge	Rootwad/Logvane
Vegetation Criteria Met (Planted Stems/Total Stems)	Rockvane
Vegetation Criteria Not Met (Planted Stems/Total Stems)	Matchline
Cross Sections	Thalweg
Wetland Area	



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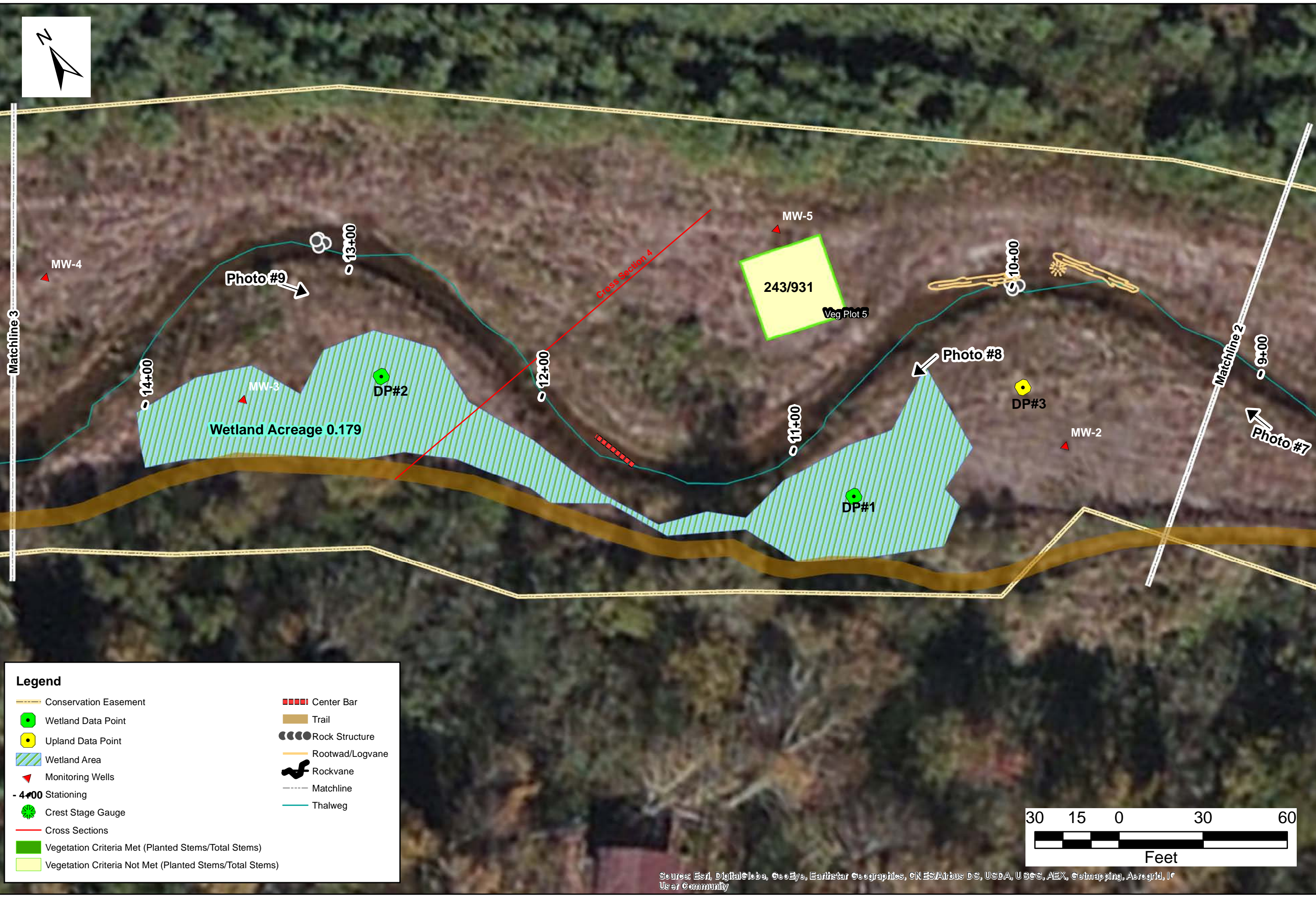
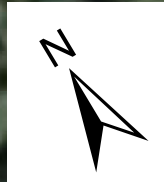
NOVEMBER
 2015

LEWIS CREEK (DMS #733)
 FALL REPORT
 CURRENT CONDITIONS PLAN VIEW
 HENDERSON COUNTY
 NORTH CAROLINA



Figure 2.2

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, User Community

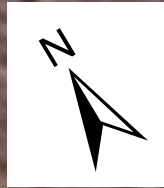


Legend

Conservation Easement	Center Bar
Wetland Data Point	Trail
Upland Data Point	Rock Structure
Wetland Area	Rootwad/Logvane
Monitoring Wells	Rockvane
Stationing	Matchline
Crest Stage Gauge	Thalweg
Cross Sections	
Vegetation Criteria Met (Planted Stems/Total Stems)	
Vegetation Criteria Not Met (Planted Stems/Total Stems)	



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGC, User Community



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NOVEMBER
2015

LEWIS CREEK (DMS #733)
 FALL REPORT
 CURRENT CONDITIONS PLAN VIEW
 HENDERSON COUNTY
 NORTH CAROLINA



Figure 2.4



Legend

Conservation Easement	Center Bar
Monitoring Wells	Trail
- 4+00 Stationing	Rock Structure
Crest Stage Gauge	Rootwad/Logvane
Vegetation Criteria Met (Planted Stems/Total Stems)	Rockvane
Vegetation Criteria Not Met (Planted Stems/Total Stems)	Matchline
Cross Sections	Thalweg
Wetland Area	



Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, Irf User Community

Table 5. Visual Stream Morphology Stability Assessment

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	Number with Stabilizing Woody	Footage with Stabilizing Woody	Adjusted % for Stabilizing Woody
1. Bed	1. Vertical Stability (Riffle and Run units)	1. <u>Aggradation</u> - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars)			0	0	100%			
	2. Riffle Condition	1. <u>Texture/Substrate</u> - Riffle maintains coarser substrate	10	10			100%			
	3. Meander Pool Condition	1. <u>Depth</u> Sufficient (Max Pool Depth : Mean Bankfull Depth \geq 1.6)	13	13			100%			
		2. <u>Length</u> appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle)	13	13			100%			
	4. Thalweg Position	1. Thalweg centering at upstream of meander bend (Run)	12	12			100%			
		2. Thalweg centering at downstream of meander (Glide)	11	11			100%			
Totals										
2. Bank	1. Scoured/Eroding	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	0	100%	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%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	0	100%	0	0	100%
Totals										
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	13	13			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	5	5			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	0	0			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does <u>not</u> exceed 15%. (See guidance for this table in EEP monitoring guidance document)	0	0			100%			
	4. Habitat	Pool forming structures maintaining - Max Pool Depth : Mean Bankfull Depth ratio \geq 1.6 Rootwads/logs providing some cover at base-flow.	13	13			100%			

Table 6. Vegetation Condition Assessment

Planted Acreage		2.53		Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage	
Vegetation Category	Definitions								
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	N/A	0	0.00	0.0%			
2. Low Stem Density Areas *	Woody stem densities clearly below target levels based on MY5 criteria.	0.1 acres	yellow polygon	0	0.00	0.0%			
Total							0	0.00	0.0%
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							0	0.00	0.0%

Easement Acreage		14		Mapping Threshold (SF)	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
Vegetation Category	Definitions							
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 MY 5, 2015



Cross Section 1 Downstream MY 5, 2015



Cross Section 2 Upstream MY 5, 2015



Cross Section 2 Downstream MY 5, 2015



Cross Section 3 Upstream MY 5, 2015



Cross Section 3 Downstream MY 5, 2015



Cross Section 4 Upstream MY 5, 2015



Cross Section 4 Downstream MY 5, 2015



Cross Section 5 Upstream MY 5, 2015



Cross Section 5 Downstream MY 5, 2015



Veg Plot 1

MY 5, 2015



Veg Plot 2

MY 5, 2015



Veg Plot 3

MY 5, 2015



Veg Plot 4

MY 5, 2015



Veg Plot 5

MY 5, 2015

Photo Point #1



Photo Point 1 (North)

MY 5, 2015



Photo Point 1 (East)

MY 5, 2015



Photo Point 1 (South)

MY 5, 2015



Photo Point 1 (West)

MY 5, 2015

Photo Point #2



Photo Point 2 (North)

MY 5, 2015



Photo Point 2 (East)

MY 5, 2015



Photo Point 2 (South)

MY 5, 2015



Photo Point 2 (West)

MY 5, 2015

Photo Point #3



Photo Point 3 (North)

MY 5, 2015



Photo Point 3 (East)

MY 5, 2015



Photo Point 3 (South)

MY 5, 2015



Photo Point 3 (West)

MY 5, 2015

Photo Point #4



Photo Point 4 (North)

MY 5, 2015



Photo Point 4 (East)

MY 5, 2015



Photo Point 4 (South)

MY 5, 2015



Photo Point 4 (West)

MY 5, 2015

Photo Point #5



Photo Point 5 (North)

MY 5, 2015



Photo Point 5 (East)

MY 5, 2015



Photo Point 5 (South)

MY 5, 2015



Photo Point 5 (West)

MY 5, 2015

Photo Point #6



Photo Point 6 (North)

MY 5, 2015



Photo Point 6 (East)

MY 5, 2015



Photo Point 6 (South)

MY 5, 2015



Photo Point 6 (West)

MY 5, 2015

Photo Point #7



Photo Point 7 (North)

MY 5, 2015



Photo Point 7 (East)

MY 5, 2015



Photo Point 7 (South)

MY 5, 2015



Photo Point 7 (West)

MY 5, 2015

Photo Point #8



Photo Point 8 (North)

MY 5, 2015



Photo Point 8 (East)

MY 5, 2015



Photo Point 8 (South)

MY 5, 2015



Photo Point 8 (West)

MY 5, 2015

Photo Point #9



Photo Point 9 (North)

MY 5, 2015



Photo Point (West)

MY 5, 2015



Photo Point 9 (South)

MY 5, 2015



Photo Point 9 (West)

MY 5, 2015

Appendix C: Vegetation Plot Data

Table 7. Vegetation Plot Criterion Attainment

Vegetation Plot ID	Vegetation Survival Threshold Met (Y/N)
Plot 1	N
Plot 2	Y
Plot 3	N
Plot 4	Y
Plot 5	N

*Note that when volunteer stems are considered, each plot has met the success criteria with the site exhibiting an overall density of 3,051 stems per acre in MY5.

Table 8. CVS Stem Counts Total & Planted

Scientific Name	Common Name	Species Type	Current Means															Annual Means																	
			Plot 1			Plot 2			Plot 3			Plot 4			Plot 5			MY5 (2015)			MY4 (2014)			MY3 (2013)			MY1 (2011)			MY0 (2010)					
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T			
Acer rubrum	red maple	Tree			1	2	2	6				16			1	2	2	24	2	2	27	2	2	23	2	2	2	2	2	2	2	2	2		
Acer saccharinum	silver maple	Tree							1								1			1															
Alnus serrulata	hazel alder	Shrub		3			6					5			1	1	5	1	1	24															
Asimina triloba	pawpaw	Tree															0						8	8	33	12	12	12	12	12	12	12			
Baccharis spp.	eastern baccharis	Shrub															0						1												
Betula nigra	river birch	Tree	1	1	21	5	5	170		9	1	1	21	5	5	11	12	12	232	12	12	223	14	14	224	15	15	15	15	15	15	15	15		
Carpinus caroliniana	American hornbeam	Tree															0						1	1	1	2	2	2	3	3	3	3			
Cornus amomum	silky dogwood	Shrub	1	1	5		1	2	2	12	4	4	7		3	7	7	28	7	7	23	9	9	24	9	9	9	9	9	9	9	9			
Diospyros virginiana	common persimmon	Tree															0						1												
Ilex opaca	American holly	Tree															0									5	5	5	5	5	5	5			
Liriodendron tulipifera	tuliptree	Tree					1				1	1	1			1	1	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
Platanus occidentalis	American sycamore	Tree									1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
Quercus falcata	southern red oak	Tree									1	1	1			1	1	1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3		
Rhus glabra	smooth sumac	Shrub									1	1	1			1	1	1	1	1	1	3	1	1	2	1	1	1	1	1	1	1	1		
Robinia pseudoacacia	black locust	Tree			5												5					5				4									
Salix cinerea	gray willow	Tree			17		3			9		4					33					42													
Salix nigra	black willow	Tree			8		4			5		5					25					27				37									
	Stem count		2	2	60	7	7	191	2	2	41	9	9	62	6	6	23	26	26	377	27	27	368	40	40	356	56	56	56	58	58	58	58		
	size (ares)		1			1			1			1			1			5			5			5			5			5			5		
	size (ACRES)		0.02			0.02			0.02			0.02			0.12			0.12			0.12			0.12			0.12			0.12					
	Species count		2	2	7	2	2	7	1	1	6	6	6	10	2	2	5	8	8	17	7	7	13	9	9	12	10	10	10	10	10	10	10		
	Stems per ACRE		81	81	2428	283	283	7729	81	81	1659	364	364	2509	243	243	931	210	210	3051	219	219	2978	324	324	2881	453	453	453	469	469	469	469		

Exceeds requirements by 10%
 Exceeds requirements, but by less than 10%
 Fails to meet requirements, by less than 10%
 Fails to meet requirements by more than 10%

Appendix D: Stream Survey Data

Appendix D: Stream Survey Data
Figure 4.0 Cross-section with Annual Overlays
Lewis Creek Stream Restoration/DMS Project No. 733
Monitoring Year 5 of 5

Project Name	Lewis Creek
EEP Project Number	733
Cross-Section ID	XS-1, Pool, +292.52
Survey Date	9/2015
SUMMARY DATA	
Bankfull Elevation (ft)	2152.17
Bankfull Cross-Sectional Area (ft ²)	247.80
Bankfull Width (ft)	23.10
Flood Prone Area Elevation (ft)	2154.83
Flood Prone Width (ft)	120.00
Bankfull Mean Depth (ft)	1.06
Bankfull Max Depth (ft)	2.66
W/D Ratio	21.79
Entrenchment Ratio	5.19
Bank Height Ratio	1.00

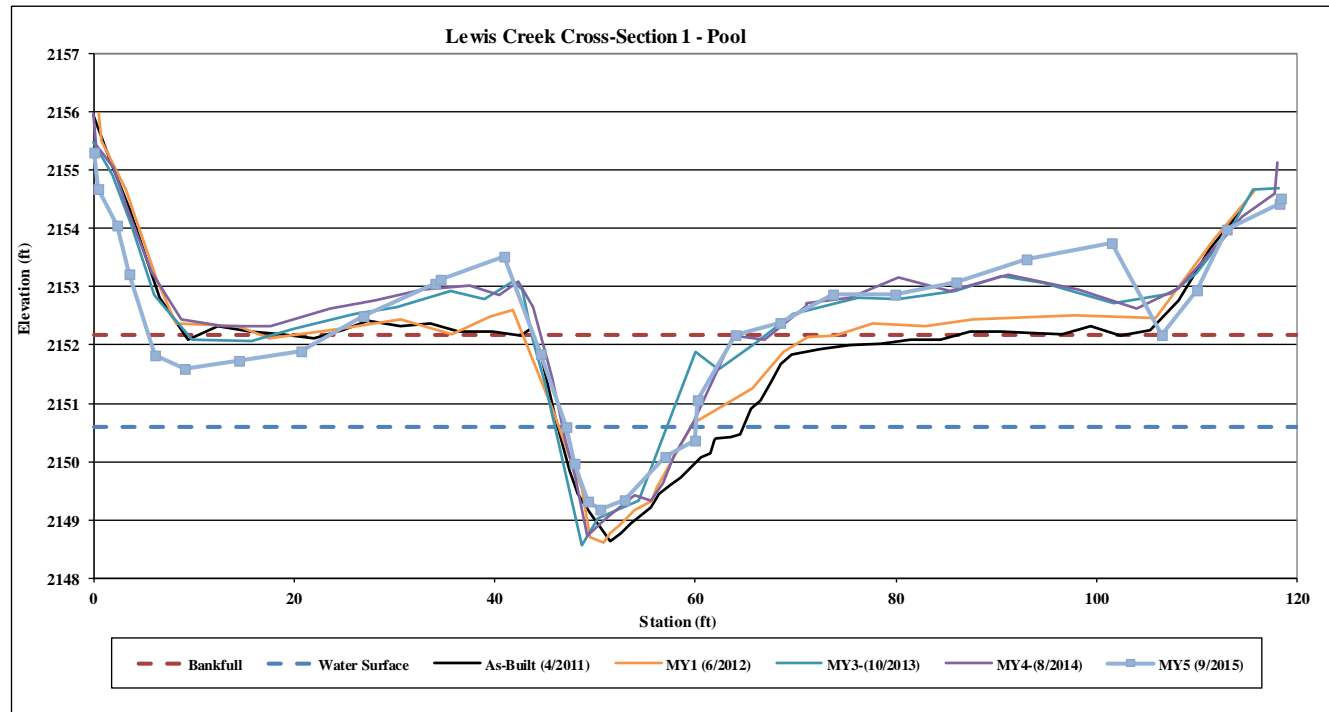


XS-1: Upstream



XS-1: Downstream

Station	Elevation	Notes
0.00	2155.30	LPIN
0.43	2154.68	xs 1
2.35	2154.05	xs 1
4.50	2153.41	xs 1
7.57	2152.02	xs 1
10.01	2151.79	xs 1
15.90	2151.93	xs 1
21.72	2152.08	xs 1
28.37	2152.70	xs 1
35.09	2153.25	xs 1
36.04	2153.32	xs 1
41.85	2153.71	LTB
46.01	2152.06	xs 1
48.14	2150.80	LEW
49.44	2150.17	xs 1
50.30	2149.51	THW
52.02	2149.38	xs 1
53.96	2149.53	xs 1
58.52	2150.30	xs 1
60.97	2150.57	REW
61.76	2151.25	xs 1
64.95	2152.37	RTB
69.99	2152.58	xs 1
74.70	2153.06	xs 1
81.40	2153.06	xs 1
86.99	2153.27	xs 1
94.55	2153.66	xs 1
102.53	2153.94	xs 1
107.97	2152.37	xs 1
111.02	2153.14	xs 1
114.53	2154.17	xs 1
119.18	2154.63	xs 1
119.83	2154.71	RPIN



Appendix D: Stream Survey Data
 Figure 4.1 Cross-section with Annual Overlays
 Lewis Creek Stream Restoration/DMS Project No. 733
 Monitoring Year 5 of 5

Project Name	Lewis Creek
EEP Project Number	733
Cross-Section ID	XS-2, Riffle +511.9
Survey Date	9/2015
SUMMARY DATA	
Bankfull Elevation (ft)	2151.48
Bankfull Cross-Sectional Area (ft ²)	330.90
Bankfull Width (ft)	23.93
Flood Prone Area Elevation (ft)	2154.17
Flood Prone Width (ft)	120.00
Bankfull Mean Depth (ft)	1.68
Bankfull Max Depth (ft)	2.69
W/D Ratio	14.24
Entrenchment Ratio	5.02
Bank Height Ratio	1.00

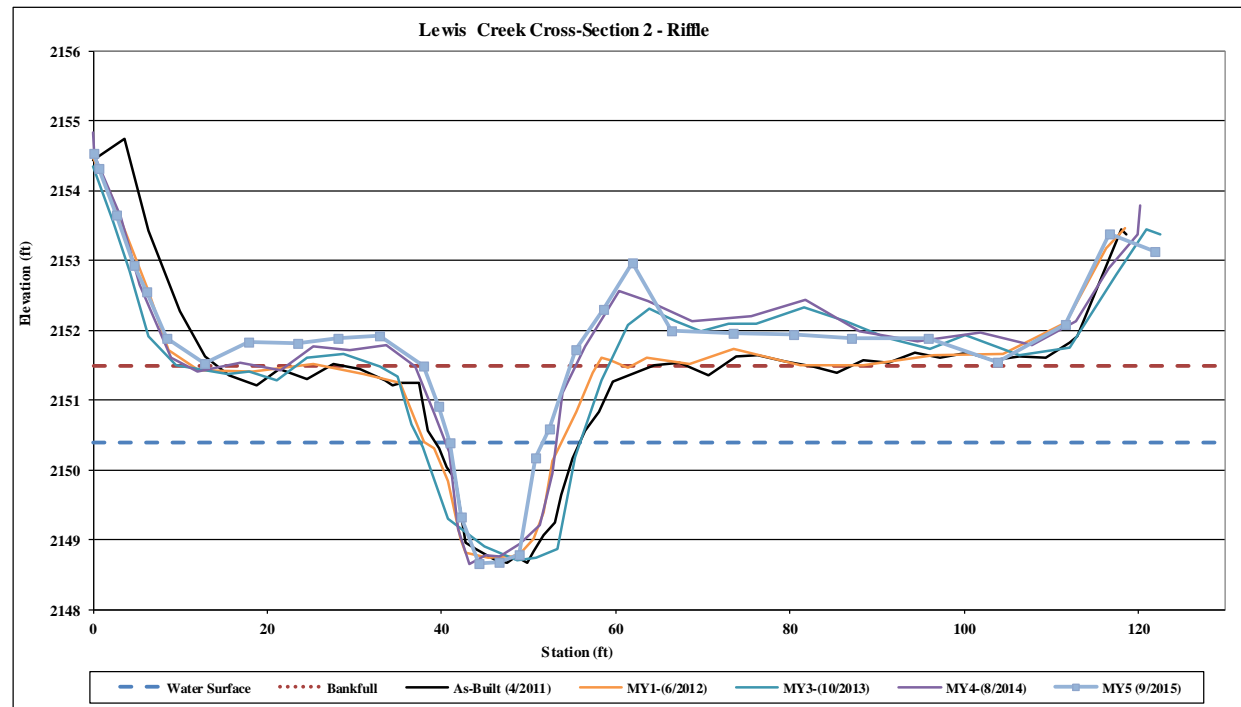


XS-2: Upstream



XS-2: Downstream

Station	Elevation	Notes
0.00	2154.54	TLP
0.63	2154.31	xs2
2.68	2153.65	xs2
4.64	2152.94	xs2
6.18	2152.56	xs2
8.39	2151.88	xs2
12.82	2151.53	xs2
17.89	2151.83	xs2
23.40	2151.81	xs2
28.16	2151.90	xs2
32.83	2151.92	xs2
37.95	2151.48	TLB
39.64	2150.91	xs2
40.97	2150.39	LEW
42.24	2149.33	xs2
44.31	2148.66	xs2
46.59	2148.69	xs2
48.86	2148.80	THW
50.85	2150.18	xs2
52.37	2150.60	xs2
55.37	2151.73	xs2
58.60	2152.31	xs2
61.88	2152.98	TRB
66.46	2152.00	xs2
73.53	2151.97	xs2
80.40	2151.94	xs2
87.12	2151.88	xs2
95.82	2151.88	xs2
103.86	2151.55	xs2
111.64	2152.08	xs2
116.73	2153.38	xs2
121.89	2153.14	TRP



Appendix D: Stream Survey Data
 Figure 4.2 Cross-section with Annual Overlays
 Lewis Creek Stream Restoration/DMS Project No. 733
 Monitoring Year 4 of 5

Project Name	Lewis Creek
EEP Project Number	733
Cross-Section ID	XS-3, Riffle, +641.70
Survey Date	9/2015
SUMMARY DATA	
Bankfull Elevation (ft)	2151.186
Bankfull Cross-Sectional Area (ft ²)	372.50
Bankfull Width (ft)	25.58
Flood Prone Area Elevation (ft)	2154.35
Flood Prone Width (ft)	120.00
Bankfull Mean Depth (ft)	0.79
Bankfull Max Depth (ft)	3.16
W/D Ratio	32.38
Entrenchment Ratio	4.69
Bank Height Ratio	1.00

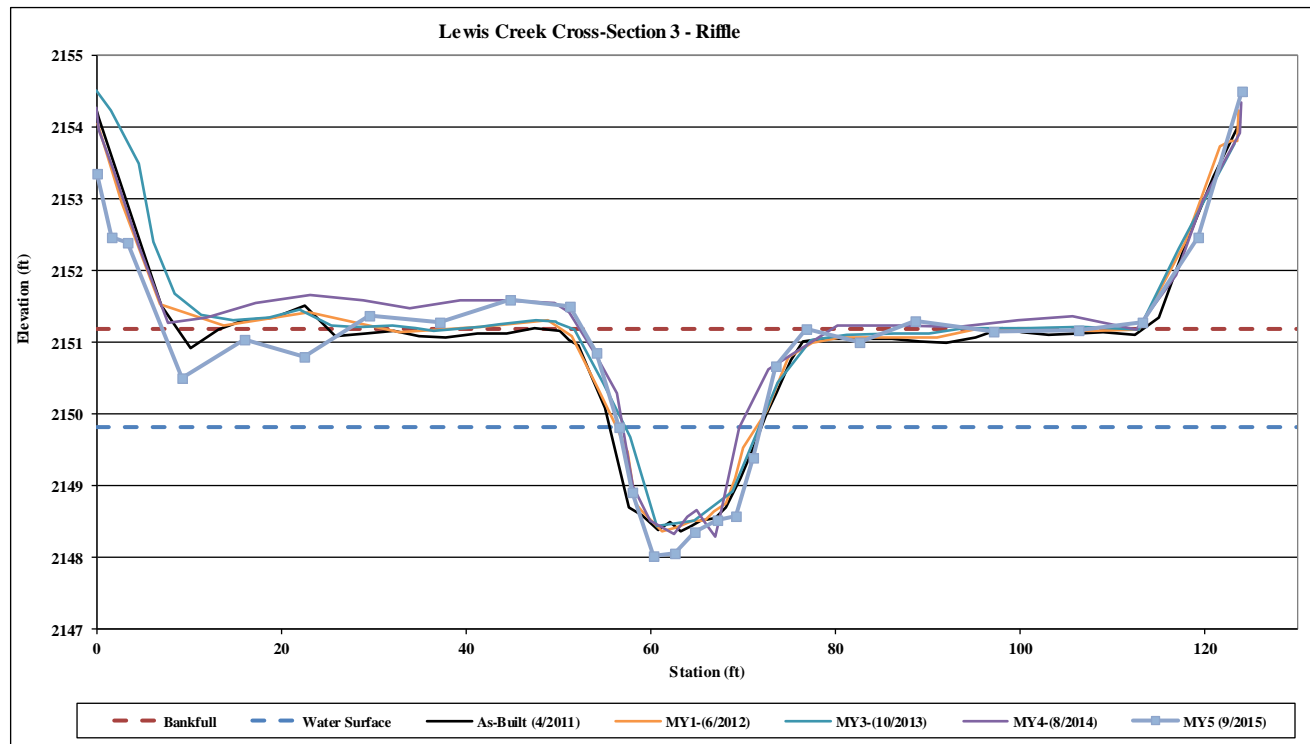


XS-3: Upstream



XS-3: Downstream

Station	Elevation	Notes
0.00	2153.35	TLP
1.64	2152.46	xs3
3.32	2152.40	xs3
9.16	2150.50	xs3
15.94	2151.03	xs3
22.38	2150.79	xs3
29.47	2151.37	xs3
37.11	2151.29	xs3
44.69	2151.60	xs3
51.27	2151.50	TLB
54.17	2150.85	xs3
56.58	2149.82	LEW
57.94	2148.91	xs3
60.27	2148.03	THW
62.57	2148.06	xs3
64.77	2148.35	xs3
67.14	2148.52	xs3
69.17	2148.57	xs3
71.02	2149.40	REW
73.55	2150.67	xs3
76.85	2151.19	TRB
82.55	2151.01	xs3
88.64	2151.31	xs3
97.18	2151.16	xs3
106.30	2151.17	xs3
113.18	2151.28	xs3
119.28	2152.47	xs3
124.04	2154.50	TRP



Appendix D: Stream Survey Data
Figure 4.3 Cross-section with Annual Overlays
Lewis Creek Stream Restoration/DMS Project No. 733
Monitoring Year 5 of 5

Project Name	Lewis Creek
EEP Project Number	733
Cross-Section ID	XS-4, Riffle 1+214.24
Survey Date	9/2015
SUMMARY DATA	
Bankfull Elevation (ft)	2150.16
Bankfull Cross-Sectional Area (ft²)	62.30
Bankfull Width (ft)	279.90
Flood Prone Area Elevation (ft)	2153.59
Flood Prone Width (ft)	150.00
Bankfull Mean Depth (ft)	0.58
Bankfull Max Depth (ft)	3.43
W/D Ratio	482.59
Entrenchment Ratio	0.54
Bank Height Ratio	1.00

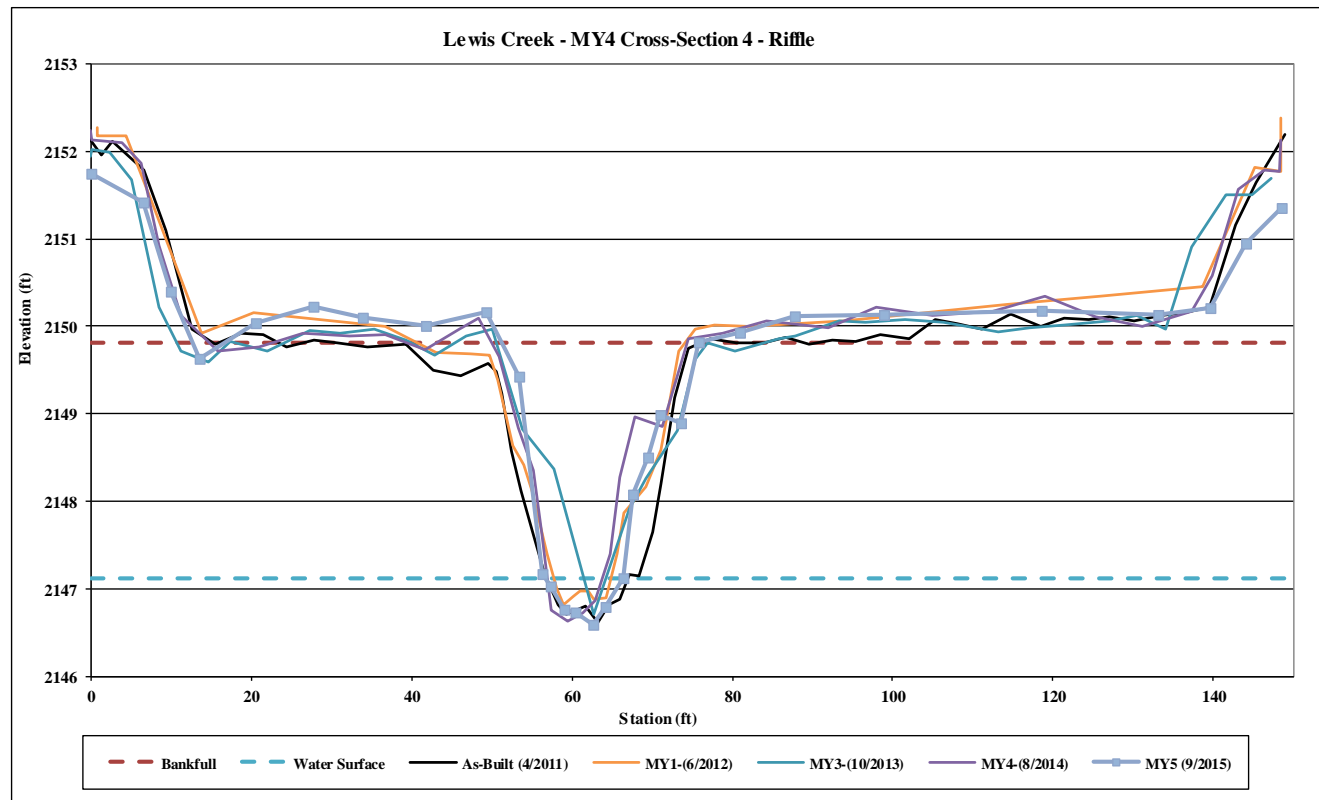


XS-4: Upstream



XS-4: Downstream

Station	Elevation	Notes
0.00	2151.75	TLP
6.48	2151.41	xs4
9.94	2150.40	xs4
13.51	2149.63	xs4
20.58	2150.04	xs4
27.68	2150.23	xs4
33.84	2150.10	xs4
41.74	2150.00	xs4
49.36	2150.16	TLB
53.41	2149.43	xs4
56.28	2147.17	xs4
57.26	2147.02	LEW
59.02	2146.75	xs4
60.36	2146.73	TWG
62.69	2146.59	xs4
64.21	2146.80	xs4
66.40	2147.12	REW
67.53	2148.08	xs4
69.50	2148.50	xs4
71.04	2148.98	xs4
73.49	2148.90	xs4
75.80	2149.81	TRB
80.99	2149.93	xs4
87.71	2150.11	xs4
98.88	2150.12	xs4
118.58	2150.18	xs4
133.03	2150.13	xs4
139.64	2150.21	xs4
144.15	2150.94	xs4
148.51	2151.36	TRP



Appendix D: Stream Survey Data
 Figure 4.4 Cross-section with Annual Overlays
 Lewis Creek Stream Restoration/DMS Project No. 733
 Monitoring Year 5 of 5

Project Name	Lewis Creek
EEP Project Number	733
Cross-Section ID	XS-5, Pool, 1+564.9
Survey Date	9/2015
SUMMARY DATA	
Bankfull Elevation (ft)	2148.78
Bankfull Cross-Sectional Area (ft ²)	210.90
Bankfull Width (ft)	24.16
Flood Prone Area Elevation (ft)	2152.13
Flood Prone Width (ft)	75.00
Bankfull Mean Depth (ft)	2.14
Bankfull Max Depth (ft)	3.35
W/D Ratio	11.29
Entrenchment Ratio	3.10
Bank Height Ratio	1.00



XS-5: Upstream



XS-5: Downstream

Station	Elevation	Notes
0.00	2150.71	TLP
3.42	2149.30	xs5
15.49	2149.11	xs5
28.45	2148.78	TLB
31.22	2147.86	LEW
33.20	2146.50	xs5
33.84	2145.99	xs5
36.99	2146.11	xs5
40.38	2146.04	xs5
43.38	2145.43	THW
45.12	2145.34	xs5
46.45	2148.02	xs5
49.88	2149.44	xs5
52.61	2150.06	TRB
55.38	2149.95	xs5
64.65	2150.27	xs5
69.24	2151.47	xs5
73.58	2151.78	TRP

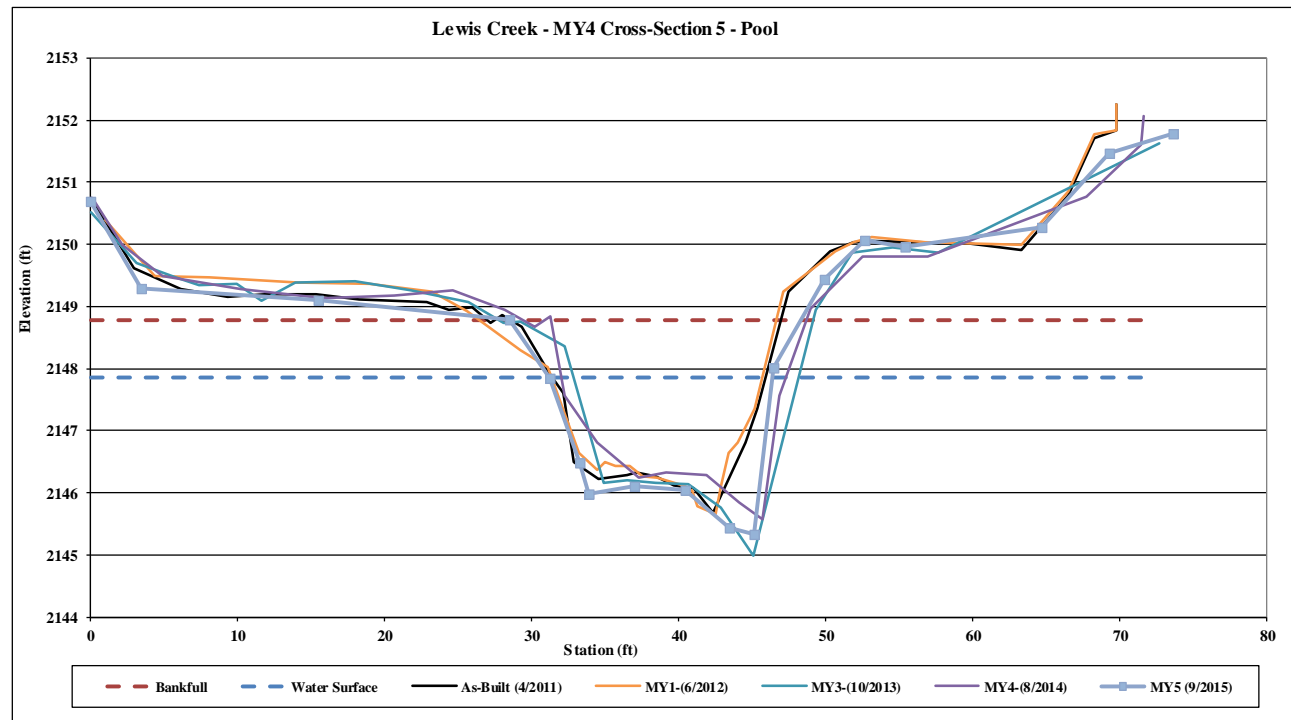


Figure 5.1. Lewis Creek Longitudinal Profile (Sta. 0-1000)

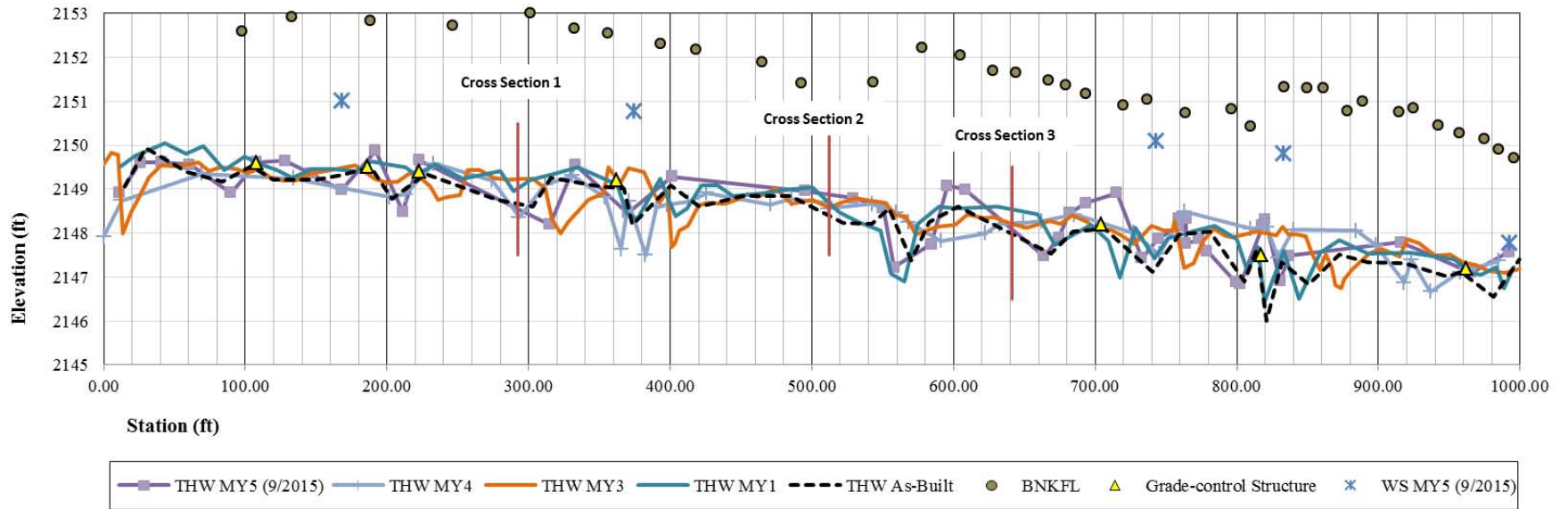
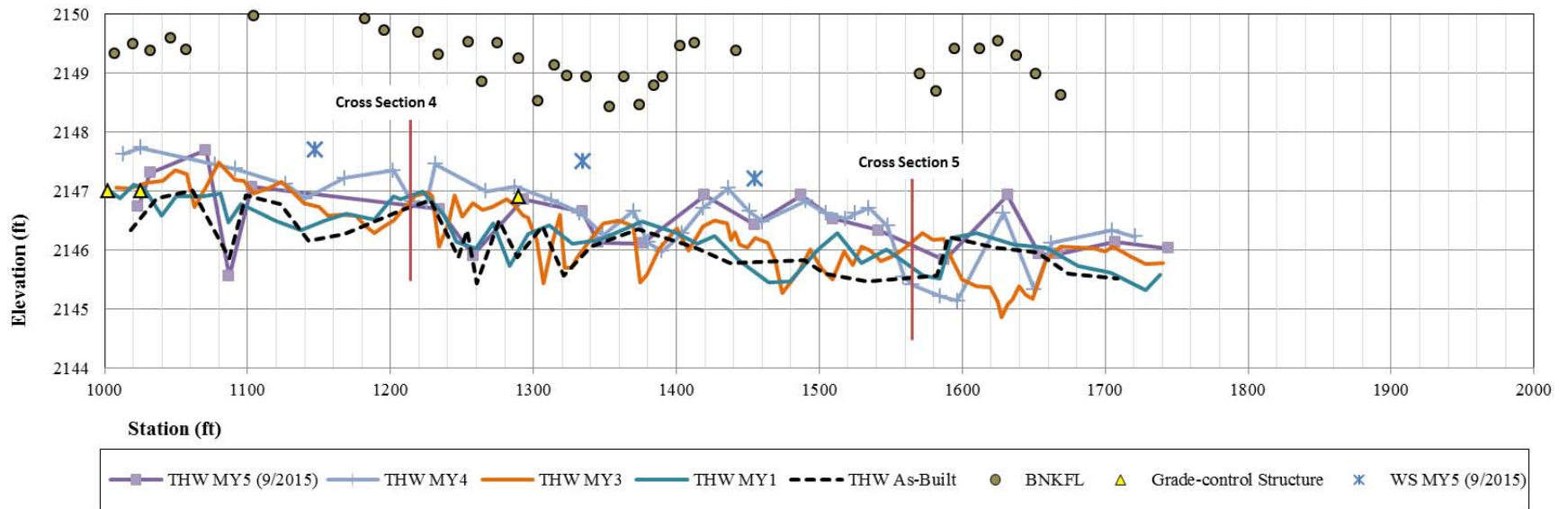


Figure 5.2. Lewis Creek Longitudinal Profile (Sta. 1000-1700)



Appendix D: Stream Survey Data

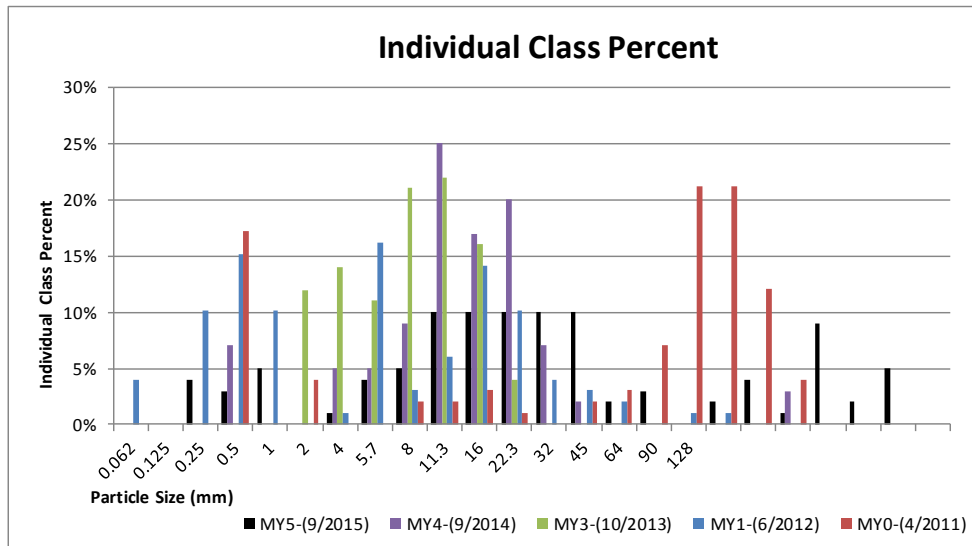
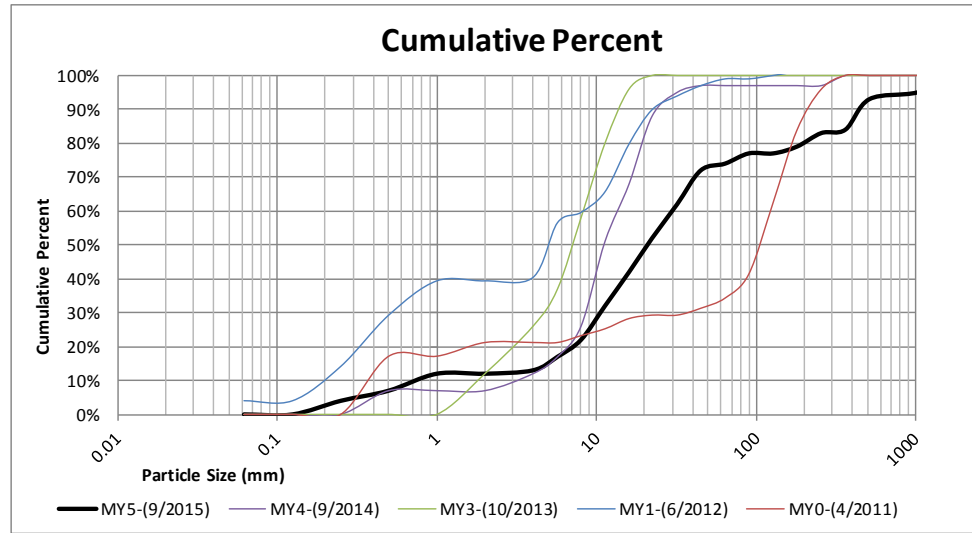
Figure 6.0 Pebble Count Plots with Annual Overlays

Lewis Creek Stream Restoration/DMS Project No. 733

Monitoring Year 5

Project Name: Lewis Creek					
Reach: 1					
Feature: Riffle (XS2)					
MY5-(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	4	4%	4%
	medium sand	0.50	3	3%	7%
	coarse sand	1.00	5	5%	12%
	very coarse sand	2.0	0	0%	12%
Gravel	very fine gravel	4.0	1	1%	13%
	fine gravel	5.7	4	4%	17%
	fine gravel	8.0	5	5%	22%
	medium gravel	11.3	10	10%	32%
	medium gravel	16.0	10	10%	42%
	course gravel	22.3	10	10%	52%
	course gravel	32.0	10	10%	62%
	very coarse gravel	45	10	10%	72%
	very coarse gravel	64	2	2%	74%
	very coarse gravel	90	3	3%	77%
Cobble	small cobble	90	3	3%	77%
	medium cobble	128	0	0%	77%
	large cobble	180	2	2%	79%
	very large cobble	256	4	4%	83%
Boulder	small boulder	362	1	1%	84%
	small boulder	512	9	9%	93%
	medium boulder	1024	2	2%	95%
	large boulder	2048	5	5%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			100	100%	100%

Summary Data	
D50	21.0
D84	362.0
D95	1024.0



Appendix D: Stream Survey Data

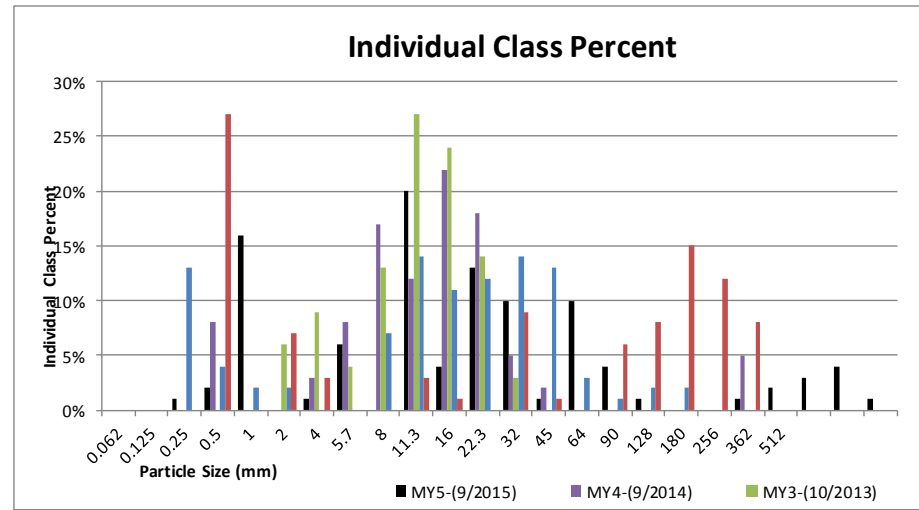
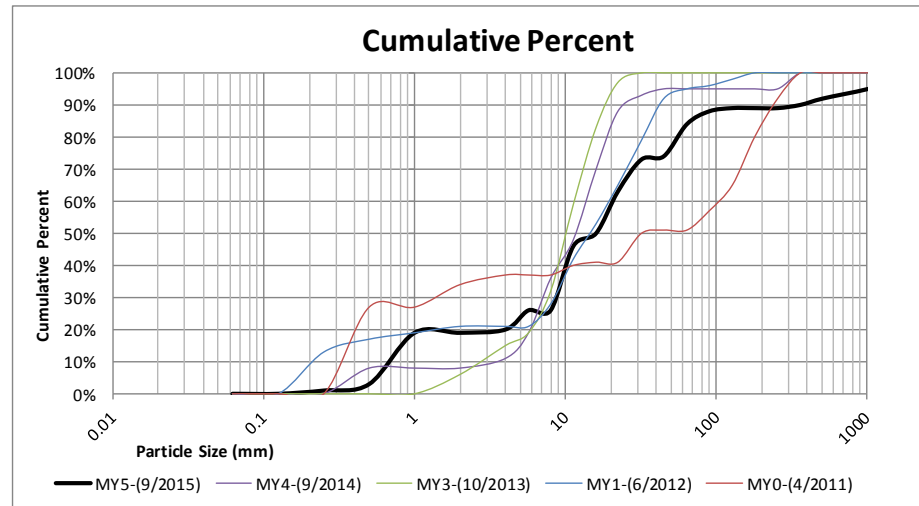
Figure 6.1 Pebble Count Plots with Annual Overlays

Lewis Creek Stream Restoration/DMS Project No. 733

Monitoring Year 5

Project Name: Lewis Creek					
Reach: 2					
Feature: Riffle (XS3)					
MY5-(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	1	1%	1%
	medium sand	0.50	2	2%	3%
	coarse sand	1.00	16	16%	19%
	very coarse sand	2.0	0	0%	19%
Gravel	very fine gravel	4.0	1	1%	20%
	fine gravel	5.7	6	6%	26%
	fine gravel	8.0	0	0%	26%
	medium gravel	11.3	20	20%	46%
	medium gravel	16.0	4	4%	50%
	course gravel	22.3	13	13%	63%
	course gravel	32.0	10	10%	73%
	very coarse gravel	45	1	1%	74%
	very coarse gravel	64	10	10%	84%
	very coarse gravel	90	4	4%	88%
Cobble	small cobble	128	1	1%	89%
	large cobble	180	0	0%	89%
	very large cobble	256	0	0%	89%
Boulder	small boulder	362	1	1%	90%
	small boulder	512	2	2%	92%
	medium boulder	1024	3	3%	95%
	large boulder	2048	4	4%	99%
Bedrock	bedrock	40096	1	1%	100%
TOTAL % of whole count			-	100	100%

Summary Data	
D50	16.0
D84	64.0
D95	1024.0



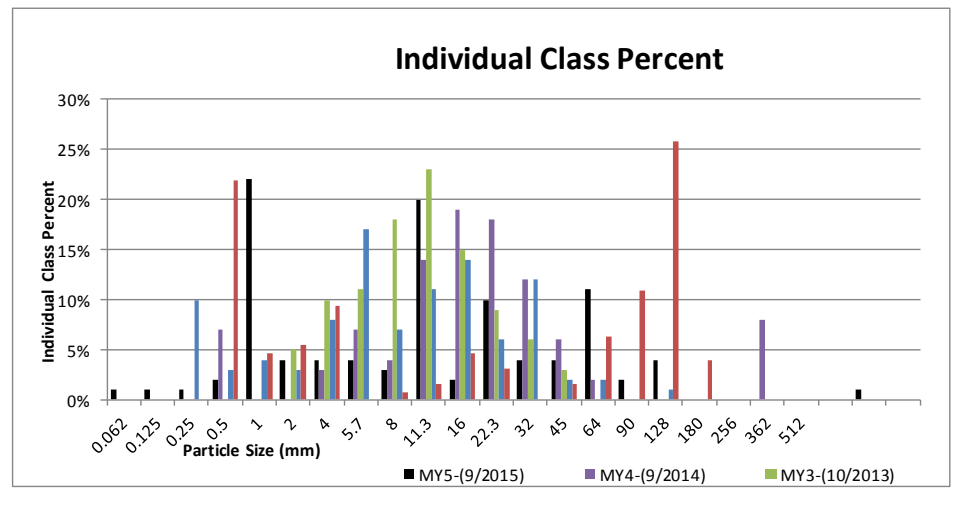
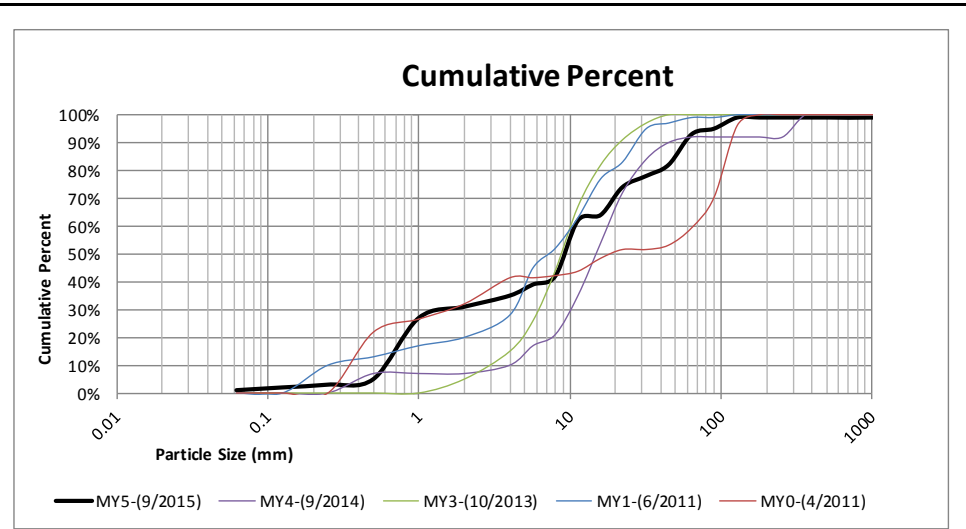
Appendix D: Stream Survey Data

Figure 6.2 Pebble Count Plots with Annual Overlays

Lewis Creek Stream Restoration/DMS Project No. 733

Monitoring Year 5

Project Name: Lewis Creek					
Reach: 3 (XS4)					
MY5-(9/2015)					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	1	1%	1%
Sand	very fine sand	0.125	1	1%	2%
	fine sand	0.250	1	1%	3%
	medium sand	0.50	2	2%	5%
	coarse sand	1.00	22	22%	27%
	very coarse sand	2.0	4	4%	31%
Gravel	very fine gravel	4.0	4	4%	35%
	fine gravel	5.7	4	4%	39%
	fine gravel	8.0	3	3%	42%
	medium gravel	11.3	20	20%	62%
	medium gravel	16.0	2	2%	64%
	course gravel	22.3	10	10%	74%
	course gravel	32.0	4	4%	78%
	very coarse gravel	45	4	4%	82%
	very coarse gravel	64	11	11%	93%
	Cobble	small cobble	90	2	2%
medium cobble		128	4	4%	99%
large cobble		180	0	0%	99%
very large cobble		256	0	0%	99%
Boulder	small boulder	362	0	0%	99%
	small boulder	512	0	0%	99%
	medium boulder	1024	0	0%	99%
	large boulder	2048	1	1%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			-	100	100%
Summary Data					
D50	10.0				
D84	55.0				
D95	90.0				



Appendix D: Stream Survey Data

Table 9.0 Baseline-Stream Data Summary Tables

Lewis Creek Stream Restoration/DMS Project: 733

Parameter	Gauge	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle	-	LL	UL	F _q	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Med	Max	Min	Mean	Med	Max	SD	n
Bankfull Width (ft)	-	-	-	-	221.11	-	-	22.21	-	3.00	15.44	-	-	15.90	-	-	24.71	-	22.65	23.98	23.81	25.38	1.08	5.00	
Floodprone Width (ft)	-	-	-	-	>100	-	-	-	-	-	100.00	-	-	100.00	-	-	60.00	-	70.91	114.25	114.93	148.86	28.02	5.00	
Bankfull Mean Depth (ft)	-	-	-	-	2.12	-	-	2.56	-	3.00	1.49	-	-	1.54	-	-	2.25	-	1.60	1.96	1.89	2.60	0.39	5.00	
Bankfull Max Depth (ft)	-	-	-	-	3.55	-	-	4.58	-	3.00	2.40	-	-	2.70	-	-	3.39	-	2.64	3.55	3.09	5.87	1.31	5.00	
Bankfull Cross-Sectional Area (ft ²)	-	-	-	-	51.41	-	-	55.22	-	3.00	23.74	-	-	23.76	-	-	55.50	-	36.31	47.15	44.25	65.97	11.29	5.00	
Width/Depth Ratio	-	-	-	-	8.25	-	-	11.51	-	3.00	10.03	-	-	10.67	-	-	11.00	-	9.76	12.56	12.36	14.62	1.94	5.00	
Entrenchment Ratio	-	-	-	-	-	-	>2.2	-	-	6.00	6.29	-	-	6.48	-	-	2.40	-	2.79	4.79	4.95	6.25	1.25	5.00	
Bank Height Ratio	-	-	-	-	1.53	-	-	1.79	-	-	1.25	-	-	1.25	-	-	1.00	-	1.00	1.00	1.00	1.00	0.00	5.00	
Pattern																									
Channel Beltwidth (ft)	-	-	-	-	22.00	-	-	51.00	-	26.00	-	52.00	-	-	-	-	49.42	-	98.83	49.42	-	-	98.83	-	-
Radius of Curvature (ft)	-	-	-	-	14.37	-	-	69.28	-	29.00	8.50	-	-	15.80	-	-	49.42	-	76.60	49.42	-	-	76.60	-	-
Rc:Bankfull width (ft/ft)	-	-	-	-	0.7	-	-	2.75	-	29.00	0.54	-	-	1.01	-	-	2.00	-	3.10	2.00	-	-	3.10	-	-
Meander Wavelength (ft)	-	-	-	-	40	-	-	163	-	26.00	30.00	3.32	-	84.00	-	-	197.67	-	296.50	197.67	-	-	296.50	-	-
Meander Width Ratio	-	-	-	-	2	-	-	6.47	-	26.00	-	-	-	-	-	-	2.00	-	4.00	2.00	-	-	4.00	-	-
Profile																									
Riffle Length (ft)	-	-	-	-	7.64	-	-	21.50	-	9.00	-	-	-	-	-	-	9.70	-	121.90	11.75	34.18	-	58.75	-	-
Riffle Slope (ft/ft)	-	-	-	-	0.00	-	-	0.02	-	9.00	-	1.74	-	-	-	-	2.40	-	2.88	0.01	0.02	-	0.05	-	-
Pool Length (ft)	-	-	-	-	6.90	-	-	294.11	-	19.00	-	-	-	-	-	-	30.30	-	125.40	14.92	19.39	-	23.86	-	-
Pool Max Depth (ft)	-	-	-	-	3.5	-	-	4.7	-	3.0	-	-	-	-	-	-	4.9	-	5.4	0.5	0.8	-	1.2	-	-
Pool Spacing (ft)	-	-	-	-	35.60	-	-	84.58	-	16.00	42.00	-	-	163.00	-	-	76.30	-	172.00	62.64	188.30	-	277.42	-	-
Transport Parameters																									
Reach Shear Stress (competency) lb/ft ²	-	-	-	-	-	0.42	-	-	-	-	-	-	-	-	-	-	0.33	-	-	-	-	-	-	-	
Max part size (mm) mobilized at bankfull	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	22.16	-	79.91	-	-	-	-	-	
Stream Power (transport capacity) W/m ²	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Additional Reach Parameters																									
Rosgen Classification	-	-	-	-	-	-	-	-	-	-	E5/CS	-	-	-	-	-	-	-	E5/CS	-	-	-	-	CS	
Bankfull Velocity (fps)	-	-	-	-	-	-	-	2.63	-	-	-	-	-	5.50	-	-	-	-	2.52	-	-	-	-	31.46	
Bankfull Discharge (cfs)	-	-	-	-	-	-	-	140	-	-	-	-	-	131	-	-	-	-	140	-	-	-	-	-	
Valley Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1326	-	-	-	-	1379	
Channel Thalweg Length (ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1750	-	-	-	-	1750	
Simuosity (ft)	-	-	-	-	-	-	-	1.11	-	-	-	-	-	1.30	-	-	-	-	1.32	-	-	-	-	1.29	
Water Surface Slope (ft/ft)	-	-	-	-	-	-	-	0.0030	-	-	-	-	-	0.0109	-	-	-	-	0.0025	-	-	-	-	0.0022	
BF slope (ft/ft)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Bankfull Floodplain Area (acres)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
% of Reach with Eroding Banks	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Channel Stability or Habitat Metric	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
Biological or Other	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	

Appendix D. Stream Survey Data

Table 9.1 Baseline Stream Data Summary (Substrate, Bed, Bank and Hydrologic Containment Parameter Distributions)

Lewis Creek Stream Restoration/DMS Project No. 733

Parameter	Pre-Existing Condition	Reference Reach Data	Design	As-built/Baseline
Ri%/Ru%/P%/G%/S%	*	*	*	20/25/27/22/4
SC% / Sa% / G% / C% / B% / Be%	*	*	*	0.01/0.53/0.13/0.29/0.02
d16 / d35 / d50 / d84 / d95 (mm)	0.08/0.17/0.28/5.02/13.14	0.12/0.30/0.75/64.00/150.00	d50=17.65	/* /* /19.30/110.18/126.39
Entrenchment Class<1.5/1.5-1.99/2.0-4.9/5.0-9.9/>10	2.0 > %100 < 4.9 (2.2)	5.0 > %100 < 9.9 (6.29,6.48)	2.0 > %100 < 4.9 (2.40)	2.0 > %100 < 9.9 (2.79,6.25)
Incision Class <1.2/1.2-1.49/1.5-1.99/>2.0	1.5 > %100 < 1.99 (1.53,1.79)	1.20 > %100 < 1.49 (1.25)	%100 < 1.20 (1.0)	%100 < 1.20 (1.0)

*2007 restoration plan did not include data for these parameters.

Appendix D: Stream Survey Data
Table 10.0 Monitoring - Cross-Section Morphology Data Table
Lewis Creek Stream Restoration/DMS Project Number 733

PARAMETER	Cross-Section 1 (Pool)						Cross-Section 2 (Riffle)					
DIMENSION	Baseline	MY1-2011	MY2-2012	MY3-2013	MY4-2014	MY5-2015	Baseline	MY1-2011	MY2-2012	MY3-2013	MY4-2014	MY5-2015
Bankfull Width (ft)	23.4	25.3	N/A	20.5	22.77	23.10	22.70	23.2	N/A	23.3	26.46	23.93
Floodprone Width (ft)	114.9	114.0	N/A	117.2	117.79	120.00	114.20	116.1	N/A	123.6	119.05	120.00
Bankfull Mean Depth	1.9	1.6	N/A	1.5	1.71	1.06	1.60	1.5	N/A	1.3	1.26	1.68
Bankfull Max Depth (ft)	3.2	3.3	N/A	3.3	3.42	2.66	3.10	2.6	N/A	2.6	2.73	2.69
Bankfull Cross-sectional Area (ft ²)	44.3	40.6	N/A	31.1	38.85	36.00	36.30	34.5	N/A	29.3	33.28	28.10
Bankfull Width/Depth Ratio	12.4	15.8	N/A	13.5	13.35	21.79	14.20	15.5	N/A	18.5	21.04	14.24
Bankfull Entrenchment Ratio	4.9	4.5	N/A	5.7	5.17	5.19	5.0	5.0	N/A	5.3	4.50	5.02
Bankfull Bankheight Ratio	1.0	1.3	N/A	1.0	1.27	1.0	1.0	1.0	N/A	1.0	1.00	1.0
Cross Sectional Area between end pins (ft ²)	46.8	46.8	N/A	266.2	247.4	247.8	347.1	347.1	N/A	334.9	368.9	330.9
d50 (mm)	0.2	2.0	N/A	N/A	N/A	N/A	105.40	5.0	N/A	7.0	11.0	21.0

PARAMETER	Cross-Section 3 (Riffle)						Cross-Section 4 (Rifle)					
DIMENSION	Baseline	MY1-2011	MY2-2012	MY3-2013	MY4-2014	MY5-2015	Baseline	MY1-2011	MY2-2012	MY3-2013	MY4-2014	MY5-2015
Bankfull Width (ft)	24.7	25.8	N/A	25.0	21.07	25.58	23.80	23.4	N/A	19.3	19.78	26.44
Floodprone Width (ft)	122.3	120.3	N/A	99.7	119.07	120.00	148.90	147.8	N/A	130.7	143.47	150.00
Bankfull Mean Depth	1.7	1.5	N/A	1.5	1.42	0.79	2.00	1.8	N/A	0.9	1.90	0.58
Bankfull Max Depth (ft)	2.6	2.6	N/A	2.6	2.49	3.16	3.00	2.9	N/A	2.1	3.26	3.43
Bankfull Cross-sectional Area (ft ²)	41.7	38.3	N/A	36.9	29.91	52.10	47.60	40.9	N/A	51.0	37.66	62.30
Bankfull Width/Depth Ratio	14.6	17.4	N/A	16.9	14.84	32.38	11.90	13.4	N/A	22.4	10.39	45.59
Bankfull Entrenchment Ratio	5.0	4.7	N/A	1.2	5.65	4.69	6.3	6.3	N/A	6.8	3.62	5.67
Bankfull Bankheight Ratio	1.0	1.0	N/A	1.0	1.24	1.0	1.0	1.0	N/A	1.0	1.00	1.0
Cross Sectional Area between end pins (ft ²)	335.7	335.7	N/A	353.6	376.23	372.5	335.7	335.7	N/A	309.6	327.91	279.9
d50 (mm)	32.0	14.7	N/A	10.0	12.0	16.0	19.30	7.3	N/A	8.9	16.0	10.0

* Data was not provided

PARAMETER	Cross-Section 5 (Pool)					
DIMENSION	Baseline	MY1-2011	MY2-2012	MY3-2013	MY4-2014	MY5-2015
Bankfull Width (ft)	23.3	24.0	N/A	22.6	19.78	24.16
Floodprone Width (ft)	69.8	68.8	N/A	72.7	71.57	75.00
Bankfull Mean Depth	1.7	1.9	N/A	2.0	1.90	2.14
Bankfull Max Depth (ft)	3.3	3.6	N/A	4.0	3.26	3.35
Bankfull Cross-sectional Area (ft ²)	40.0	45.1	N/A	44.7	37.66	42.40
Bankfull Width/Depth Ratio	13.5	12.8	N/A	11.4	10.39	11.29
Bankfull Entrenchment Ratio	3.0	2.9	N/A	3.2	3.62	3.10
Bankfull Bankheight Ratio	1.0	1.0	N/A	1.0	1.00	1.0
Cross Sectional Area between end pins (ft ²)	217.2	217.2	N/A	192.7	175.3	210.9
d50 (mm)	0.4	0.8	N/A	N/A	N/A	N/A

Appendix D. Stream Survey Data

Table 10.1a Monitoring - Stream Reach Morphology Data Table

Lewis Creek Stream Restoration/DMS Project No. 733

Parameter	Baseline						MY01-2011						MY02-2012					
	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
DIMENSION																		
Bankfull Width (ft)	22.70	23.73	23.80	24.70	*	3	23.16	24.11	23.41	25.78	*	3	N/A	N/A	N/A	N/A	N/A	N/A
Floodprone Width (ft)	114.20	128.47	122.30	148.90	*	3	116.14	128.07	120.34	147.75	*	3	N/A	N/A	N/A	N/A	N/A	N/A
Bankfull Mean Depth (ft)	1.60	1.77	1.70	2.00	*	3	1.48	1.57	1.49	1.75	*	3	N/A	N/A	N/A	N/A	N/A	N/A
Bankfull Max Depth (ft)	2.60	2.90	3.00	3.10	*	3	2.55	2.67	2.63	2.85	*	3	N/A	N/A	N/A	N/A	N/A	N/A
Bankfull Cross Sectional Area (ft ²)	36.30	41.87	41.70	47.60	*	3	34.52	37.88	38.28	40.85	*	3	N/A	N/A	N/A	N/A	N/A	N/A
Width/Depth Ratio	11.90	13.57	14.20	14.60	*	3	13.38	15.44	15.54	17.42	*	3	N/A	N/A	N/A	N/A	N/A	N/A
Entrenchment Ratio	5.00	5.43	5.00	6.30	*	3	4.67	5.33	5.01	6.31	*	3	N/A	N/A	N/A	N/A	N/A	N/A
Bank Height Ratio	1.00	1.00	1.00	1.00	*	3	1.00	1.00	1.00	1.00	*	3	N/A	N/A	N/A	N/A	N/A	N/A
Bankfull Velocity (fps)	6.27	10.22	11.23	13.16	*	3	1.23	1.73	1.47	2.49	*	3	N/A	N/A	N/A	N/A	N/A	N/A
PROFILE																		
Rifle Length (ft)	11.75	34.2	-	58.75	-	3	30.62	51.02	-	71.88	*	3	N/A	N/A	N/A	N/A	N/A	N/A
Rifle Slope (ft/ft)	0.0100	0.0120	-	0.0500	-	3	0.0101	0.0144	-	0.0245	*	3	N/A	N/A	N/A	N/A	N/A	N/A
Pool Length (ft)	14.92	19.4	-	23.86	-	3	19.97	42.60	-	62.56	*	3	N/A	N/A	N/A	N/A	N/A	N/A
Pool Max depth	0.5	0.8	-	1.2	-	3	1.04	1.24	-	1.46	*	3	N/A	N/A	N/A	N/A	N/A	N/A
Pool Spacing (ft)	62.64	188.3	-	277.42	-	3	97.17	135.33	-	206.32	*	3	N/A	N/A	N/A	N/A	N/A	N/A
PATTERN																		
Channel Beltwidth (ft)	49.42	-	-	98.83	-	-	49.42	-	-	98.83	-	-	N/A	N/A	N/A	N/A	N/A	N/A
Radius of Curvature (ft)	49.42	-	-	76.60	-	-	49.42	-	-	76.60	-	-	N/A	N/A	N/A	N/A	N/A	N/A
Meander Wavelength (ft)	197.67	-	-	296.50	-	-	197.67	-	-	296.50	-	-	N/A	N/A	N/A	N/A	N/A	N/A
Meander Width Ratio	2	-	-	4	-	-	2	-	-	4	-	-	N/A	N/A	N/A	N/A	N/A	N/A
ADDITIONAL REACH PARAMETERS																		
Rosgen Classification				C5						C4								N/A
Channel Thalweg length (ft)				1750						1750								N/A
Sinuosity (ft)				1.29						1.29								N/A
Water Surface Slope (Channel) (ft/ft)				0.0022						0.00266								N/A
BF slope (ft/ft)				0.0024						0.00247								N/A
Ri%/Ru%/P%/G%/S%				20/25/27/22/4						20/26/28/24/4			N/A	N/A	N/A	N/A	N/A	N/A
SC%/Sa%/G%/C%/B%/Be%				0.01/0.53/0.13/0.29/0.02						16/185/290/9/0			N/A	N/A	N/A	N/A	N/A	N/A
d16/ d35/ d50/ d84/ d95				d50=19.30/d84=110.18/d95=126.39						0.46/2.76/5.98/21.70/36.73			N/A	N/A	N/A	N/A	N/A	N/A
% of reach with eroding banks				0.01%						0.01%								N/A
Channel Stability or Habitat Metric				-						-								-
Biological or Other				-						-								-

Appendix D. Stream Survey Data
Table 10.1b Monitoring - Stream Reach Morphology Data Table
Lewis Creek Stream Restoration/DMS Project No. 733

Parameter	MY03-2013						MY04-2014						MY05-2015					
	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
DIMENSION																		
Bankfull Width (ft)	19.30	22.54	23.30	25.03	2.93	3	19.78	22.44	21.07	26.46	2.89	3	23.93	25.32	25.58	26.44	1.28	3
Floodprone Width (ft)	99.74	118.01	123.58	130.71	16.22	3	71.57	103.23	119.05	119.07	22.39	3	120.00	130.00	120.00	150.00	17.32	3
Bankfull Mean Depth (ft)	0.86	1.20	1.26	1.48	0.31	3	1.26	1.53	1.42	1.90	0.27	3	0.58	1.02	0.79	1.68	0.58	3
Bankfull Max Depth (ft)	2.12	2.43	2.58	2.60	0.27	3	2.49	2.83	2.73	3.26	0.32	3	2.69	3.09	3.16	3.43	0.38	3
Bankfull Cross Sectional Area (ft ²)	29.30	39.07	36.93	50.98	11.00	3	29.91	33.62	33.28	37.66	3.17	3	28.10	47.50	52.10	62.30	17.56	3
Width/Depth Ratio	16.91	19.28	18.49	22.44	2.84	3	10.39	15.43	14.84	21.04	4.37	3	14.24	30.74	32.38	45.59	15.74	3
Entrenchment Ratio	1.14	4.40	5.30	6.77	2.92	3	3.62	4.59	4.50	5.65	0.83	3	4.69	5.13	5.02	5.67	0.50	3
Bank Height Ratio	1.00	1.00	1.00	1.00		3	1.00	1.08	1.00	1.24	0.11	3	1.00	1.00	1.00	1.00	0.00	3
Bankfull Velocity (fps)	1.23	1.52	1.46	1.86	0.32	3	1.36	1.45	1.45	1.54	0.07	3	0.81	1.11	1.05	1.47	0.33	3
PROFILE																		
Rifle Length (ft)	30.10	59.47	-	94.04	-	-	18.76	50.14	-	98.40	-	-	18.76	50.14	-	98.40	-	-
Rifle Slope (ft/ft)	0.0101	0.01	-	0.0245	-	-	0.01	0.02	-	0.03	-	-	0.01	0.02	-	0.03	-	-
Pool Length (ft)	24.39	40.51	-	65.72	-	-	19.72	19.72	-	19.72	-	-	19.72	19.72	-	19.72	-	-
Pool Max depth	3.31	3.63	-	3.95	-	-	2.02	2.02	-	2.02	-	-	2.02	2.02	-	2.02	-	-
Pool Spacing (ft)	24.39	93.99	-	193.21	-	-	NA	NA	-	NA	-	-	NA	NA	-	NA	-	-
PATTERN																		
Channel Beltwidth (ft)	49.42	-	-	98.83	-	-	49.42	-	-	98.83	-	-	49.42	-	-	98.83	-	-
Radius of Curvature (ft)	49.42	-	-	76.60	-	-	49.42	-	-	76.60	-	-	49.42	-	-	76.60	-	-
Meander Wavelength (ft)	197.67	-	-	296.50	-	-	197.67	-	-	296.50	-	-	197.67	-	-	296.50	-	-
Meander Width Ratio	2	-	-	4	-	-	2.00	-	-	4.00	-	-	2.00	-	-	4.00	-	-
ADDITIONAL REACH PARAMETERS																		
Rosgen Classification				C4						C4						C4		
Channel Thalweg length (ft)				1750						1750						1750		
Sinuosity (ft)				1.29						1.29						1.29		
Water Surface Slope (Channel) (ft/ft)				0.0017						0.00171						0.00171		
BF slope (ft/ft)				0.00247						0.00308						0.00308		
Ri%/Ru%/P%/G%/S%				17/28/21/27/5						9/28/11/27/5						9/28/11/27/5		
SC%/Sa%/G%/C%/B%/Be%				0/17.6/92.3/0/0						5/23/87.3/0/5.3/0						0.3/20.3/63/6.7/9.3/0.3		
d16/ d35/ d50/ d84/ d95				3.6/7.0/8.6/15.66/22.16						5.7/11.3/16/32/362						2.5/8.1/15.7/160.3/712.7		
% of reach with eroding banks				0.01%						0.01%						0.01%		
Channel Stability or Habitat Metric																		
Biological or Other																		

Appendix E: Hydrologic Data

Table 11. Verification of Bankfull Events

Date of Collection	Date of Occurrence	Method	Photo # (if available)	Feet Above Average Bankfull Elevation
Sep-12	Unknown	Crest Gauge; visual indicators	NA	1.5
Oct-13	Sping/Summer	Crest Gauge; visual indicators	NA	0.8
Aug-14	Spring/Summer	Crest Gauge; visual indicators	NA	1
Sep-15	Spring/Summer	Crest Gauge; visual indicators	Below	0.7



Figure 7.0 Percentile Graph for Rainfall

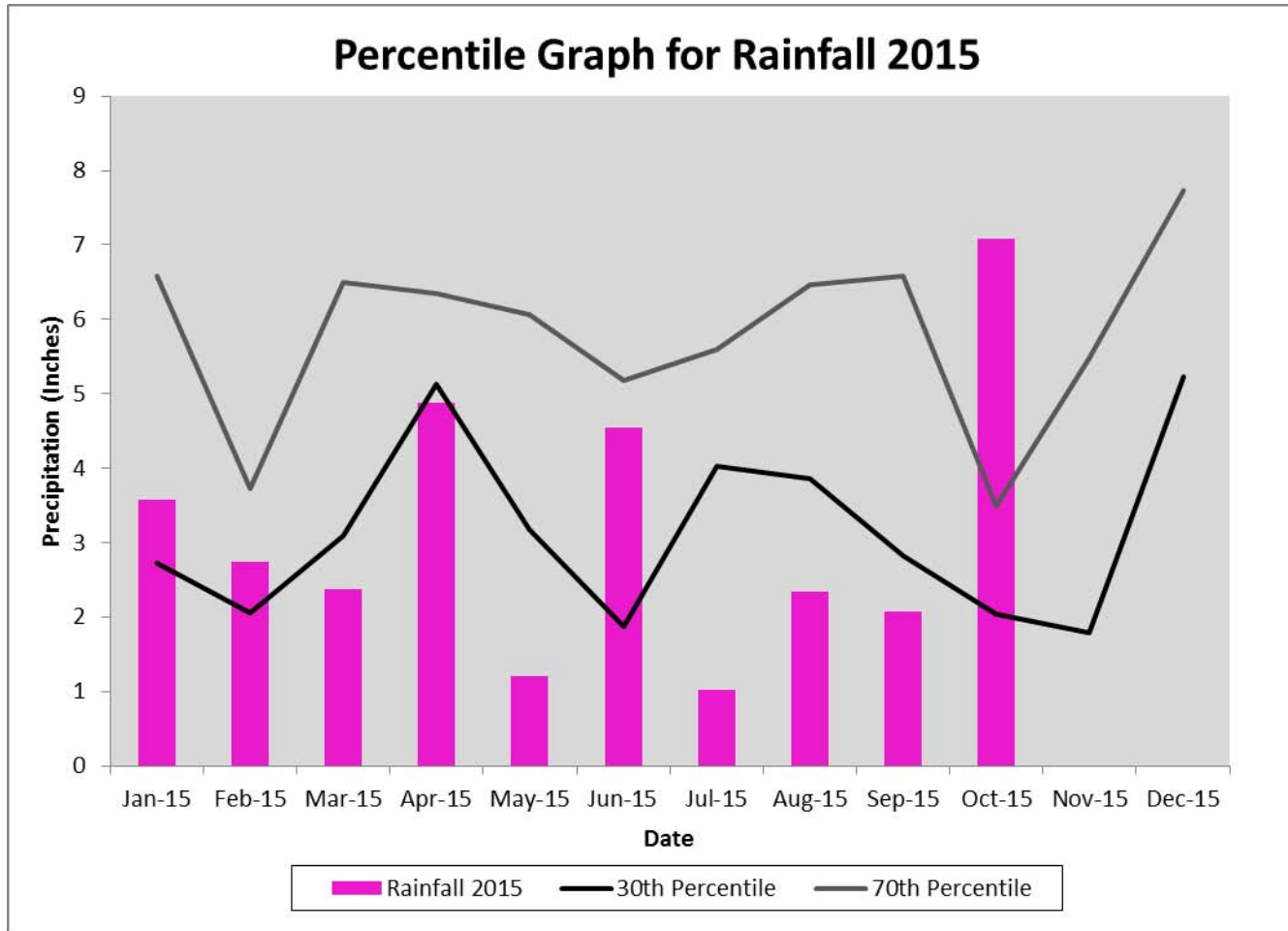


Figure 8.0 Daily Groundwater Data – Gauge 1

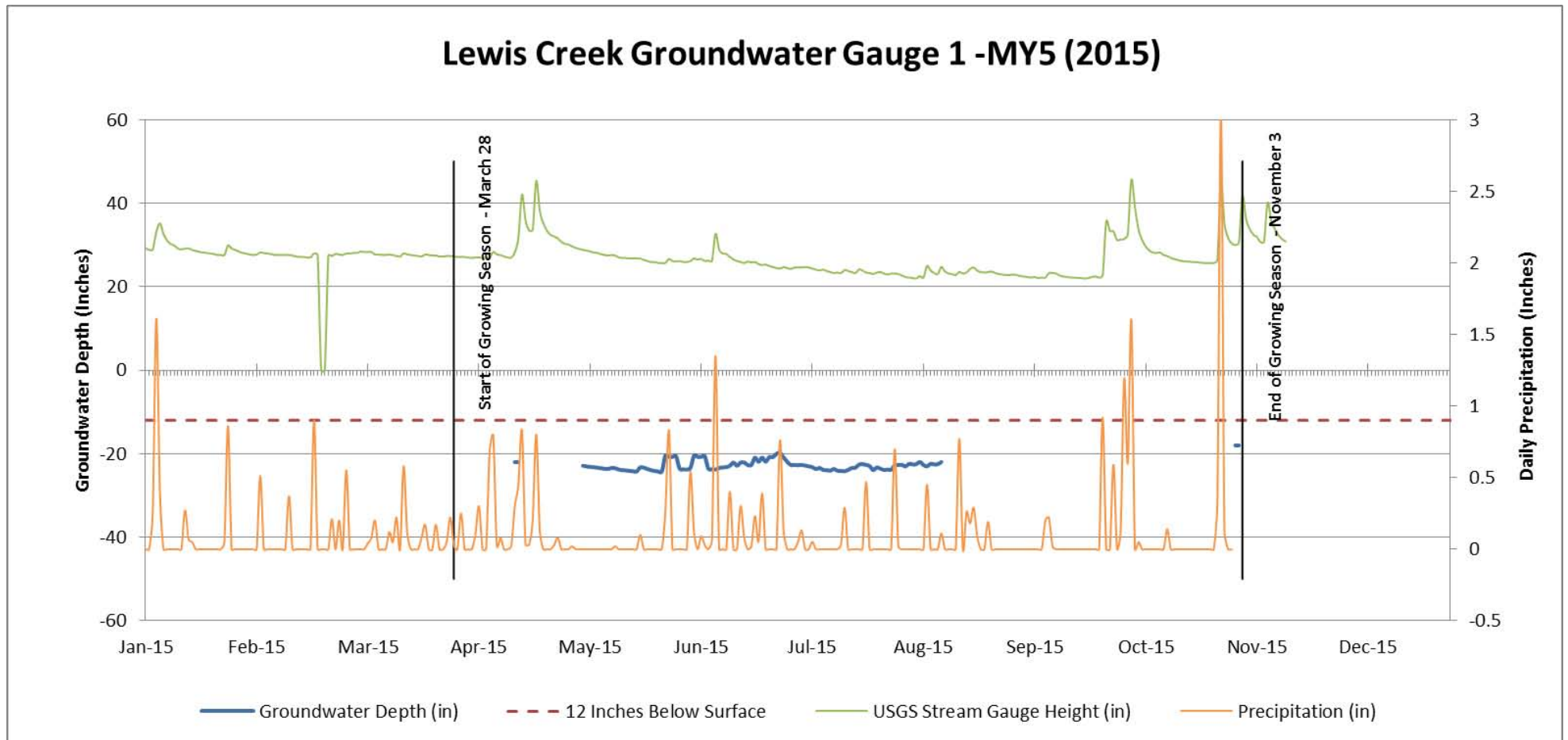


Figure 8.1 Daily Groundwater Data – Gauge 2

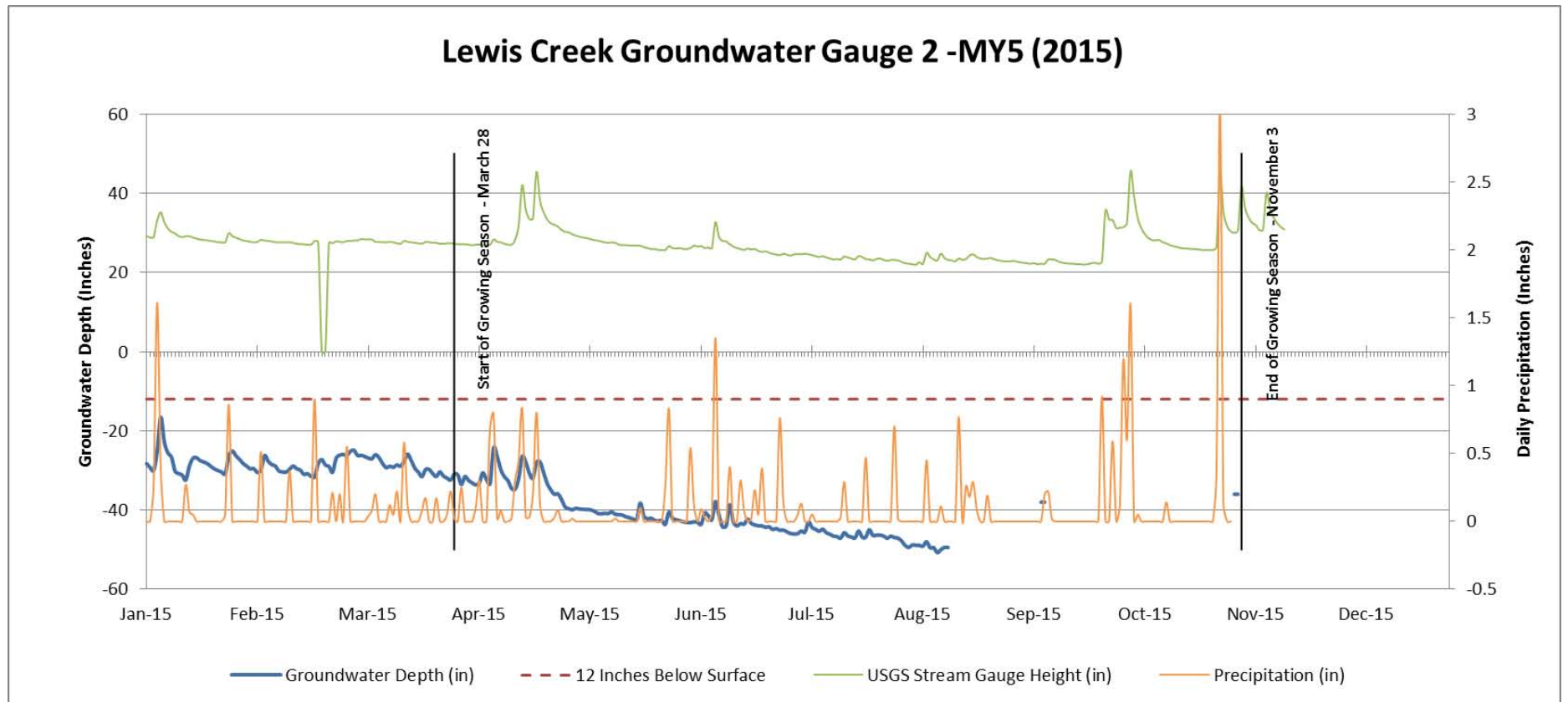


Figure 8.2 Daily Groundwater Data – Gauge 3

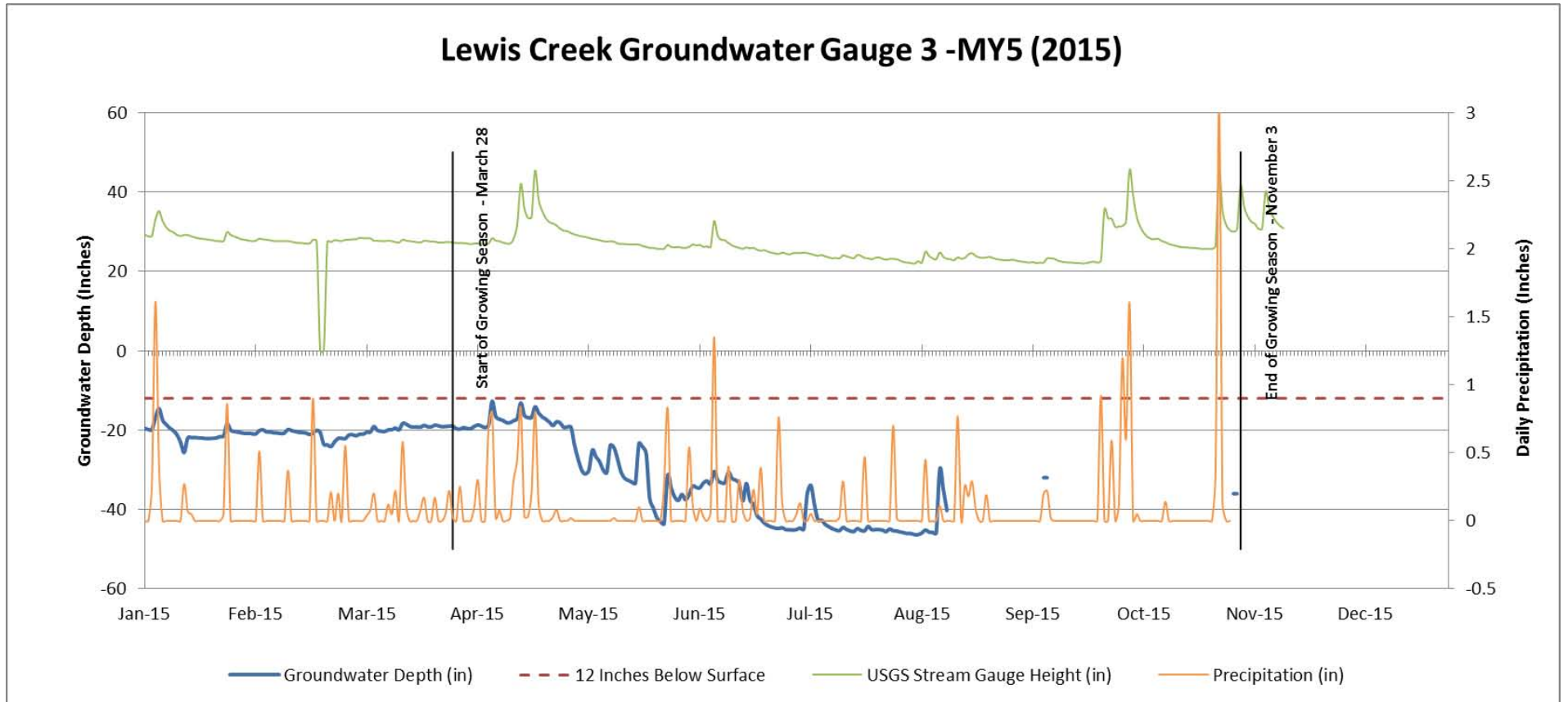


Figure 8.3 Daily Groundwater Data – Gauge 4

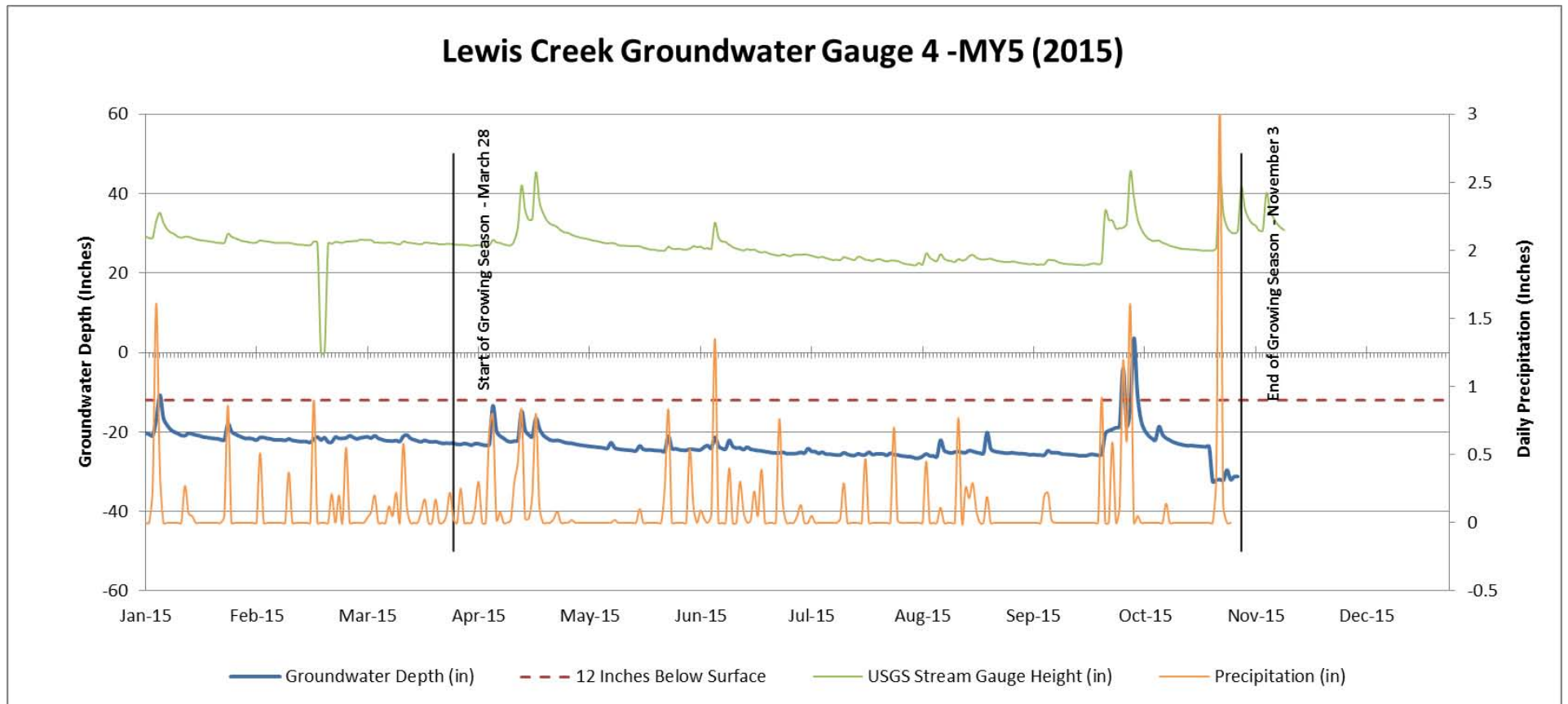


Figure 8.4 Daily Groundwater Data – Gauge 5

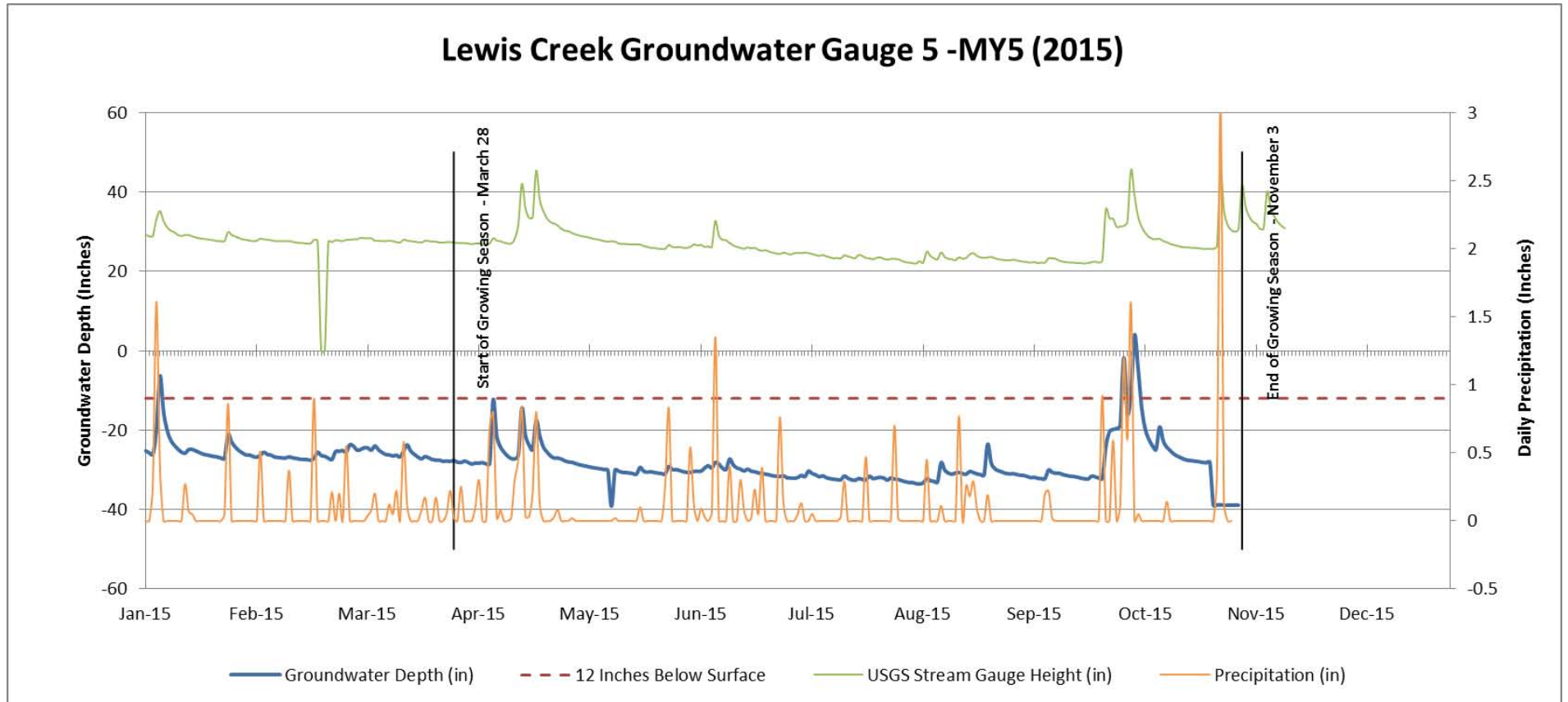


Figure 8.5 Daily Groundwater Data – Gauge 6

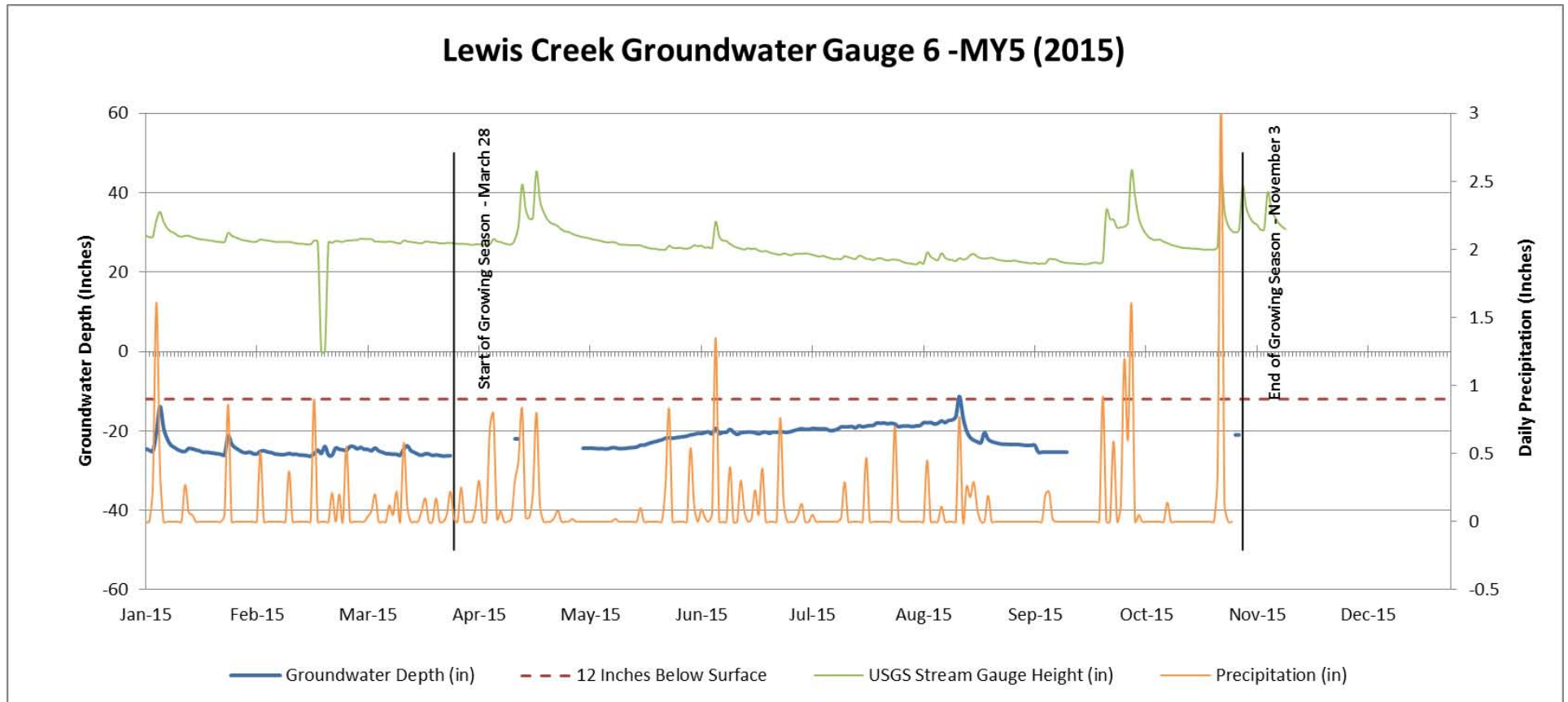


Table 12. Wetland Gauge Attainment Data

Gauge #	MY5 (2015)				MY4 (2014)				MY3 (2013)			
	Max# Conseq. Days	% Growing Season	Success Criteria Attained	% of Growing Season Monitored	Max# Conseq. Days	% Growing Season	Success Criteria Attained	% of Growing Season Monitored	Max# Conseq. Days	% Growing Season	Success Criteria Attained	% of Growing Season Monitored
1	0	0	NA	46%	3	1	NA	18%	0	0	NA	5%
2	0	0	NA	63%	0	0	NA	75%	0	0	NA	34%
3	0	0	NA	63%	1	1	NA	75%	0	0	NA	23%
4	2	1	NO	100%	0	0	NA	75%	0	0	NA	35%
5	2	1	NO	100%	4	2	NO	100%	0	0	NA	24%
6	2	1	NA	63%	2	1	NO	100%	0	0	NA	34%

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lewis Creek Stream Restoration Site City/County: Henderson County Sampling Date: 9-15-15
 Applicant/Owner: NC DEQ Division of Mitigation Services State: NC Sampling Point: DP #1
 Investigator(s): Richard Mogensen/Heath Caldwell Section, Township, Range:
 Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): Flat Slope (%): 1
 Subregion (LRR or MLRA): MLRA N-130B Lat: 35°22'43.27" N Long: 82°21'02.72"W Datum: NAD-83
 Soil Map Unit Name: Codorus/Hatboro Inclusions NWI classification: PSS1B

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

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

Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Is the Sampled Area within a Wetland? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Remarks: Area is adjacent to mountain bog and is a jurisdictional Wetland.	

HYDROLOGY

Wetland Hydrology Indicators: <u>Primary Indicators (minimum of one is required; check all that apply)</u> <input checked="" type="checkbox"/> Surface Water (A1) <input type="checkbox"/> True Aquatic Plants (B14) <input type="checkbox"/> High Water Table (A2) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input checked="" type="checkbox"/> Saturation (A3) <input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3) <input checked="" type="checkbox"/> Water Marks (B1) <input type="checkbox"/> Presence of Reduced Iron (C4) <input type="checkbox"/> Sediment Deposits (B2) <input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6) <input type="checkbox"/> Drift Deposits (B3) <input type="checkbox"/> Thin Muck Surface (C7) <input type="checkbox"/> Algal Mat or Crust (B4) <input type="checkbox"/> Other (Explain in Remarks) <input type="checkbox"/> Iron Deposits (B5) <input type="checkbox"/> Inundation Visible on Aerial Imagery (B7) <input checked="" type="checkbox"/> Water-Stained Leaves (B9) <input type="checkbox"/> Aquatic Fauna (B13)	<u>Secondary Indicators (minimum of two required)</u> <input type="checkbox"/> Surface Soil Cracks (B6) <input type="checkbox"/> Sparsely Vegetated Concave Surface (B8) <input type="checkbox"/> Drainage Patterns (B10) <input type="checkbox"/> Moss Trim Lines (B16) <input type="checkbox"/> Dry-Season Water Table (C2) <input type="checkbox"/> Crayfish Burrows (C8) <input type="checkbox"/> Saturation Visible on Aerial Imagery (C9) <input type="checkbox"/> Stunted or Stressed Plants (D1) <input type="checkbox"/> Geomorphic Position (D2) <input type="checkbox"/> Shallow Aquitard (D3) <input type="checkbox"/> Microtopographic Relief (D4) <input type="checkbox"/> FAC-Neutral Test (D5)
Field Observations: Surface Water Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Depth (inches): <u>3"</u> Water Table Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): Saturation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Depth (inches): <u>0"</u> (includes capillary fringe)	Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:	
Remarks: Surface water was present at every site visit for the last 3 years. The surface hydrology appears to be disconnected to groundwater as indicated by the groundwater gauge data. Hydrology seems to be flowing over the surface from the adjacent mountain bog.	

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: DP #1

Tree Stratum (Plot size: <u>30 ft diam</u>)	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	15	Y	FAC
2. Betula nigra	12	Y	FACW
3. Salix nigra	12	Y	OBL
4. Cornus amomum	10	N	FACW
5.			
6.			
7.			
8.			

Sapling/Shrub Stratum (Plot size: <u>30 ft diam</u>)	Absolute % Cover	Dominant Species?	Indicator Status
1. Alnus serrulata	15	Y	OBL
2. Salix cinerea	12	Y	FACW
3. Acer rubrum	8	Y	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			

Herb Stratum (Plot size: <u>30 ft diam</u>)	Absolute % Cover	Dominant Species?	Indicator Status
1. Carex lurida	18	Y	OBL
2. Juncus effusus	15	Y	FACW
3. Vernonia noveboracensis	12	Y	FACW
4. Impatiens capensis	12	Y	FACW
5. Scirpus cyperinus	10	Y	FACW
6. Polygonum hydropiperoides	10	Y	OBL
7. Eutrochium purpureum	8	N	FAC
8. Eupatorium perfoliatum	8	N	FACW
9. Solidago rugosa	5	N	FAC
10. Lobelia cardinalis	3	N	FACW
11. Ludwigia alternifolia	3	N	FACW
12.			

Woody Vine Stratum (Plot size: <u>30 ft diam</u>)	Absolute % Cover	Dominant Species?	Indicator Status
1. Toxicodendron radicans	10	Y	FAC
2. Vitus spp	8	N	N/A
3. Rubus allegheniensis	8	N	FACU
4. Parthenocissus quinquefolia	5	N	FACU
5.			
6.			

Dominance Test worksheet:
 Number of Dominant Species That Are OBL, FACW, or FAC: 13 (A)
 Total Number of Dominant Species Across All Strata: 13 (B)
 Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:
 Total % Cover of: _____ Multiply by:
 OBL species _____ x 1 =
 FACW species _____ x 2 =
 FAC species _____ x 3 =
 FACU species _____ x 4 =
 UPL species _____ x 5 =
 Column Totals: _____ (A) _____ (B)
 Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:
 ___ 1 - Rapid Test for Hydrophytic Vegetation
 x ___ 2 - Dominance Test is >50%
 ___ 3 - Prevalence Index is ≤3.0¹
 ___ 4 - Morphological Adaptations¹ (Provide supporting data in Remarks or on a separate sheet)
 ___ Problematic Hydrophytic Vegetation¹ (Explain)
¹Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:
Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.
Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.
Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.
Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No

Remarks: (Include photo numbers here or on a separate sheet.)
 Hydrophytic vegetation dominant in each strata.

SOIL

Sampling Point: DP #1

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-6	7.5 YR 3/4	95					Sandy Loam	
6-12	10 YR 3/1	85	Mottling	20			Sandy Loam	Low chroma with prominent mottling
12-24	10YR 3/1	95	Mottling	20			Loam	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:		Indicators for Problematic Hydric Soils ³ :	
<input type="checkbox"/> Histosol (A1)	<input type="checkbox"/> Dark Surface (S7)	<input type="checkbox"/> 2 cm Muck (A10) (MLRA 147)	
<input type="checkbox"/> Histic Epipedon (A2)	<input type="checkbox"/> Polyvalue Below Surface (S8) (MLRA 147, 148)	<input type="checkbox"/> Coast Prairie Redox (A16) (MLRA 147, 148)	
<input type="checkbox"/> Black Histic (A3)	<input type="checkbox"/> Thin Dark Surface (S9) (MLRA 147, 148)	<input type="checkbox"/> Piedmont Floodplain Soils (F19) (MLRA 136, 147)	
<input type="checkbox"/> Hydrogen Sulfide (A4)	<input type="checkbox"/> Loamy Gleyed Matrix (F2)	<input type="checkbox"/> Very Shallow Dark Surface (TF12)	
<input type="checkbox"/> Stratified Layers (A5)	<input type="checkbox"/> Depleted Matrix (F3)	<input type="checkbox"/> Other (Explain in Remarks)	
<input type="checkbox"/> 2 cm Muck (A10) (LRR N)	<input type="checkbox"/> Redox Dark Surface (F6)		
<input checked="" type="checkbox"/> Depleted Below Dark Surface (A11)	<input type="checkbox"/> Depleted Dark Surface (F7)		
<input type="checkbox"/> Thick Dark Surface (A12)	<input type="checkbox"/> Redox Depressions (F8)		
<input type="checkbox"/> Sandy Mucky Mineral (S1) (LRR N, MLRA 147, 148)	<input type="checkbox"/> Iron-Manganese Masses (F12) (LRR N, MLRA 136)		
<input type="checkbox"/> Sandy Gleyed Matrix (S4)	<input type="checkbox"/> Umbric Surface (F13) (MLRA 136, 122)		
<input checked="" type="checkbox"/> Sandy Redox (S5)	<input checked="" type="checkbox"/> Piedmont Floodplain Soils (F19) (MLRA 148)		
<input type="checkbox"/> Stripped Matrix (S6)	<input type="checkbox"/> Red Parent Material (F21) (MLRA 127, 147)		

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed): Type: Depth (inches):	Hydric Soil Present? Yes <input checked="" type="checkbox"/> No
--	---

Remarks: Mapped as Codorus which is a Hydric B soil with inclusions of Hatboro silt loam. Hatboro is a Hydric A soil which appears to be present at the wetland area.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lewis Creek Stream Restoration Site City/County: Henderson County Sampling Date: 9-15-15
 Applicant/Owner: NC DEQ Division of Mitigation Services State: NC Sampling Point: DP #2
 Investigator(s): Richard Mogensen/Heath Caldwell Section, Township, Range:
 Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): Flat Slope (%): 1
 Subregion (LRR or MLRA): MLRA Lat: 35°22'43.27" N Long: 82°21'02.72" W Datum: NAD-83
 Soil Map Unit Name: Codorus/Hatboro Inclusions NWI classification: PSS1B

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

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

Hydrophytic Vegetation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Hydric Soil Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Is the Sampled Area within a Wetland? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Remarks: Area is adjacent to mountain bog and is a jurisdictional Wetland.	

HYDROLOGY

Wetland Hydrology Indicators: <u>Primary Indicators (minimum of one is required; check all that apply)</u> <input checked="" type="checkbox"/> Surface Water (A1) <input type="checkbox"/> True Aquatic Plants (B14) <input type="checkbox"/> High Water Table (A2) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input checked="" type="checkbox"/> Saturation (A3) <input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3) <input checked="" type="checkbox"/> Water Marks (B1) <input type="checkbox"/> Presence of Reduced Iron (C4) <input type="checkbox"/> Sediment Deposits (B2) <input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6) <input type="checkbox"/> Drift Deposits (B3) <input type="checkbox"/> Thin Muck Surface (C7) <input type="checkbox"/> Algal Mat or Crust (B4) <input type="checkbox"/> Other (Explain in Remarks) <input type="checkbox"/> Iron Deposits (B5) <input type="checkbox"/> Inundation Visible on Aerial Imagery (B7) <input checked="" type="checkbox"/> Water-Stained Leaves (B9) <input type="checkbox"/> Aquatic Fauna (B13)	<u>Secondary Indicators (minimum of two required)</u> <input type="checkbox"/> Surface Soil Cracks (B6) <input type="checkbox"/> Sparsely Vegetated Concave Surface (B8) <input type="checkbox"/> Drainage Patterns (B10) <input type="checkbox"/> Moss Trim Lines (B16) <input type="checkbox"/> Dry-Season Water Table (C2) <input type="checkbox"/> Crayfish Burrows (C8) <input type="checkbox"/> Saturation Visible on Aerial Imagery (C9) <input type="checkbox"/> Stunted or Stressed Plants (D1) <input type="checkbox"/> Geomorphic Position (D2) <input type="checkbox"/> Shallow Aquitard (D3) <input type="checkbox"/> Microtopographic Relief (D4) <input type="checkbox"/> FAC-Neutral Test (D5)
Field Observations: Surface Water Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Depth (inches): 3" Water Table Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): Saturation Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Depth (inches): 0" (includes capillary fringe)	Wetland Hydrology Present? Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:	
Remarks: Surface water was present at every site visit for the last 3 years. The surface hydrology appears to be disconnected to groundwater as indicated by the groundwater gauge data. Hydrology seems to be flowing over the surface from the adjacent mountain bog.	

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: DP #2

Tree Stratum (Plot size: <u>30 ft diam</u>)	Absolute % Cover	Dominant Species?	Indicator Status
1. Acer rubrum	15	Y	FAC
2. Betula nigra	12	Y	FACW
3. Salix nigra	12	Y	OBL
4. Cornus amomum	10	N	FACW
5.			
6.			
7.			
8.			

Sapling/Shrub Stratum (Plot size: <u>30 ft diam</u>)	Absolute % Cover	Dominant Species?	Indicator Status
1. Alnus serrulata	15	Y	OBL
2. Salix cinerea	12	Y	FACW
3. Acer rubrum	8	Y	FAC
4.			
5.			
6.			
7.			
8.			
9.			
10.			

Herb Stratum (Plot size: <u>30 ft diam</u>)	Absolute % Cover	Dominant Species?	Indicator Status
1. Carex lurida	18	Y	OBL
2. Juncus effusus	15	Y	FACW
3. Vernonia noveboracensis	12	Y	FACW
4. Impatiens capensis	12	Y	FACW
5. Scirpus cyperinus	10	Y	FACW
6. Polygonum hydropiperoides	10	Y	OBL
7. <u>Eutrochium purpureum</u>	8	N	FAC
8. Eupatorium perfoliatum	8	N	FACW
9. Solidago rugosa	5	N	FAC
10. Lobelia cardinalis	3	N	FACW
11. Ludwigia alternifolia	3	N	FACW
12.			

Woody Vine Stratum (Plot size: <u>30 ft diam</u>)	Absolute % Cover	Dominant Species?	Indicator Status
1. Toxicodendron radicans	10	Y	FAC
2. Vitus spp	8	N	N/A
3. Rubus allegheniensis	8	N	UPL
4. Parthenocissus quinquefolia	5	N	FACU
5.			
6.			

Dominance Test worksheet:
 Number of Dominant Species That Are OBL, FACW, or FAC: 13 (A)
 Total Number of Dominant Species Across All Strata: 13 (B)
 Percent of Dominant Species That Are OBL, FACW, or FAC: 100% (A/B)

Prevalence Index worksheet:
 Total % Cover of: _____ Multiply by:
 OBL species _____ x 1 =
 FACW species _____ x 2 =
 FAC species _____ x 3 =
 FACU species _____ x 4 =
 UPL species _____ x 5 =
 Column Totals: _____ (A) _____ (B)
 Prevalence Index = B/A =

Hydrophytic Vegetation Indicators:
 ___ 1 - Rapid Test for Hydrophytic Vegetation
 x ___ 2 - Dominance Test is >50%
 ___ 3 - Prevalence Index is ≤3.0¹
 ___ 4 - Morphological Adaptations¹ (Provide supporting data in Remarks or on a separate sheet)
 ___ Problematic Hydrophytic Vegetation¹ (Explain)
¹Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic.

Definitions of Four Vegetation Strata:
Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height.
Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall.
Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall.
Woody vine – All woody vines greater than 3.28 ft in height.

Hydrophytic Vegetation Present? Yes X No

Remarks: (Include photo numbers here or on a separate sheet.)

Hydrophytic vegetation dominant in each strata.

SOIL

Sampling Point: DP #2

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features			Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹		
0-6	7.5 YR 3/4	95				Sandy Loam	
6-12	10 YR 3/1	85	Mottling	20		Sandy Loam	Low chroma with prominent mottling
12-24	10YR 3/1	95	Mottling	20		Loam	

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

Indicators for Problematic Hydric Soils³:

- Histosol (A1)
- Histic Epipedon (A2)
- Black Histic (A3)
- Hydrogen Sulfide (A4)
- Stratified Layers (A5)
- 2 cm Muck (A10) (LRR N)
- Depleted Below Dark Surface (A11)
- Thick Dark Surface (A12)
- Sandy Mucky Mineral (S1) (LRR N, MLRA 147, 148)
- Sandy Gleyed Matrix (S4)
- Sandy Redox (S5)
- Stripped Matrix (S6)

- Dark Surface (S7)
- Polyvalue Below Surface (S8) (MLRA 147, 148)
- Thin Dark Surface (S9) (MLRA 147, 148)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)
- Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- Umbric Surface (F13) (MLRA 136, 122)
- Piedmont Floodplain Soils (F19) (MLRA 148)
- Red Parent Material (F21) (MLRA 127, 147)

- 2 cm Muck (A10) (MLRA 147)
- Coast Prairie Redox (A16) (MLRA 147, 148)
- Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:
Depth (inches):

Hydric Soil Present? Yes No

Remarks:

Mapped as Codorus which is a Hydric B soil with inclusions of Hatboro silt loam. Hatboro is a Hydric A soil which appears to be present at the wetland area.

WETLAND DETERMINATION DATA FORM – Eastern Mountains and Piedmont Region

Project/Site: Lewis Creek Stream Restoration Site City/County: Henderson County Sampling Date: 12-5-15
 Applicant/Owner: NC DEQ Division of Mitigation Services State: NC Sampling Point: DP #3
 Investigator(s): Richard Mogensen/Heath Caldwell Section, Township, Range:
 Landform (hillslope, terrace, etc.): Floodplain Local relief (concave, convex, none): Flat Slope (%): 1
 Subregion (LRR or MLRA): MLRA Lat: 35°22'41.94" N Long: 82°20'58.47" W Datum: NAD-83
 Soil Map Unit Name: Codorus NWI classification: UPL

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

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

Hydrophytic Vegetation Present? Yes <input type="checkbox"/> No <input type="checkbox"/> Hydric Soil Present? Yes <input type="checkbox"/> No <input type="checkbox"/> Wetland Hydrology Present? Yes <input type="checkbox"/> No <input type="checkbox"/>	Is the Sampled Area within a Wetland? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Remarks: Area is upland floodplain adjacent to mountain bog and is not a jurisdictional Wetland. <u>No</u> obvious signs of surface or subsurface hydrology.	

HYDROLOGY

Wetland Hydrology Indicators: <u>Primary Indicators (minimum of one is required; check all that apply)</u> <input type="checkbox"/> Surface Water (A1) <input type="checkbox"/> True Aquatic Plants (B14) <input type="checkbox"/> High Water Table (A2) <input type="checkbox"/> Hydrogen Sulfide Odor (C1) <input type="checkbox"/> Saturation (A3) <input type="checkbox"/> Oxidized Rhizospheres on Living Roots (C3) <input type="checkbox"/> Water Marks (B1) <input type="checkbox"/> Presence of Reduced Iron (C4) <input type="checkbox"/> Sediment Deposits (B2) <input type="checkbox"/> Recent Iron Reduction in Tilled Soils (C6) <input checked="" type="checkbox"/> Drift Deposits (B3) <input type="checkbox"/> Thin Muck Surface (C7) <input type="checkbox"/> Algal Mat or Crust (B4) <input type="checkbox"/> Other (Explain in Remarks) <input type="checkbox"/> Iron Deposits (B5) <input type="checkbox"/> Inundation Visible on Aerial Imagery (B7) <input type="checkbox"/> Water-Stained Leaves (B9) <input type="checkbox"/> Aquatic Fauna (B13)	<u>Secondary Indicators (minimum of two required)</u> <input type="checkbox"/> Surface Soil Cracks (B6) <input type="checkbox"/> Sparsely Vegetated Concave Surface (B8) <input type="checkbox"/> Drainage Patterns (B10) <input type="checkbox"/> Moss Trim Lines (B16) <input type="checkbox"/> Dry-Season Water Table (C2) <input type="checkbox"/> Crayfish Burrows (C8) <input type="checkbox"/> Saturation Visible on Aerial Imagery (C9) <input type="checkbox"/> Stunted or Stressed Plants (D1) <input type="checkbox"/> Geomorphic Position (D2) <input type="checkbox"/> Shallow Aquitard (D3) <input type="checkbox"/> Microtopographic Relief (D4) <input type="checkbox"/> FAC-Neutral Test (D5)
Field Observations: Surface Water Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): Water Table Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): Saturation Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Depth (inches): (includes capillary fringe)	Wetland Hydrology Present? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>
Describe Recorded Data (stream gauge, monitoring well, aerial photos, previous inspections), if available:	
Remarks: NO signs of standing water. Groundwater gauges and regular field measurements taken over three years throughout the Lewis Creek Floodplain do not indicate wetland hydrology is present.	

VEGETATION (Four Strata) – Use scientific names of plants.

Sampling Point: DP #3

	Absolute % Cover	Dominant Species?	Indicator Status	
Tree Stratum (Plot size: <u>30 ft diam</u>)				
1. Acer rubrum	15	Y	FAC	Dominance Test worksheet: Number of Dominant Species That Are OBL, FACW, or FAC: <u>8</u> (A) Total Number of Dominant Species Across All Strata: <u>11</u> (B) Percent of Dominant Species That Are OBL, FACW, or FAC: <u>72%</u> (A/B)
2. Betula nigra	6	N	FACW	
3. Salix cinerea	20	Y	FACW	
4. Liquidambar styraciflua	15	Y	FAC	
5. Platanus occidentalis	5	N	FACW	
6.				
7.				
8.				
_____ = Total Cover				
Sapling/Shrub Stratum (Plot size: <u>30 ft diam</u>)				
1. Liquidambar styraciflua	15	Y	FAC	Prevalence Index worksheet: Total % Cover of: _____ Multiply by: OBL species _____ x 1 = FACW species _____ x 2 = FAC species _____ x 3 = FACU species _____ x 4 = UPL species _____ x 5 = Column Totals: _____ (A) _____ (B) Prevalence Index = B/A = _____ Hydrophytic Vegetation Indicators: ___ 1 - Rapid Test for Hydrophytic Vegetation x ___ 2 - Dominance Test is >50% ___ 3 - Prevalence Index is ≤3.0 ¹ ___ 4 - Morphological Adaptations ¹ (Provide supporting data in Remarks or on a separate sheet) ___ Problematic Hydrophytic Vegetation ¹ (Explain)
2. Salix cinerea	12	Y	FACW	
3. Acer rubrum	8	N	FAC	
4. Pinus strobus	5	N	UPL	
5.				
6.				
7.				
8.				
9.				
10.				
_____ = Total Cover				
Herb Stratum (Plot size: <u>30 ft diam</u>)				
1. Ambrosia psilostachya	25	Y	FAC	¹ Indicators of hydric soil and wetland hydrology must be present, unless disturbed or problematic. Definitions of Four Vegetation Strata: Tree – Woody plants, excluding vines, 3 in. (7.6 cm) or more in diameter at breast height (DBH), regardless of height. Sapling/Shrub – Woody plants, excluding vines, less than 3 in. DBH and greater than or equal to 3.28 ft (1 m) tall. Herb – All herbaceous (non-woody) plants, regardless of size, and woody plants less than 3.28 ft tall. Woody vine – All woody vines greater than 3.28 ft in height.
2. Apios americana	15	Y	FACW	
3. Agrimonia gryposepala	10	Y	FACU	
4. Impatiens capensis	5	N	FACW	
5. Sorghum halapense	5	N	FACW	
6. Polygonum pennsylvanica	5	N	FAC	
7. Solidago rugosa	8	N	FAC	
8. Elymus canadensis	8	N	FACU	
9. Echinochloa crus-gali	8	N	FAC	
10.				
11.				
12.				
_____ = Total Cover				
Woody Vine Stratum (Plot size: <u>30 ft diam</u>)				
1. Toxicodendron radicans	10	Y	FAC	Hydrophytic Vegetation Present? Yes <u>X</u> No
2. Vitus spp	8	N	N/A	
3. Rubus allegheniensis	25	Y	FACU	
4. Parthenocissus quinquefolia	5	N	FACU	
5. Rosa multiflora	10	Y	FACU	
6.				
_____ = Total Cover				
Remarks: (Include photo numbers here or on a separate sheet.)				
Hydrophytic vegetation isn't dominant in any strata.				

SOIL

Sampling Point: DP #3

Profile Description: (Describe to the depth needed to document the indicator or confirm the absence of indicators.)

Depth (inches)	Matrix		Redox Features				Texture	Remarks
	Color (moist)	%	Color (moist)	%	Type ¹	Loc ²		
0-3	2.5 Y 7/8	100					Sand	
3-10	2.5 Y 5/3	85					Loam	
10-24	2.5 Y 6/4	95	Mottling	20			Clay Loam	Some mottling

¹Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. ²Location: PL=Pore Lining, M=Matrix.

Hydric Soil Indicators:

- Histosol (A1)
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- Sandy Redox (S5)
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- Dark Surface (S7)
- Polyvalue Below Surface (S8) (MLRA 147, 148)
- Thin Dark Surface (S9) (MLRA 147, 148)
- Loamy Gleyed Matrix (F2)
- Depleted Matrix (F3)
- Redox Dark Surface (F6)
- Depleted Dark Surface (F7)
- Redox Depressions (F8)
- Iron-Manganese Masses (F12) (LRR N, MLRA 136)
- Umbric Surface (F13) (MLRA 136, 122)
- Piedmont Floodplain Soils (F19) (MLRA 148)
- Red Parent Material (F21) (MLRA 127, 147)

Indicators for Problematic Hydric Soils³:

- 2 cm Muck (A10) (MLRA 147)
- Coast Prairie Redox (A16) (MLRA 147, 148)
- Piedmont Floodplain Soils (F19) (MLRA 136, 147)
- Very Shallow Dark Surface (TF12)
- Other (Explain in Remarks)

³Indicators of hydrophytic vegetation and wetland hydrology must be present, unless disturbed or problematic.

Restrictive Layer (if observed):

Type:
Depth (inches):

Hydric Soil Present? Yes _____ No

Remarks:

Mapped as Codorus which is a Hydric B soil and can be a wetland or upland soil depending on the aquic moisture regime. Not a wetland soil.