WELLS CREEK #2 -- DMS #92688
Alamance County NC – Cape Fear River HUC# 03030002-050050
MY-4 (2014) Annual Monitoring Report

North Carolina Department of Environment & Natural Resources
Division of Mitigation Services (DENR-DMS) -- Contract # 5714

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1.0. Project Summary

1.1. Project Setting & Pre-Restoration Conditions

Wells Creek #2 (DMS Project # 92688) is a stream mitigation project located near Snow Camp in southwestern Alamance County, NC, in the Carolina Slate Belt region (Figure 1.0). The project consists of two separate parcels: 1) The Northern Reach (stream enhancement) is located along Wells Creek upstream and downstream of Carl Noah Road and along tributary UT3. The Southern Reach (stream preservation) is located along Wells Creek tributaries UT1 and UT2 downstream of Longest Acres Road, 4000 feet southwest of the Northern Reach. The stream segments immediately downstream of each project reach along Wells Creek and UT1 were previously restored (NCEEP project #414, Wells Creek). Tributary UT1 flows into Wells Creek approximately 2,000 feet downstream of the Southern Reach, just north of Beale Road. From there, Wells Creek flows southeast into Cane Creek, which in turn flows eastward into the Haw River upstream of Jordan Lake.

Wells Creek on the Northern Reach parcel is an 8- to 15-foot wide perennial stream with a mixed substratum of bedrock, cobble, gravel, sand, and silt, and low to moderate channel incision. Its tributary UT3 is intermittent, with a substratum of cobble, sand, and silt/mud, and is moderately incised toward the lower end. The banks along both streams are mostly forested with large hardwood trees, but the riparian areas were trampled and heavily grazed by cattle and hogs, with little understory or groundcover vegetation between the canopy trees prior to project implementation in 2009-2010. Rooting activity by hogs in and adjacent to UT3 has destabilized the stream banks and bed, causing frequent high turbidity and sediment load in this stream and in the Wells Creek segment downstream of UT3.

Unnamed tributary UT1 on the Southern Reach parcel is a 6- to 12-foot wide perennial stream with a rocky substratum, meandering pattern, and minimal channel incision. UT2 is a 5-foot wide intermittent stream with a cobble and clay dominated bed, moderately incised. Only the lowermost 50-ft segment of this stream is within the project easement. Like the Northern Reach, both streams in this area have mature hardwood forest along most of their banks. Minor understory damage and bank trampling by cattle or hogs was present prior to project implementation.

1.2. Project Goals & Objectives

The Wells Creek #2 project is in Cape Fear River Basin HUC #03030002-050050, designated as a Targeted Local Watershed in the 2009 Cape Fear River Basin Restoration Priority report. The goals of the project are to improve and protect stream bank stability, water quality and riparian habitat. To achieve these goals, the project has the following objectives:

- Reduce direct nutrient loading and fecal coliform inputs into the streams by fencing out cattle and hogs and providing an alternative livestock water system;
- Reduce excess sedimentation into the streams by eliminating livestock impacts from hoof shear to forest floor and stream banks;

- Reestablish and enhance native forested buffers by planting native plants, removing invasive exotic vegetation, and preventing future negative impacts within the buffer;
- Increase surface runoff infiltration and non-point pollutant removal through the buffer, and preserve existing well-established riparian plant communities.

1.3. Project Approach, Components, and Mitigation Assets

Mitigation components for the project include 1,897 feet of stream enhancement (EII) and 1,616 feet of stream preservation, providing 1,082 stream mitigation units (SMU) assets. Total conservation easement area is 12.14 acres. Farm BMPs installed in December 2009 at the Northern Reach include 2,610 feet of cattle exclusion fencing, 1,958 feet of hog exclusion fencing, two troughs and water lines for cattle and two troughs and water lines for pigs. Farm BMPs at the Southern Reach consist of 683 feet of cattle exclusion fencing.

Patches of invasive exotic weeds (mainly *Ligustrum sinense* and *Rosa multiflora*) along both reaches received herbicide treatments in August 2010 and again in May 2011. The Northern Reach (enhancement areas) received tree and shrub plantings in non-forested (former pasture) areas along Wells Creek south of Carl Noah Rd, and understory shrubs were planted beneath the forest canopy along UT3 where livestock had destroyed nearly all of the understory. Planting was done between Nov 2010 and Apr 2011, using existing plant communities along UT1 (Piedmont Alluvial Forest, Mesic Mixed Hardwood Forest, and Dry-Mesic Oak-Hickory Forest) as a reference for tree and shrub species selection (Schafale and Weakley 1990). Non-forested areas were planted at a density of 436 stems/acre with containerized stock. Areas with mature canopy were planted with understory shrubs to achieve 436 stems/acre total density of existing and planted vegetation. Stream banks alon UT3 were planted at a density of 681 stems/acre within 10 feet of the channel. Additional wetland shrubs and herbs were planted in a muddy hog-wallow area along UT3.

1.4. Project Success Criteria

Wells Creek #2 success criteria are based on vegetation survival, success of livestock exclusion, and invasive treatment success as evidenced by a visual assessment, and documented through permanent photo points.

Quantitative survival and growth data for planted woody stems are collected from two CVS monitoring plots established along Wells Creek in the Northern Reach (Figure 1.1). Following the 2003 USACE Stream Mitigation Guidelines, vegetation success in the riparian buffer will be based upon an average density of 320 stems per acre at the end of three years of monitoring. A tolerance of 10% mortality rate will be acceptable for year four (288 stems/acre) and year five (260 stems/acre) (USACE 2003).

2.0. Monitoring Results: 2014

2.1. Stream Conditions

No stream-bank instability problem or significant loss of riparian vegetation was observed along Wells Creek, UT1 or UT2 during the Apr and Oct 2014 site visits. These stream segments appeared unchanged from last year's observations. Several trees had blown down along the upper portion of UT3 during a storm sometime between Oct 2013 and Apr 2014, causing minor pattern adjustments to the upper stream channel in this area. The lower end of UT3 near its confluence with Wells Creek remains incised with steep and sparsely wooded banks, similar to its pre-project condition (as reported in previous years), but does not appear to have eroded further since the 2011 baseline report. The livestock exclusion fence in this area is close to the stream bank, which limits the potential for woody vegetation recovery along this bank segment.

2.2. Vegetation Conditions

CVS Plots: Both vegetation monitoring plots met the project success criteria for year 4, with an average density of 486 planted stems per acre. Native volunteer woody seedlings are abundant in both plots, and average density of planted plus native volunteer stems was 2084 stems per acre in 2014. Invasive *Lespedeza cuneata* is becoming abundant along the western edge of plot 2 and some adjacent enhancement areas, but is not widespread in the project area.

Enhancement Areas Beyond CVS Plots: Based on visual assessment of the former pasture areas along Wells Creek outside of the CVS plots, planted woody stem survival and native volunteer recruitment appears to be good throughout the enhancement area, despite dense growth of tall grasses and herbaceous weeds. Visual assessment of the understory enhancement area along UT3 revealed good to fair survival of the planted shrubs. Dense forest canopy may be limiting shrub growth rates. Some shrubs were presumably buried or crushed under fallen trees in late 2013 or early 2014, but the canopy gaps created may increase growth rates of the remaining shrubs (mainly buckeye, pawpaw, and spicebush). Invasive *Microstegium* grass is abundant along much of UT3 and near the confluence with Wells Creek. Volunteer tree seedlings are numerous in this area, especially green ash and sweetgum.

Preservation Areas: Portions of the Northern Reach along Wells Creek, including the segment north of Carl Noah Rd, have patches of multiflora rose (*Rosa multiflora*), Chinese privet (*Ligustrum sinense*), and Japanese honeysuckle (*Lonicera japonica*), despite herbicide treatments in 2010-2011. These species are abundant beyond the conservation easement, especially along adjacent roadsides and powerlines. The Southern Reach also has patches of invasive *Ligustrum* and *Rosa* both within and adjacent to the conservation easement, mainly at the upper and lower ends where these weeds are common along roadsides and pasture edges. Invasive species patches are mapped in the CCPV figures, and are unchanged since last year.

2.3. Conservation Easement Conditions

Wells Creek Main Stem (Northern Reach): At the two cattle crossings on Wells Creek south of Carl Noah Rd, the fencing wire remains disengaged from the fence posts in some areas, as noted in previous years reports. However, the crossing ends are blocked with electric wires so that cattle do not have access to the crossings except under controlled conditions. The downstream cattle crossing has a gap below the lower fence wire where Wells Creek flows under it (accessible only when an end wire is detatched), but there was no evidence of livestock taking advantage of this gap to access the conservation area. No livestock encroachment or damage inside the conservation areas along Wells Creek was evident. The Wells Creek preservation segment north of Carl Noah Rd is not fenced, but no livestock are kept adjacent to this area.

Wells Creek UT3 (Northern Reach): A storm during the winter of 2013-2014 knocked down numerous trees onto the easement fence, mainly along the upper portion of UT3 in the Northern Reach. All of the fence breaks had been repaired at the time of the Apr 2014 field visit, and no new fence damage was noted in Oct 2014. In Apr and Oct 2013 there was no further evidence of livestock encroachment in this area. The landowner has removed the hogs and now uses the adjacent pastures for cattle only.

Wells Creek UT1 & UT2 (Southern Reach): Livestock exclusion fencing along the northeast and southeast boundaries of the Southern Reach appeared to be intact in Apr and Oct 2014, and no livestock encroachment or damage inside the conservation area was evident. A gap under the fence is present where it crosses UT-2, but the existing fence appears adequate to exclude cattle. The fence segment previously broken by a fallen tree in 2013 was repaired in 2014. There is no fence along the roadside (Longest Acres Rd) or along the southwest easement boundary, which is bordered by forest.

3.0. References

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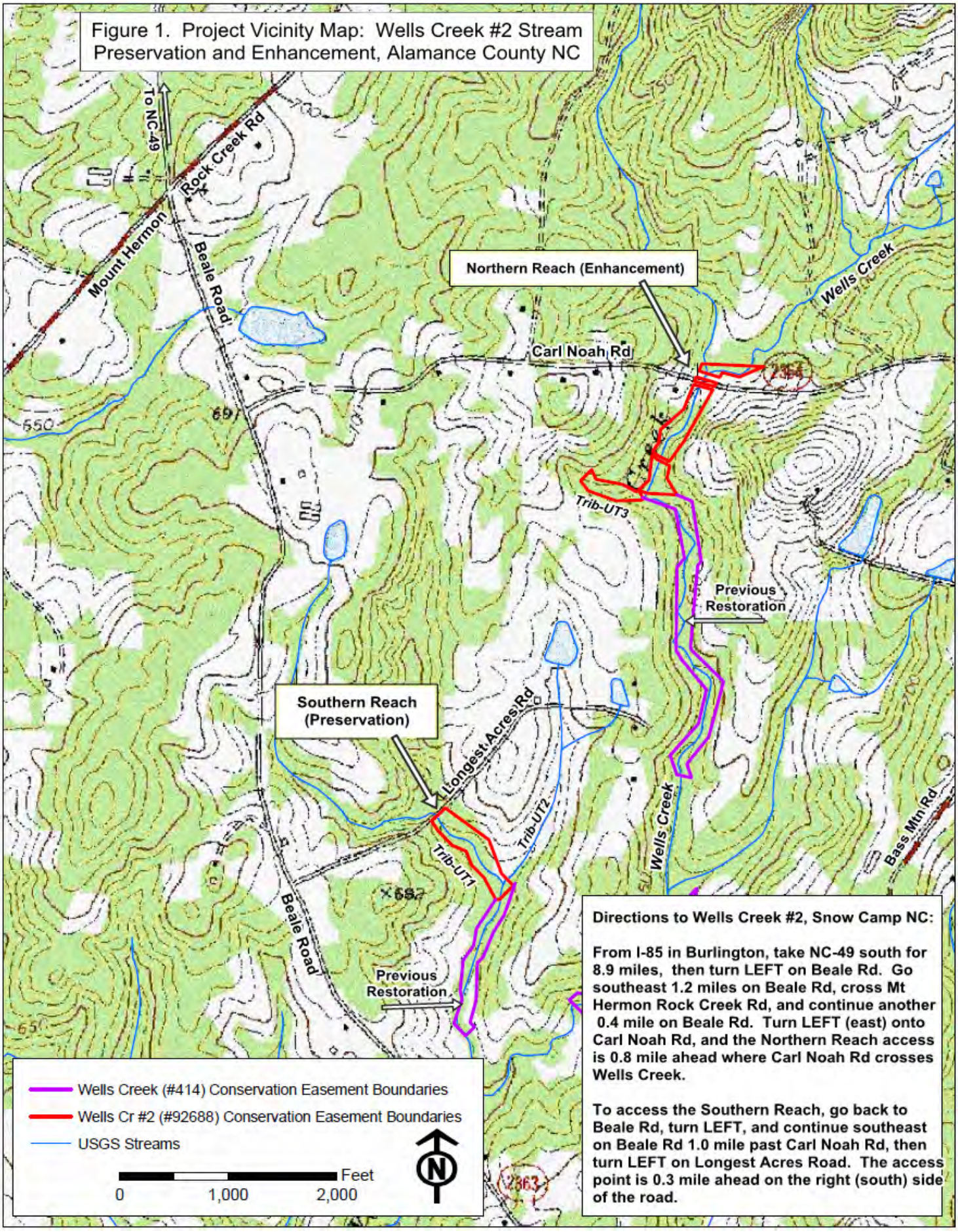


Figure 1. Project Vicinity Map: Wells Creek #2 Stream Preservation and Enhancement, Alamance County NC
To NC-49
Rock Creek Rd
Mount Hermon
Beale Road
Northern Reach (Enhancement)
Wells Creek
Carl Noah Rd
Trib-UT3
Previous Restoration
Southern Reach (Preservation)
Longest Acres Rd
Trib-UT2
Trib-UT1
Wells Creek
Bass Mtn Rd
Beale Road
Previous Restoration
Directions to Wells Creek #2, Snow Camp NC:
From I-85 in Burlington, take NC-49 south for 8.9 miles, then turn LEFT on Beale Rd. Go southeast 1.2 miles on Beale Rd, cross Mt Hermon Rock Creek Rd, and continue another 0.4 mile on Beale Rd. Turn LEFT (east) onto Carl Noah Rd, and the Northern Reach access is 0.8 mile ahead where Carl Noah Rd crosses Wells Creek.
To access the Southern Reach, go back to Beale Rd, turn LEFT, and continue southeast on Beale Rd 1.0 mile past Carl Noah Rd, then turn LEFT on Longest Acres Road. The access point is 0.3 mile ahead on the right (south) side of the road.
Wells Creek (#414) Conservation Easement Boundaries
Wells Cr #2 (#92688) Conservation Easement Boundaries
USGS Streams
Feet
0
1,000
2,000
N

Table 1A. Project Components: Wells Creek #2 (EEP #92688)								
Project Reach ID	**Existing Length (ft)**	**Approach Level**	**Mitigation Length (ft)**	**Stationing[+]**	**Mitigat Ratio**	**Stream Mitigat Units**	**BMP Elements[1]**	**Comment**
Wells Creek - Preservation	438	P	438	00+00 to 04+38	5:1	87	CF, WS	Invasive vegetation treatment,
Wells Creek - Enhancement	1321	E2	1253*	04+98 to 18+19	2.5:1	501	CF, WS	Invasive vegetation treatment,
UT 3 - Enhancement	644	E2	644	00+00 to 06+44	2.5:1	258	CF, WS	Invasive vegetation treatment,
UT1 - Preservation	1130	P	1130	00+00 to 11+30	5:1	226	CF	Invasive vegetation treatment
UT2 - Preservation	48	P	48	00+00 to 00+48	5:1	10	CF	Invasive vegetation treatment

[1] = BR = Bioretention Cell; SF = Sand Filter; SW = Stormwater Wetland; WDP = Wet Detention Pond; O = Other; DDP = Dry Detention Pond; FS = Filter Strip; Grassed Swale = S; LS = Level Spreader; NI = Natural Infiltration Area, CF = Cattle Fencing; WS = Watering System; CH = Livestock Housing

[+] Stationing is based on stream length measurements in ArcGIS, upstream to downstream for each reach.

* Wells Creek enhancement reach mitigation excludes two cattle crossings and Carl Noah Road crossing.

Table 1B. Component Summations: Wells Creek #2 (EEP #92688)							
Restoration Level	Stream Length (ft)	Riparian Wetland (ac)		**Mitigation Length (ft)**	**Station[+]**	Buffer (acres)	BMP's
		Riverine	Non-Riverine				
Restoration							
Enhancement							
Enhancement I							
Enhancement II	1897						
Creation							
Preservation	1616						
HQ Preservat							
	3513						
MU Totals	**1082**						

Table 2. Project Activity and Reporting History
Wells Creek #2 (#92688) - Monitoring Year 4 (2014)

Elapsed Time Since Grading Complete: n/a
Elapsed Time Since Planting Complete: 4 years, 2 mo
Number of Reporting Years[1]: 4

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Permanent Conservation Easement Executed & Recorded	n/a	December 31, 2008
Cattle Exclusion Fencing & Livestock Watering System	n/a	December 2009
Final Design – Construction Plans	January 2010	April 2010
Planting	n/a	November 2010
Invasive Exotic Vegetation Treatments	January 2010	December 2010
MY0 As-built Survey & Baseline Report	May 2011	June 2011
Monitoring Year 1 Report	September 2011	September 2011
Monitoring Year 2 Report	September 2012	March 2013
Monitoring Year 3 Report	October 2013	November 2013
Monitoring Year 4 Report	October 2014	March 2015

* *Saururus cernuus* and *Lobelia cardinalis* planted within UT3 wetland seep in May 2011.

Table 3. Project Contacts

Wells Creek #2 (#92688) - Monitoring Year 3 (2013)

Designer	Robert J. Goldstein & Associates
	1221 Corporation Parkway, suite 100
	Raleigh, NC 27610
Design POC -	Gerald Pottern, Sean Doig, (919) 872-1174
Farm BMPs Design	Alamance County SWCD
	Burlington NC
POC -	Phil Ross, (336) 228-1753
Planting / Invasives Contractor	Habitat Assessment and Restoration Program
	301 McCullough Drive, 4th Floor
	Charlotte, NC 28262
POC -	Karri Blackmon, (704) 841-2841
Nursery Stock Suppliers	Cure Nursery, 919-542-6186
	Parks Seed, 800-845-3369
	Coastal Plain Conservation Nursery, 252-482-5707
	Habitat And Restoration Plants (HARP), 704-841-2841
Monitoring Firm	Robert J. Goldstein & Associates
	1221 Corporation Parkway, suite 100
	Raleigh, NC 27610
Monitoring POC -	Gerald Pottern, (919) 872-1174

Table 4. Project Attributes Wells Creek #2 -- EEP#92688		
Project County	Alamance	
Physiographic Region	Piedmont	
Ecoregion	Carolina Slate Belt	
Project River Basin	Cape Fear	
USGS HUC for Project (14 digit)	3030002-050050	
NCDWQ Sub-basin for Project	Cape Fear 03-06-04	
Within extent of EEP Watershed Plan?	2009 Cape Fear River Basin Restoration Priority Report	
WRC Hab Class (Warm, Cool, Cold)	Warm	
% of project easement fenced or demarcated	100%	
Beaver activity observed during design phase?	No	
Restoration Component Attribute Table		
	Preservation	Enhancement
Drainage area	377 acres	958 acres
Stream order	1	1
Restored length (feet)	n/a	n/a
Perennial or Intermittent	Perennial	Intermittent/Perennial
Watershed type (Rural, Urban, Developing etc.)	Rural	Rural
Watershed LULC Distribution (e.g.)		
Residential	4	4
Ag-Row Crop	2	0
Ag-Livestock	57	21
Forested	28	73
Etc.	9	2
Watershed impervious cover (%)	2	2
NCDWQ AU/Index number	16-28-1	16-28-1
NCDWQ classification	C-NSW	C-NSW
303d listed?	No	No
Upstream of a 303d listed segment?	No	No
Reasons for 303d listing or stressor	n'a	n/a
Total acreage of easement	4.62	7.52
Total vegetated acreage within the easement	4.62	6.07
Total planted acreage as part of the restoration	0	2.99 (including areas with existing overstory)
Rosgen classification of pre-existing	n/a	n/a
Rosgen classification of As-built	n/a	n/a
Valley type	n/a	n/a
Valley slope	n/a	n'a
Valley side slope range (e.g. 2-3.%)	n/a	n/a
Valley toe slope range (e.g. 2-3.%)	n/a	n/a
Cowardin classification	n/a	n/a
Trout waters designation	n/a	n/a
Species of concern, endangered etc.? (Y/N)	N	N
Dominant soil series and characteristics		
Series	Colfax	Colfax
Depth	65	65
Clay%	19	19
K	0.17	0.17
T	4	4

Use N/A for items that may not apply. Use "-" for items that are unavailable and "U" for items that are unknown

Appendix B. Visual Assessment Data

Figure 2.1.-2.2 Current Conditions Plan View
Table 5. Vegetation Condition Assessment
Figure 3.1-3.8 Permanent Stream Photopoints
Figure 4. Vegetation Monitoring Plot Photos

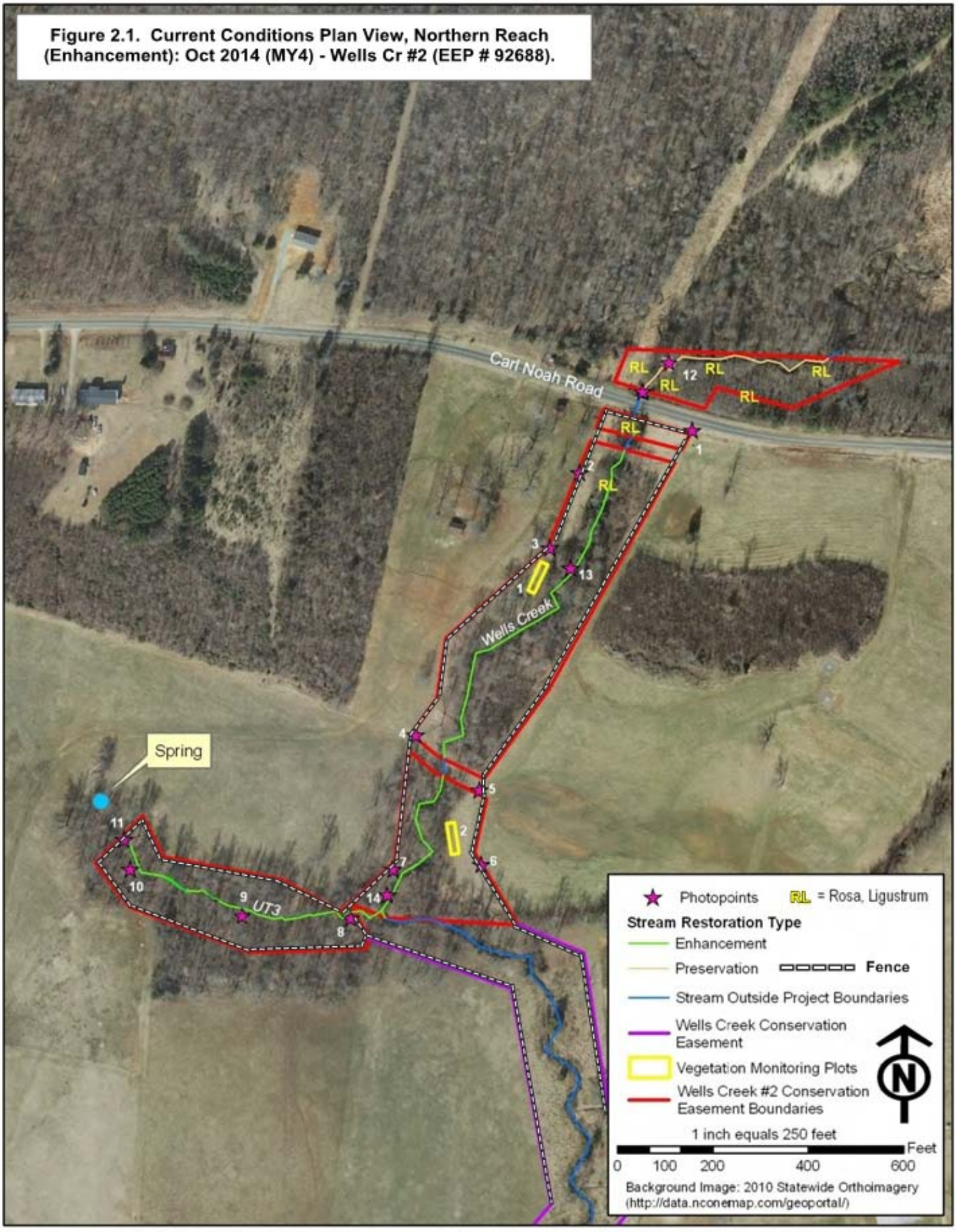


Figure 2.1. Current Conditions Plan View, Northern Reach (Enhancement): Oct 2014 (MY4) - Wells Cr #2 (EEP # 92688).
Carl Noah Road
Wells Creek
UT3
Spring
RL
Photopoints
RL = Rosa, Ligustrum
Stream Restoration Type
Enhancement
Preservation
Fence
Stream Outside Project Boundaries
Wells Creek Conservation Easement
Vegetation Monitoring Plots
Wells Creek #2 Conservation Easement Boundaries
N
1 inch equals 250 feet
Feet
0 100 200 400 600
Background Image: 2010 Statewide Orthoimagery (http://data.nconemap.com/geoportal/)

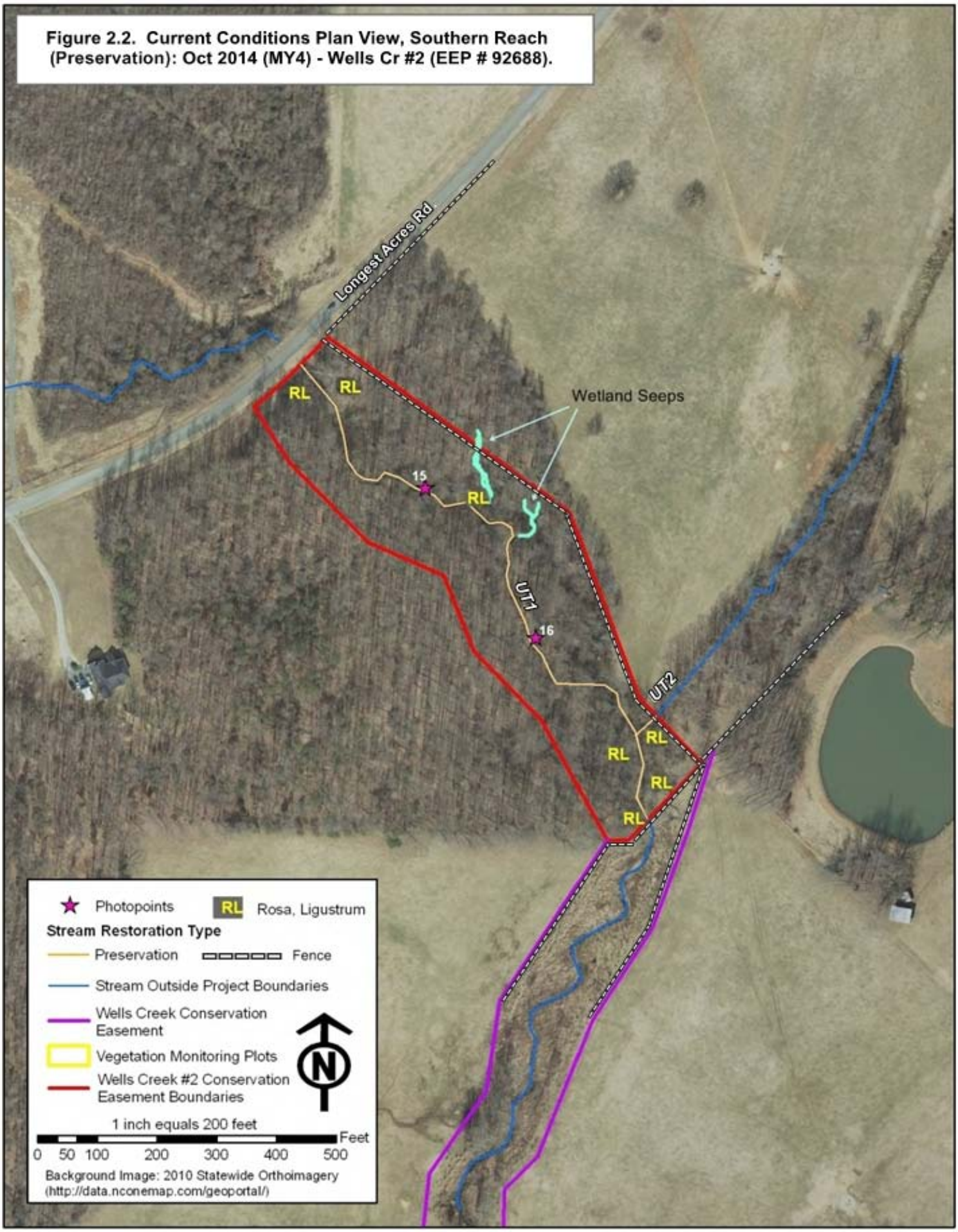


Figure 2.2. Current Conditions Plan View, Southern Reach (Preservation): Oct 2014 (MY4) - Wells Cr #2 (EEP # 92688).
Longest Acres Rd
Wetland Seeps
RL
RL
RL
RL
RL
RL
RL
15
16
UT1
UT2
Photopoints
RL Rosa, Ligustrum
Stream Restoration Type
Preservation
Fence
Stream Outside Project Boundaries
Wells Creek Conservation Easement
Vegetation Monitoring Plots
Wells Creek #2 Conservation Easement Boundaries
N
1 inch equals 200 feet
0 50 100 200 300 400 500 Feet
Background Image: 2010 Statewide Orthoimagery (http://data.nconemap.com/geoportal/)

Table 5. Vegetation Visual Assessment - Wells Creek #2 (#92688) - Monitoring Year 4

Planted Acreage[1]	**3.04**					
Vegetation Category	**Definitions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Planted Acreage**
1. Bare Areas	Very limited cover of both woody and herbaceous material.	0.1 acres	Pattern and Color	0	0.00	0.0%
2. Low Stem Density Areas	Woody stem densities clearly below target levels based on MY3, 4, or 5 stem count criteria.	0.1 acres	Pattern and Color	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	Pattern and Color	0	0.00	0.0%
			Cumulative Total	0	0.00	0.0%

Easement Acreage[2]	**12.14**					
Vegetation Category	**Definitions**	**Mapping Threshold**	**CCPV Depiction**	**Number of Polygons**	**Combined Acreage**	**% of Easement Acreage**
4. Invasive Areas of Concern[4]	Areas or **points** (if too small to render as polygons at map scale). **"RL" on ccpv**	1000 SF	Pattern and Color	~30 clumps	0.02	0.2%
5. Easement Encroachment Areas[3]	Areas or points (if too small to render as polygons at map scale).	none	Pattern and Color	0	0.00	0.0%

Figure 3.1. Permanent Photo Points - Wells Creek #2 - Monitoring Year 4 (2014) - Project #92688

PP #1 – Looking S from Carl Noah Rd, E of Wells Cr (09/16/09)

PP #1 – Looking S from Carl Noah Rd, E of Wells Cr (10/28/14)

PP #2 – Looking S along easement, W of Wells Cr (09/16/09)

PP #2 – Looking S along easement, W of Wells Cr (10/28/14)

Figure 3.2. Permanent Photo Points - Wells Creek #2 - Monitoring Year 4 (2014) - Project #92688

PP #3 – Looking SW along easement, W of Wells Cr (09/16/09)

PP #3 – Looking SW along easement, W of Wells Cr (10/28/14)

PP #4 – Looking East from easement toward Wells Cr (09/16/09)

PP #4 – Looking East from easement toward Wells Cr (10/28/14)

Figure 3.3. Permanent Photo Points - Wells Creek #2 - Monitoring Year 4 (2014) - Project #92688

PP #5 – Looking south along easement, E of Wells Cr (09/16/09)

PP #5 – Looking south along easement, E of Wells Cr (10/28/14)

PP #6 – Looking south from easement toward Wells Cr (09/16/09)

PP #6 – Looking south from easement toward Wells Cr (10/28/14)

Figure 3.4. Permanent Photo Points - Wells Creek #2 - Monitoring Year 4 (2014) - Project #92688

PP #7 – Looking South beside RBK Wells Cr (09/16/09)

PP #7 – Looking South beside RBK Wells Cr (10/28/14)

PP #8 – Looking up UT3 from lower end (09/16/09)

PP #8 – Looking up UT3 from lower end (10/28/14)

Figure 3.5. Permanent Photo Points - Wells Creek #2 - Monitoring Year 4 (2014) - Project #92688

PP #9 – Looking downstream (east) along UT3 (09/16/09)

PP #9 – Looking downstream (east) along UT3 (10/28/14)

PP #10 – Looking across trampled banks, upper UT3 (09/16/09)

PP #10 – Looking across trampled banks, upper UT3 (10/28/14)

Figure 3.6. Permanent Photo Points - Wells Creek #2 - Monitoring Year 4 (2014) - Project #92688

PP #11 – Looking downstream from UT3 Head (09/16/09)

PP #11 – Looking downstream from UT3 Head (10/28/14)

PP #12 – Wells Cr north of Carl Noah Rd, looking upstr (01/03/10)

PP #12 – Wells Cr north of Carl Noah Rd, looking upstr (10/28/14)

Figure 3.7. Permanent Photo Points - Wells Creek #2 - Monitoring Year 4 (2014) - Project #92688

PP #13 – Wells Creek South of Carl Noah Road (01/03/10)

PP #13 – Wells Creek South of Carl Noah Road (10/28/14)

PP #14 – Confluence of Wells Creek and UT3 (09/16/09)

PP #14 – Confluence of Wells Creek and UT3 (10/28/14)

Figure 3.8. Permanent Photo Points - Wells Creek #2 - Monitoring Year 4 (2014) - Project #92688

PP #15 – UT#1 Preservation Reach (01/03/10)

PP #15 – UT#1 Preservation Reach (10/12/14)

PP #16 – UT1 Preservation Reach (01/03/10)

PP #16 – UT1 Preservation Reach (10/12/14)

Figure 4.0. Vegetation Plot Photos - Wells Creek #2 - Monitoring Year 4 (2014) - Project #92688

VegPlot-1 (27 April 2011)

VegPlot-1 (28 October 2014)

VegPlot-2 (27 April 2011)

VegPlot-2 (28 October 2014)

Appendix C. Vegetation Plot Data

Table 6. CVS Vegetation Plot Mitigation Success Summary, Wells Cr #2 - MY4

Wells Creek #2 (#92688) -- Year 4 (Oct 2014)							
Vegetation Plot Summary Information (per acre)							
Plot #	**Riparian Buffer Stems[1]**	**Stream/ Wetland Stems[2]**	**Live Stakes**	**Invasives**	**Volunteers[3]**	**Total[4]**	**Unknown Growth Form**
0001	n/a	15	0	0	38	**53**	0
0002	n/a	9	0	0	41	**50**	0

Wetland/Stream Vegetation Totals (per acre)				
Plot #	**Stream/ Wetland Stems[2]**	**Volunteers[3]**	**Total[4]**	**Success Criteria Met?**
0001	607	1538	2145	Yes
0002	364	1659	2023	Yes
Project Avg	**486**	**1599**	**2084**	**Yes**

Riparian Buffer Vegetation Totals (per acre)		
Plot #	**Riparian Buffer Stems[1]**	**Success Criteria Met?**
0001	n/a	n/a
0002	n/a	n/a
Project Avg	**n/a**	**n/a**

Stem Class characteristics

[1]**Buffer Stems** = Native planted hardwood trees. Does NOT include pines, shrubs, or vines.

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

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

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

Color Key for Density Success

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

Table 7. CVS Vegetation Plot Stem Density by Species and Year, Wells Cr #2 - MY4

			Current Plot Data (MY4 2014)						Annual Means 2011 to 2014														
			E92688-SD-0001			E92688-SD-0002			MY4 (2014)			MY3 (2013)			MY2 (2012)			MY1 (2011)			MY0 (2011)		
Scientific Name	Common Name	Growth Form	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
Alnus serrulata	hazel alder	Shrub	3	3	3				3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
Baccharis halimifolia	eastern baccharis	Shrub												2			2			1			1
Carpinus caroliniana	American hornbeam	Tree	1	1	1			6	1	1	7	1	1	6	1	1	6						7
Carya	hickory	Tree						4			4												
Carya alba	mockernut hickory	Tree												5			5						
Carya cordiformis	bitternut hickory	Tree																		5			6
Celtis laevigata	sugarberry	Tree																1	1	1	1	1	1
Cercis canadensis	eastern redbud	Tree			1						1												
Diospyros virginiana	common persimmon	Tree				1	1	1	1	1	1	1	1	1	1	1	1				1	1	1
Fraxinus pennsylvanica	green ash	Tree			5			4			9	1	1	8	1	1	8	1	1	3	2	2	4
Juglans nigra	black walnut	Tree			4						4			2			2			3			1
Juniperus virginiana	eastern redcedar	Tree						5			5												
Lindera benzoin	northern spicebush	Shrub	2	2	4	1	1	1	3	3	5	5	5	5	6	6	6	6	6	6	6	6	6
Liquidambar styraciflua	sweetgum	Tree						12			12			12			12			4			2
Liriodendron tulipifera	tuliptree	Tree			24	3	3	9	3	3	33	3	3	25	3	3	25	3	3	15	3	3	3
Nyssa sylvatica	blackgum	Tree	3	3	3				3	3	3	3	3	3	3	3	3	4	4	4	3	3	3
Platanus occidentalis	American sycamore	Tree	1	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Prunus serotina	black cherry	Tree												1			1						1
Quercus michauxii	swamp chestnut oak	Tree	1	1	1	2	2	2	3	3	3	3	3	3	3	3	3	5	5	5	5	5	5
Quercus rubra	northern red oak	Tree	1	1	1				1	1	1	1	1	1	2	2	2	1	1	1	2	2	3
Quercus stellata	post oak	Tree				1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			
Quercus velutina	black oak	Tree				1	1	1	1	1	1	1	1	1	1	1	1						
Rhus copallinum	flameleaf sumac	shrub						4			4			2			2			1			
Ulmus americana	American elm	Tree			2						2			2			2			1			
Viburnum dentatum	southern arrowwood	Shrub	3	3	3				3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	Stem count		15	15	53	9	9	50	24	24	103	27	27	87	29	29	89	29	29	58	30	30	52
	size (ares)		1.00			1.00			2.00			2.00			2.00			2.00			2.00		
	size (ACRES)		0.0247			0.0247			0.0494			0.0494			0.0494			0.0494			0.0494		
	Species count		8	8	13	6	6	12	12	12	20	13	13	20	13	13	20	11	11	17	11	11	18
	Stems per ACRE		607	607	2145	364	364	2023	486	486	2084	546	546	1760	587	587	1801	587	587	1174	607	607	1052

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%

Plot (continued): E92688-SD-0001

ID	Species	map char	source	X (m)	Y (m)	Last Year's Data ddh (mm)	Last Year's Data Height (cm)	Last Year's Data DBH (cm)	Notes*	THIS YEAR'S DATA ddh (mm)	THIS YEAR'S DATA Height (cm)	THIS YEAR'S DATA DBH (cm)	THIS YEAR'S DATA Re-sprout	Vigor*	Damage*	Notes

Vegetation Monitoring Data (VMD) Datasheet — **Please fill in any missing data and correct any errors.**

Plot E92688-SD-0001

VMD Year (1-5): 4 Date: 28 / OCT / 14 - / /

Taxonomic Standard:

Taxonomic Standard DATE:

Latitude or UTM-N: (dec.deg. or m) 791407.026 Datum: NAD83/WGS84

Longitude or UTM-E: 1867889.853 UTM Zone: 17

Coordinate Accuracy (m): X-Axis bearing (deg): 30

Plot Dimensions: X: 20 Y: 5 ☐ Plot has reverse orientation for X and Y axis (Y is 90 degrees to the right of X

Party: G Pottern Role:

Date last planted:

New planting date m/yy? /

☐ Check box if plot was not sampled, specify reason below

Notes:

ID	Species Name	Map char	Source*	X 0.1m	Y 0.1m	Last Year's Data Height 1cm*	Last Year's Data DBH 1 cm	Notes*	THIS YEAR'S DATA 2014 Height 1cm*	DBH 1 cm	Re-sprout	Vigor*	Damage*	Notes
1	Viburnum dentatum	(a)	P	1.4	4.0	56.0		☐	45		☐	1		
2	Alnus serrulata	(k)	P	4.1	3.3	50.0		☐	30		☐	2		leader dead
3	Quercus rubra	(j)	P	3.4	0.1	47.0		☑	29		☐	1		leader dead
4	Nyssa sylvatica	(l)	P	7.1	1.9	100.0		☐	68		☐	2		
5	Nyssa sylvatica	(m)	P	7.9	0.2	73.0		☐	67		☐	2		
6	Platanus occidentalis	(n)	P	9.8	1.1	205.0	0.7	☐	130		☐	2		leader dead
7	Viburnum dentatum	(o)	P	9.9	4.3	57.0		☐	61		☐	2		
8	Lindera benzoin	(b)	P	12.0	2.0	100.0		☐	120		☐	3		
9	Alnus serrulata	(c)	P	12.8	4.3	95.0		☑	89		☐	2		
10	Quercus michauxii	(d)	P	14.4	2.0	91.0		☑	87		☐	3		
11	Lindera benzoin	(e)	P	15.6	0.5	94.0		☐	115		☐	3		
13	Alnus serrulata	(f)	P	17.1	4.0	45.0		☑	38		☐	2		
14	Nyssa sylvatica	(g)	P	18.0	0.2	98.0		☐	92		☐	2		
15	Viburnum dentatum	(i)	P	18.9	2.8	40.0		☑	31		☐	2		
16	Carpinus caroliniana	(h)	P	18.7	4.8	81.0		☐	75		☐	2		

 # stems: 15

New Stems, not included last year, but are obviously planted. If more space needed, use blank PWS (Planted Woody Stems) Form:

Species Name	Source*	X (m)	Y (m)	Height 1 cm*	DBH 1 cm	Vigor*	Damage*	Notes

***Notes by ID:**

3-yr1: top broken off | yr3: lead dead
☐ 9-top broken off
☐ 10-lead dead
☐ 13-leader broken
☐ 15-top broken off

*SOURCE: Tr=Transplant, L=Live stake, B=Ball and burlap, P=Potted, Tu=Tubling, R=bare Root, M=Mechanically, U=Unknown

*VIGOR: 4=excellent, 3=good, 2=fair, 1=unlikely to survive year, 0=dead, M=missing.

*DAMAGE: REMoval, CUT, MOWing, BEAVer, DEER, RODents, INSects, GAME, LIVESTock, Other/Unknown ANIMal, Human TRAMpled, Site Too WET, Site Too DRY, FLOOD, DROUght, STORM, HURRicane, DISeased, VINE Strangulation, UNKNown, specify other.

*HEIGHT PRECISION drops to 10cm if >2.5m and 50cm if >4m.

Printed in the CVS-EEP Entry Tool ver. 2.3.1

Plot (continued): E92688-SD-0001

ID	Species	map char	source	X (m)	Y (m)	Last Year's Data ddh (mm)	Height (cm)	DBH (cm)	Notes*	THIS YEAR'S DATA 2014 ddh (mm)	Height (cm)	DBH (cm)	Re-sprout	Vigor*	Damage*	Notes

Natural Woody Stems - tallied by species

Explanation of cut-off & subsampling**:

Height Cut-Off (All stems shorter than this are ignored. If >10cm, explain why to the right.): ☐ 10cm ☐ 50cm ☐ 100cm ☐ 137cm

Species Name	☑ c	Seedlings — Height Classes: Sub-Seed	10 cm-50 cm	50 cm-100 cm	100 cm-137 cm	Saplings — DBH: Sub-Sapl	0-1 cm	1-2.5	Trees — DBH: 2.5-	5-	=10 (write DBH)
Frax penn		___	3	2		___					
Lirio tulip		___	18	6		___					
Juglans nigra		___	2	1	1	___					
Ulmus amer		___	2			___					
Lindera benz		___	2			___					
Cercis canad		___	1			___					
		___				___					

**Required if cut-off >10cm or subsample ? 100%.

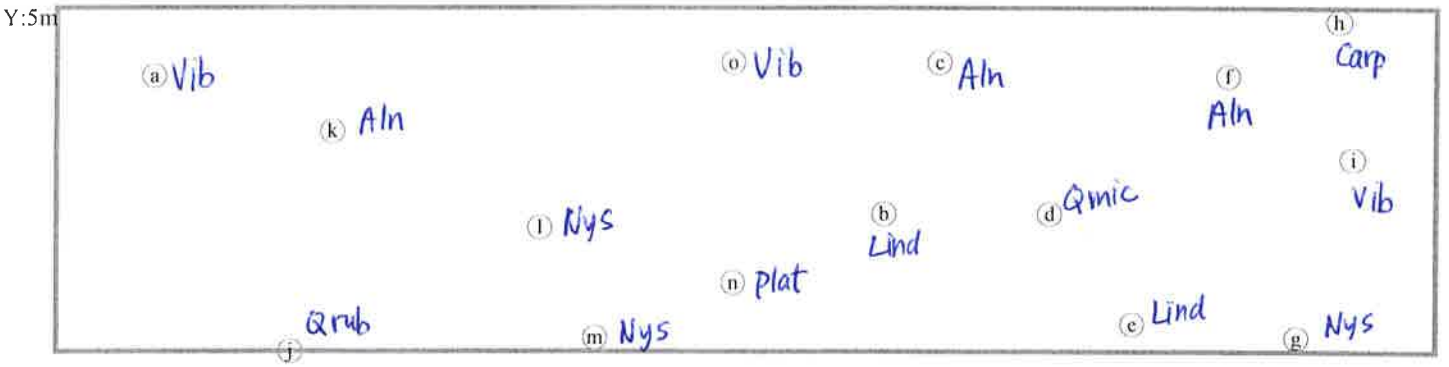
●1 ●2 ●3 ●4 ●5 ●6 ●7 ●8 ●9 ●10

Form WS2, ver 9.1

Map of stems on plot E92688-SD-0001

X-axis: 30° N

 # stems: 15
map size: LARGE



dense grasses, solidago, eupatorium

Creek

*SOURCE: Tr=Transplant, L=Live stake, B=Ball and burlap, P=Potted, Tu=Tubling, R=bare Root, M=Mechanically, U=Unknown

*VIGOR: 4=excellent, 3=good, 2=fair, 1=unlikely to survive year, 0=dead, M=missing.

*DAMAGE: REMoval, CUT, MOWing, BEAVer, DEER, RODents, INSects, GAME, LIVESTock, Other/Unknown ANIMal, Human TRAMpled, Site Too WET, Site Too DRY, FLOOD, DROUght, STORM, HURRicane, DISeased, VINE Strangulation, UNKNown, specify other.

*HEIGHT PRECISION drops to 10cm if >2.5m and 50cm if >4m.

Vegetation Monitoring Data (VMD) Datasheet **Please fill in any missing data and correct any errors.**

Plot E92688-SD-0002

VMD Year (1-5): 4 | Date: 28/OCT/14 - / /

Taxonomic Standard:

Taxonomic Standard DATE:

Latitude or UTM-N: (dec.deg. or m) 790858.058 | Datum: NAD83/WGS84

Longitude or UTM-E: 1867733.181 | UTM Zone: 17

Coordinate Accuracy (m): | X-Axis bearing (deg): 345

Plot Dimensions: X: 20 | Y: 5 | Plot has reverse orientation for X and Y axis (Y is 90 degrees to the right of X

Party: G. POTTERN | Role:

Date last planted:

New planting date m/yy? /

Check box if plot was not sampled, specify reason below

Notes:

ID	Species Name	Map char	Source*	X 0.1m	Y 0.1m	Last Year's Data Height 1cm*	Last Year's Data DBH 1 cm	Notes*	THIS YEAR'S DATA 2014 Height 1cm*	DBH 1 cm	Re-sprout	Vigor*	Damage*	Notes
18	Quercus michauxii	(a)	P	0.2	1.5	260.0	1.3	☐	250	1.8	☐	3		
20	Quercus velutina	(l)	P	7.2	4.2	153.0	0.4	☑	167	0.6	☐	3		
21	Lindera benzoin	(k)	P	7.2	2.4	30.0		☑	—		☐	M		missing
22	Quercus michauxii	(m)	P	9.5	1.4	56.0		☑	67		☐	2		
23	Liriodendron tulipifera	(i)	P	2.5	1.1	112.0	*DBH?*	☐	195	1.1	☐	3		
24	Lindera benzoin	(c)	P	11.9	1.5	57.0		☑	—		☐	M		missing
25	Liriodendron tulipifera	(d)	P	13.4	1.9	142.0	0.5	☐	195	0.7	☐	3		
26	Liriodendron tulipifera	(g)	P	17.0	1.0	255.0	1.6	☐	300	2.0	☐	3		
27	Quercus stellata	(h)	P	18.6	1.9	230.0	1.8	☑	230	2.1	☐	3		
28	Lindera benzoin	(e)	P	16.7	2.3	44.0		☑	—		☐	M	tree fall	missing
29	Fraxinus pennsylvanica	(f)	P	16.9	4.7	56.0		☑	—		☐	M	tree fall	missing
30	Lindera benzoin	(b)	P	10.8	4.5	*Missing*		☑	53		☐	1		
119	Diospyros virginiana	(j)	P	6.7	3.9	70.0		☐	70		☐	2		

 # stems: 13

New Stems, not included last year, but are obviously planted. If more space needed, use blank PWS (Planted Woody Stems) Form:

Species Name	Source*	X (m)	Y (m)	Height 1 cm*	DBH 1 cm	Vigor*	Damage*	Notes

***Notes by ID:**

20-confirm species may be vol?
21-yr0: confirm | yr2: resprout
22-yr1: top dead | yr3: lead dead
24-yr0: confirm | yr2: resprout
27-galls
28-yr0: confirm | yr1: herbaceous are outcompeting plant | yr2: leader died | yr3: lead dead
29-yr2: leader died | yr3: lead dead
30-yr2: leader died | yr3: missing

*SOURCE: Tr=Transplant, L=Live stake, B=Ball and burlap, P=Potted, Tu=Tubling, R=bare Root, M=Mechanically, U=Unknown

*VIGOR: 4=excellent, 3=good, 2=fair, 1=unlikely to survive year, 0=dead, M=missing.

*DAMAGE: REMoval, CUT, MOWing, BEAVer, DEER, RODents, INSects, GAME, LIVESTock, Other/Unknown ANIMal, Human TRAMpled, Site Too WET, Site Too DRY, FLOOD, DROUght, STORM, HURRicane, DISeased, VINE Strangulation, UNKNown, specify other.

*HEIGHT PRECISION drops to 10cm if >2.5m and 50cm if >4m.

Plot (continued): E92688-SD-0002

ID	Species	map char	source	X (m)	Y (m)	Last Year's Data ddh (mm)	Last Year's Data Height (cm)	Last Year's Data DBH (cm)	Notes*	THIS YEAR'S DATA OCT 2014 ddh (mm)	Height (cm)	DBH (cm)	Re-sprout	Vigor*	Damage*	Notes

Natural Woody Stems - tallied by species

Explanation of cut-off & subsampling**:

Height Cut-Off (All stems shorter than this are ignored. If >10cm, explain why to the right.): ☐ 10cm ☐ 50cm ☐ 100cm ☐ 137cm

Species Name	☑ c	Seedlings — Height Classes: Sub-Seed	10 cm-50 cm	50 cm-100 cm	100 cm-137 cm	Saplings — DBH: Sub-Sapl	0-1 cm	1-2.5	Trees — DBH: 2.5-	5-	=10 (write DBH)
Carpinus carol		___	2	1	2	___					
Carya		___		3	1	___					
Bacchanis		___				___	1				
Liquid styra		___	4	2	3	___	2	1	1		
Lirio tulip		___	2	2	1	___	1				
Junip virgin		___		3	1	___	1				
Rhus copal		___		2	1	___	1				

**Required if cut-off >10cm or subsample ? 100%.

FRAX PENN (2) 10-50, (2) 50-100

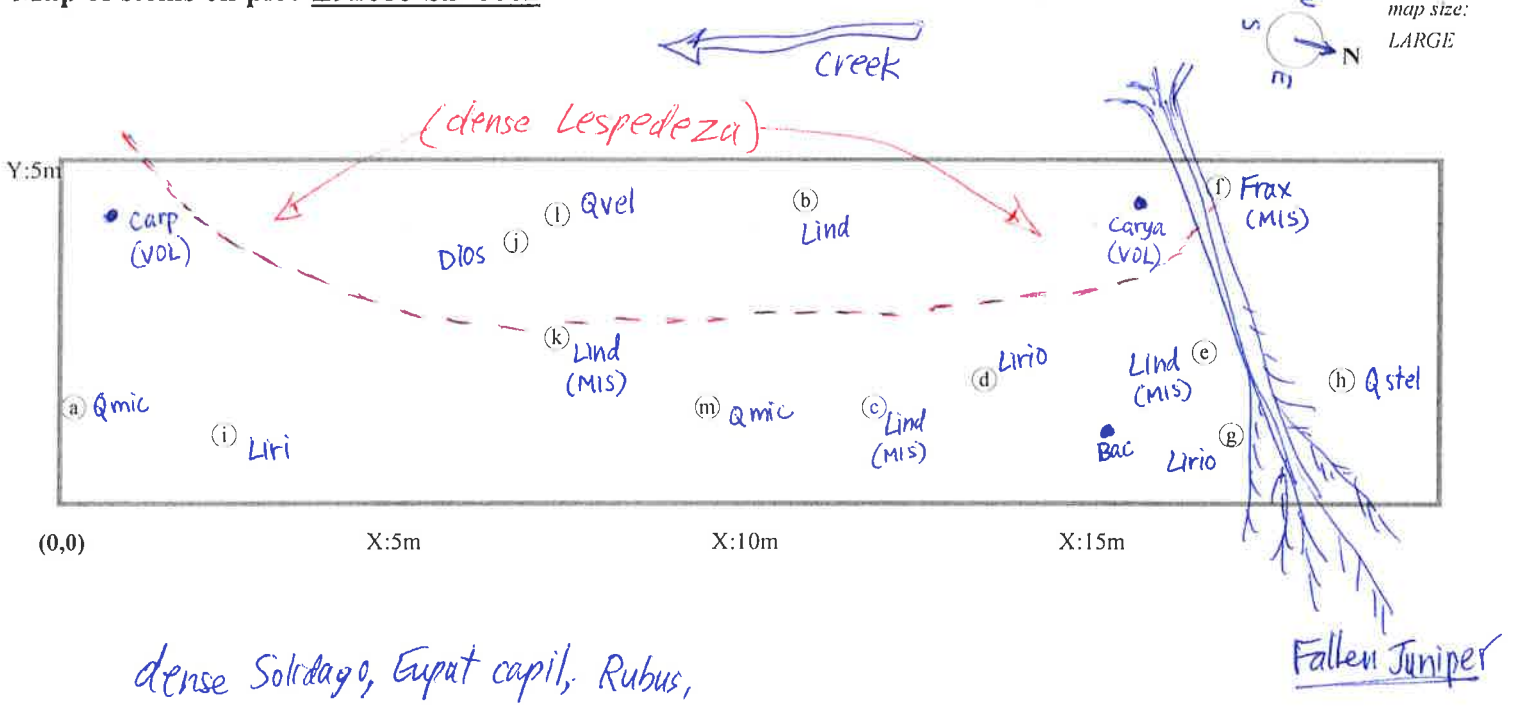
●1 ●2 ●3 ●●4 ●●5 ●●6 ●●7 ●●8 ●●9 ●●10

Form WS2, ver 9.1

Map of stems on plot E92688-SD-0002

X-axis: 345°

stems: 13
map size: LARGE



dense Solidago, Eupat capil, Rubus, Lespedeza cune on west side.

*SOURCE: Tr=Transplant, L=Live stake, B=Ball and burlap, P=Potted, Tu=Tubling, R=bare Root, M=Mechanically, U=Unknown

*VIGOR: 4=excellent, 3=good, 2=fair, 1=unlikely to survive year, 0=dead, M=missing.

*DAMAGE: REMoval, CUT, MOWing, BEAVer, DEER, RODents, INSects, GAME, LIVESTock, Other/Unknown ANIMal, Human TRAMpled, Site Too WET, Site Too DRY, FLOOD, DROUght, STORM, HURRicane, DISeased, VINE Strangulation, UNKNown, specify other.

*HEIGHT PRECISION drops to 10cm if >2.5m and 50cm if >4m.