

Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project

**EEP Project No. 370
2011 Monitoring Report: Year 2 of 5**

**Construction Completed: November 2009
Submission Date: May 2012**



Submitted to: NCDENR-EEP
1652 Mail Service Center
Raleigh, NC 27699





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SECTION 1
EXECUTIVE SUMMARY

SECTION 1

EXECUTIVE SUMMARY

Dutch Buffalo Creek (Site) is located in Cabarrus County, North Carolina, northeast of the City of Concord. The project is located in the Yadkin-Pee Dee River Basin, Catalog Unit 03040105, DWQ Subbasin 30712 with a watershed land use dominated by rural pasture land and forest. Dutch Buffalo Creek is a third order stream with an approximate drainage area of 23 square miles at the farthest downstream point of the project. The unnamed tributary (UT) to Dutch Buffalo Creek is a first order stream with an approximate drainage area of 0.3 square miles. Dutch Buffalo Creek drains into the Pee Dee River and is listed as WS-II class waters. Construction of the restoration project was completed in November 2009.

This report serves as year two of the five year monitoring plan for the Site.

1.1 Goals and Objectives

Historically, the Site had been disturbed through management required for cattle grazing and rearing. Past alterations to the Site include removal of riparian vegetation, dredging, ditching and conversion of wetlands, and straightening of drainage channels and tributaries to Dutch Buffalo Creek. The primary objectives of the project were to stabilize and protect degraded or vulnerable streambanks along an UT to Dutch Buffalo Creek and along the main channel of Dutch Buffalo Creek. Specifically, the goals for the project include:

- Stabilize and protect degraded or vulnerable streambanks along the main reach of Dutch Buffalo Creek.
- Enhance the upper project reach of Dutch Buffalo Creek through limiting livestock access and reestablishing vegetation along reaches of the main channel where necessary.
- Restore a natural, stable dimension, pattern, and profile along an unnamed tributary using natural channel design techniques.
- Improve riffle and pool habitats supportive of macrobenthos and fish communities.
- Restore and/or enhance the natural hydrology, vegetation, and soil characteristics in adjacent wetlands.
- Provide alternate cattle watering sources and road access across Dutch Buffalo Creek to supplement fencing exclusion efforts along the main channel.
- Improve the aesthetics of the stream.

To meet these goals, the following objectives have been established for the Dutch Buffalo Creek Stream and Wetland Restoration project:

- Enhancing approximately 3,004 linear feet in the main channel's upper reach.

- Preserving approximately 3,583 linear feet in the main channel's lower and upper reaches.
- Restoring 608 linear feet of an UT into a Rosgen C/E stream type.
- Preserving approximately 1.67 acres, enhancing approximately 4.26 acres, and restoring approximately 7.29 acres of riparian non-riverine¹ wetland area.
- Constructing access crossings across the main channel and the unnamed tributary of Dutch Buffalo Creek.
- Creating an alternative livestock watering source and install livestock exclusion fencing.

1.2 Vegetation Assessment

JJG conducted the 2011 (Year 2 of 5) vegetation assessment and vegetation plot analysis in August 2011. Vegetation assessments were conducted following the CVS-NCEEP Level 2 Protocol (Lee et al., 2008) to monitor and assess the planted woody vegetation in the wetland areas and along the UT stream reach. Seven vegetation plots were established in the design phase and situated randomly within the riparian buffer zone. The planted vegetation community goal for these plots is to establish a Piedmont floodplain forest. The following success criteria for vegetation were established for the Site:

- 320 stems per acre years 1 through 3
- 288 stems per acre year 4
- 260 stems per acre year 5

Vegetation problem areas are limited to the slower growth of planted woody vegetation within the riparian areas due to shading from adjacent mature trees and damage from wildlife grazing and rooting throughout the main preservation channel and enhancement floodplain areas. Japanese stiltgrass (*Microstegium vimineum*) has also been observed along the UT and is dominating the herbaceous layer in areas along Dutch Buffalo Creek. Growth of this invasive species; however, has not been observed to outcompete or stunt any planted or naturally recruited woody species within the vegetation plots. Typical on-site growth occurs as a uniform groundcover and is observed to dominate the herbaceous layer where limited woody canopy or native understory exists. Currently, the propagation and location of this species do not present any problem to the desired vegetation populations. Overall the streambanks are well vegetated. Herbaceous seeding along the restored streambanks and plugged wetland areas appears to provide adequate soil cover.

The 2011 vegetation monitoring results indicate that the Site appears to be meeting the vegetation success criteria in four of the seven established vegetation plots. Three plots (Plots 1, 3 and 4) were found to have limited planted species; however, all plots greatly

¹ The primary source hydrology appears to be groundwater and slope drainage, based on site observations. The incised state of Dutch Buffalo Creek precludes a frequent flooding interval due to overall floodplain disconnection.

exceeded the vegetation criteria when including naturally recruited specimens. Potential growth, vigor, and survival of the planted vegetation within Plot 1 have been limited by competition with surrounding herbaceous grasses. Low growth rates and survivability in Plots 3 and 4 are likely due to the abovementioned factors and have been reduced through wildlife grazing and competition with surrounding canopy. Overall, average survivability for planted species within the Site greatly exceeds the required threshold by 102 planted species per acre with a density of approximately 422 identified stems per acre (plot size = 0.0247 ac). Please refer to Appendix C, for detailed information regarding the 2011 vegetation current conditions and monitoring data results.

1.3 Stream Assessment

Assessments were conducted along the main channel of the Dutch Buffalo Creek enhancement reach (3,004 lf) and the restoration reach (608 lf) of the UT. Stream dimension, profile and substrate were also evaluated along the restored reach of the UT at four established cross-sections. Please refer to Appendix D for detailed geomorphologic information.

Main Channel

The main channel is exhibiting bare and undercutting banks along much of the project length. Attempts to stabilize and protect localized streambanks along the reach appear to be ineffective due to the lack of flood prone area and extensive flood flows within the confined channel. Reachwide disequilibrium does not appear to be a concern at this time. Debris jams within the creek are common and will be monitored to ensure they do not become problematic. Vegetation growth in the channel is also present at several locations throughout the reach. The installed stream crossings appear to be in stable condition. Cattle exclusion fencing and devices appear to be intact and are working as intended to keep cattle out of the conservation areas.

Unnamed Tributary

A total of four cross-sections and 608 lf of longitudinal profile were monitored within the restored reach of the UT to Dutch Buffalo. Stream pattern, profile, and dimension are maintaining vertical and lateral stability and development within the channel is transitioning as anticipated. Limited problem areas associated with aggradation and growth of in-stream vegetation and structural complications (one affected sill and associated riffle structure, mid-reach) were noted; however, complications observed during this assessment are not affecting intended function and are anticipated to stabilize as monitoring progresses.

In-stream vegetation does not appear to have affected channel flow at this time and is associated with a minor, aggraded mid-channel bar. Aggraded sections of the restored reach are likely a result of accumulated fine bed material that has not flushed from the system as the restored channel matures. These problem areas are not of immediate concern and will be monitored for an increase in negative trends during subsequent

assessments. Overall, the streambanks and riparian areas are well vegetated and bed features are performing as intended with appropriate depths, lengths, and spacing. The log step-pools used to transition the restored reach to the main channel elevation are performing well and are in stable condition.

Restored parameters are closely consistent with as-built and MY1 Average bankfull width (8.59 ft) of the surveyed riffle cross-sections falls within the range of the as-built widths (8.34-11.01 ft), and the average surveyed mean bankfull depth of 1.03 ft is consistent with as-built conditions (1.02 ft). The surveyed bankfull widths and depths exhibit an average Width/Depth (W/D) ratio of 8.38 and an average cross-sectional area of 8.82, which are consistent with as-built values. At the time of the survey a majority of the restored channel was dry; however, the defining characteristics of the stream display typical dimensions of an E-type channel and are expected to narrow and deepen.

Visual inspection of the channel indicated a stable profile characterized by well-defined riffle and pool features. Step-pool structures transitioning the UT channel to Dutch Buffalo Creek are functioning appropriately and have maintained scour pools and zones of re-aeration, improving in-stream habitat while supporting grade. Particle size distribution has developed toward a larger and more evenly distributed substrate population with limited areas exhibiting increased siltation and embedding, but has declined since last monitoring period. This may be due to offsite, upstream erosion or the embedding and flushing of particles used during construction.

1.4 Wetland Assessment

The following general observations were noted regarding the riparian and wetland areas and associated vegetation.

- Herbaceous seeding appears to provide adequate soil cover along the restored streambanks and plugged wetland areas.
- Multiflora rose (*Rosa multiflora*) and Japanese stiltgrass is evident sporadically throughout the main channel preservation and enhancement floodplain, but does not appear to be a concern at this time.
- Visual assessment of planted woody vegetation suggests densities in riparian areas are adequate, but growth appears to be slower than expected due to shading from adjacent mature trees. Vegetation within Wetland Area C is being outcompeted by vigorous switchgrass growth.
- Log sills installed to stabilize filled ditches and increase hydrology in wetland enhancement areas are performing as expected, although water is piping under one sill. The piping is not a concern at this time as the grade is being maintained and there is no erosion resulting.

Currently, there are ten (10) groundwater gauges located on the site. The monitoring gauges are programmed to download groundwater levels daily and were downloaded monthly from March to November in order to capture hydrological data during the 2011

growing season. The target wetland hydrological success criterion is saturation or inundation for at least eight percent of the growing season in the lower landscape (floodplain) positions. To achieve the hydrologic success criterion, groundwater levels must be within 12-inches of the ground surface for 18 consecutive days, which equates to eight percent of the March 23 to November 7 (229 days) growing season.

Five of the ten gauges on-site achieved the wetland success criterion of soil saturation within the upper 12 inches for eight percent of the growing season. GW3, GW4, GW5, GW9 and GW10 did not meet the required duration of inundation/saturation, which is likely to do the proximity of the wells to Dutch Buffalo Creek. The incised creek is most likely creating a steep hydraulic gradient through drawdown of the groundwater table. The drawdown is reducing the groundwater table below the 12-inch threshold required for these wells to meet the success criterion. Determination of wetland limits and repositioning of the non-achieving gauges may be necessary to better characterize the site hydrology and wetland extents. The wells that did attain the success threshold exhibited improved hydrology compared to the MY1 monitoring period. This improvement may be due to increased precipitation and/or the maturation of the site. Further assessment and comparison throughout the monitoring phase will be necessary to confirm this trend.

Within the wetland zones, hydrophytic vegetation and hydrology indicators have developed. In some areas, the appropriate soil chroma has also developed. It is suspected that these areas may have already had hydric conditions present. Surface inundation to ground saturation was observed throughout the site; therefore, appropriate hydrological condition for the wetland zones appears to be present. Please refer to Appendix E for wetland plots and a summary of the wetland criteria attainment.

Log sills installed to stabilize filled ditches and increase hydrology in wetland enhancement areas are performing as expected, although water is piping under a majority of the sills. The piping is not a concern at this time as the grade is being maintained and there is no resulting erosion.

1.5 Annual Monitoring Summary

In summary, the Site has met the stream, vegetation, and a portion of the wetland mitigation goals for monitoring year 2. The 2011 vegetation plot monitoring results indicate that the planted vegetation is doing well at the Site, although competition with vigorous herbaceous species and mature canopy may be reducing growth rates. Recruit vegetation is compensating for reduced growth rates of planted specimens. Performance of vegetation establishment will be further assessed as the Site matures and planted vegetation has an opportunity to stabilize through additional growing seasons. The pattern, profile, and dimension of the restored UT channel appear to be maintaining vertical and lateral stability with stable structures and minimal bank erosion. A few problem areas were observed, such as mild aggradation and in-stream vegetation growth, and slight reduction in particle distribution. These areas of stream instability do not appear to have advanced from the previous monitoring years. For the 2011

monitoring year, half of the wetland gauges achieved the wetland success criterion of soil saturation within the upper 12 inches for eight percent of the growing season.

The conservation easement appears to be in a good condition. Exclusion fencing and cattle crossings are intact and appear to be functioning as intended. There was no evidence of cattle entry into the conservation easement. There was no evidence of human intervention such as mowing, harvesting, application of herbicides, or other mechanical or anthropogenic disturbance activities. Any natural resource issues outlined in this report are resulting from natural perturbations or circumstances.

The background information provided in this report is referenced from the restoration plan (JJG 2007) and previous monitoring reports (JJG 2011) and is available on EEP's website. All raw data supporting the tables and figures in the appendices is available from EEP upon request.



SECTION 2
METHODOLOGY

SECTION 2

METHODOLOGY

2.1 Methodology

Methods employed for the Site were a combination of those established by standard regulatory guidance and procedure documents as well as methods addressed in the Restoration Plan (JJG, 2007) and Baseline Monitoring Document and As-Built Baseline Report (JJG, 2011). Geomorphic and stream assessments were performed following guidelines outlined in the Stream Channel Reference Sites: An Illustrated Guide to Field Techniques (Harrelson et al., 1994) and in the Stream Restoration a Natural Channel Design Handbook (Doll et al, 2003). Vegetation assessments were performed following the Carolina Vegetation Survey-NCEEP Level 2 Protocol (Lee et al., 2006). JJG used the *Flora of the Carolinas, Virginia, Georgia, and surrounding areas* by Alan S. Weakley as the taxonomic standard for vegetation nomenclature for this report. Precipitation data for the hydrographs was obtained from an off-site resource in Concord, NC weather station (the nearest station offering daily precipitation data) through Weather Underground URL (<http://www.wunderground.com/history/airport/KJQF/2010/12/16/CustomHistory.html>).



SECTION 3
REFERENCES

SECTION 3

REFERENCES

Doll, B.A., Grabow, G.L., Hall, K.A., Halley, J., Harman, W.A., Jennings, G.D., and Wise, D.E., 2003. *Stream Restoration A Natural Channel Design Handbook*.

Harrelson, Cheryl C; Rawlins, C.L.; Potyondy, John P. 1994. *Stream Channel Reference Sites: An Illustrated Guide to Field Technique*. Gen. Tech. Rep. RM-245. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Forest and Range Experiment Station. 61 p.

Jordan, Jones, and Goulding. 2007. Restoration Plan, Dutch Buffalo Creek, Stream Restoration. Cabarrus County, North Carolina.

Jordan, Jones, and Goulding. 2011. Baseline Monitoring Document and As-built Baseline Report – Final, Suther (Dutch Buffalo Creek), Stream and Wetland Restoration Project. Cabarrus County, North Carolina.

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

Weakley, A.S. 2008. *Flora of the Carolinas, Virginia, Georgia, Northern Florida, and Surrounding Areas* (Draft April 2008). University of North Carolina at Chapel Hill: Chapel Hill, NC.



SECTION 4 APPENDICES

Appendix A – Project Vicinity Map and Background Tables

Appendix B – Visual Assessment Data

Appendix C – Vegetation Plot Data

Appendix D – Stream Survey Data

Appendix E – Hydrologic Data



APPENDIX A PROJECT VICINITY MAP AND BACKGROUND TABLES

Figure 1	Project Vicinity Map and Directions
Table 1	Project Restoration Components
Table 2	Project Activity and Reporting History
Table 3	Project Contacts Table
Table 4	Project Attribute Table

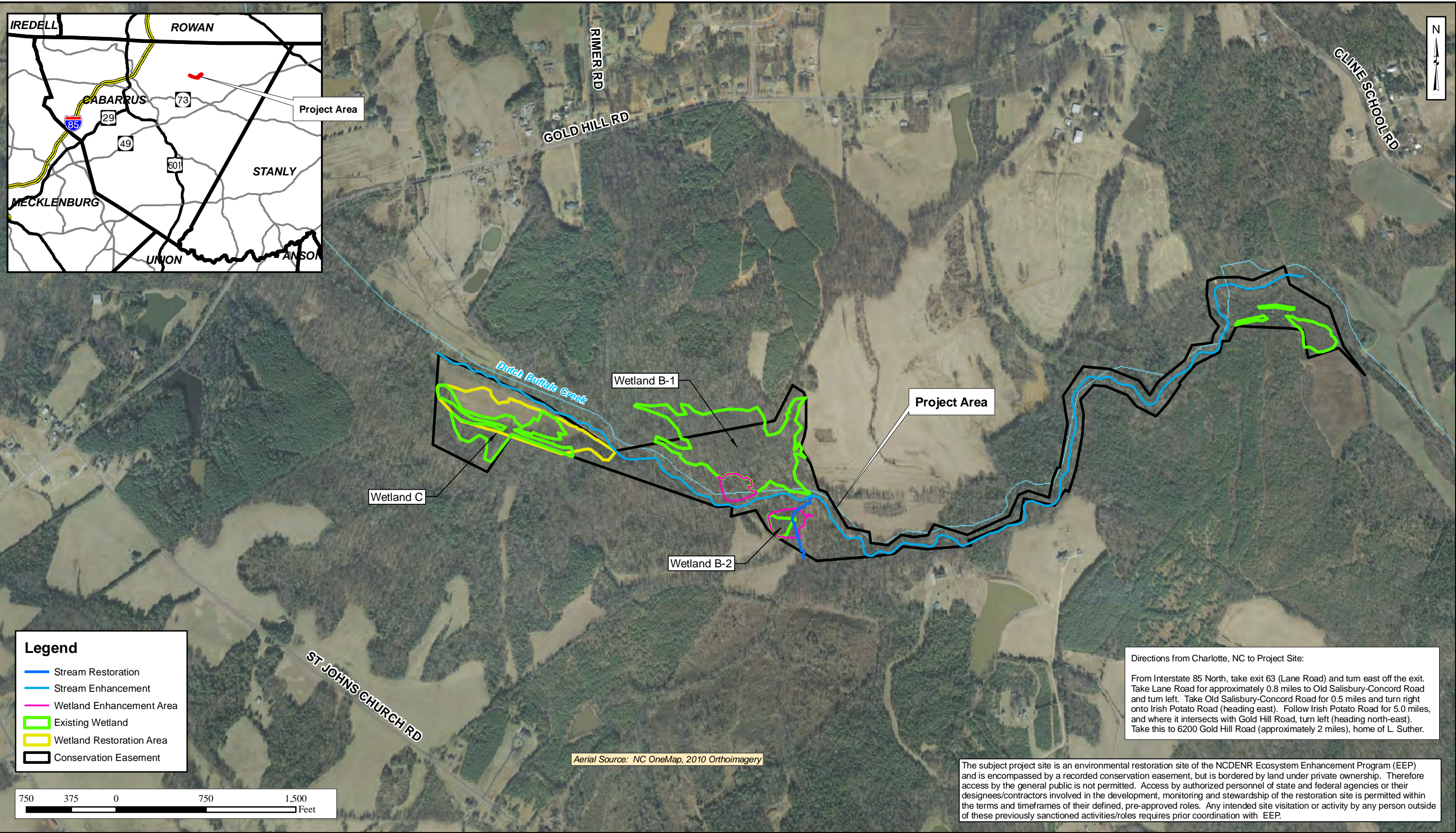


Figure 1. Vicinity Map
 Dutch Buffalo Creek Stream and Wetland Restoration Project
 Cabarrus County, NC
 February 2012



Table 1. Project Components and Mitigation Credits
Dutch Buffalo Creek Stream and Wetland Restoration Project/EEP Project No. 370

Mitigation Credits						
	Stream (SMU)	Riparian Wetland (WMU)	Non-riparian Wetland	Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	EII/P/R	P/E/R	N/A	N/A	N/A	N/A
Totals	1,201.6/935.6/608	0.33/2.13/7.29	N/A	N/A	N/A	N/A
Project Components						
Project Component/Reach ID	Stationing (ft)	Existing Footage/ Acreage	Approach	Restoration or Restoration Equivalent	Restoration Footage or Acres	Mitigation Ratio
Dutch Buffalo Creek- Upper Reach	0+00 – 17+61	N/A	N/A	N/A	N/A	N/A
	17+61 - 53+72	3,004 lf	N/A	RE	3,004 lf	2.5:1
Dutch Buffalo Creek- Lower Reach	53+72 – 100+50	4,678 lf	N/A	RE	4,678 lf	5:1
Unnamed Tributary	0+00 – 6+08	527 lf	P1, 2	R	608 lf	1:1
Wetland Area B-2	N/A	1.67 ac	N/A	RE	1.67 ac	5:1
Wetland Area B-1	N/A	4.44 ac	N/A	RE	2.47 ac	2:1
				R	1.97 ac	1:1
Wetland Area C	N/A	4.64 ac	N/A	RE	1.79 ac	2:1
				R	5.32 ac	1:1
Component Summations						
Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration (R)	608	N/A	7.29	N/A	N/A	N/A
Enhancement (E)		N/A	4.26	N/A	N/A	N/A
Enhancement I (E)	N/A					
Enhancement II (E)	3,004					
Creation (C)		N/A	N/A	N/A		
Preservation (P)	4,678	N/A	1.67	N/A		N/A
HQ Preservation (P)	N/A	N/A	N/A	N/A		N/A
Totals	8,290	N/A	13.22	N/A	N/A	N/A
BMP Elements						

**Table 2. Project Activity and Reporting History
Dutch Buffalo Creek Stream and Wetland Restoration Project
EEP Project No. 370**

Activity or Report	Data Collection Completed	Actual Completion or Delivery
Restoration Plan	Jan-06	Sep-07
Final Design-90%	Nov-08	Nov-08
Construction	Nov-09	Dec-09
Temporary S&E mix applied to entire project area*	Nov-09	Nov-09
Permanent seed mix applied to reach	Nov-09	Nov-09
Bare root and livestake plantings for reach	Dec-09	Dec-09
Mitigation Plan/ As-Built (Year 0 Monitoring)	Dec-09	Jan-09
Year 1 Monitoring	Oct-10	Jun-11
Year 2 Monitoring	Aug-11	May-12
Year 3 Monitoring		
Year 4 Monitoring		
Year 5 Monitoring		

*Seed and mulch is added as each section of construction is completed.

Table 3. Project Contact Table Dutch Buffalo Creek Stream and Wetland Restoration Project EEP Project No. 370	
Designer Matthew Clabaugh, PE*	Jacobs Engineering Group 6801 Governors Lake Parkway Norcross, GA 30071 770-455-8555
Construction Will Pedersen	River Works, Inc. 8000 Regency Parkway, Suite 200 Cary, NC 27511 919-459-9001
Planting Contractor	River Works, Inc.
Seeding Contractor	River Works, Inc.
Monitoring Performers: Baseline Year 0	Jacobs Engineering Group 6801 Governors Lake Parkway Norcross, GA 30071
Stream Monitoring, POC	Alison Nichols, 704-247-9065
Vegetation Monitoring, POC	
Wetland Monitoring, POC	

*No longer employed by Jacobs Engineering Group

Table 4. Project Baseline Information and Attributes

Project Information			
Project Name		Dutch Buffalo Creek Stream and Wetland Restoration Project	
County		Cabarrus County, North Carolina	
Project Area (acres)		66	
Project Coordinates (latitude and longitude)		35° 27' 05" N, 80° 29' 32" W	
Project Watershed Summary Information			
Physiographic Province		Piedmont	
River Basin		Yadkin PeeDee	
USGS Hydrologic Unit 8-digit	3040105	USGS Hydrologic Unit 14-digit	03040105020060
DWQ Sub-basin		03-07-12	
Project Drainage Area (sq mi)		21.3	
Project Drainage Area Percentage of Impervious Area		3%	
CGIA Land Use Classification		Cultivated (3.00); Mixed Upland Hardwoods (10.00)	
Reach Summary Information			
Parameters		Main Channel	UT
Length of Reach (linear feet)		10,050	608
Valley Classification		VIII	
Drainage Area (sq.mi.)		21.3	0.31
NCDWQ stream identification score		13-17-11-(4.5)	
NCDWQ Water Quality Classification		WS-II; HQW,CA	
Morphological Description (stream type)		Perennial	Intermittent
Evolutionary trend		C→G→F→C	E→Gc→F→C→E
Underlying mapped soils		Altavista, Cecil, Chewacala, Cullen, Enon, Pacolet, Mecklenburg	
Drainage class**		MWD, WD, SPD, WD, WD, WD, WD	
Soil Hydric status		Class B (Chewacla and Altavista)	
Slope		0.0011	0.0093
FEMA Classification		100-year floodplain	
Native vegetation community		Piedmont/Mountain Bottomland Forest; Piedmont/Low Mountain Alluvial Forest	
Percent composition of exotic invasive vegetation		10	80
Wetland Summary Information			
Parameters		Main Channel	UT
Size of Wetland (acres)		11.55	1.67
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)		riparian riverine	riparian riverine
Mapped Soil Series		Chewacla	
Drainage class		SPD	SPD
Soil Hydric Status		B	B
Source of Hydrology		streamflow, groundwater	streamflow, stormwater
Hydrologic Impairment		ditching	ditching
Native vegetation community		Piedmont/Mountain Bottomland Forest; Piedmont/Low Mountain Alluvial Forest; Piedmont/Low Mountain Bottomland Forest	Piedmont/Low Mountain Alluvial Forest
Percent composition of exotic invasive vegetation		5	5
Regulatory Considerations			
Regulation	Applicable?	Resolved?	Supporting Documentation
Waters of the United States - Section 404	Yes	Yes	Approved JD, NWP 27
Waters of the United States - Section 401	Yes	Yes	Approved 401 Certification
Endangered Species Act	No	N/A	N/A
Historic Preservation Act	No	N/A	N/A
Coastal Zone Management Act (CZMA)/Coastal Area Management Act (CAMA)	No	N/A	N/A
FEMA Floodplain Compliance	No	N/A	N/A
Essential Fisheries Habitat	No	N/A	N/A

*Beaver activity was observed along the main channel of Dutch Buffalo Creek during the early stages of the design phase and has not impacted the UT. Beaver activity has not been observed in subsequent years.

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

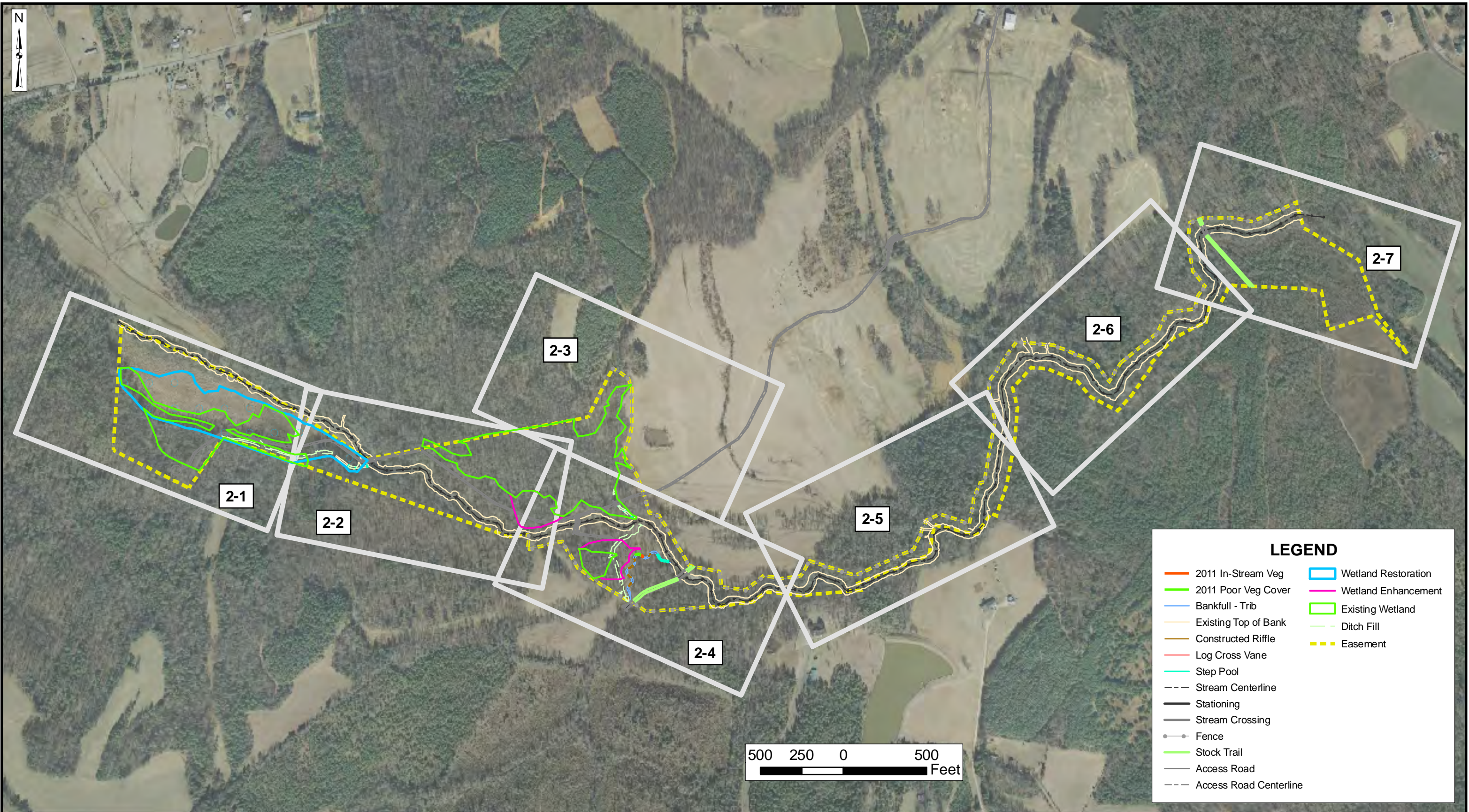
SPD: Somewhat Poorly Drained; MWD: Moderately Well Drained; WD: Well Drained

**Drainage classes correspond to the underlying mapped soils listed.



APPENDIX B VISUAL ASSESSMENT DATA

Figure 2	Current Condition Plan View (CPV)
Table 5	Visual Stream Morphology Stability Assessment Table
Table 6	Vegetation Condition Assessment Table
Photos	Stream Station Photos
Photos	Vegetation Plot Photos



NOTES:

1. GENERAL SITE DATA ARE PROVIDED BY NCEEP.
2. ALL LOCATIONS ARE APPROXIMATE

PROJECT NO. 370
 CABARRUS COUNTY
 NORTH CAROLINA
 MONITORING YEAR 2 OF 5



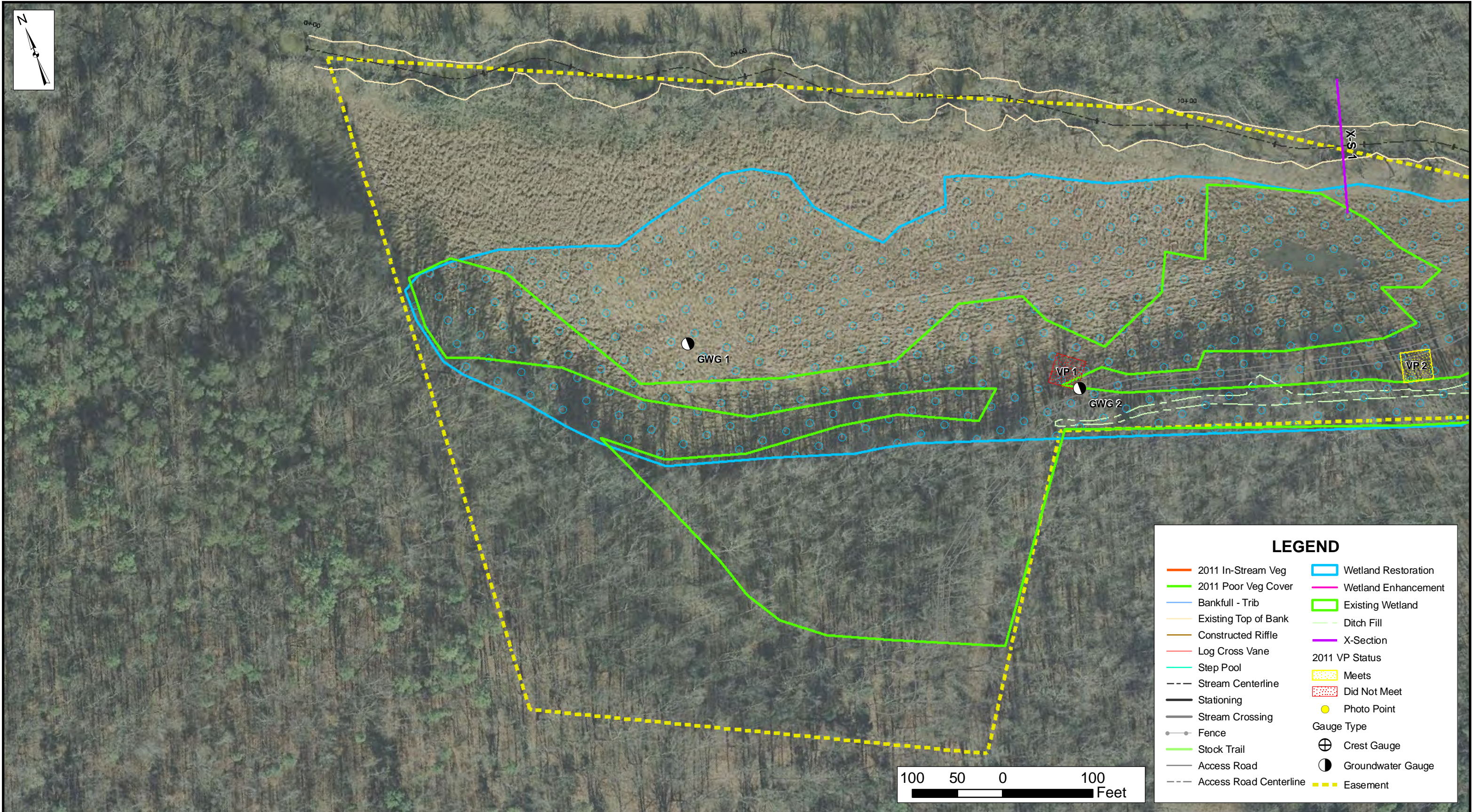
NC ECOSYSTEM ENHANCEMENT PROGRAM
 DUTCH BUFFALO CREEK STREAM AND WETLAND RESTORATION

CURRENT CONDITION PLAN VIEW

DATE: MAY 2012
 SCALE: Not To Scale
 JOB NO.: JJX31100

FIGURE 2 INDEX





LEGEND			
Orange line	2011 In-Stream Veg	Blue outline	Wetland Restoration
Green line	2011 Poor Veg Cover	Pink line	Wetland Enhancement
Blue line	Bankfull - Trib	Green outline	Existing Wetland
Yellow line	Existing Top of Bank	Green dashed line	Ditch Fill
Brown line	Constructed Riffle	Purple line	X-Section
Red line	Log Cross Vane	2011 VP Status	
Cyan line	Step Pool	Yellow dotted box	Meets
Black dashed line	Stream Centerline	Red dotted box	Did Not Meet
Black solid line	Stationing	Yellow circle	Photo Point
Black dashed line	Stream Crossing	Gauge Type	
Grey line	Fence	Circle with cross	Crest Gauge
Green line	Stock Trail	Circle with dot	Groundwater Gauge
Grey line	Access Road	Yellow dashed line	Easement
Black dashed line	Access Road Centerline		

NOTES:
 1. GENERAL SITE DATA ARE PROVIDED BY NCEEP.
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PROJECT NO. 370
 CABARRUS COUNTY
 NORTH CAROLINA
 MONITORING YEAR 2 OF 5



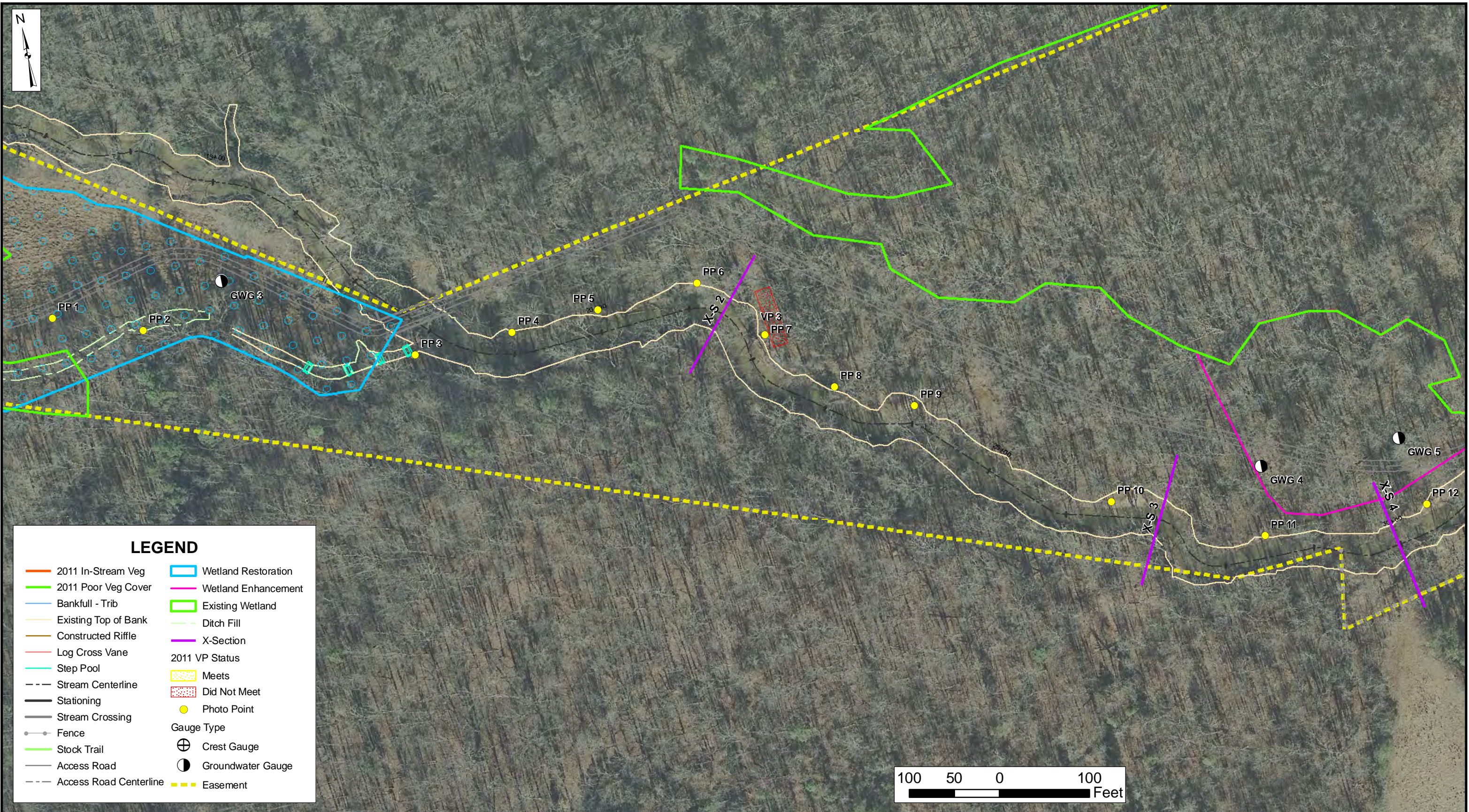
NC ECOSYSTEM ENHANCEMENT PROGRAM
 DUTCH BUFFALO CREEK STREAM AND WETLAND RESTORATION

CURRENT CONDITION PLAN VIEW

DATE: MAY 2012
 SCALE: 1" = 100'
 JOB NO.: JJX31100

FIGURE 2-1





LEGEND

- 2011 In-Stream Veg
- 2011 Poor Veg Cover
- Bankfull - Trib
- Existing Top of Bank
- Constructed Riffle
- Log Cross Vane
- Step Pool
- Stream Centerline
- Stationing
- Stream Crossing
- Fence
- Stock Trail
- Access Road
- Access Road Centerline
- Wetland Restoration
- Wetland Enhancement
- Existing Wetland
- Ditch Fill
- X-Section
- 2011 VP Status**
- Meets
- Did Not Meet
- Photo Point
- Gauge Type**
- ⊕ Crest Gauge
- ◐ Groundwater Gauge
- Easement

NOTES:
 1. GENERAL SITE DATA ARE PROVIDED BY NCEEP.
 2. ALL LOCATIONS ARE APPROXIMATE

PROJECT NO. 370
 CABARRUS COUNTY
 NORTH CAROLINA
 MONITORING YEAR 2 OF 5



NC ECOSYSTEM ENHANCEMENT PROGRAM
 DUTCH BUFFALO CREEK STREAM AND WETLAND RESTORATION

CURRENT CONDITION PLAN VIEW

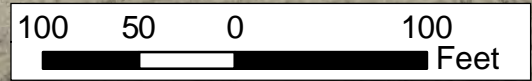
DATE: MAY 2012
 SCALE: 1" = 100'
 JOB NO.: JJX31100

FIGURE 2-2

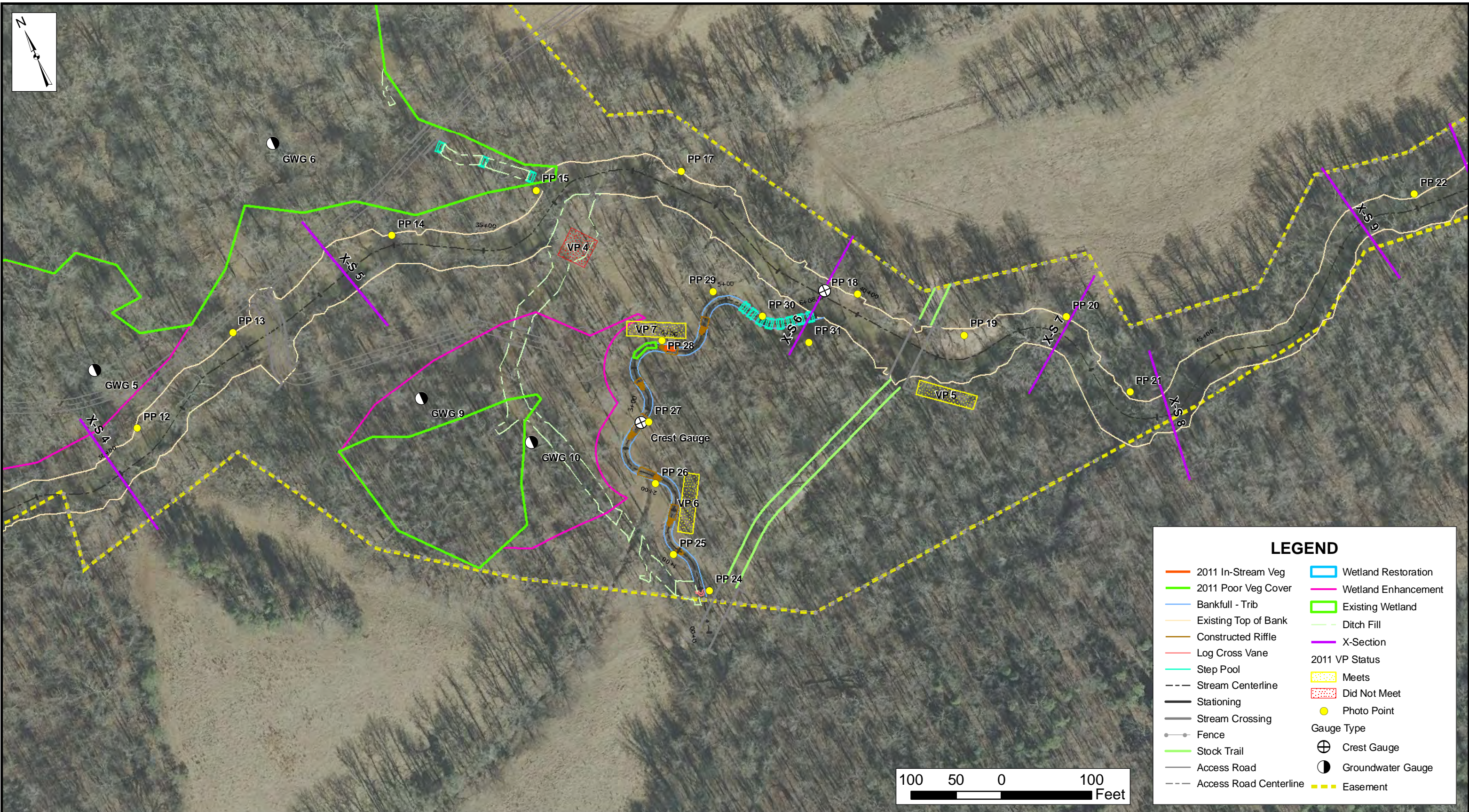


LEGEND

2011 In-Stream Veg	Wetland Restoration
2011 Poor Veg Cover	Wetland Enhancement
Bankfull - Trib	Existing Wetland
Existing Top of Bank	Ditch Fill
Constructed Riffle	X-Section
Log Cross Vane	2011 VP Status
Step Pool	Meets
Stream Centerline	Did Not Meet
Stationing	Photo Point
Stream Crossing	Gauge Type
Fence	Crest Gauge
Stock Trail	Groundwater Gauge
Access Road	Easement
Access Road Centerline	

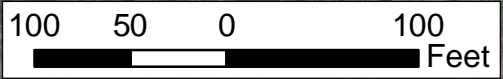


	<p>NOTES:</p> <ol style="list-style-type: none"> GENERAL SITE DATA ARE PROVIDED BY NCEEP. ALL LOCATIONS ARE APPROXIMATE 	<p>PROJECT NO. 370 CABARRUS COUNTY NORTH CAROLINA MONITORING YEAR 2 OF 5</p>		<p>NC ECOSYSTEM ENHANCEMENT PROGRAM DUTCH BUFFALO CREEK STREAM AND WETLAND RESTORATION</p>	<p>DATE: MAY 2012 SCALE: 1" = 100' JOB NO.: JJX31100</p>
				<p>CURRENT CONDITION PLAN VIEW</p>	<p>FIGURE 2-3</p>



LEGEND

2011 In-Stream Veg	Wetland Restoration
2011 Poor Veg Cover	Wetland Enhancement
Bankfull - Trib	Existing Wetland
Existing Top of Bank	Ditch Fill
Constructed Riffle	X-Section
Log Cross Vane	2011 VP Status
Step Pool	Meets
Stream Centerline	Did Not Meet
Stationing	Photo Point
Stream Crossing	Gauge Type
Fence	Crest Gauge
Stock Trail	Groundwater Gauge
Access Road	Easement
Access Road Centerline	

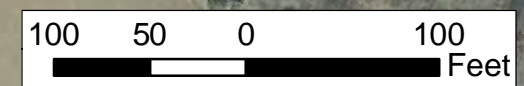
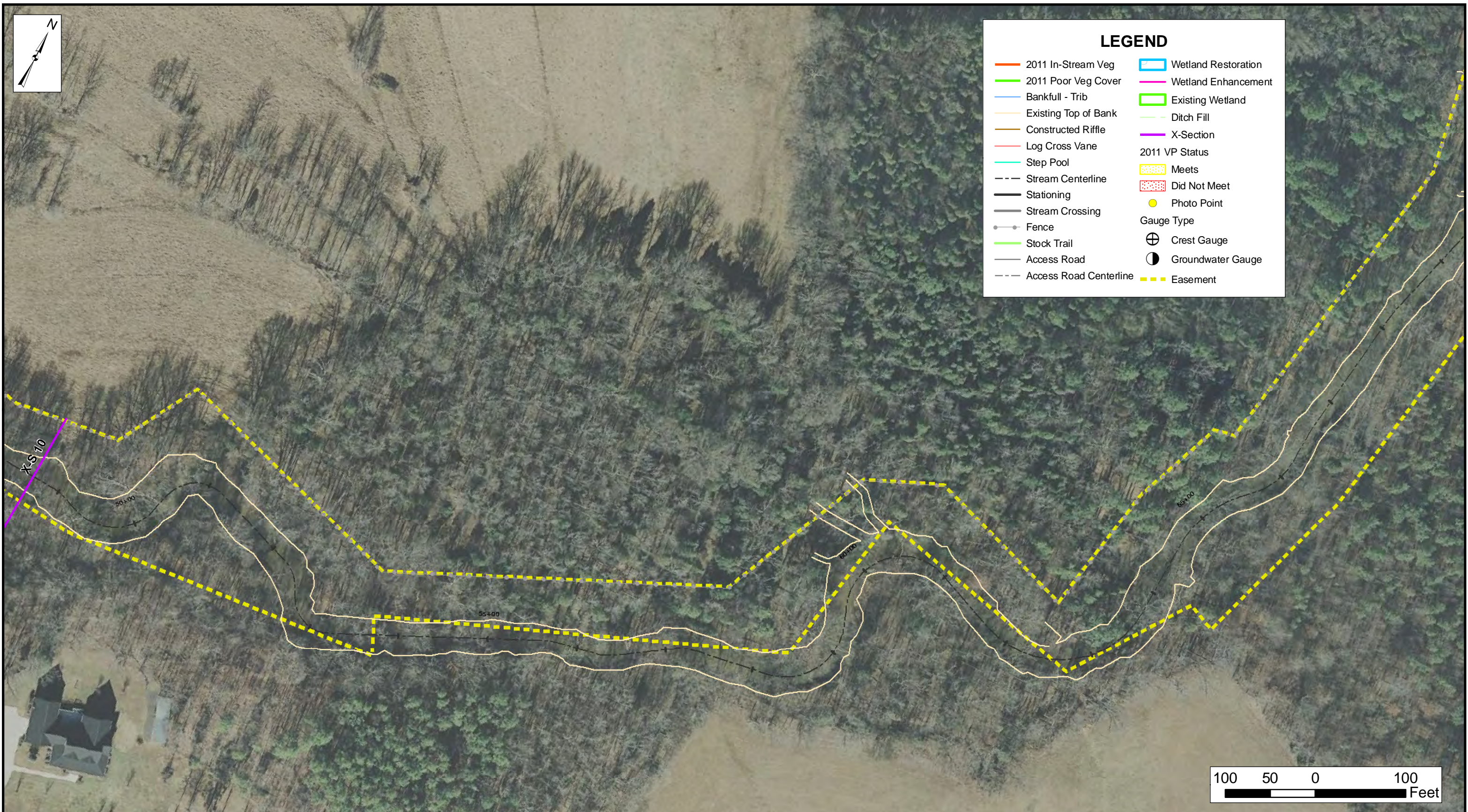


	<p>NOTES:</p> <ol style="list-style-type: none"> GENERAL SITE DATA ARE PROVIDED BY NCEEP. ALL LOCATIONS ARE APPROXIMATE 	<p>PROJECT NO. 370 CABARRUS COUNTY NORTH CAROLINA MONITORING YEAR 2 OF 5</p>		<p>NC ECOSYSTEM ENHANCEMENT PROGRAM DUTCH BUFFALO CREEK STREAM AND WETLAND RESTORATION</p>	<p>DATE: MAY 2012 SCALE: 1" = 100' JOB NO.: JJX31100</p>
	<p>CURRENT CONDITION PLAN VIEW</p>			<p>FIGURE 2-4</p>	

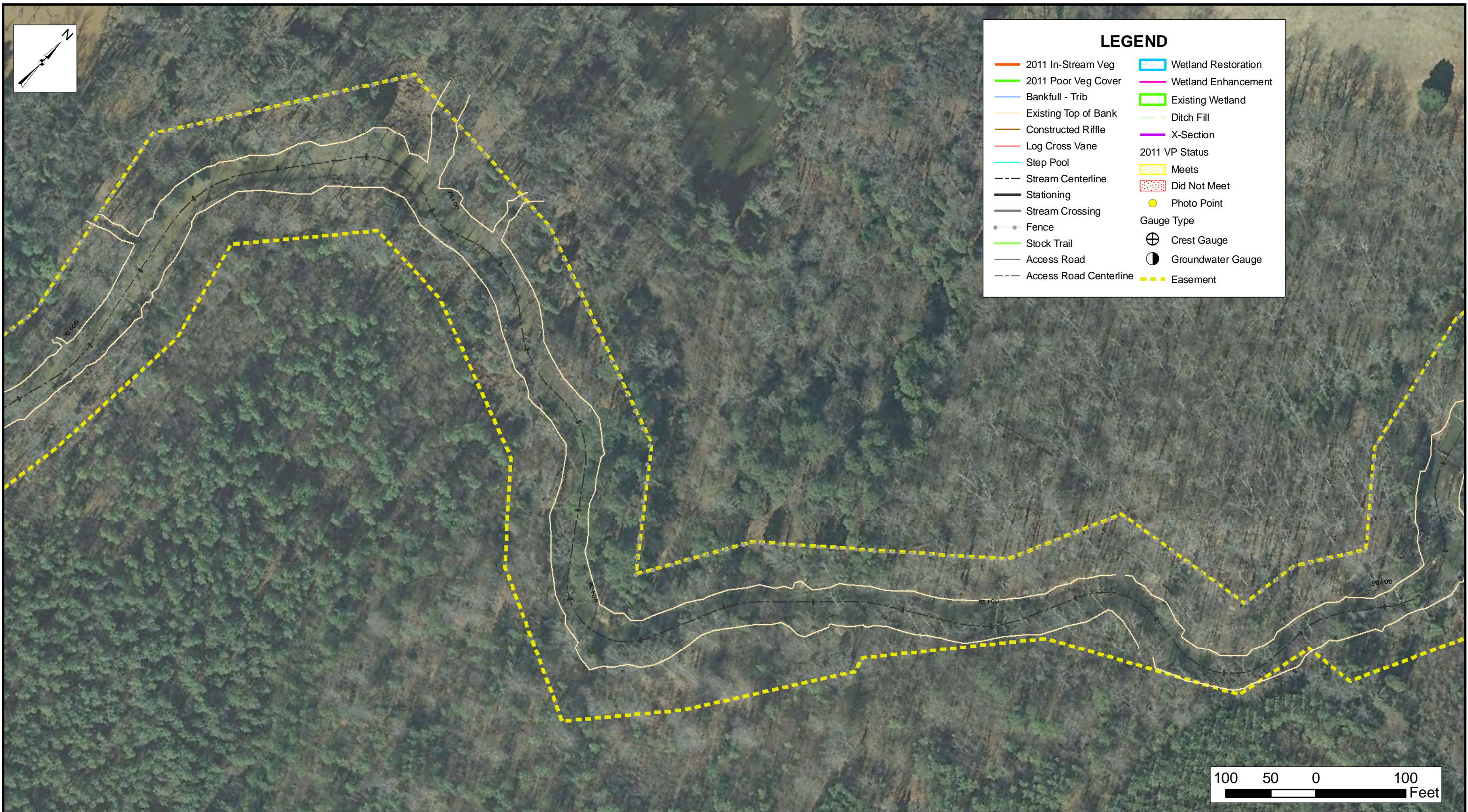
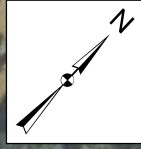


LEGEND

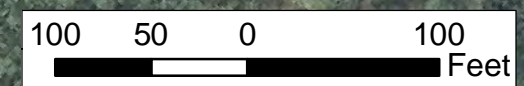
2011 In-Stream Veg	Wetland Restoration
2011 Poor Veg Cover	Wetland Enhancement
Bankfull - Trib	Existing Wetland
Existing Top of Bank	Ditch Fill
Constructed Riffle	X-Section
Log Cross Vane	2011 VP Status
Step Pool	Meets
Stream Centerline	Did Not Meet
Stationing	Photo Point
Stream Crossing	Gauge Type
Fence	Crest Gauge
Stock Trail	Groundwater Gauge
Access Road	Easement
Access Road Centerline	



	<p>NOTES:</p> <ol style="list-style-type: none"> GENERAL SITE DATA ARE PROVIDED BY NCEEP. ALL LOCATIONS ARE APPROXIMATE 	<p>PROJECT NO. 370 CABARRUS COUNTY NORTH CAROLINA MONITORING YEAR 2 OF 5</p>		<p>NC ECOSYSTEM ENHANCEMENT PROGRAM DUTCH BUFFALO CREEK STREAM AND WETLAND RESTORATION</p>	<p>DATE: MAY 2012 SCALE: 1" = 100' JOB NO.: JJX31100</p>
				<p>CURRENT CONDITION PLAN VIEW</p>	<p>FIGURE 2-5</p>



LEGEND			
	2011 In-Stream Veg		Wetland Restoration
	2011 Poor Veg Cover		Wetland Enhancement
	Bankfull - Trib		Existing Wetland
	Existing Top of Bank		Ditch Fill
	Constructed Riffle		X-Section
	Log Cross Vane	2011 VP Status	
	Step Pool		Meets
	Stream Centerline		Did Not Meet
	Stationing		Photo Point
	Stream Crossing	Gauge Type	
	Fence		Crest Gauge
	Stock Trail		Groundwater Gauge
	Access Road		Easement
	Access Road Centerline		



NOTES:
 1. GENERAL SITE DATA ARE PROVIDED BY NCEEP.
 2. ALL LOCATIONS ARE APPROXIMATE

PROJECT NO. 370
 CABARRUS COUNTY
 NORTH CAROLINA
 MONITORING YEAR 2 OF 5



NC ECOSYSTEM ENHANCEMENT PROGRAM
 DUTCH BUFFALO CREEK STREAM AND WETLAND RESTORATION

CURRENT CONDITION PLAN VIEW

DATE: MAY 2012
 SCALE: 1" = 100'
 JOB NO.: JJX31100

FIGURE 2-6



LEGEND

2011 In-Stream Veg	Wetland Restoration
2011 Poor Veg Cover	Wetland Enhancement
Bankfull - Trib	Existing Wetland
Existing Top of Bank	Ditch Fill
Constructed Riffle	X-Section
Log Cross Vane	2011 VP Status
Step Pool	Meets
Stream Centerline	Did Not Meet
Stationing	Photo Point
Stream Crossing	Gauge Type
Fence	Crest Gauge
Stock Trail	Groundwater Gauge
Access Road	Easement
Access Road Centerline	



NOTES:
 1. GENERAL SITE DATA ARE PROVIDED BY NCEEP.
 2. ALL LOCATIONS ARE APPROXIMATE

PROJECT NO. 370
 CABARRUS COUNTY
 NORTH CAROLINA
 MONITORING YEAR 2 OF 5



NC ECOSYSTEM ENHANCEMENT PROGRAM
 DUTCH BUFFALO CREEK STREAM AND WETLAND RESTORATION

CURRENT CONDITION PLAN VIEW

DATE: MAY 2012
 SCALE: 1" = 100'
 JOB NO.: JJX31100

FIGURE 2-7

Appendix B. Visual Assessment Data

Table 5. Visual Stream Morphology Stability Assessment Table

Main Channel Dutch Buffalo Creek (4,678 lf)

Dutch Buffalo Creek Stream and Wetland Restoration/EEP Project No. 370

Monitoring Year 2 of 5

Major Channel Category	Channel Category	Sub-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 Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			0	0	100%			
		Degradation			0	0	100%			
	2. Riffle Condition	Texture/Substrate	-	-		-				
	3. Meander Pool Condition	Depth Sufficient	-	-		-				
		Length Appropriate	-	-		-				
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	-	-		-				
Thalweg centering at downstream of meander bend (Glide)		-	-	-						
Totals										
2. Bank	1. Scoured/Eroded	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion			0	10	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	10	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse			0	10	100%	0	0	100%
Totals										
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	0	2			0%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	-	-			-			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms	-	-			-			
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%	0	2			0%			
	4. Habitat	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth ≥ 1.6 Rootwads/logs providing some cover at baseflow	-	-			N/A			

The channel is incised and eroding. No restoration was performed on this stream. Values are visual estimates of stream condition.

Appendix B. Visual Assessment Data

Table 5. Visual Stream Morphology Stability Assessment Table

Unnamed Tributary to Dutch Buffalo Creek (608 lf)

Dutch Buffalo Creek Stream and Wetland Restoration/EEP Project No. 370

Monitoring Year 2 of 5

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 Vegetation	Footage with Stabilizing Woody Vegetation	Adjust % for Stabilizing Woody Vegetation	
1. Bed	1. Vertical Stability (Riffle and Run units)	Aggradation			1	11	98%				
		Degradation			0	0	100%				
	2. Riffle Condition	Texture/Substrate	7	7		100%					
	3. Meander Pool Condition*	Depth Sufficient	-	-		N/A					
		Length Appropriate	8	8		100%					
	4. Thalweg Position	Thalweg centering at upstream of meander bend (Run)	7	7		100%					
Thalweg centering at downstream of meander bend (Glide)		7	7	100%							
					Totals	0	0	100%	0	0	100%
2. Bank	1. Scoured/Eroded	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	0	0	100%	0	0	100%
3. Engineered Structures	1. Overall Integrity	Structures physically intact with no dislodged boulders or logs.	7	8		88%					
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill	8	8		100%					
	2a. Piping	Structures lacking any substantial flow underneath sills or arms	1	8		13%					
	3. Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%	8	8		100%					
	4. Habitat*	Pool forming structures maintaining ~Max Pool Depth : Bankfull Depth \geq 1.6 Rootwads/logs providing some cover at baseflow	-	-		N/A					

* Survey performed during dry conditions in channel. Parameter unable to be assessed.

Appendix B
Table 6: Vegetation Condition Assessment Table
Dutch Buffalo Creek (Suther) Stream and Wetland Restoration/EEP Project No. 370
Monitoring Year 2 of 5

Planted Acreage

Vegetation Category	Definitions	Mapping Threshold (acres)	Number of Polygons	Combined Acreage	% of Planted Acreage
Bare Areas	Very limited cover of both woody and herbaceous material	0.1	0	0	0%
Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1	0	0	0%
Total			0	0	0%
Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.				

Easement Acreage

Vegetation Category	Definitions	Mapping Threshold (SF)	Number of Polygons	Combined Acreage	% of Planted Acreage
Invasive Areas of Concern*	Areas of points (if too small to render as polygons at map scale).	1000	0	0	0%
Easement Encroachment Areas	Areas of points (if too small to render as polygons at map scale).	none	0	0	0%

* Large portions of the site consist of invasive vegetation, but no areas are a concern at this time.



Photo Point 1: View Northwest
(MY 1 - 10/2010)



Photo Point 1: View Northwest
(MY 2 - 8/2011)



Photo Point 1: View Southeast
(MY 1 - 10/2010)



Photo Point 1: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

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Photo Point 2: View Upstream
(MY 1 - 10/2010)



Photo Point 2: View Upstream
(MY 2 - 8/2011)



Photo Point 2: View Downstream
(MY 1 - 10/2010)



Photo Point 2: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

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Photo Point 3: View Upstream
(MY 1 – 10/2010)



Photo Point 3: View Upstream
(MY 2 - 8/2011)



Photo Point 3: View Downstream
(MY 2 - 8/2011)

Photo Point 3: No Available Downstream
Photograph

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

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Photo Point 4: View Upstream
(MY 1 - 10/2010)



Photo Point 4: View Upstream
(MY 2 - 8/2011)



Photo Point 4: View Downstream
(MY 1 - 10/2010)



Photo Point 4: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

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Photo Point 5: View Upstream
(MY 1 - 10/2010)



Photo Point 5: View Upstream
(MY 2 - 8/2011)



Photo Point 5: View Downstream
(MY 1 - 10/2010)

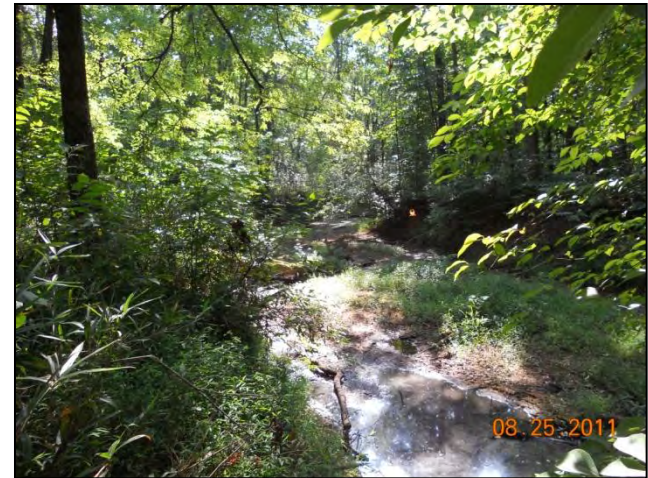


Photo Point 5: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

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Photo Point 6: View Upstream
(MY 1 - 10/2010)



Photo Point 6: View Upstream
(MY 2 - 8/2011)



Photo Point 6: View Downstream
(MY 1 - 10/2010)



Photo Point 6: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

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Photo Point 7: View Upstream
(MY 1 - 10/2010)



Photo Point 7: View Upstream
(MY 2 - 8/2011)



Photo Point 7: View Downstream
(MY 1 - 10/2011)



Photo Point 7: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

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Photo Point 8: View Upstream
(MY 1 - 10/2010)



Photo Point 8: View Upstream
(MY 2 - 8/2011)



Photo Point 8: View Downstream
(MY 1 - 10/2010)



Photo Point 8: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

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Photo Point 9: View Upstream
(MY 1 - 10/2010)



Photo Point 9: View Upstream
(MY 2 - 8/2011)

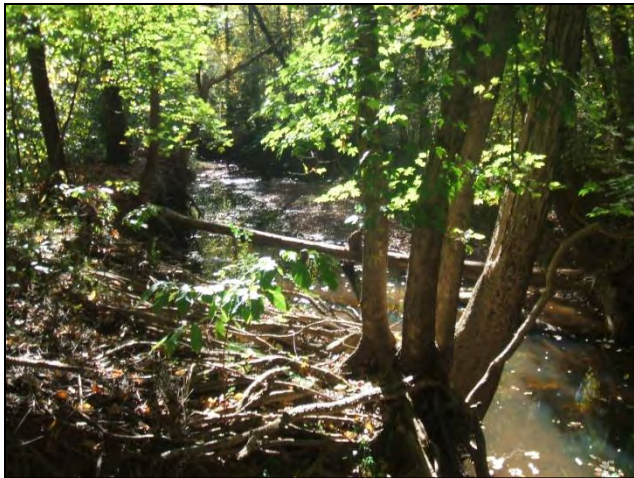


Photo Point 9: View Downstream
(MY 1 - 10/2010)



Photo Point 9: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

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Photo Point 10: View Upstream
(MY 1 - 10/2010)



Photo Point 10: View Upstream
(MY 2 - 8/2011)



Photo Point 10: View Downstream
(MY 1 - 10/2010)



Photo Point 10: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

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Photo Point 11: View Upstream
(MY 1 - 10/2010)



Photo Point 11: View Upstream
(MY 2 - 8/2011)



Photo Point 11: View Downstream
(MY 1 - 10/2010)



Photo Point 11: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

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Photo Point 12: View Upstream
(MY 1 - 10/2010)



Photo Point 12: View Upstream
(MY 2 - 8/2011)



Photo Point 12: View Downstream
(MY 1 - 10/2010)



Photo Point 12: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

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Photo Point 13: View Upstream
(MY 1 - 10/2010)



Photo Point 13: View Upstream
(MY 2 - 8/2011)



Photo Point 13: View Downstream
(MY 1 - 10/2010)



Photo Point 13: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

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Photo Point 14: View Upstream
(MY 1 - 10/2010)



Photo Point 14: View Upstream
(MY 2 - 8/2011)



Photo Point 14: View Downstream
(MY 1 - 10/2010)



Photo Point 14: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

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Photo Point 15: View Upstream
(MY 1 - 10/2010)



Photo Point 15: View Upstream
(MY 2 - 8/2011)



Photo Point 15: View Downstream
(MY 1 - 10/2010)



Photo Point 15: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

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Photo Point 17: View Upstream
(MY 1 - 10/2010)



Photo Point 17: View Upstream
(MY 2 - 8/2011)

Photo Point 17: No Available Downstream
Photograph



Photo Point 17: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

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Photo Point 18: View Upstream
(MY 1 - 10/2010)



Photo Point 18: View Upstream
(MY 2 - 8/2011)



Photo Point 18: View Downstream
(MY 1 - 10/2010)



Photo Point 18: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

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Photo Point 19: View Upstream
(MY 1 - 10/2010)



Photo Point 19: View Upstream
(MY 2 - 8/2011)



Photo Point 19: View Downstream
(MY 1 - 10/2010)



Photo Point 19: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

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Photo Point 20: View Upstream
(MY 1 - 10/2010)



Photo Point 20: View Upstream
(MY 2 - 8/2011)



Photo Point 20: View Downstream
(MY 1 - 10/2010)



Photo Point 20: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
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Submittal Date: February 2012

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Photo Point 21: View Upstream
(MY 1 - 10/2010)



Photo Point 21: View Upstream
(MY 2 - 8/2011)



Photo Point 21: View Downstream
(MY 1 - 10/2010)



Photo Point 21: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

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Photo Point 22: View Upstream
(MY 1 - 10/2010)



Photo Point 22: View Upstream
(MY 2 - 8/2011)



Photo Point 22: View Downstream
(MY 1 - 10/2010)



Photo Point 22: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

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Photo Point 23: View Upstream
(MY 1 - 10/2010)



Photo Point 23: View Upstream
(MY 2 - 8/2011)



Photo Point 23: View Downstream
(MY 1 - 10/2010)

Photo Point 23: View Downstream
(not available)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

Prepared By:





Photo Point 24: View Upstream
(MY 1 - 10/2010)



Photo Point 24: View Upstream
(MY 2 - 8/2011)



Photo Point 24: View Downstream
(MY 1 - 10/2010)



Photo Point 24: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

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Photo Point 25: View Upstream
(MY 1 - 10/2010)



Photo Point 25: View Upstream
(MY 2 - 8/2011)



Photo Point 25: View Downstream
(MY 1 - 10/2010)



Photo Point 25: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

Prepared By:





Photo Point 26: View Upstream
(MY 1 - 10/2010)



Photo Point 26: View Upstream
(MY 2 - 8/2011)



Photo Point 26: View Downstream
(MY 1 - 10/2010)



Photo Point 26: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

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Photo Point 27: View Upstream
(MY 1 - 10/2010)



Photo Point 27: View Upstream
(MY 2 - 8/2011)



Photo Point 27: View Downstream
(MY 1 - 10/2010)



Photo Point 27: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
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Submittal Date: February 2012

Prepared By:





Photo Point 28: View Upstream
(MY 1 - 10/2010)



Photo Point 28: View Upstream
(MY 2 - 8/2011)



Photo Point 28: View Downstream
(MY 1 - 10/2010)



Photo Point 28: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
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Submittal Date: February 2012

Prepared By:





Photo Point 29: View Upstream
(MY 1 - 10/2010)



Photo Point 29: View Upstream
(MY 2 - 8/2011)



Photo Point 29: View Downstream
(MY 1 - 10/2010)



Photo Point 29: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

Prepared By:





Photo Point 30: View Upstream
(MY 1 - 10/2010)



Photo Point 30: View Upstream
(MY 2 - 8/2011)



Photo Point 30: View Downstream
(MY 1 - 10/2010)



Photo Point 30: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

Prepared By:





Photo Point 31: View Upstream
(MY 1 - 10/2010)



Photo Point 31: View Upstream
(MY 2 - 8/2011)



Photo Point 31: View Downstream
(MY 1 - 10/2010)



Photo Point 31: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

Prepared By:





Cross Section 1: View Upstream
(MY 1 - 1/2011)



Cross Section 1: View Upstream
(MY 2 - 8/2011)



Cross Section 1: View Downstream
(MY 1 - 1/2011)



Cross Section 2: View Downstream
(MY 2 - 8/2011)

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Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

Prepared By:





Cross Section 2: View Upstream
(MY 1 - 1/2011)



Cross Section 2: View Upstream
(MY 2 - 8/2011)



Cross Section 2: View Downstream
(MY 1 - 1/2011)



Cross Section 2: View Downstream
(MY 3 - 6/2011)

Prepared For:



Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

Prepared By:





Cross Section 3: View Upstream
(MY 1 - 1/2011)



Cross Section 3: View Upstream
(MY 2 - 8/2011)



Cross Section 3: View Downstream
(MY 1 - 1/2011)



Cross Section 3: View Downstream
(MY 2 - 8/2011)

Prepared For:



Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

Prepared By:





Cross Section 4: View Upstream
(MY 1 - 1/2011)



Cross Section 4: View Upstream
(MY 2 - 8/2011)



Cross Section 4: View Downstream
(MY 1 - 1/2011)



Cross Section 4: View Downstream
(MY 2 - 8/2011)

Prepared For:



Appendix B – Visual Assessment Data
Stream Station & Cross Section Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
Submittal Date: February 2012

Prepared By:





Vegetation Plot 1
(MY 1 - 11/2010)



Vegetation Plot 1
(MY 2 - 8/2011)



Vegetation Plot 1
(MY 2 - 8/2011)

Prepared For:



Appendix B – Visual Assessment Data

Vegetation Plot Photos

Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project

EEP Project No. 370

Monitoring Year 2 of 5

February 2012

Prepared By:





Vegetation Plot 2
(MY 1 - 11/2010)



Vegetation Plot 2
(MY 2 - 8/2011)



Vegetation Plot 2
(MY 1 - 11/2010)



Vegetation Plot 2
(MY 2 - 8/2011)

Prepared For:



Appendix B – Visual Assessment Data

Vegetation Plot Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
February 2012

Prepared By:





Vegetation Plot 3
(MY 1 - 11/2010)



Vegetation Plot 3
(MY 2 - 8/2011)



Vegetation Plot 3
(MY 1 - 11/2010)



Vegetation Plot 3
(MY 2 - 8/2011)

Prepared For:



Appendix B – Visual Assessment Data

Vegetation Plot Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
February 2012

Prepared By:



Vegetation Plot 4
No available photograph (MY 1 - 11/2010)



Vegetation Plot 4
(MY 2 - 8/2011)



Vegetation Plot 4
(MY 2 - 8/2011)

Prepared For:



Appendix B – Visual Assessment Data

Vegetation Plot Photos

Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project

EEP Project No. 370

Monitoring Year 2 of 5

February 2012

Prepared By:





Vegetation Plot 5
(MY 1 - 11/2010)



Vegetation Plot 5
(MY 2 - 8/2011)



Vegetation Plot 5
(MY 1 - 11/2010)



Vegetation Plot 5
(MY 2 - 8/2011)

Prepared For:



Appendix B – Visual Assessment Data

Vegetation Plot Photos

Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project

EEP Project No. 370

Monitoring Year 2 of 5

February 2012

Prepared By:





Vegetation Plot 6
(MY 1 - 11/2010)



Vegetation Plot 6
(MY 2 - 8/2011)



Vegetation Plot 6
(MY 1 - 11/2010)



Vegetation Plot 6
(MY 2 - 8/2011)

Prepared For:



Appendix B – Visual Assessment Data

Vegetation Plot Photos

Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project

EEP Project No. 370

Monitoring Year 2 of 5

February 2012

Prepared By:





Vegetation Plot 7
(MY 1 - 11/2010)



Vegetation Plot 7
(MY 2 - 8/2011)



Vegetation Plot 7
(MY 1 - 11/2010)



Vegetation Plot 7
(MY 2 - 8/2011)

Prepared For:



Appendix B – Visual Assessment Data

Vegetation Plot Photos
Suther (Dutch Buffalo Creek) Stream and Wetland Restoration Project
EEP Project No. 370
Monitoring Year 2 of 5
February 2012

Prepared By:





APPENDIX C VEGETATION PLOT DATA

Table 7	Vegetation Plot Mitigation Success Summary Table
Table 8	CVS Vegetation Metadata Table
Table 9	CVS Stem Count Total and Planted by Plat and Species

Appendix C

Table 7 Vegetation Plot Mitigation Success

**Dutch Buffalo Creek (Suther) Stream and Wetland Restoration/EEP Project
Monitoring Year 2 of 5**

Vegetation Plot ID	Vegetation Survival Threshold Met
Plot 1	N
Plot 2	Y
Plot 3	N
Plot 4	N
Plot 5	Y
Plot 6	Y
Plot 7	Y

Appendix C

Table 8: CVS Vegetation Metadata Table

**Dutch Buffalo Creek (Suther) Stream and Wetland Restoration/EEP Project No. 370
Monitoring Year 2 of 5**

Report Prepared By	Heath Caldwell
Date Prepared	9/13/2011 12:26
database name	DBC_2011.mdb
database location	J:\JX31100\M5-Field Monitoring Data\MY 2011\VEGETATION\DBC (Suther)
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT-----	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Plots	List of plots surveyed with location and summary data (live stems, dead stems, missing, etc.).
Vigor	Frequency distribution of vigor classes for stems for all plots.
Vigor by Spp	Frequency distribution of vigor classes listed by species.
Damage	List of most frequent damage classes with number of occurrences and percent of total stems impacted
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Stem Count by Plot and Spp	A matrix of the count of total living stems of each species (planted and natural volunteers combined) for each plot; dead and missing stems are excluded.
PROJECT SUMMARY-----	
Project Code	6067501
project Name	Dutch Buffalo Creek
Description	Stream and Wetland Restoration and Enhancement Project
length(ft)	608
stream-to-edge width (ft)	33
area (sq m)	3727
Required Plots (calculated)	4
Sampled Plots	4



APPENDIX D STREAM SURVEY DATA

Figure 3a-d	Cross-sections with Annual Overlays
Figure 4	Longitudinal Profiles with Annual Overlays
Figure 5a-d	Pebble Count Plots with Annual Overlays
Tables 10a,b	Baseline – Stream Data Summary Tables
Table 11a	Monitoring – Cross-Section Morphology Data Table
Table 11b	Monitoring – Stream Reach Morphology Data Table

Appendix D. Stream Survey Data

Figure 3a: Cross-Section Plots and Raw Data Tables

Dutch Buffalo Creek (Suther) Stream and Wetland Restoration/EEP Project No. 370

Unnamed Tributary to Dutch Buffalo Creek

Monitoring Year 2 of 5

Project Name	DBC (Suther)
EEP Project Number	370
Cross-Section ID	XS-1, Riffle
Survey Date	8/2011

SUMMARY DATA	
Bankfull Elevation (ft)	648.52
Bankfull Cross-Sectional Area (ft²)	8.77
Bankfull Width (ft)	8.28
Flood Prone Area Elevation (ft)	650.16
Flood Prone Width (ft)	55.77
Bankfull Mean Depth (ft)	1.06
Bankfull Max Depth (ft)	1.64
W/D Ratio	7.81
Entrenchment Ratio	6.74
Bank Height Ratio	1.00

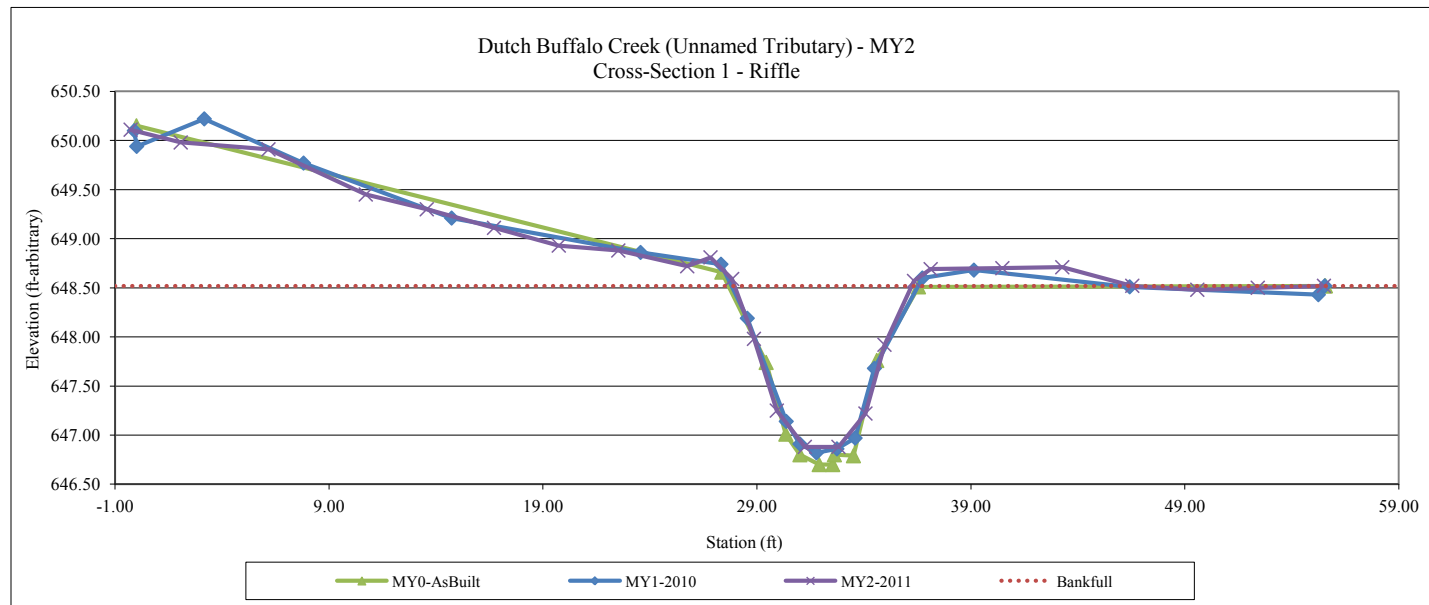


XS-1: View Upstream



XS-1: View Downstream

Station	Elevation	Notes
-0.27	650.11	xs1-lpt
2.07	649.98	xs1
6.17	649.91	xs1
10.72	649.45	xs1
13.57	649.3	xs1
16.71	649.11	xs1
19.74	648.93	xs1
22.52	648.88	xs1
25.74	648.72	xs1
26.83	648.81	lb
27.84	648.59	xs1
28.86	647.98	xs1
29.93	647.25	xs1
31.24	646.88	xs1
32.81	646.88	xs1
34.07	647.22	xs1
34.96	647.92	xs1
36.34	648.57	xs1
37.12	648.69	rb
40.47	648.7	xs1
43.27	648.71	xs1
46.54	648.52	xs1
49.58	648.48	xs1
52.41	648.5	xs1
55.5	648.52	xs1-rpt



Appendix D. Stream Survey Data

Figure 3b: Cross-Section Plots and Raw Data Tables

Dutch Buffalo Creek (Suther) Stream and Wetland Restoration/EEP Project No. 370

Unnamed Tributary to Dutch Buffalo Creek

Monitoring Year 2 of 5

Project Name	DBC (Suther)
EEP Project Number	370
Cross-Section ID	XS-2, Riffle
Survey Date	8/2011

SUMMARY DATA	
Bankfull Elevation (ft)	647.41
Bankfull Cross-Sectional Area (ft ²)	9.42
Bankfull Width (ft)	9.34
Flood Prone Area Elevation (ft)	649.03
Flood Prone Width (ft)	53.33
Bankfull Mean Depth (ft)	1.01
Bankfull Max Depth (ft)	1.62
W/D Ratio	9.25
Entrenchment Ratio	5.71
Bank Height Ratio	1.00

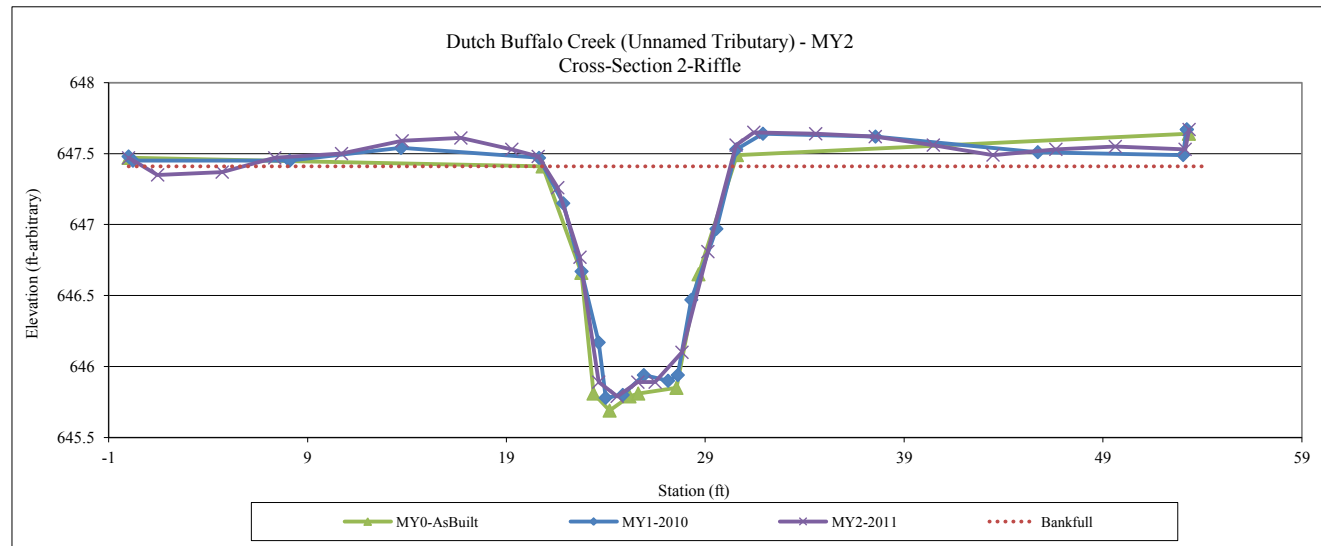


XS-2: View Upstream



XS-2: View Downstream

Station	Elevation	Notes
0	647.47	xs2-lpt
1.46	647.35	xs2
4.71	647.37	xs2
7.35	647.47	xs2
10.71	647.5	xs2
13.76	647.59	xs2
16.71	647.61	xs2
19.27	647.53	lb
20.6	647.48	xs2
21.58	647.26	xs2
22.7	646.77	xs2
23.64	645.89	xs2
24.57	645.79	xs2
25.61	645.89	xs2
26.48	645.89	xs2
27.83	646.1	xs2
29.13	646.81	xs2
30.55	647.56	xs2
31.44	647.65	rb
34.55	647.64	xs2
37.55	647.62	xs2
40.47	647.56	xs2
43.47	647.49	xs2
46.63	647.53	xs2
49.62	647.55	xs2
53.13	647.53	xs2
53.33	647.67	xs2-rpt



Appendix D. Stream Survey Data

Figure 3c: Cross-Section Plots and Raw Data Tables

Dutch Buffalo Creek (Suther) Stream and Wetland Restoration/EEP Project No. 370

Unnamed Tributary to Dutch Buffalo Creek

Monitoring Year 2 of 5

Project Name	DBC (Suther)
EEP Project Number	370
Cross-Section ID	XS-3, Pool
Survey Date	8/2011

SUMMARY DATA	
Bankfull Elevation (ft)	645.96
Bankfull Cross-Sectional Area (ft ²)	7.63
Bankfull Width (ft)	10.40
Flood Prone Area Elevation (ft)	647.55
Flood Prone Width (ft)	55.25
Bankfull Mean Depth (ft)	0.73
Bankfull Max Depth (ft)	1.59
W/D Ratio	14.25
Entrenchment Ratio	5.31
Bank Height Ratio	1.00

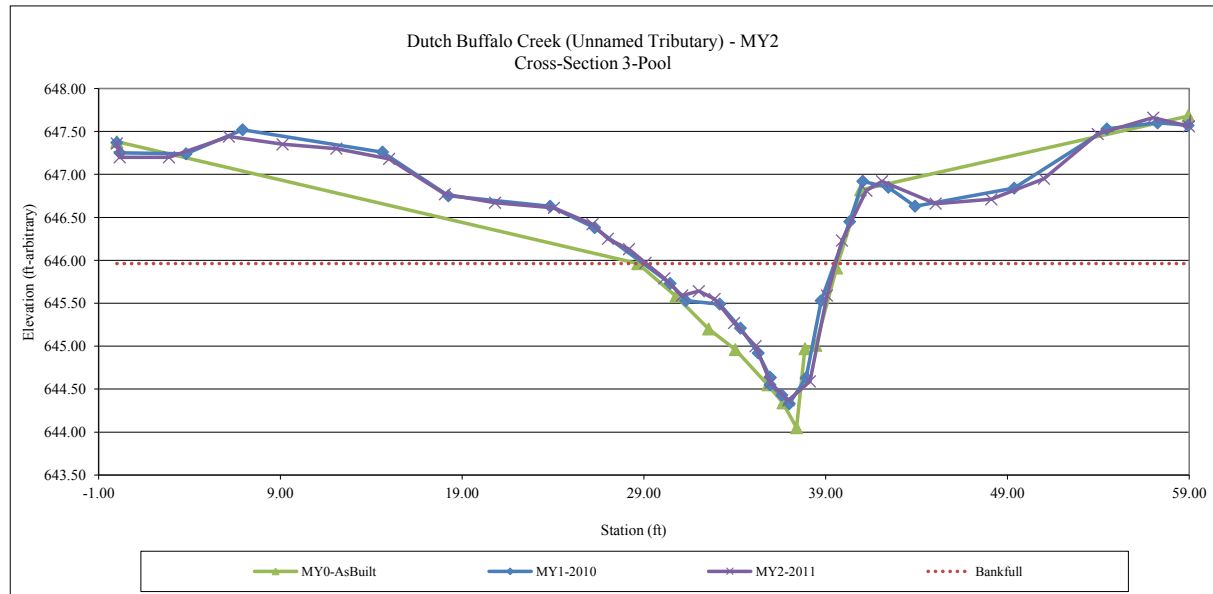


XS-3: View Upstream



XS-3: View Downstream

Station	Elevation	Notes
0	647.36	xs3-lpt
0.16	647.2	xs3
2.87	647.2	xs3
6.17	647.44	xs3
9.12	647.35	xs3
12.08	647.3	xs3
14.98	647.18	xs3
18.05	646.77	xs3
20.81	646.67	xs3
24.05	646.61	xs3
26.17	646.42	lb
27.02	646.25	xs3
28.18	646.13	xs3
29.09	645.97	xs3
30.12	645.79	xs3
31.1	645.59	xs3
32.02	645.64	xs3
32.89	645.55	xs3
33.96	645.27	xs3
35.14	645	xs3
35.97	644.57	xs3
36.95	644.37	xs3
38.13	644.59	xs3
39.07	645.59	xs3
39.9	646.23	xs3
41.24	646.81	rb
42.1	646.92	xs3
45.05	646.66	xs3
48.11	646.71	xs3
51.01	646.95	xs3
53.97	647.47	xs3
57.02	647.66	xs3
58.99	647.56	xs3
59.13	647.68	xs3-rpt



Appendix D. Stream Survey Data

Figure 3d: Cross-Section Plots and Raw Data Tables

Dutch Buffalo Creek (Suther) Stream and Wetland Restoration/EEP Project No. 370

Unnamed Tributary to Dutch Buffalo Creek

Monitoring Year 2 of 5

Project Name	DBC (Suther)
EEP Project Number	370
Cross-Section ID	XS-4, Riffle
Survey Date	8/2011

SUMMARY DATA	
Bankfull Elevation (ft)	646.38
Bankfull Cross-Sectional Area (ft²)	8.27
Bankfull Width (ft)	8.16
Flood Prone Area Elevation (ft)	648.03
Flood Prone Width (ft)	55.09
Bankfull Mean Depth (ft)	1.01
Bankfull Max Depth (ft)	1.65
W/D Ratio	8.08
Entrenchment Ratio	6.75
Bank Height Ratio	1.00

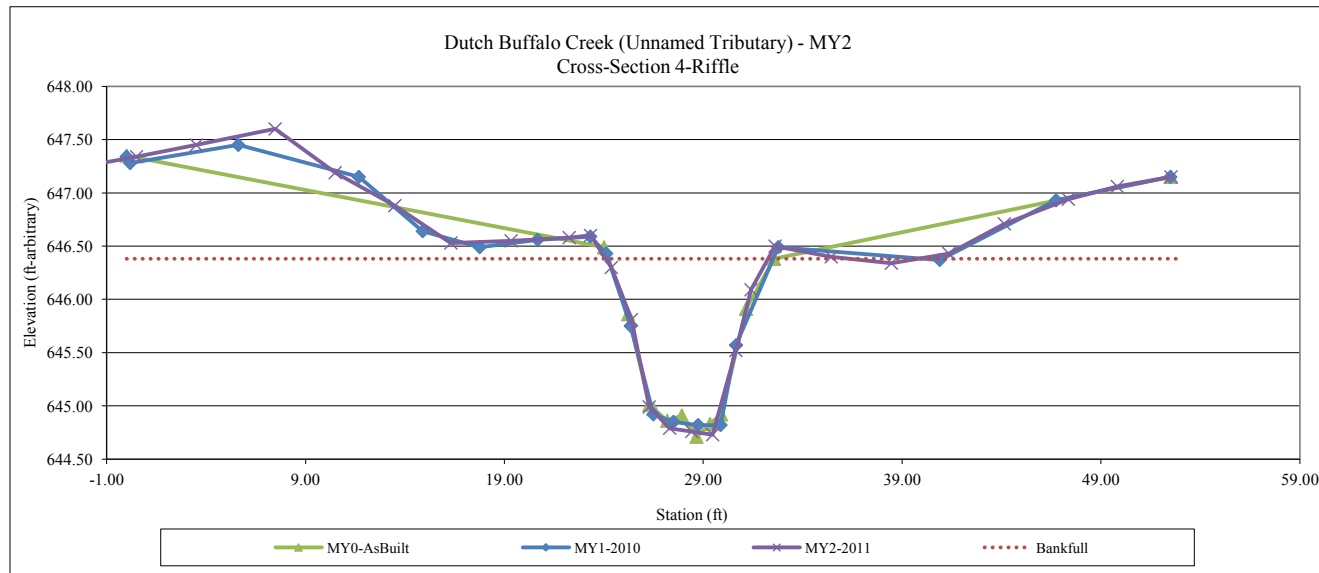


XS-4: View Upstream



XS-4: View Downstream

Station	Elevation	Notes
-2.6	647.37	xs4lpt
-1.5	647.27	xs4
0.5	647.34	xs4
3.5	647.45	xs4
7.5	647.6	xs4
10.5	647.19	xs4
13.5	646.88	xs4
16.3	646.53	xs4
19.3	646.55	xs4
22.3	646.58	xs4
23.3	646.6	lb
24.4	646.3	xs4
25.4	645.81	xs4
26.3	644.99	xs4
27.3	644.79	xs4
28.4	644.76	xs4
29.5	644.73	xs4
30.6	645.52	xs4
31.4	646.09	xs4
32.61	646.5	rb
35.44	646.4	xs4
38.46	646.34	xs4
41.35	646.43	xs4
44.14	646.71	xs4
47.36	646.94	xs4
49.82	647.06	xs4
52.52	647.15	xs4-rpt

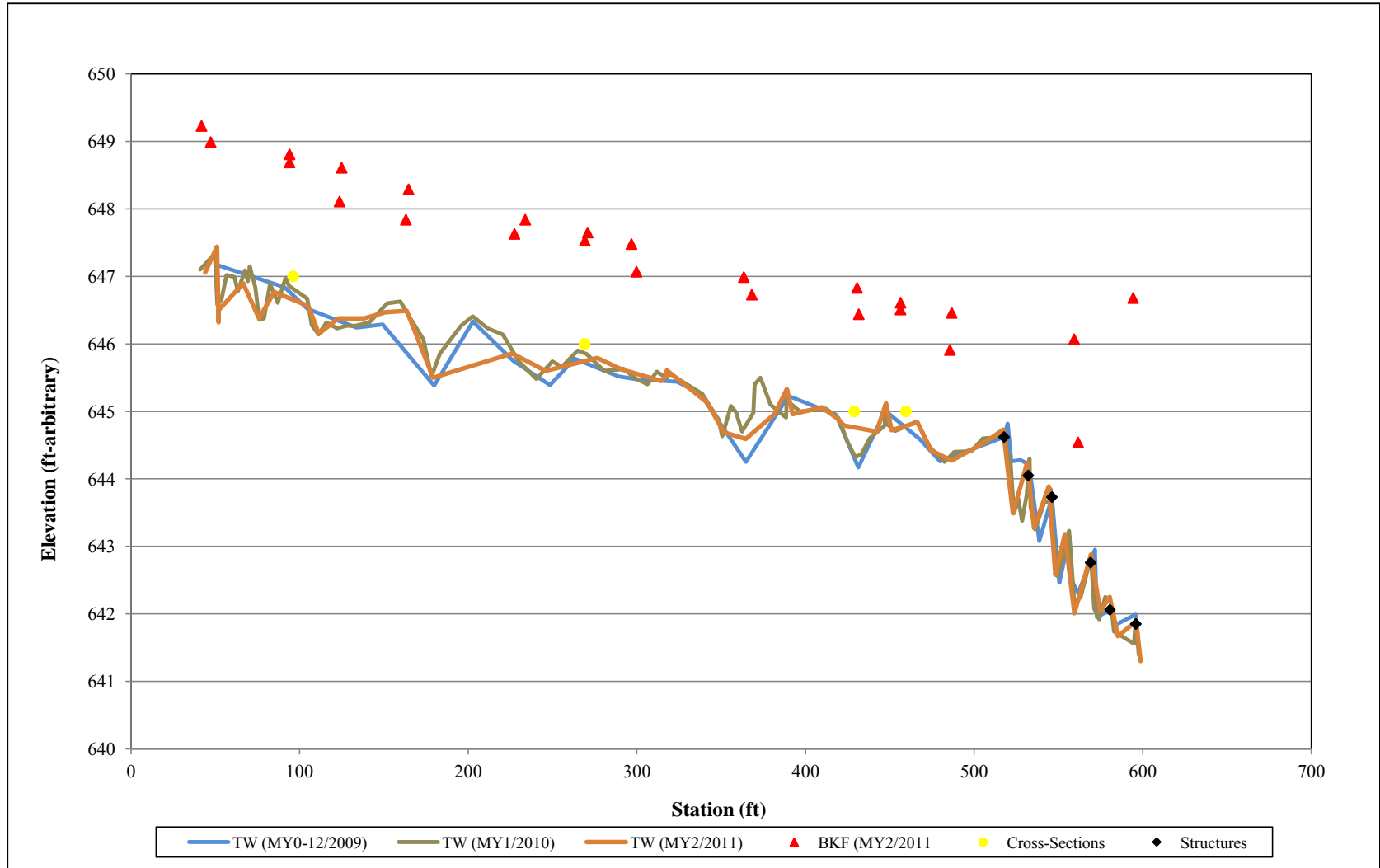


Appendix D

Figure 4. Longitudinal Profile with Annual Overlays

Dutch Buffalo Creek Stream and Wetland Restoration EEP Project No. 370

Monitoring Year 2 of 5



*No water in the channel during survey.

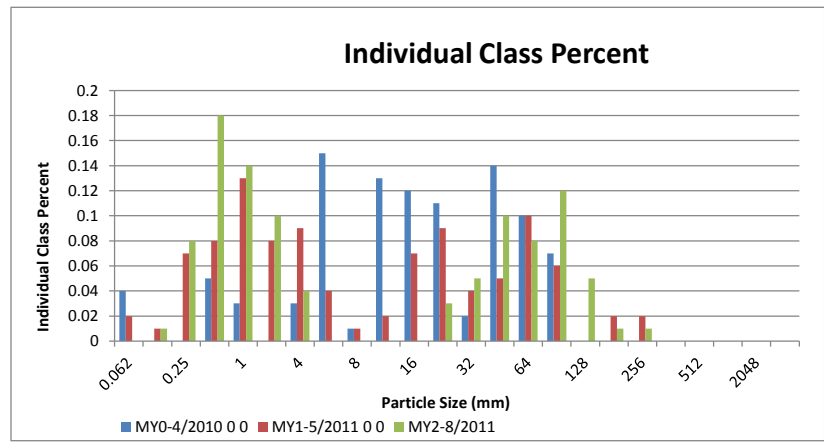
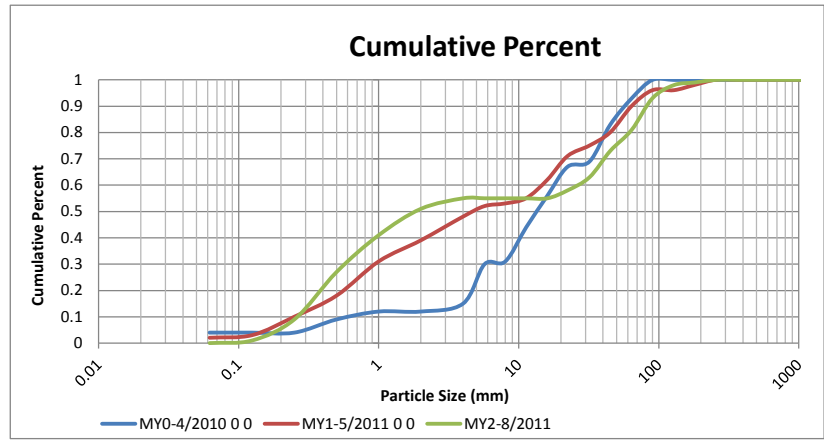
Appendix D. Stream Survey Data

Figure 5a: Pebble Count Plots with Annual Overlays

DBC (Suther) Stream and Wetland Restoration/EEP Project No. 370
Monitoring Year 2 of 5

Project Name: Dutch Buffalo Creek (Unnamed Tributary)					
Cross-Section: 1					
Feature: Riffle					
MY2-8/2011					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	0	0%	0%
Sand	very fine sand	0.125	1	1%	1%
	fine sand	0.250	8	8%	9%
	medium sand	0.50	18	18%	27%
	coarse sand	1.00	14	14%	41%
	very coarse sand	2.0	10	10%	51%
Gravel	very fine gravel	4.0	4	4%	55%
	fine gravel	5.7	0	0%	55%
	fine gravel	8.0	0	0%	55%
	medium gravel	11.3	0	0%	55%
	medium gravel	16.0	0	0%	55%
	course gravel	22.3	3	3%	58%
	course gravel	32.0	5	5%	63%
	very coarse gravel	45	10	10%	73%
	very coarse gravel	64	8	8%	81%
	Cobble	small cobble	90	12	12%
medium cobble		128	5	5%	98%
large cobble		180	1	1%	99%
very large cobble		256	1	1%	100%
Boulder		small boulder	362	0	0%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			100	100%	100%

Summary Data	
D50	1.9
D84	70.50
D95	105.20



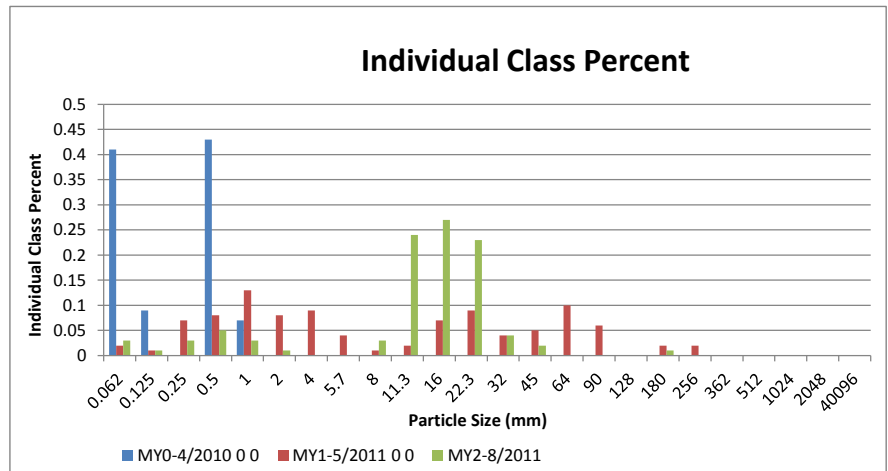
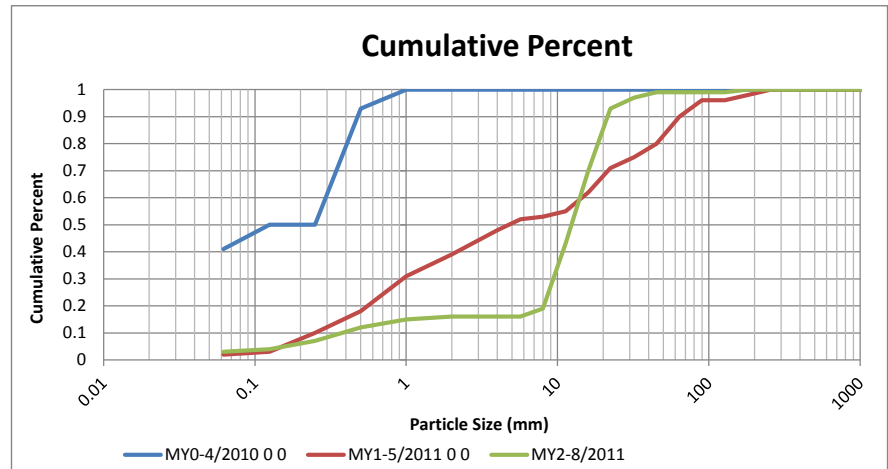
Appendix D. Stream Survey Data

Figure 5b: Pebble Count Plots with Annual Overlays

DBC (Suther) Stream and Wetland Restoration/EEP Project No. 370
Monitoring Year 2 of 5

Project Name: Dutch Buffalo Creek (Unnamed Tributary)					
Cross-Section: 2					
Feature: Pool					
MY2-8/2011					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	3	3%	3%
Sand	very fine sand	0.125	1	1%	4%
	fine sand	0.250	3	3%	7%
	medium sand	0.50	5	5%	12%
	coarse sand	1.00	3	3%	15%
	very coarse sand	2.0	1	1%	16%
Gravel	very fine gravel	4.0	0	0%	16%
	fine gravel	5.7	0	0%	16%
	fine gravel	8.0	3	3%	19%
	medium gravel	11.3	24	24%	43%
	medium gravel	16.0	27	27%	70%
	course gravel	22.3	23	23%	93%
	course gravel	32.0	4	4%	97%
	very coarse gravel	45	2	2%	99%
	very coarse gravel	64	0	0%	99%
	Cobble	small cobble	90	0	0%
medium cobble		128	0	0%	99%
large cobble		180	1	1%	100%
very large cobble		256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			100	100%	100%

Summary Data	
D50	12.52
D84	20.02
D95	27.30



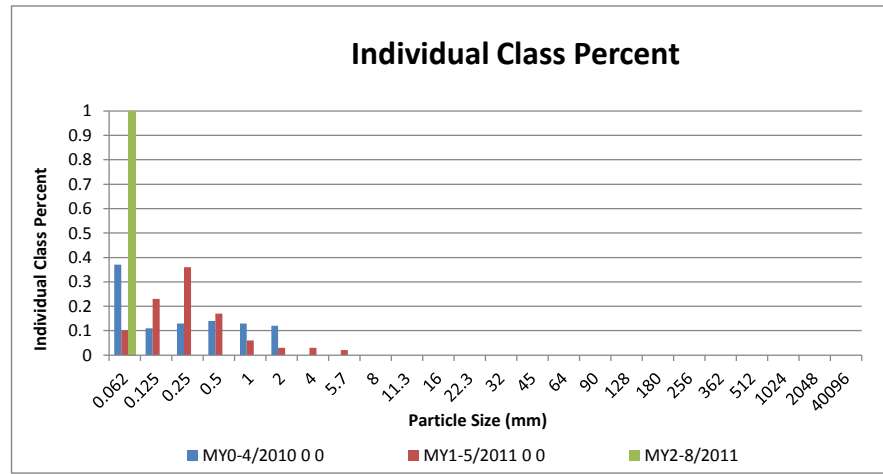
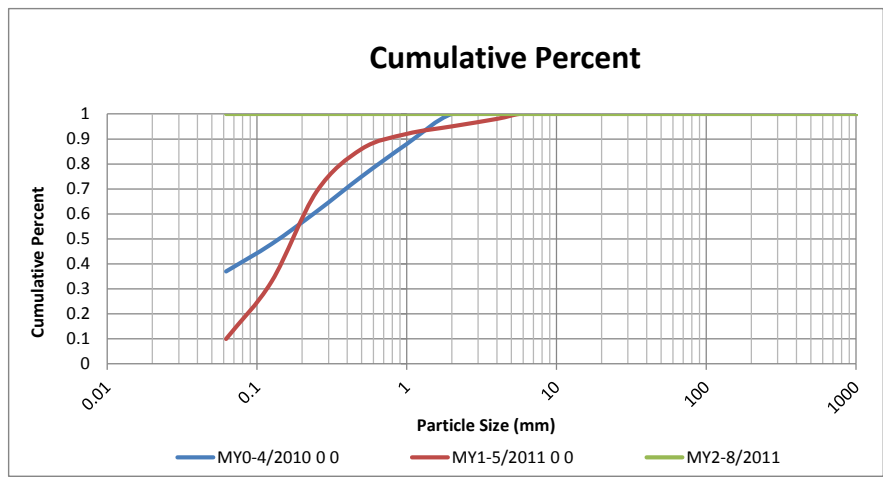
Appendix D. Stream Survey Data

Figure 5c: Pebble Count Plots with Annual Overlays

DBC (Suther) Stream and Wetland Restoration/EEP Project No. 370
Monitoring Year 2 of 5

Project Name: Dutch Buffalo Creek (Unnamed Tributary)					
Cross-Section: 3					
Feature: Pool					
MY2-8/2011					
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	100	100%	100%
Sand	very fine sand	0.125	0	0%	100%
	fine sand	0.250	0	0%	100%
	medium sand	0.50	0	0%	100%
	coarse sand	1.00	0	0%	100%
	very coarse sand	2.0	0	0%	100%
Gravel	very fine gravel	4.0	0	0%	100%
	fine gravel	5.7	0	0%	100%
	fine gravel	8.0	0	0%	100%
	medium gravel	11.3	0	0%	100%
	medium gravel	16.0	0	0%	100%
	course gravel	22.3	0	0%	100%
	course gravel	32.0	0	0%	100%
	very coarse gravel	45	0	0%	100%
	very coarse gravel	64	0	0%	100%
	Cobble	small cobble	90	0	0%
medium cobble		128	0	0%	100%
large cobble		180	0	0%	100%
very large cobble		256	0	0%	100%
Boulder	small boulder	362	0	0%	100%
	small boulder	512	0	0%	100%
	medium boulder	1024	0	0%	100%
	large boulder	2048	0	0%	100%
Bedrock	bedrock	40096	0	0%	100%
TOTAL % of whole count			100	100%	100%

Summary Data	
D50	0.03
D84	0.05
D95	0.06



Appendix D. Stream Survey Data

Figure 5d: Pebble Count Plots with Annual Overlays

DBC (Suther) Stream and Wetland Restoration/EEP Project No. 370
Monitoring Year 2 of 5

Project Name: Dutch Buffalo Creek (Unnamed Tributary)					
Cross-Section: 4					
Feature: Riffle					
		MY2-8/2011			
Description	Material	Size (mm)	Total #	Item %	Cum %
Silt/Clay	silt/clay	0.062	2	2%	2%
Sand	very fine sand	0.125	5	5%	7%
	fine sand	0.250	4	4%	11%
	medium sand	0.50	6	6%	17%
	coarse sand	1.00	1	1%	18%
	very coarse sand	2.0	0	0%	18%
Gravel	very fine gravel	4.0	0	0%	18%
	fine gravel	5.7	1	1%	19%
	fine gravel	8.0	2	2%	21%
	medium gravel	11.3	17	17%	38%
	medium gravel	16.0	23	23%	61%
	course gravel	22.3	20	20%	81%
	course gravel	32.0	13	13%	94%
	very coarse gravel	45	2	2%	96%
	very coarse gravel	64	3	3%	99%
	Cobble	small cobble	90	1	1%
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	13.75
D84	24.77
D95	38.50

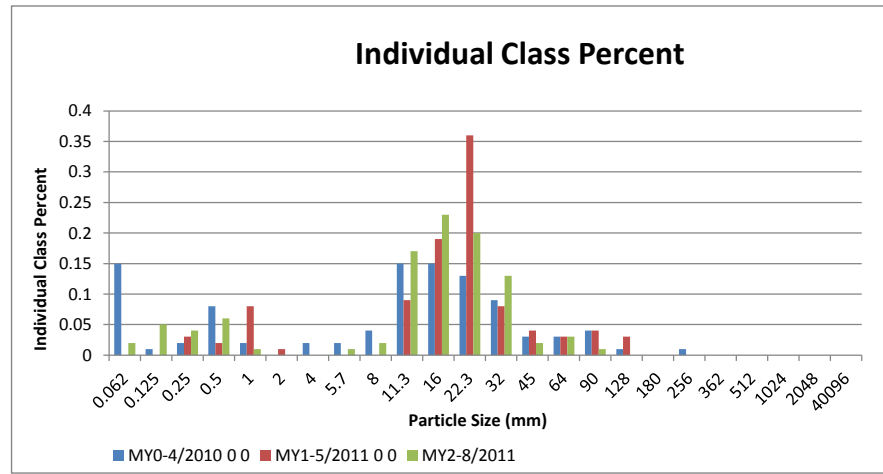
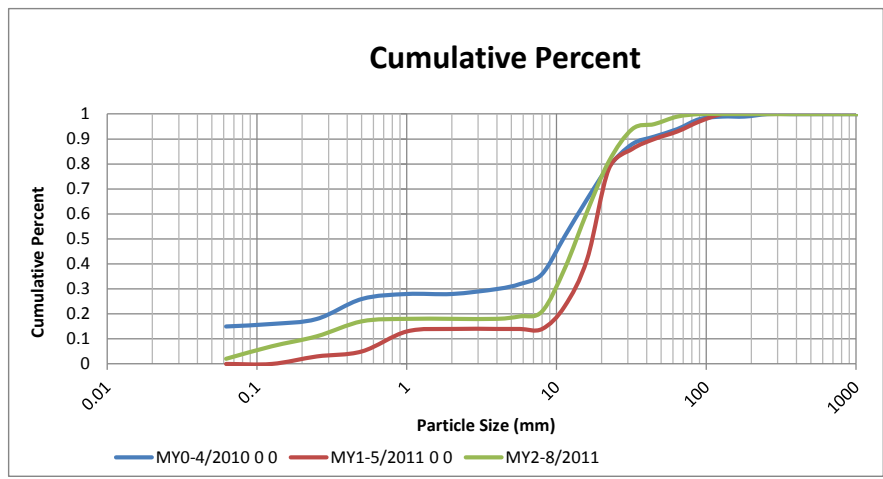


Table 10a. Baseline Stream Data Summary

Dutch Buffalo Creek Stream and Wetland Restoration/EEP Project Number 370

Unnammed Tributary to Dutch Buffalo (608 linear feet)

Parameter	Gauge	Regional Curve			Pre-Existing Condition						Reference Reach Data						Design			Monitoring Baseline					
		LL	UL	Eq.	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Med	Max	Min	Mean	Med	Max	SD	n
Dimension and Substrate - Riffle																									
Bankfull Width (ft)	-	6.83	7.55	7.19	-	8.68	-	-	-	10	-	8.3	-	-	-	-	-	9	-	8.34	8.60	8.60	8.85	-	2
Floodprone Width (ft)					-	9.8	-	-	-	10	-	130	-	-	-	-	-	150	-	52.52	54.05	54.05	55.57	-	2
Bankfull Mean Depth (ft)	-	0.98	1.08	1.03	-	1.17	-	-	-	10	-	1.3	-	-	-	-	-	1	-	1.00	1.02	1.02	1.04	-	2
Bankfull Max Depth (ft)	-				-	1.49	-	-	-	10	-	1.9	-	-	-	-	-	1.5	-	1.67	1.74	1.74	1.81	-	2
Bankfull Cross-Sectional Area (ft ²)	-	9.18	10.14	9.66	-	10.17	-	-	-	10	-	10.95	-	-	-	-	-	9	-	8.30	8.77	8.77	9.24	-	2
Width/Depth Ratio	-				-	7.42	-	-	-	10	-	6.4	-	-	-	-	-	9	-	8.34	8.43	8.43	8.51	-	2
Entrenchment Ratio	-				-	1.13	-	-	-	10	-	15.66	-	-	-	-	-	16.67	-	6.28	6.29	6.29	6.30	-	2
Bank Height Ratio	-				-	2.53	-	-	-	10	-	1.2	-	-	-	-	-	1.0	-	1.0	1.0	1.0	1.0	-	2
Pattern																									
Channel Beltwidth (ft)					2.5	-	-	19.4	-	46	33	51	-	69	-	2	33.3	57.15	81	33.3	57.15	57.15	81	-	-
Radius of Curvature (ft)					10.38	-	-	37.99	-	76	12	15.5	-	19	-	2	22.5	24.75	27	22.5	24.75	24.75	27	-	-
Rc:Bankfull width (ft/ft)					1.2	-	-	4.38	-	76		8.3	-		-	1	2.5	2.75	3	2.5	2.75	3	-	-	
Meander Wavelength (ft)					43	-	-	109	-	50	60	64.5	-	69	-	2	57.6	91.80	126	57.6	91.8	91.8	126	-	-
Meander Width Ratio					0.29	-	-	2.24	-	46	4	6.15	-	8.3	-	2	3.7	6.35	9	3.7	6.35	6.35	9	-	-
Profile																									
Riffle Length (ft)					6.76	-	-	41.57	-	4	5.4	-	-	23	-	2	14.4	33.40	52.4	13.76	-	-	19.36	-	-
Riffle Slope (ft/ft)					0.0031	-	-	0.0386	-	4	0.016	-	-	0.024	-		0.014	0.02	0.024	0.00142	-	-	0.01113	-	-
Pool Length (ft)					5.89	-	-	37.56	-	7	7.8	-	-	35	-	2	54.12	64.72	75.32	10.32	-	-	31.4	-	-
Pool Max Depth (ft)						1.79	-	-	-	7		2.4	-	-	-	-	1	1.40	1.8	-	-	-	-	-	
Pool Spacing (ft)					17.35	-	-	125.66	-	7	40.3	-	-	60	-	-	44.1	54.45	64.8	10.32	-	-	52.04	-	-
Transport Parameters																									
Reach Shear Stress (competency) lb/ft ²					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Max part size (mm) mobilized at bankful					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Stream Power (transport capacity) W/m ²					-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Additional Reach Parameters																									
Rosgen Classification	-							G5c						E4				C/E4						E4	
Bankful Velocity (fps)	-	-	-	-				3.8						3.5				3.65						3.65	
Bankful Discharge (cfs)	-	-	-	-				39.04*						38				39.04*						39.04*	
Valley Length (ft)								-						-				-						-	
Channel Thalweg Length (ft)								608						608				608						608	
Sinuosity (ft)								1.24						1.8				1.13						1.16	
Water Surface Slope (ft/ft)	-							0.008						0.005				0.006						0.008	
BF slope (ft/ft)	-							0.008						0.005				0.006						0.008	
Bankful Floodplain Area (acres)								0.14						1.81				2.09						0.75	
% of Reach with Eroding Banks								-						-				-						0	
Channel Stability or Habitat Metric								-						-				-						-	
Biological or Other								-						-				-						-	

*Calculated using Flowmaster

Table 10b. Baseline Stream Data Summary (Substrate, Bed, Bank and Hydrologic Containment Parameter Distributions)				
Dutch Buffalo Creek Stream and Wetland Restoration/EEP Project No. 370				
Unnammed Tributary to Dutch Buffalo (608 linear feet)				
Parameter	Pre-Existing Condition	Reference Reach Data	Design	As-built/Baseline
Ri%/Ru%/P%/G%/S%	-	-	-	-
SC% / Sa% / G% / C% / B% / Be%	-	-	-	24.5/35.75/36.75/3.25/0/0
d16 / d35 / d50 / d84 / d95 (mm)	0.12/0.83/2.36/11.03/22.6	-	-	1.45/5.85/8.29/25.06/47.52
Entrenchment Class <1.5/1.5-1.99/2.0-4.9/5.0-9.9/>10	100% <1.5 (1.13)	100% > 10 (15.66)	100% > 10 (16.67)	5.0 < 100% < 9.9 (5.35, 6.30)
Incision Class <1.2/1.2-1.49/1.5-1.99/>2.0	(2.53) 100% > 2.0	1.2=(1.2) 100% <1.49	(1.0) 100%< 1.2	(1.0) 100%< 1.2

Table 11a: Morphologic and Hydraulic Monitoring Summary
Dutch Buffalo Creek Stream and Wetland Restoration Project/SCO #06-06752-01
Unnammed Tributary to Dutch Buffalo (608 linear feet)

PARAMETER	Cross-Section 1 (Riffle)						Cross-Section 2 (Riffle)					
	Baseline	MY1-2010	MY2-2011	MY3-2012	MY4-2013	MY5-2014	Baseline	MY1-2010	MY2-2011	MY3-2012	MY4-2013	MY5-2014
DIMENSION												
Bankfull Width (ft)	8.9	8.7	8.3				9.6	9.7	9.4			
Floodprone Width (ft)	55.6	55.6	55.8				53.3	53.2	53.3			
Bankfull Mean Depth	1.0	1.1	1.1				1.1	1.0	1.0			
Bankfull Max Depth (ft)	1.8	1.7	1.6				1.7	1.6	1.6			
Bankfull Cross-sectional Area (ft ²)	9.2	8.8	8.8				10.2	9.4	9.4			
Bankfull Width/Depth Ratio	8.5	8.6	7.8				9.1	10.0	9.3			
Bankfull Entrenchment Ratio	6.3	6.4	6.7				5.6	5.5	5.7			
Bankfull Bankheight Ratio	1.0	1.0	1.0				1.0	1.0	1.0			
Cross Sectional Area between end pins (ft ²)	75.0	69.6	75.5				12.0	9.8	19.1			
d50 (mm)	13.7	4.9	1.9				0.1	11.6	12.5			
PARAMETER	Cross-Section 3 (Pool)						Cross-Section 4 (Riffle)					
	Baseline	MY1-2010	MY2-2011	MY3-2012	MY4-2013	MY5-2014	Baseline	MY1-2010	MY2-2011	MY3-2012	MY4-2013	MY5-2014
DIMENSION												
Bankfull Width (ft)	11.0	10.5	10.4				8.3	8.3	8.2			
Floodprone Width (ft)	59.0	58.0	55.3				52.5	52.5	55.1			
Bankfull Mean Depth	0.8	0.7	0.7				1.0	1.0	1.0			
Bankfull Max Depth (ft)	8.9	8.7	1.6				8.9	8.7	1.7			
Bankfull Cross-sectional Area (ft ²)	9.3	7.5	7.6				8.3	8.4	8.3			
Bankfull Width/Depth Ratio	13.1	14.8	14.3				8.3	8.2	8.1			
Bankfull Entrenchment Ratio	5.4	5.5	5.3				6.3	6.3	6.8			
Bankfull Bankheight Ratio	1.0	1.0	1.0				1.0	1.0	1.0			
Cross Sectional Area between end pins (ft ²)	49.8	35.4	53.4				39.6	36.3	41.3			
d50 (mm)	0.1	0.2	0.03				11.1	17.5	13.8			

Table 11b. Monitoring Data - Stream Reach Data Summary
Dutch Buffalo Creek Stream and Wetland Restoration Project/SCO #06-06752-01
Unnammed Tributary to Dutch Buffalo (608 linear feet)

Parameter	Baseline						MY 1 2010						MY 2 2011					
	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n	Min	Mean	Med	Max	SD	n
DIMENSION																		
Bankfull Width (ft)	8.34	8.60	8.60	8.85	-	3	8.31	8.52	8.52	8.72	-	3	8.16	8.59	8.28	9.34	0.65	3
Floodprone Width (ft)	52.52	54.05	54.05	55.57	-	3	52.49	54.07	54.07	55.64	-	3	53.33	54.73	55.09	55.77	1.26	3
Bankfull Mean Depth (ft)	1.00	1.02	1.02	1.04	-	3	1.01	1.01	1.01	1.01	-	3	1.01	1.03	1.01	1.06	0.03	3
Bankfull Max Depth (ft)	1.67	1.74	1.74	1.81	-	3	1.56	1.63	1.63	1.70	-	3	1.62	1.64	1.64	1.65	0.02	3
Bankfull Cross Sectional Area (ft2)	8.30	8.77	8.77	9.24	-	3	8.42	8.62	8.62	8.82	-	3	8.27	8.82	8.77	9.42	0.58	3
Width/Depth Ratio	8.34	8.43	8.43	8.51	-	3	8.23	8.43	8.43	8.63	-	3	7.81	8.38	8.08	9.25	0.77	3
Entrenchment Ratio	6.28	6.29	6.29	6.30	-	3	6.32	6.35	6.35	6.38	-	3	5.71	6.40	6.74	6.75	0.60	3
Bank Height Ratio	1.0	1.0	1.0	1.0	-	3	1.0	1.0	1.0	1.0	-	3	1.0	1.0	1.0	1.0	0.00	3
Bankfull Velocity (fps)	4.70	4.45	4.45	4.23	-	3	4.64	4.53	4.53	4.43	-	3	4.14	4.44	4.45	4.72	0.29	3
PROFILE																		
Riffle Length (ft)	13.76	21.29	21.29	28.82	-	2	16.07	22.09	22.09	28.11	-	3	9.01	16.90	17.46	22.53	5.05	6
Riffle Slope (ft/ft)	0.00142	0.01	0.01	0.01856	-	2	0.00916	0.01006	0.01006	0.01096	-	3	0.0093	0.0203	0.0158	0.0472	0.0140	6
Pool Length (ft)	10.32	31.83	31.83	53.33	-	2	18.30	27.90	27.90	37.49	-	3	15.77	38.02	40.93	61.57	15.69	8
Pool Max depth	1.72	1.82	1.82	1.91	-	2	1.62	1.63	1.63	1.63	-	2	1.95	2.29	2.17	2.8	0.30	9
Pool Spacing (ft)	10.32	42.80	42.80	75.27	-	2	19.98	23.64	23.64	27.29	-	3	25.45	54.46	58.32	77.41	18.41	8
PATTERN																		
Channel Beltwidth (ft)	33.30	57.15	57.15	81.00	-	5	33.30	57.15	57.15	81.00	-	5	33.30	57.15	57.15	81.00	-	5
Radius of Curvature (ft)	22.50	24.75	24.75	27.00	-	9	22.50	24.75	24.75	27.00	-	9	22.50	24.75	24.75	27.00	-	9
Meander Wavelength (ft)	57.60	91.80	91.80	126.00	-	7	57.60	91.80	91.80	126.00	-	7	57.60	91.80	91.80	126.00	-	7
Meander Width Ratio	3.70	6.35	6.35	9.00	-	-	3.70	6.35	6.35	9.00	-	-	3.70	6.35	6.35	9.00	-	-
ADDITIONAL REACH PARAMETERS																		
Rosgen Classification	E4						E4						E4					
BF slope (ft/ft)	0.008						0.008						0.006					
Ri%/Ru%/P%/G%/S%	-	-	-	-	-	-	29.00	1.20	38.10	-	0.2	-	17.00	-	50.00	-	0.2	-
SC%/Sa%/G%/C%/B%/Be%																		
d16 / d35 / d50 / d84 / d95																		
% of reach with eroding banks	0						4						0					
Channel Stability or Habitat Metric	-						-						-					
Biological or Other	-						-						-					

*Insufficient water in channel to estimate an approximate value



APPENDIX E HYDROLOGIC DATA

Table 12	Verification of Bankfull Events
Figure 6	Monthly Rainfall Data
Figure 7	Precipitation and Water Level Plots
Table 13	Wetland Hydrology Criteria Attainment

Appendix E. Hydrologic Data

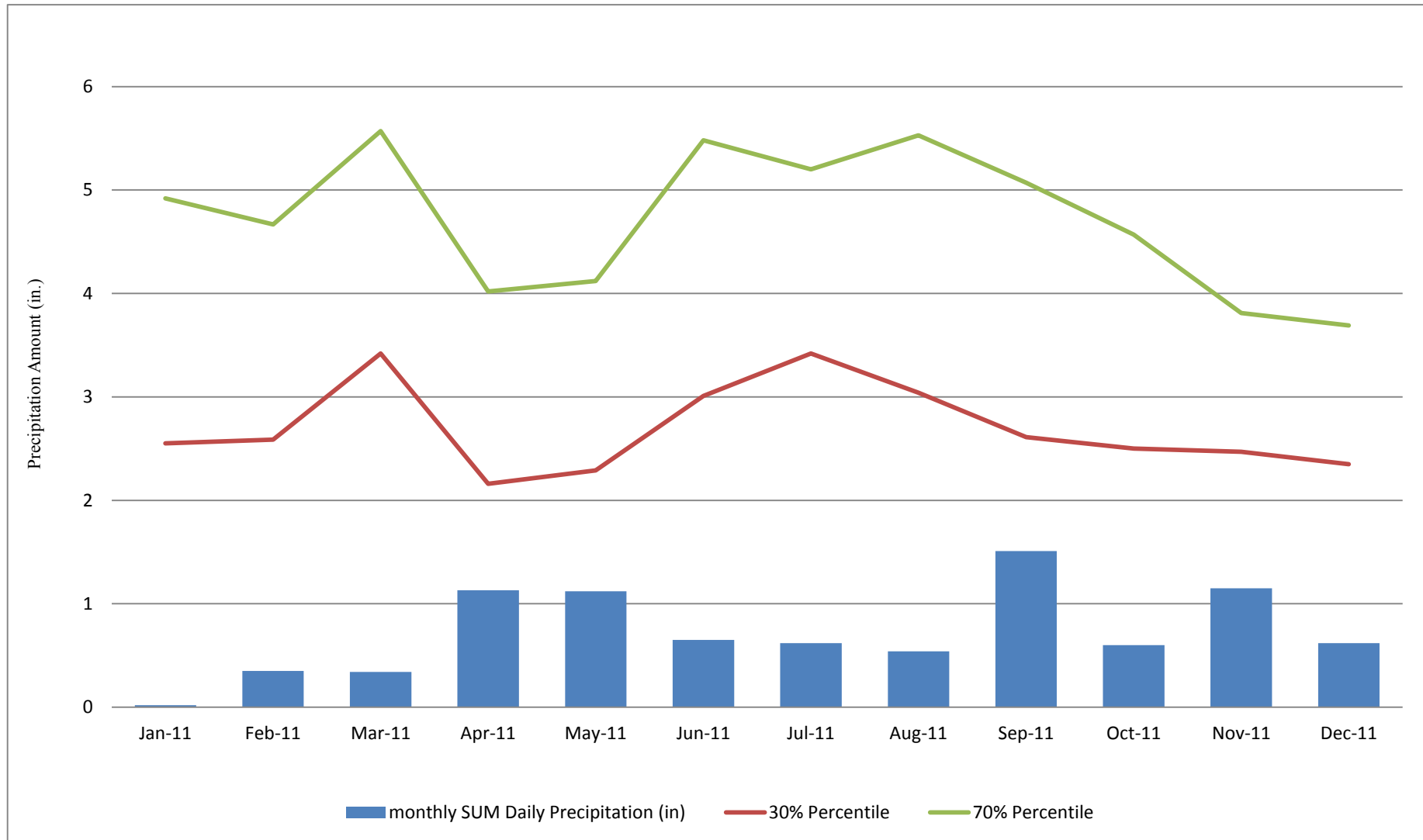
Table 12. Verification of Bankfull Events

Dutch Buffalo Creek Stream and Wetland Restoration/EEP Project No. 370

Monitoring Year 2 of 5

Date of Collection	Date of Occurrence	Method	Photo # (if available)
5/19/2011	Unknown	Crest Gauge	N/A
6/23/2011	Unknown	Crest Gauge	N/A
		Crest Gauge	N/A
		Crest Gauge	N/A
		Crest Gauge	N/A
		Crest Gauge	N/A

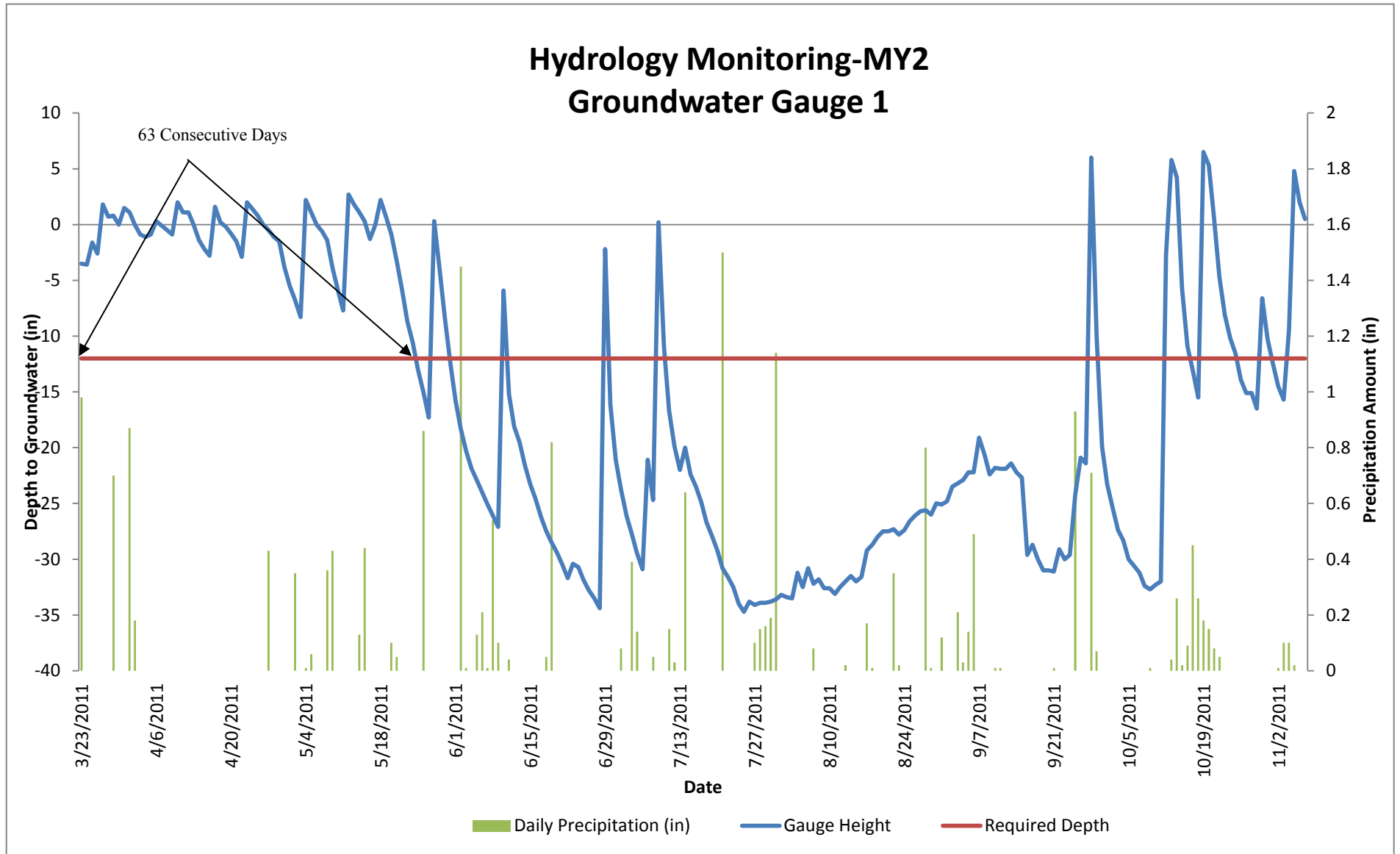
Figure 6: Dutch Buffalo Creek 30-70 Percentile Graph for Rainfall in 2011, Concord NC
DBC (Suther) Stream and Wetland Restoration/EEP Project No. 370
Monitoring Year 2 of 5



*Historical rainfall data referenced from NC Cronos Database Divisonal Data for the Southern Piedmont of North Carloina - Data Period January 2011 through December 2011
 monthly rainfall data from <http://www.wunderground.com/history/airport/KJQF/2010/12/16/CustomHistory.html>

**Figure 7a: Precipitation and Water Level Plots for Gauges
DBC (Suther) Stream and Wetland Restoration/EEP Project No. 370
Monitoring Year 2 of 5**

Growing Season: March 23-November 7



**Figure 7b: Precipitation and Water Level Plots for Gauges
DBC (Suther) Stream and Wetland Restoration/EEP Project No. 370
Monitoring Year 2 of 5**

Growing Season: March 23-November 7

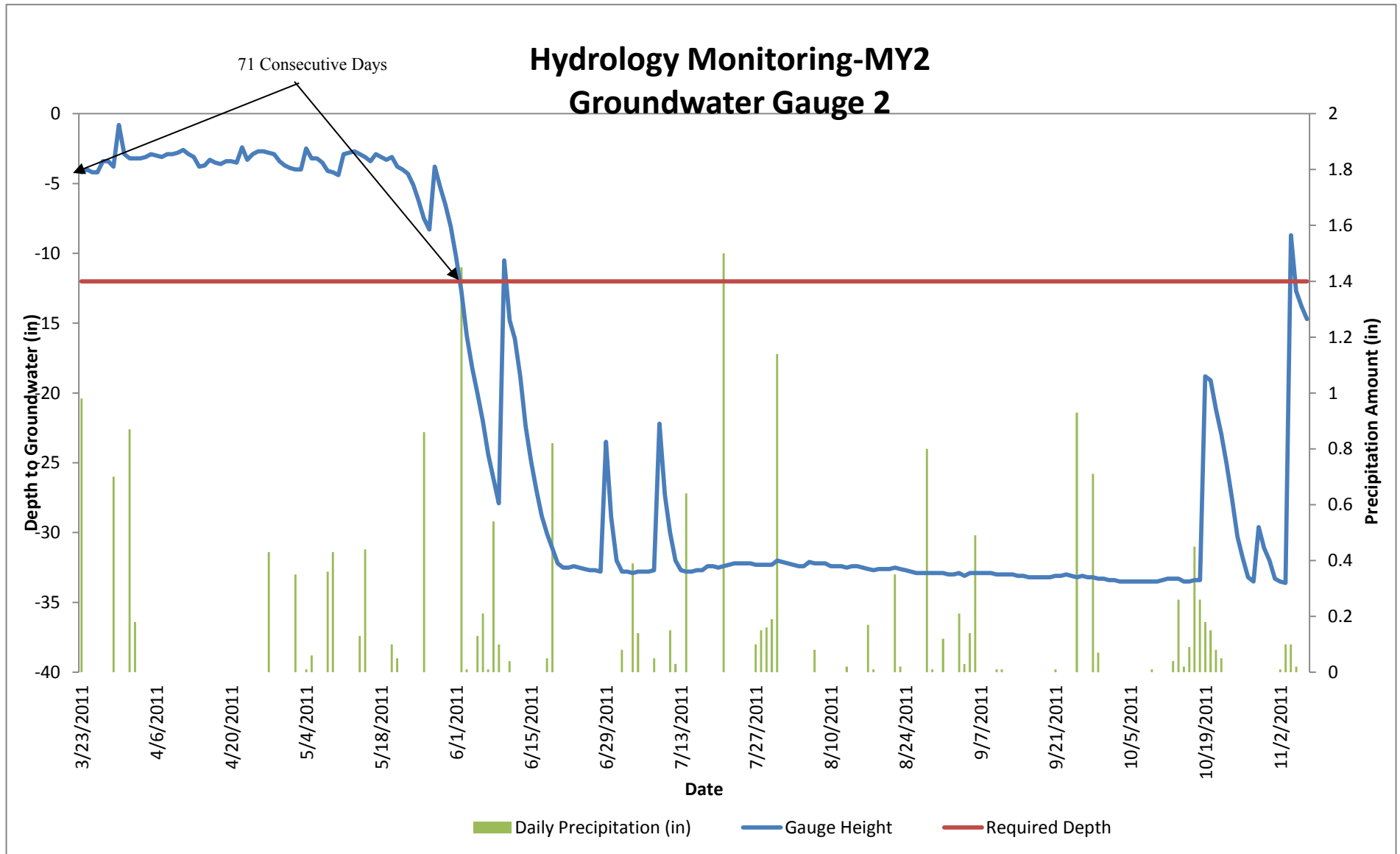


Figure 7c: Precipitation and Water Level Plots for Gauges
DBC (Suther) Stream and Wetland Restoration/EEP Project No. 370
Monitoring Year 2 of 5

Growing Season: March 23-November 7

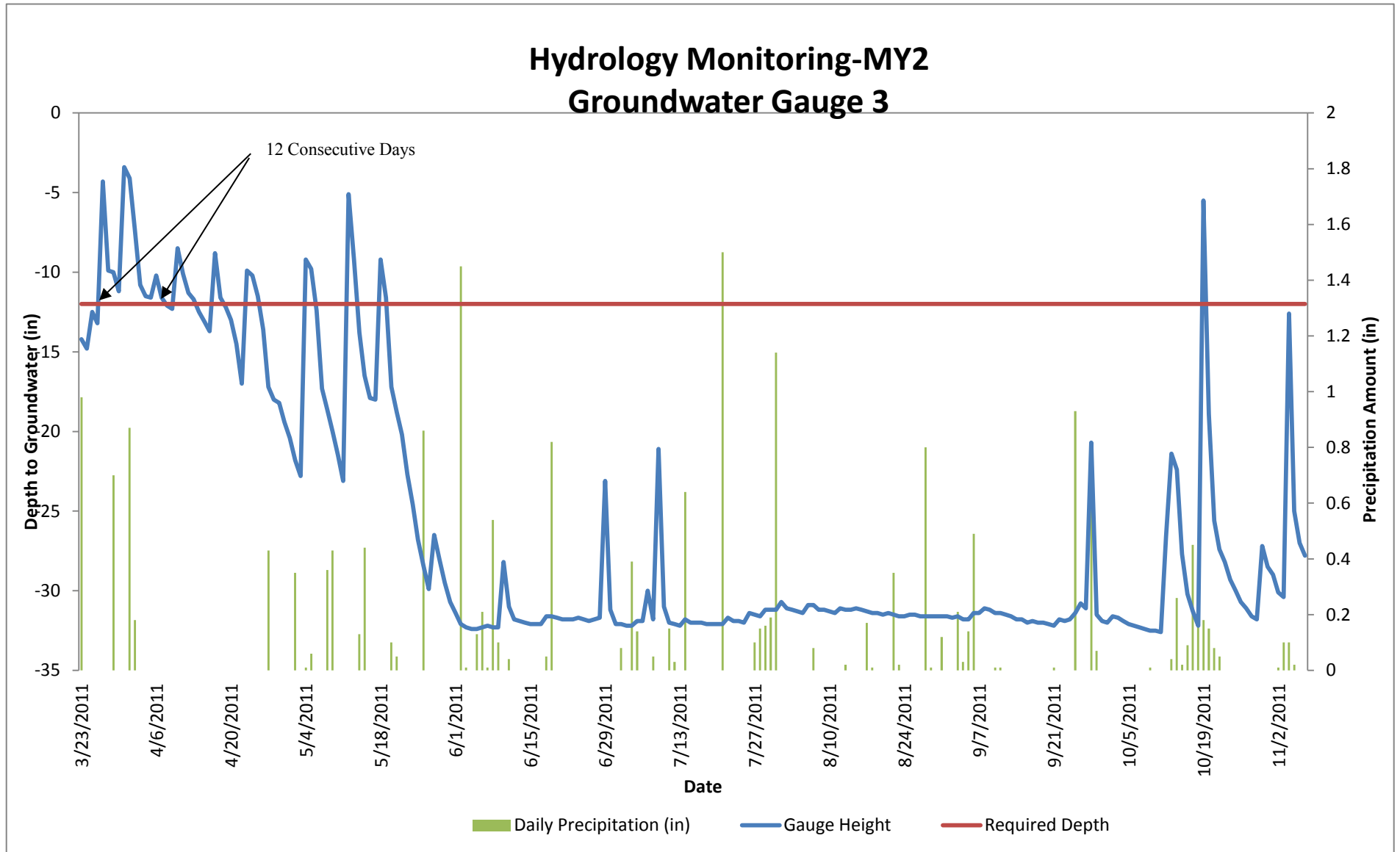


Figure 7d: Precipitation and Water Level Plots for Gauges
 DBC (Suther) Stream and Wetland Restoration/EEP Project No. 370
 Monitoring Year 2 of 5

Growing Season: March 23-November 7

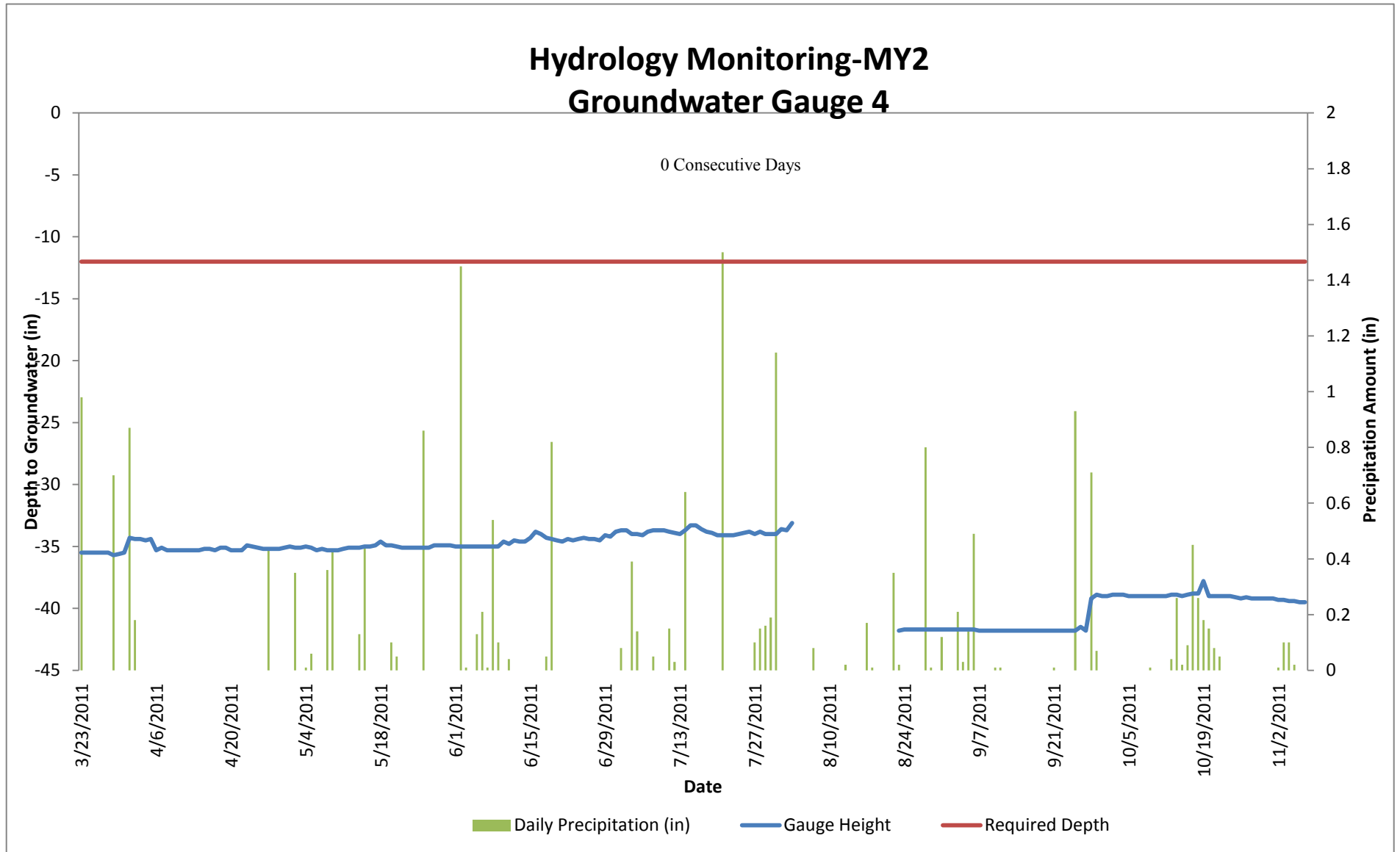
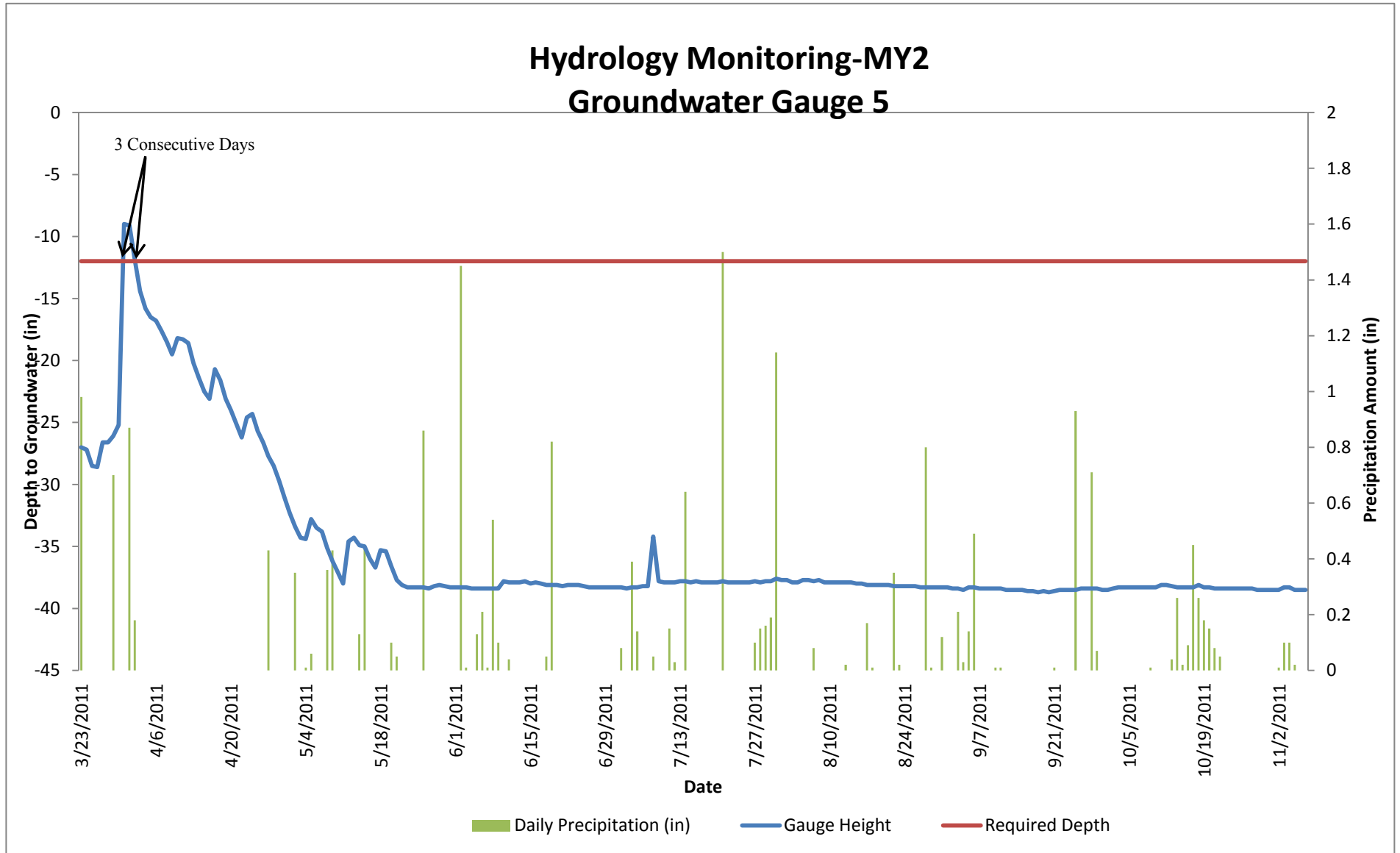


Figure 7e: Precipitation and Water Level Plots for Gauges
DBC (Suther) Stream and Wetland Restoration/EEP Project No. 370
Monitoring Year 2 of 5

Growing Season: March 23-November 7



**Figure 7f: Precipitation and Water Level Plots for Gauges
 DBC (Suther) Stream and Wetland Restoration/EEP Project No. 370
 Monitoring Year 2 of 5**

Growing Season: March 23-November 7

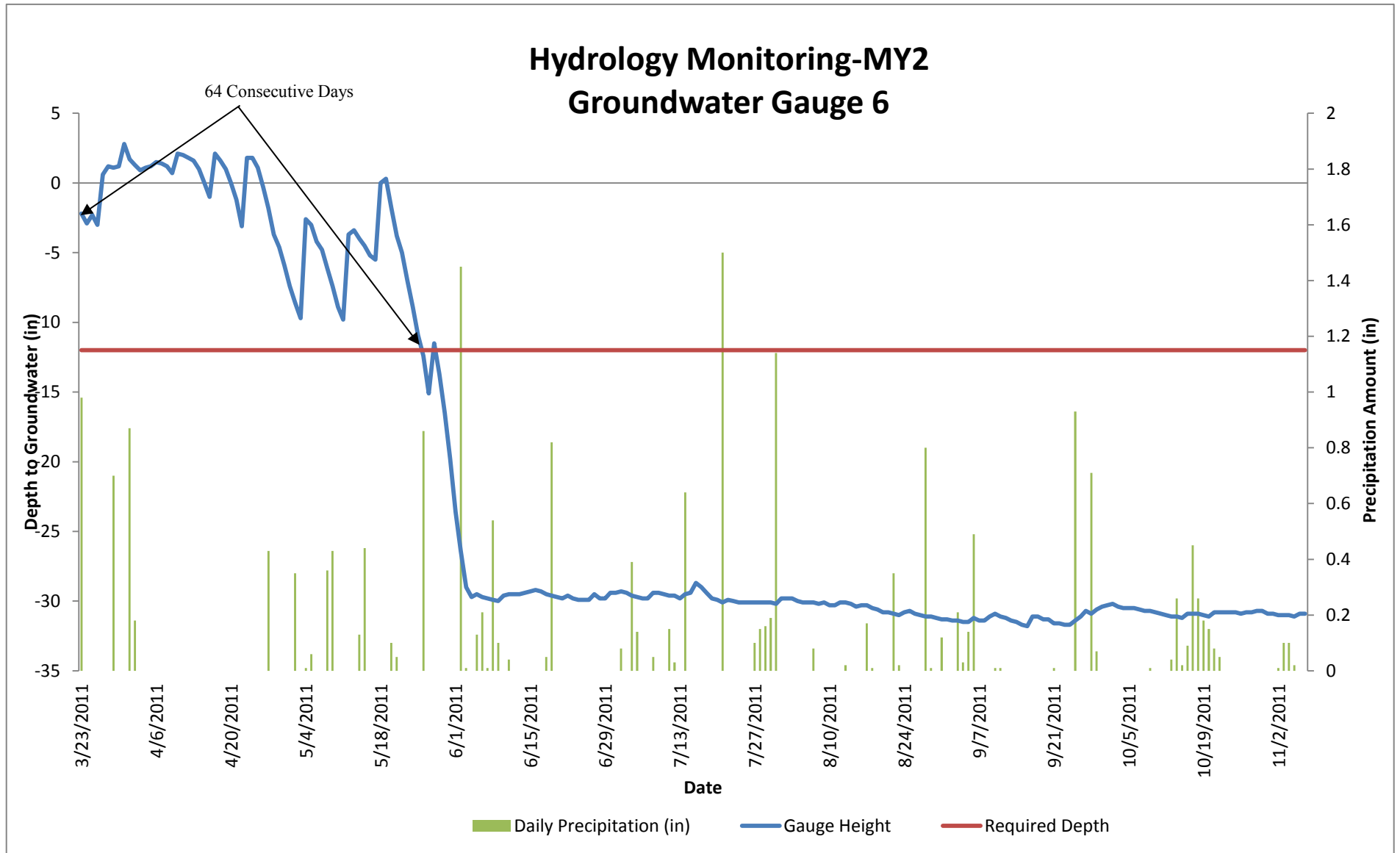


Figure 7g: Precipitation and Water Level Plots for Gauges
DBC (Suther) Stream and Wetland Restoration/EEP Project No. 370
Monitoring Year 2 of 5

Growing Season: March 23-November 7

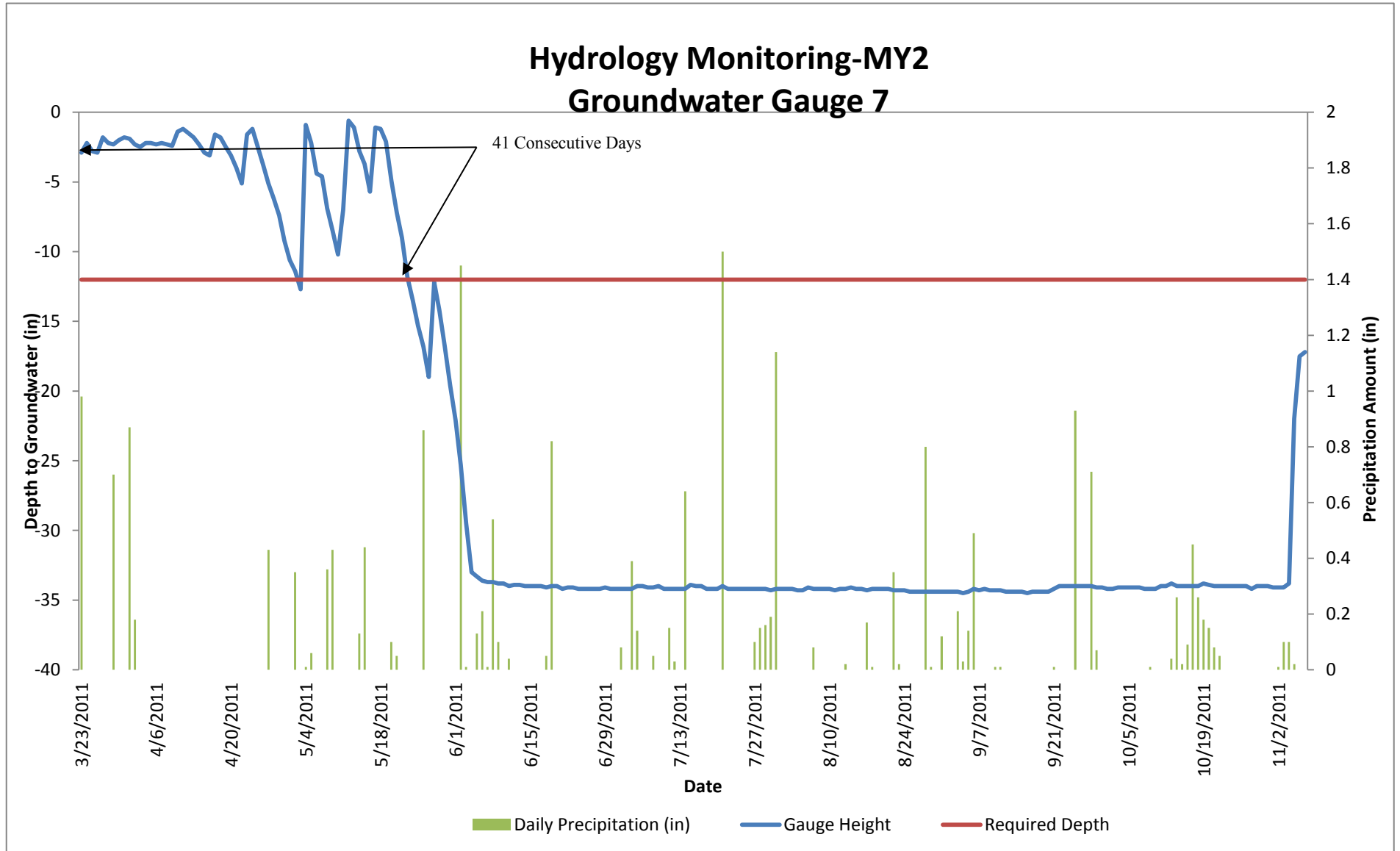
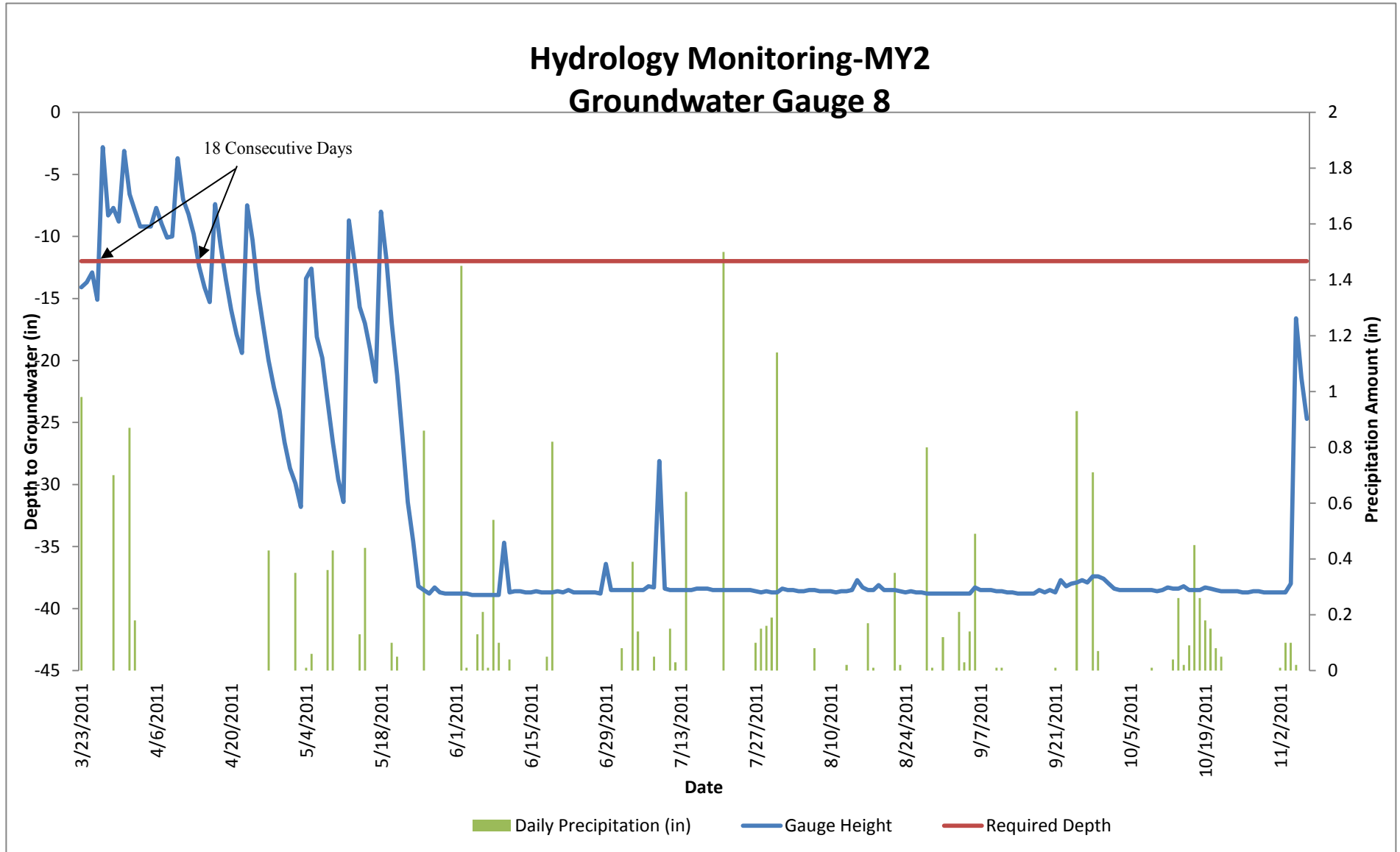


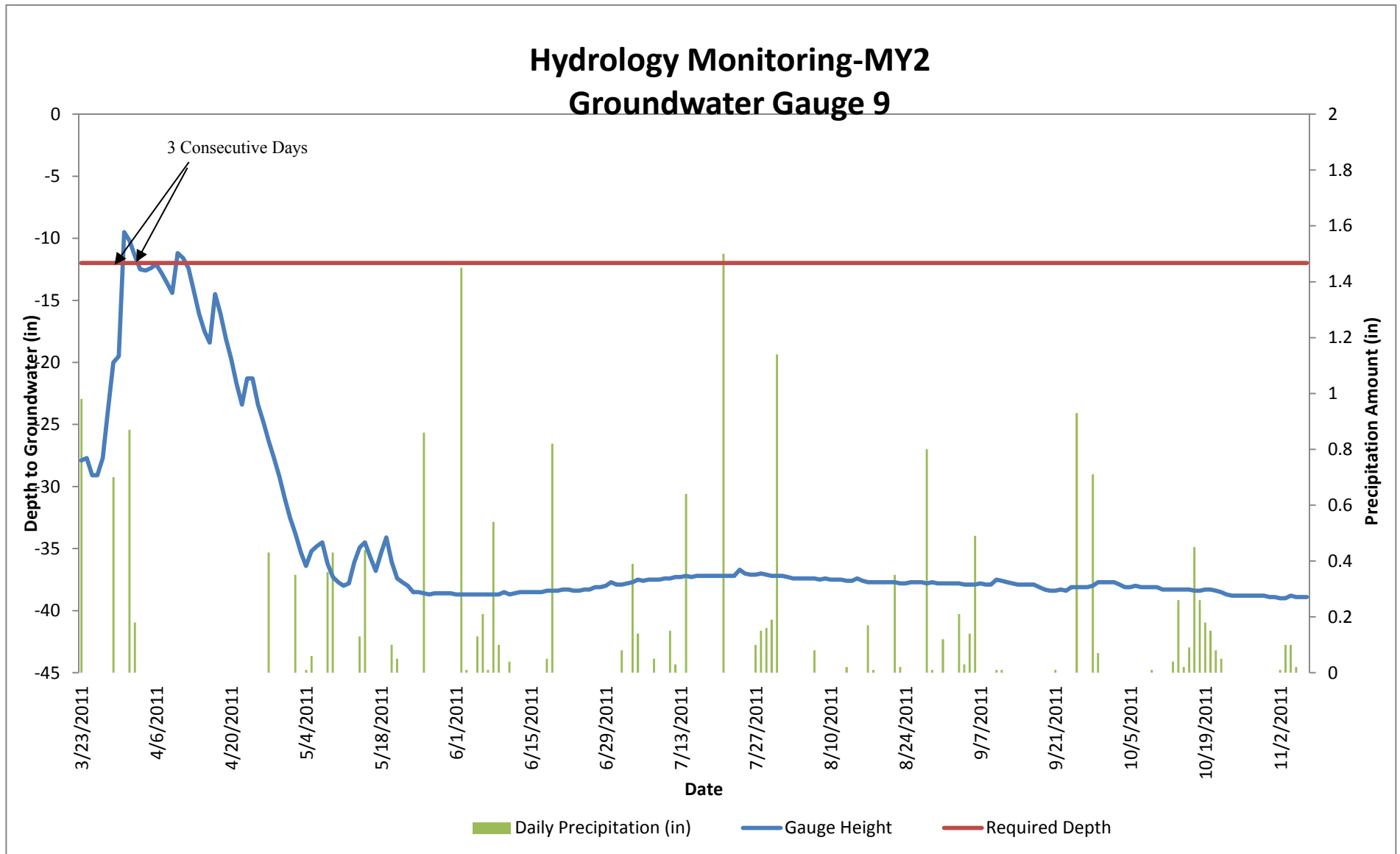
Figure 7h: Precipitation and Water Level Plots for Gauges
DBC (Suther) Stream and Wetland Restoration/EEP Project No. 370
Monitoring Year 2 of 5

Growing Season: March 23-November 7



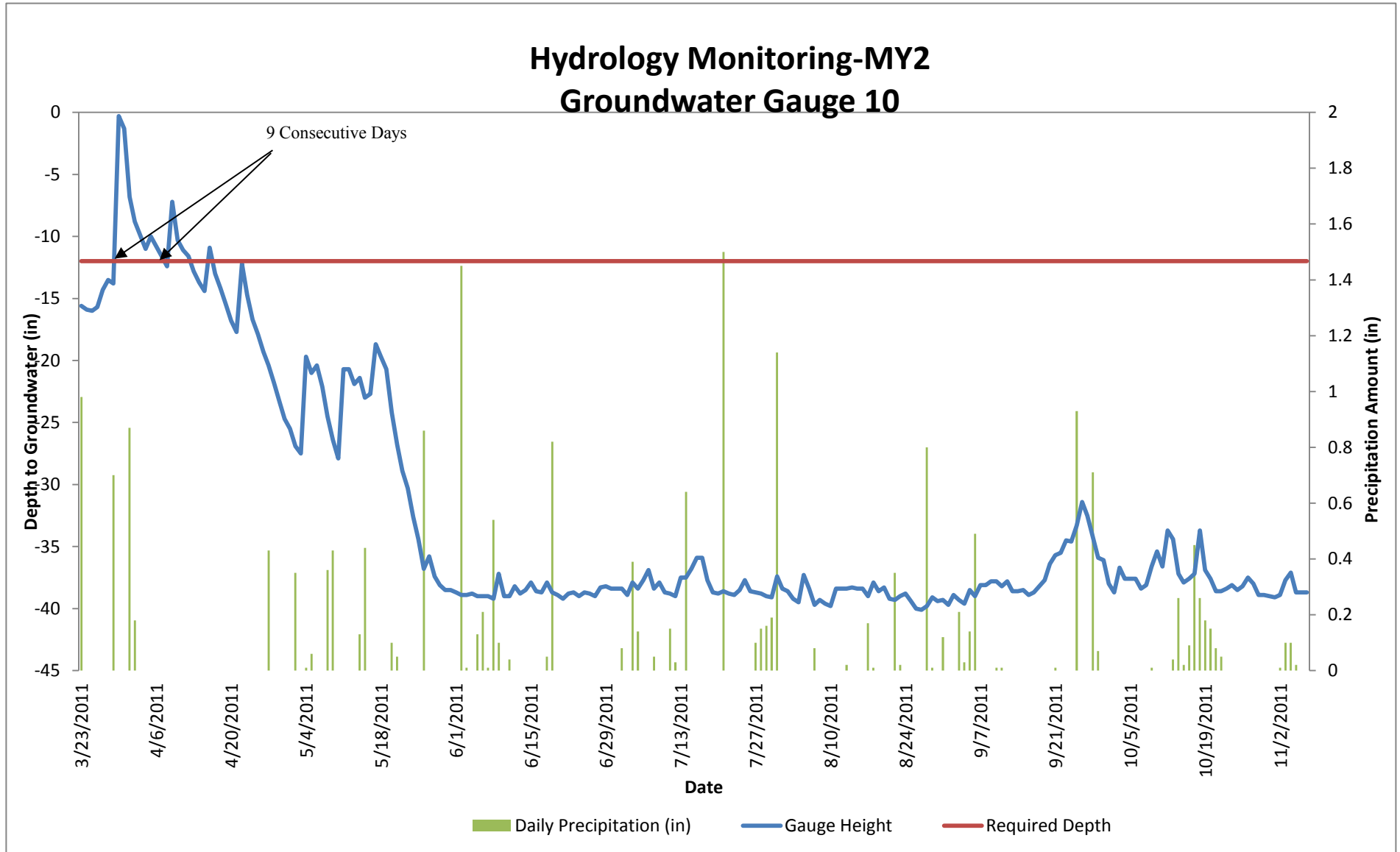
**Figure 7i: Precipitation and Water Level Plots for Gauges
 DBC (Suther) Stream and Wetland Restoration/EEP Project No. 370
 Monitoring Year 2 of 5**

Growing Season: March 23-November 7



**Figure 7j: Precipitation and Water Level Plots for Gauges
 DBC (Suther) Stream and Wetland Restoration/EEP Project No. 370
 Monitoring Year 2 of 5**

Growing Season: March 23-November 7



Appendix E. Hydrologic Data

Table 13: Wetland Hydrology Criteria Attainment

DBC (Suther) Stream and Wetland Restoration/EEP Project No. 370

Monitoring Year 2 of 5

Summary of Groundwater Gauge Results for Years 1 through 5					
Gauge	Success Criteria Achieved/Max Consecutive Days During Growing Season (Percentage %)				
	Year 1 (2010)	Year 2 (2011)	Year 3 (2012)	Year 4 (2013)	Year 5 (2014)
GW1	Yes/20 Days (9%)	Yes/63 Days (28%)			
GW2	Yes/52 Days (23%)	Yes/71 Days (31%)			
GW3	Yes/19 Days (8%)	No/12 Days (5%)			
GW4	No/4 Days (2%)	No/0 Days (0%)			
GW5	No/0 Days (0%)	No/3 Days (1%)			
GW6	Yes/46 Days (20%)	Yes/64 Days (28%)			
GW7	*N/A	Yes/41 Days (18%)			
GW8	*N/A	Yes/18 Days (8%)			
GW9	No/10 Days (4%)	No/3 Days (1%)			
GW10	Yes/53 Days (23%)	No/9 Days (4%)			