Moore Property
Monitoring Report
FINAL
Year 2 (2012)

Johnston County, North Carolina

USGS HUC: 03020201

EEP Project ID #725

EEP Project Manager: Jessica Kemp

Submitted to:

NCDENR-Ecosystem Enhancement Program
1652 Mail Service Center
Raleigh, North Carolina 27699-1652

Submitted February 2013

Executive Summary

General

The project site is located in the USGS Hydrologic Unit Code 03020201. In 2003, the restoration of the site was initiated by the North Carolina Department of Transportation (NCDOT), and the property owner (Michael Todd Moore) conveyed an 84.2 acre conservation easement in perpetuity to NCDOT in March 2003. NCDOT conducted a Mitigation Feasibility in May 2003, followed by a Mitigation Plan in January 2005.

Upon completion of the Mitigation Plan, the project was transitioned to the North Carolina Ecosystem Enhancement Program (EEP). Construction Plans were prepared by Kimley-Horn and Associates, Inc. (KHA) in March 2009, and Environmental Quality Resources, LLC (EQR) completed construction of the project in July 2011. During this time, in 2010, the property was conveyed from Mr. Moore, to Mr. Blackmon.

The primary goals for the Site were to restore wetland hydrology and an appropriate water table hydroperiod of the floodplain wetland (i.e. elevated water table levels and longer duration of saturation of the upper soil surface during the growing season) through the removal of drainage ditches and field crowns; re-vegetation of species to establish the native wetland, upland, and riparian vegetation communities; provide habitat protection for federally protected species in Swift Creek through the establishment of a permanent conservation easement along the west bank of Swift Creek through the project area; generally improve water quality and flood storage capacity functions within the restoration area by providing longer residence time and filtering for runoff through the wetland area prior to entering Swift Creek; and minimize permanent open water habitat to reduce avian hazards for the adjacent airport. These goals were accomplished through the following objectives:

- Re-graded the Site to remove the field crowns and drainage ditch system.
- Redistributed topsoil for wetland vegetation establishment.
- Planted riparian buffer and wetland vegetation to restore the area back to natural riparian floodplain and wetland communities.

The conservation area for riparian buffer along Swift Creek is 200 feet wide and measures from the top of the stream bank within the project area. The Site also contains two (2) distinct areas with two different primary hydrologic inputs. The eastern area nearest to Swift Creek (WED), is a likely historic remnant of Swift Creek and is now a wetter depression in the floodplain. The primary hydrologic inputs for this area will be backwater affect from Swift Creek and precipitation. The western area (TOM) is located further from Swift Creek along the toe of slope of the floodplain and receives hydrologic inputs from Swift Creek and runoff from the adjacent watershed area west of the Site (approximately 0.2 square miles). The following table lists the different assets included in the Site's restoration.

Project Asset Table		
Project Asset	Restoration Acreage	Mitigation Ratio
Riparian Wetland	51.5	1:1
Riparian Buffer Restoration	5.7	1:1

KHA performed wetland monitoring in the fall of 2012 for this Year 2 Monitoring Report with site visits occurring on October 3, October 5, and November 19, 2012. Site monitoring field work included Carolina Vegetation Survey (CVS) level 2 assessment, groundwater well data collection, and visual assessment of the vegetation and wetland restoration components of the project. The following table details the rainfall by month for the site for the 2012 monitoring year.

Rainfall by Month for 2012 Monitoring Year (Year 2)							
Month	**Year**	**Rainfall* (in)**	**Average Rainfall** (in)**	**Month**	**Year**	**Rainfall* (in)**	**Average Rainfall** (in)**
November	2011	3.25	3.14	May	2012	12.03	3.76
December	2011	1.25	3.15	June	2012	1.51	3.74
January	2012	2.23	4.17	July	2012	15.74	5.04
February	2012	3.54	3.66	August	2012	3.93	4.56
March	2012	6.49	4.23	September	2012	6.80	4.35
April	2012	3.30	3.00	October	2012	2.15	3.14
Total for Monitoring Year = 62.22 inches							
*Data from station CLA2 in Clayton, NC (5 mi. NW of site)							
**Historical period of record ranges from 1971-2000							

Summary information/data related to the occurrence of items such as encroachment and statistics related to performance of various project and monitoring elements can be found in the table and figures in the report appendices. Narrative background and supporting information is provided in the 2011 As-Built and Baseline Monitoring Report and in the 2008 Restoration Plan documents available on EEP's website (www.nceep.net). All raw data supporting the tables and figures in the appendices is available from EEP upon request.

Hydrology

The restored wetland area was visually assessed and wetland gauge data was downloaded and assessed as part of the Year 2 monitoring. The downloaded wetland gauge data is shown graphically against local precipitation data in Appendix E for monitoring locations shown in the Current Conditions Plan View (CCPV). As described in the 2008 Restoration Plan, success of the restoration of wetland hydrology will be determined by meeting U.S. Army Corps of Engineers (USACE) minimum criteria and providing water table at or near the surface consistent with frequency and duration of reference wetlands. For year's one (1) through three (3), minimum successful wetland hydrology is defined as less than or equal to 50% deviation in sustained water table levels near the surface compared to the reference wetlands. For year four (4) and beyond until the minimum success criteria is met, successful wetland hydrology is defined as less than or equal to 20% deviation in sustained water table levels near the surface

compared to the reference wetlands. The hydroperiod of the reference and site wetlands will be measured using groundwater gauges that record the water table elevation near the ground surface on a daily basis. The following observations were made regarding the hydrologic conditions during the Year 2 Monitoring site visit:

- While 2012 received above average rainfall (62" recorded against an annual average of 46"), the site did not experience any overbank floodwaters from Swift Creek this monitoring year. Therefore, hydrology for the site was supported by groundwater seepage and overland flow from the adjacent uplands, as well as by the above average rainfall.

- Ponded water was observed in lower elevations of the site at various times of the year during visual inspections and gauge data download field visits. The surface water that was observed was likely due to recent rainstorm events before the field visits. This indicates that water is remaining on the site for extended periods after significant rainfall events.

- The wetland appears to be trending towards the design goals. The site was observed at the end of the growing season (beginning of the dormant season) and the site hydrology and vegetation community appeared to be functioning as intended.

- The crest gauge located in the outlet ditch for the wetland recorded one bankfull event in Swift Creek in the monitoring year (Appendix B, Photo WP1). It should be noted that the crest gauge was installed so that the bottom of the gauge was at the same elevation as the bankfull indicators located along the outlet ditch. While one bankfull event occurred in Swift Creek and the outlet ditch, it does not appear that the site received any overbank floodwaters from Swift Creek this monitoring year as previously mentioned.

- A US Geological Survey ambient water quality monitoring station is located approximately 6 miles upstream on Swift Creek at Barber Mill Road, in Clayton, NC (USGS 0208773375). During this monitoring year, the peak readings on the gage on Swift Creek were 5.03' in the spring (4/22/2012) and 3.16' in the fall (10/1/2012). The peak two-year median daily statistics for the same periods are much higher however. April has typically seen a peak flow of over 7', and October has recorded a median daily value over 6'. This indicates that while Swift Creek did have high flow events, they were lower than the flows experienced in previous years, and as stated above, peak flow events occurring in Swift Creek this monitoring year were not high enough to flood the site.

Per the Natural Resource Conservation Service (NRCS) Johnston County Soil Survey, the growing season in Johnston County is from March 21 until November 16 (241 total days). Eleven (11) of the sixteen (16) groundwater gauges indicate that the wetland is meeting the minimum success wetland hydrology for the site. The groundwater gauges that did not meet the minimum success criteria are located adjacent to upland areas, so marginal wetland hydrology at these locations would be expected if rainfall levels were lower and/or the site doesn't receive and overbank flooding from Swift Creek. (see Tables 13a and 13b for more detail).

Vegetation

The minimum success criteria has been established by EEP to verify that the re-established wetland and riparian buffer vegetation includes an appropriate species composition for the target wetland community type. Also the minimum success criteria includes the density and growth of characteristic forest species. For wetlands, a minimum mean density of 260 woody stems (planted and volunteer stems) per acre must be surviving for five (5) years after initial planting, and an interim success criteria of 320 stem/acre Year 3. For riparian buffers, a minimum mean density of 320 characteristic trees species (planted stems only) per acre must be surviving for five (5) years after initial planting. These minimum requirements are according to the NCDENR DWQ Administrative Code 15A NCAC 02B.0242 (Neuse Buffer Basin, Mitigation Program for Protection and Maintenance of Existing Riparian Buffers). This site was instituted prior to October 2007 and, therefore, will generate Riparian Buffer Restoration credit within the conservation easement where planted hardwood stem density requirements are met AND there is a minimum of 50' and a maximum of 200' from the top of bank of Swift Creek. Herbaceous vegetation will be assessed visually during the initial assessment for ground cover and target species. Supplemental plantings will be performed as needed to achieve the vegetation success criteria.

During the monitoring process, KHA conducted a CVS Level 2 assessment of sixteen (16) vegetation plots and a visual assessment of the vegetation community. Refer to the Appendices B and C of this report for the collected vegetation data and assessment summary data. The following observations were made regarding the vegetation condition during the Year 2 Monitoring site visit on October 3 and October 5, 2012:

- Currently two (2) (VQ-12 and VQ-16) of the four (4) riparian vegetation plots (VQ-11, VQ-12, VQ-14, and VQ-16) are meeting the minimum success criteria of 320 stems/acre.
- Additionally, four (4) (VQ-4, VQ-5, VQ-6, VQ-8, and VQ-13) of the twelve (12) wetland vegetation plots are meeting the minimum success criteria of 320 woody stems/acre.
- Of the eight (8) vegetation plots that are not meeting the minimum success criteria, none are within 50 stems/acre of meeting the 320 stem/acre criteria. From visual observations, the plots that are not meeting the vegetation success criteria are generally dominated by herbaceous vegetation. Areas around these plots do include natural propagation of native woody species (i.e., Red Maple, Sweetgum, and Loblolly Pine).
- As shown on the Current Conditions Plan View, cattails (*Typha latifolia*) have begun to establish in the wetland swale, in the historic agricultural ditch locations, and in the wetland seep (Appendix B, Photo WP2).
- Lespedeza (*Lespedeza cantata)* is established in the southwestern portion of the site, between vegetation plots 8 and 9.
- Dog fennel (*Eupatorium capillifolium)* is established throughout the upland areas of the site, and is propagating to the wetland areas, which is an indicator that the site has not been significantly flooded this monitoring year. Vegetation plot 16 is dominated by dog fennel, and multiple plots on the west side of the upland area have significant dog fennel populations established.

- The herbaceous vegetation has vigorously propagated throughout the project site except for the previously mentioned minor areas. Upon inspection, it appeared that most of the herbaceous vegetation was planted as part of the temporary or permanent seed mix, except for the invasive species encountered on site.
- At this time, DWQ has not set an interim year criteria for riparian buffer restoration areas. However, a plot that only has 320 stems/acre in Year 1 will not likely meet the Year 5 success criteria. Those plots should be closely watched and recommended as replant areas as necessary in future years.

Soils

Hydric soils were present throughout the site during the site assessment. There are indicators of ponding and saturation at the surface and infiltration rates are low for several days after rain events.

References

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. United States Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.
LeGrand, H.E. and S.P. Hall.

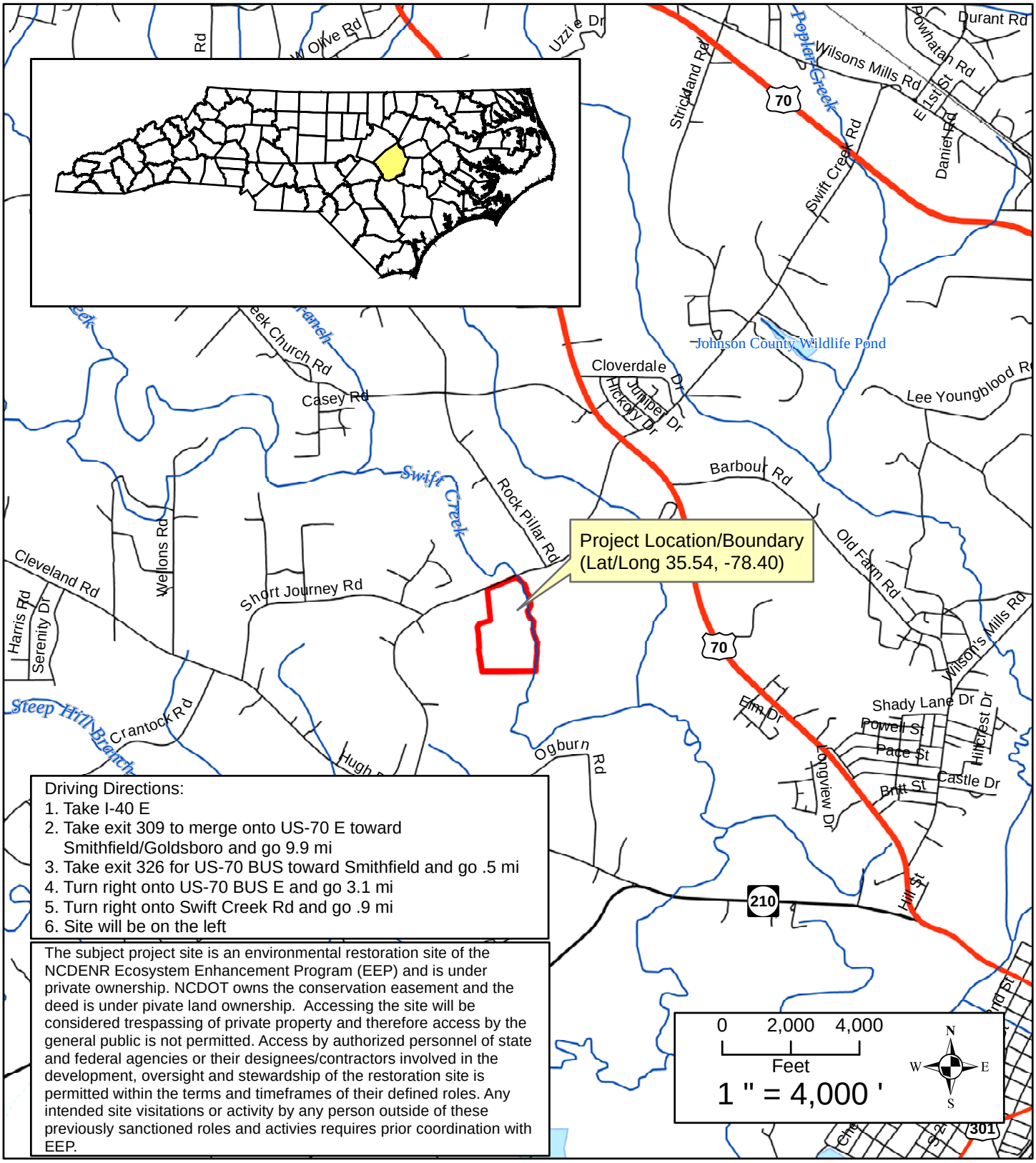
Lee, Michael T., Peet, Robert K., Roberts, Steven D., Wentworth, Thomas R. 2006. CVS-EEP Protocol for Recording Vegetation, All Levels of Sampling, Version 4.0.

SCO Station CLA2 – DAQ Clayton Profiler
Daily Precipitation Data
http://www.nc-climate.ncsu.edu/cronos/?station=CLA2

WETS Station CLAYTON 3 W, NC1820
Average Monthly Precipitation Data
http://www.wcc.nrcs.usda.gov/climate/wets_doc.html

TABLE OF CONTENTS

APPENDIX A
PROJECT VICINITY MAP AND
BACKGROUND TABLES



Driving Directions:
1. Take I-40 E
2. Take exit 309 to merge onto US-70 E toward Smithfield/Goldsboro and go 9.9 mi
3. Take exit 326 for US-70 BUS toward Smithfield and go .5 mi
4. Turn right onto US-70 BUS E and go 3.1 mi
5. Turn right onto Swift Creek Rd and go .9 mi
6. Site will be on the left

The subject project site is an environmental restoration site of the NCDENR Ecosystem Enhancement Program (EEP) and is under private ownership. NCDOT owns the conservation easement and the deed is under pivate land ownership. Accessing the site will be considered trespassing of private property and therefore access by the general public is not permitted. Access by authorized personnel of state and federal agencies or their designees/contractors involved in the development, oversight and stewardship of the restoration site is permitted within the terms and timeframes of their defined roles. Any intended site visitations or activity by any person outside of these previously sanctioned roles and activies requires prior coordination with EEP.

Title	**Vicinity Map**		
Prepared For: Ecosystem Enhancement Program	**Project**	Moore Property Monitoring Report (725) 2012 - Year 2 Johnston County, North Carolina	
	Date 10/16/2012	**KHA Project Number** 011795033	**Figure** 1

Kimley-Horn and Associates, Inc.

Table 1. Project Components and Mitigation Credits

Moore Property/725

Mitigation Credits

	Stream		Riparian Wetland		Non-riparian Wetland		Neuse Riparian Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
Type	R	RE	R	RE	R	RE			
Totals			51.5	0			248,292		

Project Components

Project Component -or- Reach ID	Stationing/Location	Existing Footage/Acreage	Approach (PI, PII, etc.)	Restoration -or- Restoration Equivalent	Restoration Footage or Acreage	Mitigation Ratio
RPN				Restoration	5.7	1:1
WED				Restoration	10.4	1:1
TOM-A				Restoration	39.8	1:1
TOM-B				Restoration	1.3	1:1

Component Summation

Restoration Level	Stream (linear feet)	Riparian Wetland (acres)		Non-riparian Wetland (acres)	Buffer (square feet)	Upland (acres)
		Riverine	Non-Riverine			
Restoration		51.5	0		248,292	
Enhancement						
Enhancement I						
Enhancement II						
Creation						
Preservation						
High Quality Preservation						

Table 2. Project Activity and Reporting History Moore Property/725		
Activity or Deliverable	**Data Collection Complete**	**Completion or Delivery**
Restoration Plan	NA	March 2008
Final Design – Construction Plans	NA	May 2009
Containerized, bare root and B&B plantings	NA	January 2011
Construction	NA	July 2011
As-Built & Baseline Monitoring Report	January 2011	July 2011
Monitoring Year 1	November 2011	January 2012
Monitoring Year 2	October 2012	February 2013

- Bolded items are examples of those items that are not standard, but may come up and should be included
- Non-bolded items represent events that are standard components over the course of a typical project.
- The above are obviously not the extent of potential relevant project activities, but are just provided as example as part of this exhibit.

Table 3. Project Contacts Table Moore Property/725	
Designer	Kimley-Horn and Associates, Inc.
	3001 Weston Parkway Cary, NC 27513
Primary project design POC	Daren Pait (757) 355-6677
Construction Contractor	Environmental Quality Resources, LLC
	1405 Benson Ct Arbutus, MD 21227
Construction contractor POC	John Talley (443) 304-3310
Survey Contractor	Turner Land Surveying, PLLC
	3201 Glenridge Dr Raleigh, NC 27604
Survey contractor POC	David Turner (919) 875-1378
Planting Contractor	Natives, Inc.
	550 E. Westinghouse Blvd Charlotte, NC 28273
Planting contractor POC	Gregg Antemann (704) 527-1177
Seeding Contractor	Natives, Inc.
	550 E. Westinghouse Blvd Charlotte, NC 28273
Contractor point of contact	Gregg Antemann (704) 527-1177
Seed Mix Sources	Natives, Inc.
	Gregg Antemann (704) 527-1177
Nursery Stock Suppliers	Natives, Inc.
	Gregg Antemann (704) 527-1177
Monitoring Performers	Kimley-Horn and Associates, Inc.
	3001 Weston Parkway Cary, NC 27513
Stream Monitoring POC	N/A
Vegetation Monitoring POC	Chad Evenhouse (919) 677-2121
Wetland Monitoring POC	Chad Evenhouse (919) 677-2121

Table 4. Project Attribute Table Moore Property/725	
Project County	Johnston
Physiographic Region	Coastal Plain
Ecoregion	Rolling Coastal Plain
Project River Basin	Neuse
USGS HUC for Project (14 digit)	3020201110070
NCDWQ Sub-basin for Project	03-04-02
Within extent of EEP Watershed Plan?	No
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

	RPN	WED	TOM	Swift Creek *
Drainage area	N/A	0.03 sq. mi.	0.2 sq. mi.	145.2 sq. mi.
Stream order	N/A	N/A	N/A	4th
Restored length (feet)	N/A	N/A	N/A	N/A
Perennial or Intermittent	N/A	N/A	N/A	Perennial
Watershed type (Rural, Urban, Developing etc.)		Rural	Rural	Developing
Watershed LULC Distribution (e.g.)				
Residential		2%	2%	20%
Ag-Row Crop		69%	69%	40%
Ag-Livestock		0%	0%	0%
Forested		29%	29%	40%
Etc.		0%	0%	0%
Watershed impervious cover (%)		0%	0%	15%
NCDWQ AU/Index number	N/A	N/A	N/A	27-43-(8)
NCDWQ classification	N/A	N/A	N/A	C; Sw; NSW
303d listed?	N/A	N/A	N/A	No
Upstream of a 303d listed segment?	N/A	N/A	N/A	Yes
Reasons for 303d listing or stressor	N/A	N/A	N/A	WS-III; NSW; CA
Total acreage of easement	84.2	84.2	84.2	N/A
Total vegetated acreage within the easement	84.2	84.2	84.2	N/A
Total planted acreage as part of the restoration	5.7	10.4	41.1	N/A
Rosgen classification of pre-existing	N/A	N/A	N/A	N/A
Rosgen classification of As-built	N/A	N/A	N/A	N/A
Valley type	N/A	N/A	N/A	N/A
Valley slope	N/A	N/A	N/A	N/A
Valley side slope range (e.g. 2-3.%)	N/A	N/A	N/A	N/A
Valley toe slope range (e.g. 2-3.%)	N/A	N/A	N/A	N/A
Cowardin classification	N/A	N/A	N/A	N/A
Trout waters designation	N/A	N/A	N/A	No
Species of concern, endangered etc.? (Y/N)	No	No	No	Yes
Dominant soil series and characteristics	Altavista	Wedhadkee	Tomotley	N/A
Series	AaA	Wt	To	N/A
Depth	60 inches	63 inches	60 inches	N/A
Clay%	10-35	5-20	5-35	N/A
K	0.24	0.24	0.2	N/A
T	5	5	5	N/A

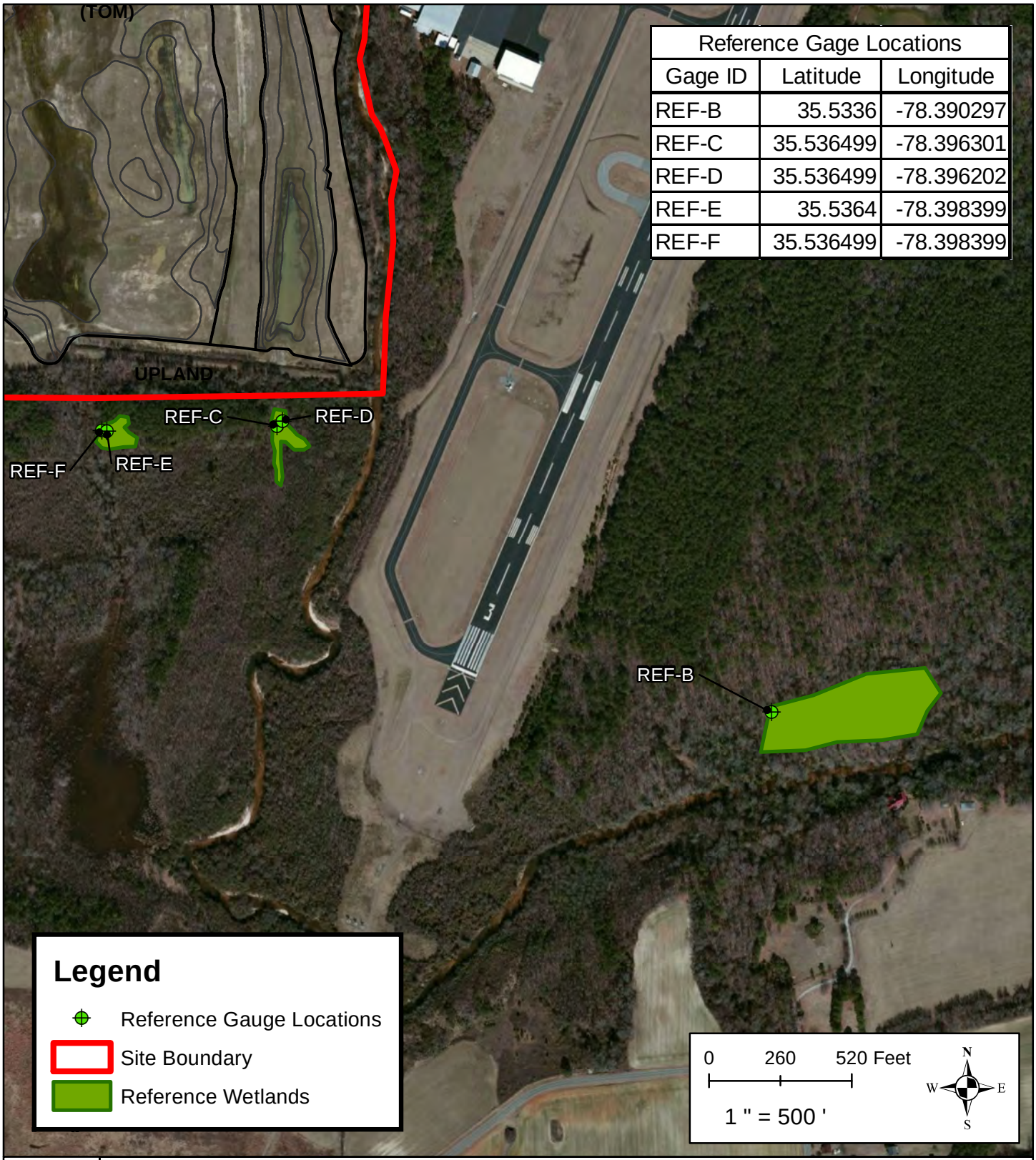
Use N/A for items that may not apply. Use "-" for items that are unavailable and "U" for items that are unknown

*There is no restoration of Swift Creek involved with this project

APPENDIX B
VISUAL ASSESSMENT DATA

Title	Current Conditions Plan View (2011 Aerial)		
Prepared For: Ecosystem Enhancement Program	Project	Moore Property Monitoring (725) 2012 - Year 2 Johnston County, NC	
	Date 02/14/2013	KHA Project Number 011795033	Figure 2

Kimley-Horn and Associates, Inc.



Title	**Reference Gauge Locations**
Prepared For: Ecosystem Enhancement Program	**Project:** Moore Property Monitoring (725) 2012 - Year 2 Johnston County, North Carolina
Date 02/14/2013	**KHA Project Number** 011795033
Figure 3	

Kimley-Horn and Associates, Inc.

Table 6 Vegetation Condition Assessment

Planted Acreage[1] **56.9**

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	10	5.70	10.0%
			Total	10	5.70	10.0%
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	10	5.70	10.0%

Easement Acreage[2] **84.2**

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).	1000 SF	Pattern and Color	6	2.07	2.5%
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%

1 = Enter the planted acreage within the easement. This number is calculated as the easement acreage minus any existing mature tree stands that were not subject to supplemental planting of the understory, the channel acreage, crossings or any other elements not directly planted as part of the project effort.

2 = The acreage within the easement boundaries.

3 = Encroachment may occur within or outside of planted areas and will therefore be calculated against the overall easement acreage. In the event a polygon is cataloged into items 1, 2 or 3 in the table and is the result of encroachment, the associated acreage should be tallied in the relevant item (i.e., item 1,2 or 3) as well as a parallel tally in item 5.

4 = Invasives may occur in or out of planted areas, but still within the easement and will therefore be calculated against the overall easement acreage. Invasives of concern/interest are listed below. The list of high concern spcies are those with the potential to directly outcompete native, young, woody stems in the short-term (e.g. monitoring period or shortly thereafter) or affect the community structure for existing, more established tree/shrub stands over timeframes that are slightly longer (e.g. 1-2 decades). The low/moderate concern group are those species that generally do not have this capacity over the timeframes discussed and therefore are not expected to be mapped with regularity, but can be mapped, if in the judgement of the observer their coverage, density or distribution is suppressing the viability, density, or growth of planted woody stems. Decisions as to whether remediation will be needed are based on the integration of risk factors by EEP such as species present, their coverage, distribution relative to native biomass, and the practicality of treatment. For example, even modest amounts of Kudzu or Japanese Knotweed early in the projects history will warrant control, but potentially large coverages of Microstegium in the herb layer will not likley trigger control because of the limited capacities to impact tree/shrub layers within the timeframes discussed and the potential impacts of treating extensive amounts of ground cover. Those species with the "watch list" designator in gray shade are of interest as well, but have yet to be observed across the state with any frequency. Those in *red italics* are of particular interest given their extreme risk/threat level for mapping as points where isolated specimens are found, particularly ealry in a projects monitoring history. However, areas of discreet, dense patches will of course be mapped as polygons. The symbology scheme below was one that was found to be helpful for symbolzing invasives polygons, particulalry for situations where the conditon for an area is somewhere between isolated specimens and dense, discreet patches. In any case, the point or polygon/area feature can be symbolized to describe things like high or low concern and species can be listed as a map inset, in legend items if the number of species are limited or in the narrative section of the executive summary.

PP1 (2012)

PP2 (2012)

PP3 (2012)

PP4 (2012)

WP1 (2012)
Bankfull events recorded by crest gauge in wetland outlet ditch

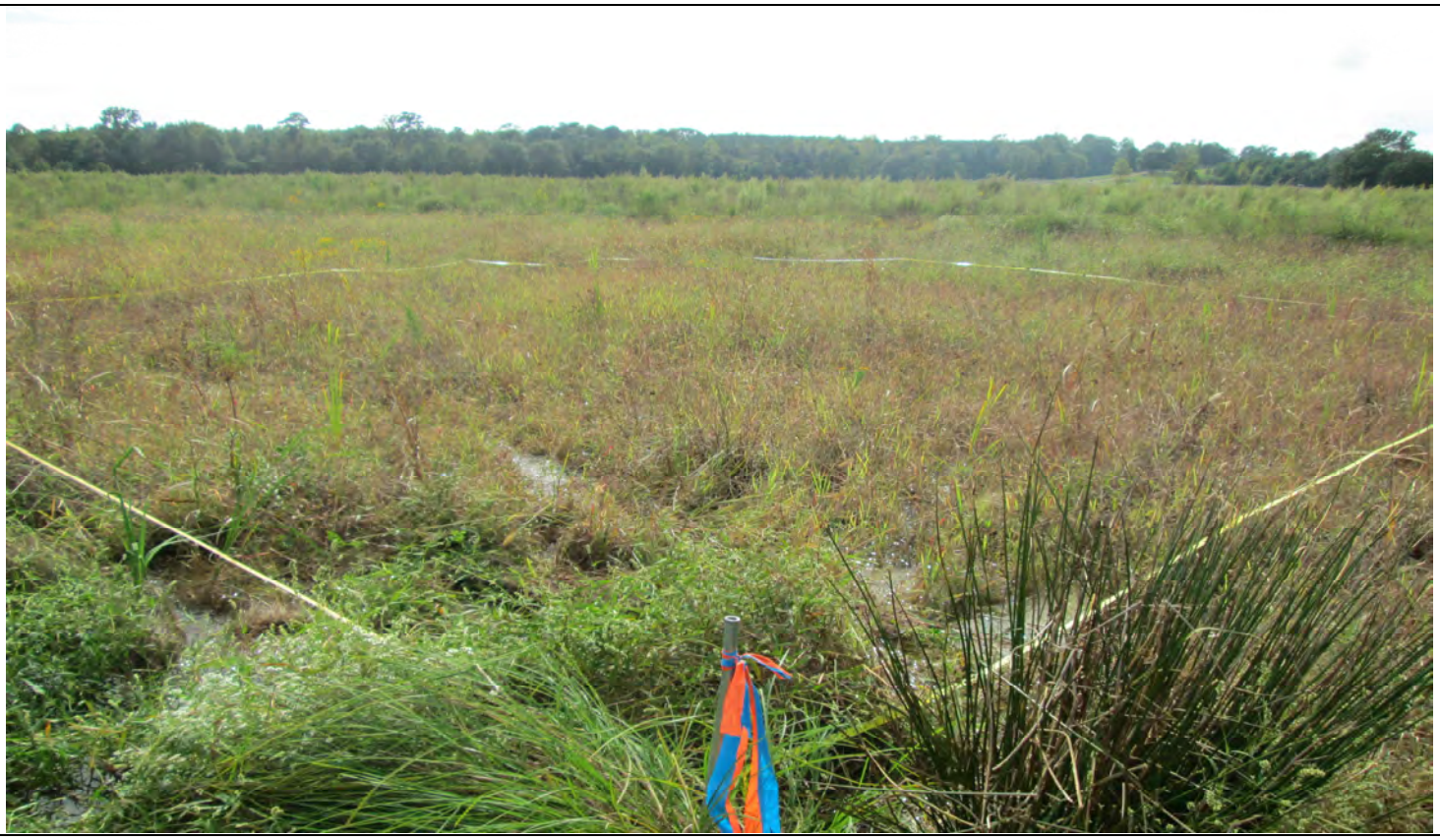
WP2 (2012)
Typha latifolia colonization near groundwater seep on west end of site

VQ1 (2012)

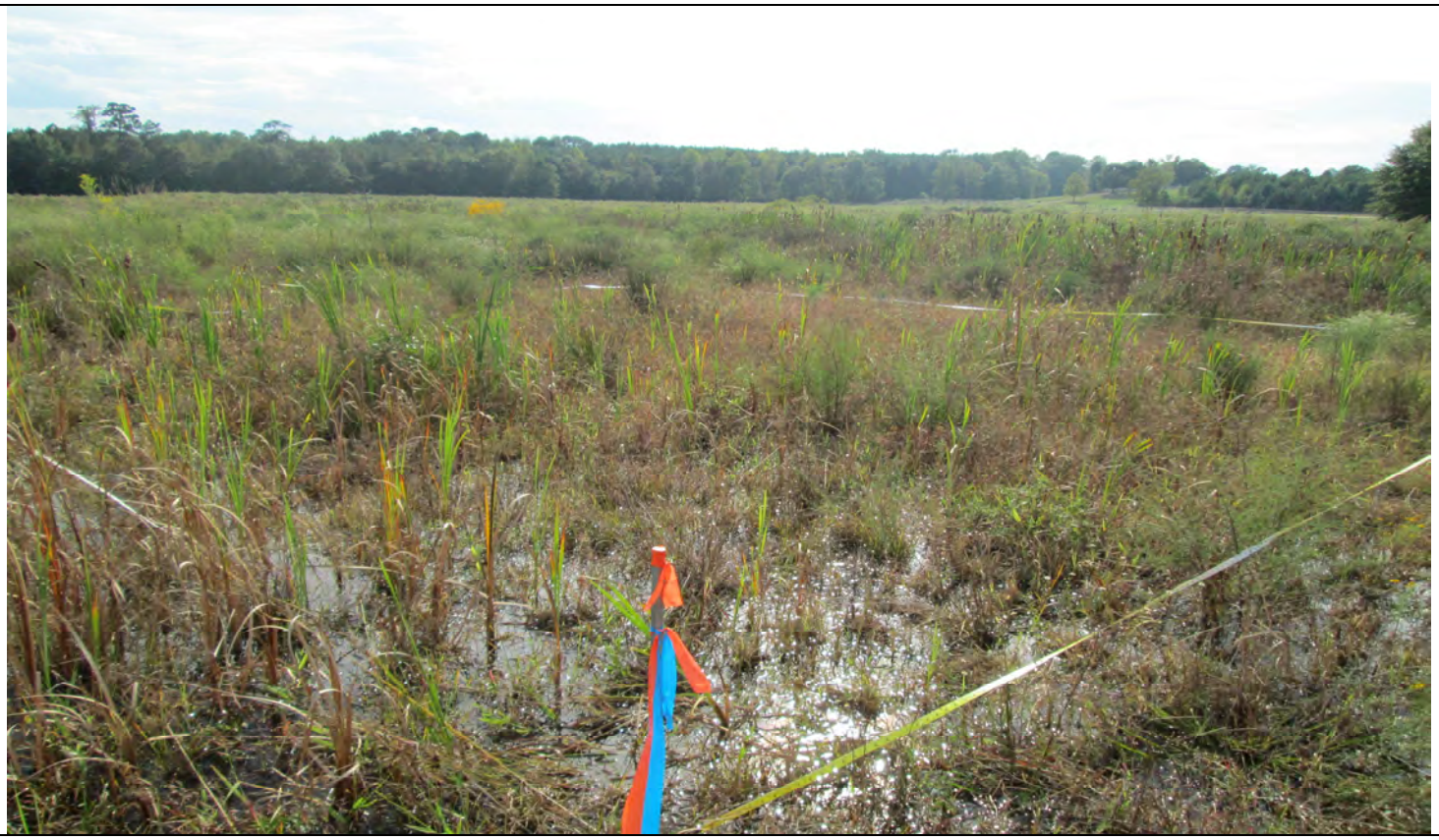
VQ2 (2012)

VQ3 (2012)

VQ4 (2012)

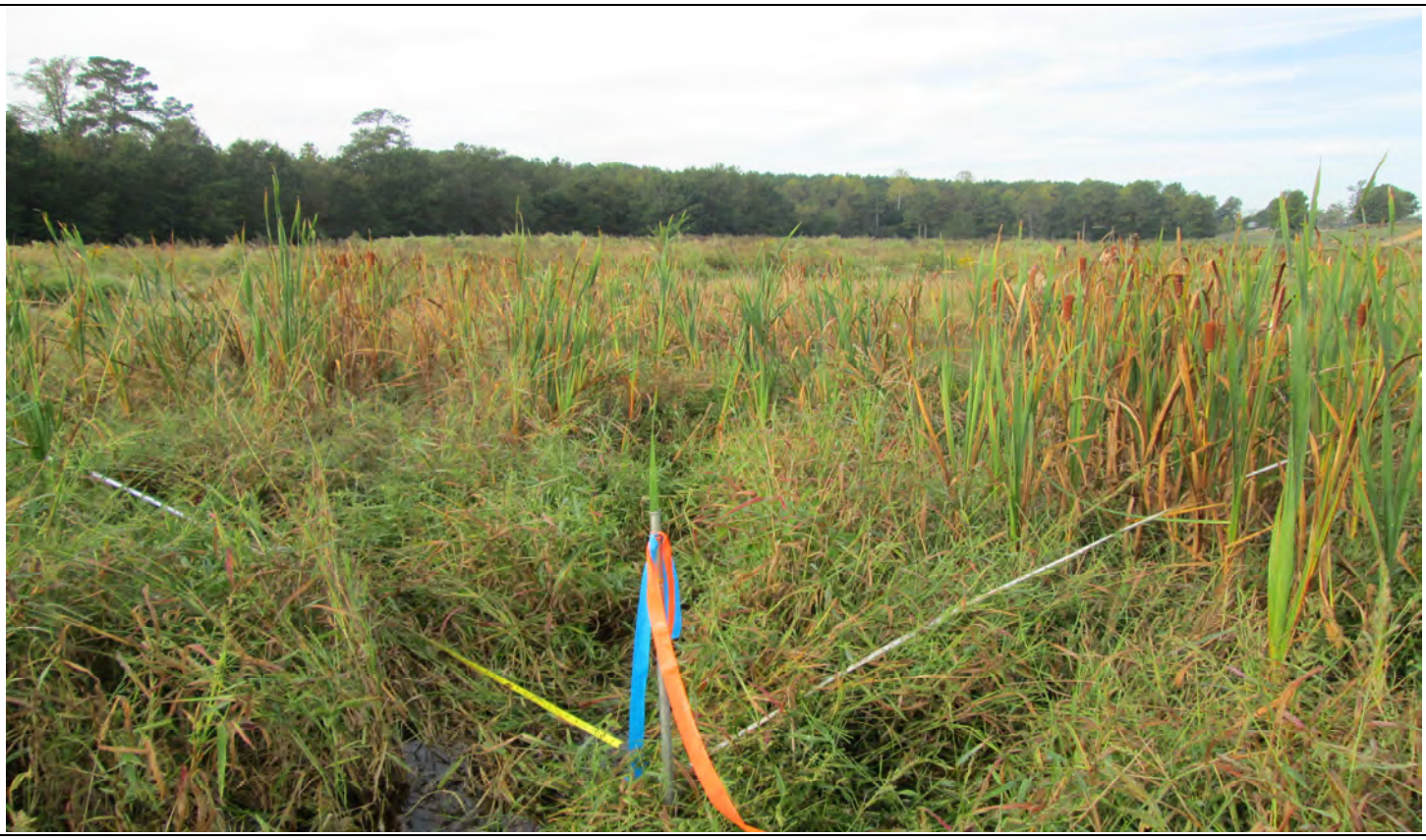


VQ5 (2012)

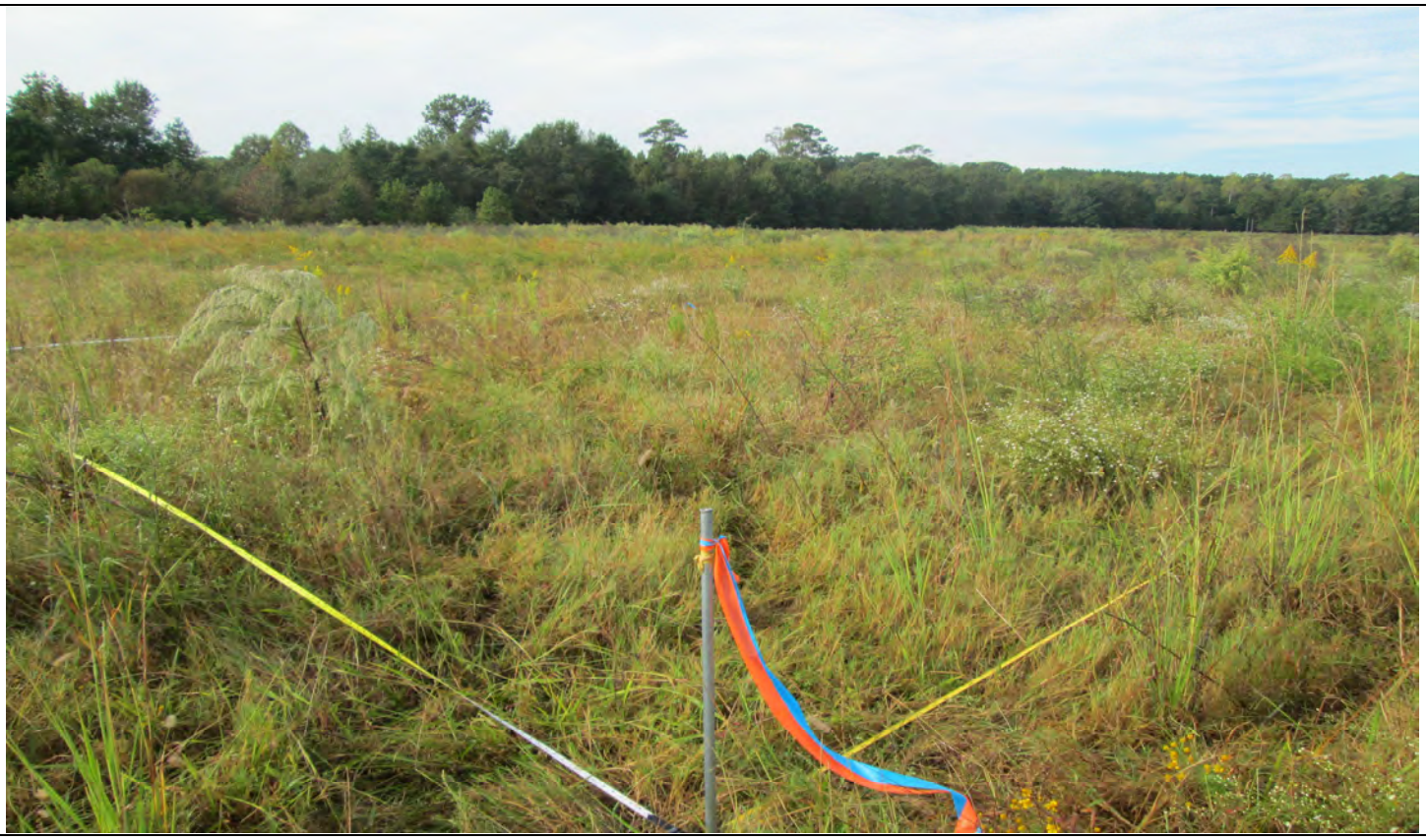


VQ6 (2012)

VQ7 (2012)

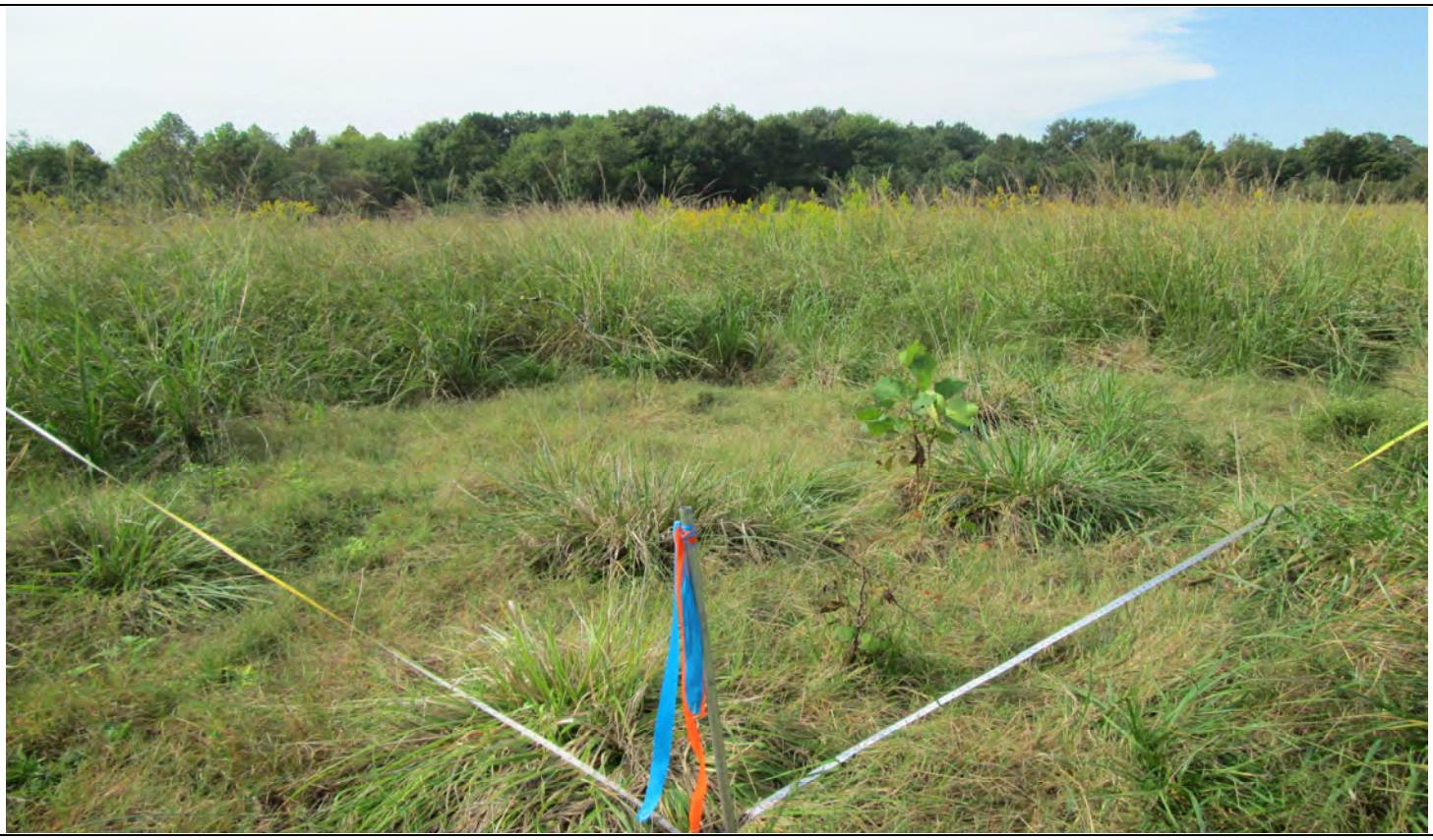


VQ8 (2012)

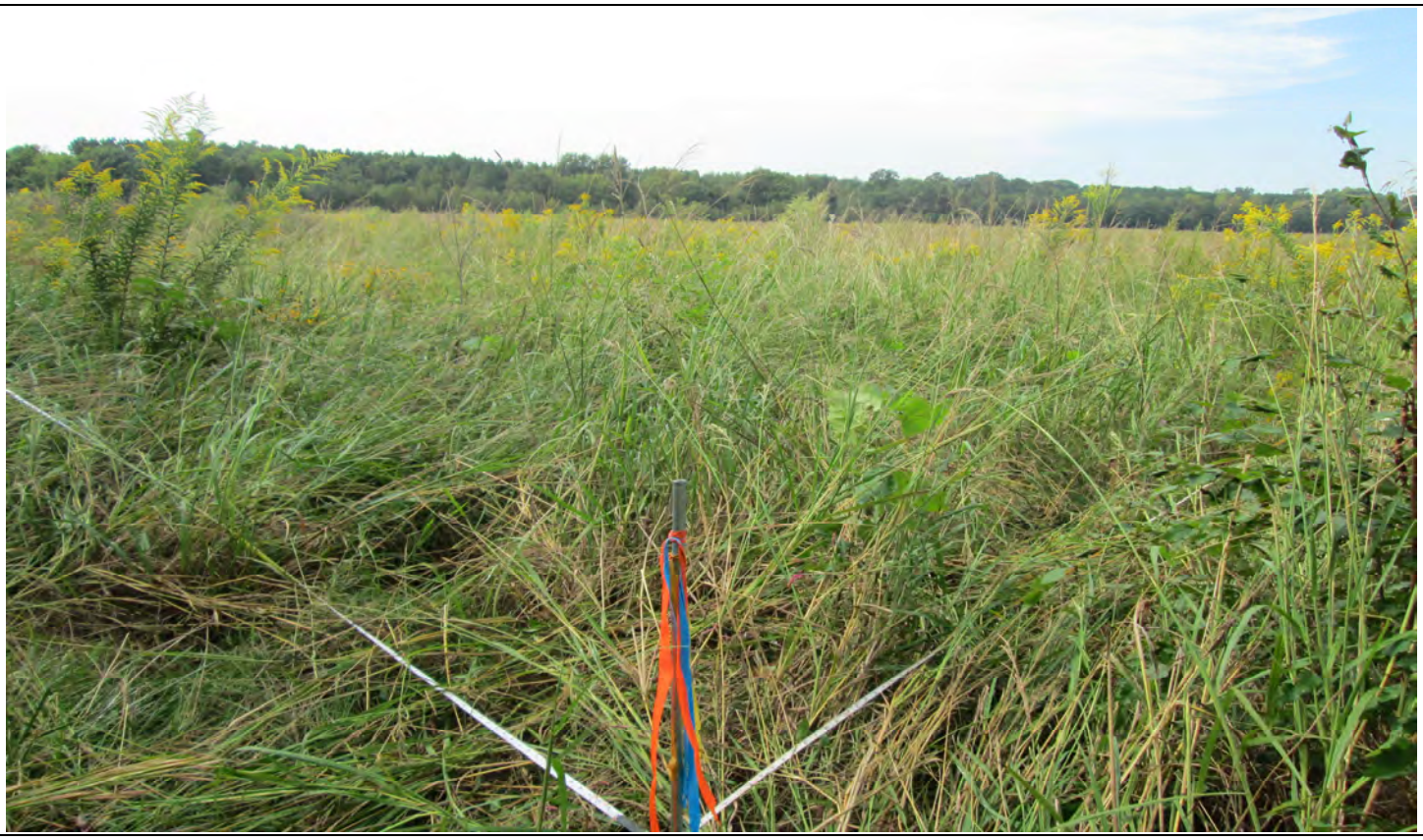


VQ9 (2012)

VQ10 (2012)



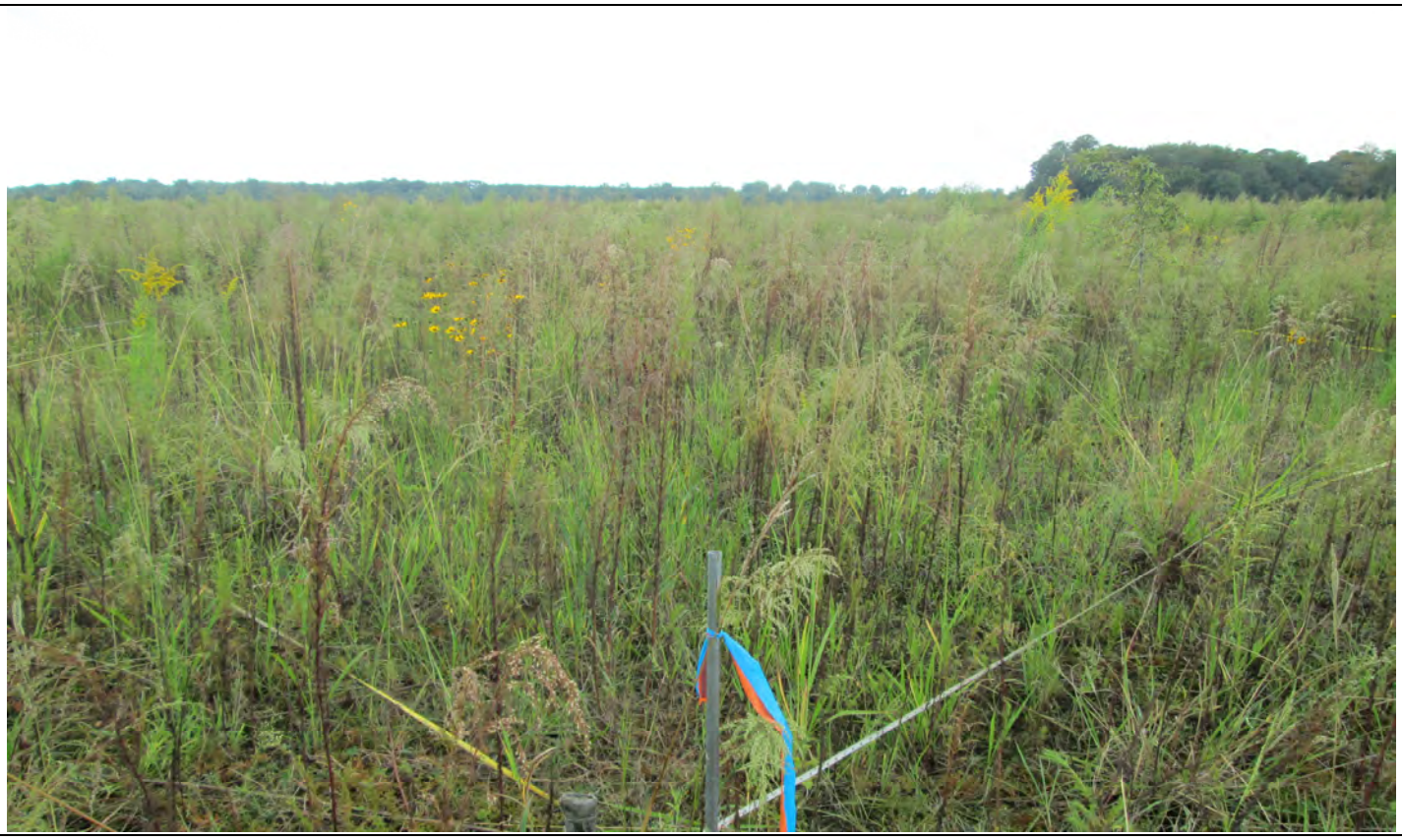
VQ11 (2012)



VQ12 (2012)

VQ13 (2012)

VQ14 (2012)



VQ15 (2012)

VQ16 (2012)

APPENDIX C
VEGETATION PLOT DATA

Table 7. Vegetation Plot Criteria Attainment
Moore Property/725

Vegetation Plot ID	Vegetation Community	MY1		MY2		MY3		MY4		MY5	
		Vegetation Survival Threshold (320 stems/acre) Met?	Tract Mean	Vegetation Survival Threshold (320 stems/acre) Met?	Tract Mean	Vegetation Survival Threshold Met?	Tract Mean	Vegetation Survival Threshold Met?	Tract Mean	Vegetation Survival Threshold Met?	Tract Mean
VQ1	Coastal Plain Brownwater Bottomland	N	50%	N	25%						
VQ2		N		N							
VQ3		N		N							
VQ4		Y		Y							
VQ7		Y		N							
VQ9		N		N							
VQ13		Y		Y							
VQ15		Y		N							
VQ5	Coastal Plain Brownwater Swamp	Y	100%	Y	75%						
VQ6		Y		Y							
VQ8		Y		Y							
VQ10		Y		N							
VQ11	Coastal Plain Brownwater Levee (Riparian)	N	50%	N	50%						
VQ12		Y		Y							
VQ14		N		N							
VQ16		Y		Y							

Table 8. CVS Vegetation Plot Metadata Moore Property/725	
Report Prepared By	Jennifer Yenawine
Date Prepared	2/11/2013 14:16
database name	Moore Property_cvs-eep-entrytool-v2.3.1.mdb
database location	K:\RAL_Environmental\011795 Moore Property Monitoring\Vegetation Data
computer name	DD84040
file size	47710208
DESCRIPTION OF WORKSHEETS IN THIS DOCUMENT----------	
Metadata	Description of database file, the report worksheets, and a summary of project(s) and project data.
Proj, planted	Each project is listed with its PLANTED stems per acre, for each year. This excludes live stakes.
Proj, total stems	Each project is listed with its TOTAL stems per acre, for each year. This includes live stakes, all planted stems, and all natural/volunteer stems.
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 by each.
Damage by Spp	Damage values tallied by type for each species.
Damage by Plot	Damage values tallied by type for each plot.
Planted Stems by Plot and Spp	A matrix of the count of PLANTED living stems of each species for each plot; dead and missing stems are excluded.
PROJECT SUMMARY----------	
Project Code	725
project Name	Moore Property
Description	Wetland Restoration
River Basin	Neuse
length(ft)	N/A
stream-to-edge width (ft)	N/A
area (sq m)	3,441,240 (1.33 square miles)
Required Plots (calculated)	61
Sampled Plots	16

* As approved by EEP

For projects using CVS, this table will be produced directly to the performer. For projects not using CVS this spreadsheet can be used/built upon to provide the desired format

Table 9 Planted and Total Stem Counts (Species by Plot with Annual Means)

Current Plot Data (MY2 2012)

Scientific Name	Common Name	Species Type	000-01-0001			000-01-0002			000-01-0003			000-01-0004		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	**red maple**	Tree			4									
Betula nigra	**river birch**	Tree	1	1	9			1						
Carpinus caroliniana	**American hornbeam**	Tree												
Carya aquatica	**water hickory**	Tree												
Diospyros virginiana	**common persimmon**	Tree	1	1	1						1			
Fraxinus pennsylvanica	**green ash**	Tree												
Liquidambar styraciflua	sweetgum	Tree			2			1						
Nyssa aquatica	**water tupelo**	Tree												
Nyssa biflora	**swamp tupelo**	Tree												
Pinus taeda	loblolly pine	Tree			2									1
Platanus occidentalis	**American sycamore**	Tree												
Populus deltoides	**eastern cottonwood**	Tree			1			1						
Quercus laurifolia	**laurel oak**	Tree												
Quercus lyrata	**overcup oak**	Tree							1	1	1	6	6	7
Quercus michauxii	**swamp chestnut oak**	Tree				1	1	1	1	1	1	2	2	2
Quercus nigra	**water oak**	Tree												
Quercus phellos	**willow oak**	Tree				2	2	2						
Taxodium distichum	**bald cypress**	Tree												
Ulmus alata	**winged elm**	Tree			1									
Totals		Stem count	2	2	20	3	3	6	2	2	3	8	8	10
		size (ares)	1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02		
		Species count	2	2	7	2	2	5	2	2	3	2	2	3
		Stems per ACRE	80.9	80.9	809.4	121.4	121.4	242.8	80.9	80.9	121.4	323.7	323.7	404.7
Riparian Buffer Success Criteria		Stem count	2	2	16	3	3	5	2	2	3	8	8	9
		size (ares)	1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02		
		Species count	2	2	5	2	2	4	2	2	3	2	2	2
		Stems per ACRE	80.9	80.9	647.5	121.4	121.4	202.3	80.9	80.9	121.4	323.7	323.7	364.2

Scientific Name	Common Name	Species Type	000-01-0005			000-01-0006			000-01-0007			000-01-0008		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	**red maple**	Tree												
Betula nigra	**river birch**	Tree												
Carpinus caroliniana	**American hornbeam**	Tree												
Carya aquatica	**water hickory**	Tree												
Diospyros virginiana	**common persimmon**	Tree	6	6	6	9	9	9	1	1	1	10	10	10
Fraxinus pennsylvanica	**green ash**	Tree												
Liquidambar styraciflua	sweetgum	Tree												
Nyssa aquatica	**water tupelo**	Tree												
Nyssa biflora	**swamp tupelo**	Tree										1	1	1
Pinus taeda	loblolly pine	Tree												
Platanus occidentalis	**American sycamore**	Tree												
Populus deltoides	**eastern cottonwood**	Tree							1	1	1			
Quercus laurifolia	**laurel oak**	Tree												
Quercus lyrata	**overcup oak**	Tree												
Quercus michauxii	**swamp chestnut oak**	Tree												
Quercus nigra	**water oak**	Tree												
Quercus phellos	**willow oak**	Tree												
Taxodium distichum	**bald cypress**	Tree	2	2	2									
Ulmus alata	**winged elm**	Tree												
Totals		Stem count	8	8	8	9	9	9	2	2	2	11	11	11
		size (ares)	1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02		
		Species count	2	2	2	1	1	1	2	2	2	2	2	2
		Stems per ACRE	323.7	323.7	323.7	364.2	364.2	364.2	80.9	80.9	80.9	445.2	445.2	445.2
Riparian Buffer Success Criteria		Stem count	8	8	8	9	9	9	2	2	2	11	11	11
		size (ares)	1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02		
		Species count	2	2	2	1	1	1	2	2	2	2	2	2
		Stems per ACRE	323.7	323.7	323.7	364.2	364.2	364.2	80.9	80.9	80.9	445.2	445.2	445.2

Scientific Name	Common Name	Species Type	000-01-0009			000-01-0010			000-01-0011			000-01-0012		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	**red maple**	Tree									1			
Betula nigra	**river birch**	Tree									1	2	2	5
Carpinus caroliniana	**American hornbeam**	Tree	1	1	1									
Carya aquatica	**water hickory**	Tree												1
Diospyros virginiana	**common persimmon**	Tree				4	4	5			2			2
Fraxinus pennsylvanica	**green ash**	Tree										3	3	5
Liquidambar styraciflua	sweetgum	Tree												
Nyssa aquatica	**water tupelo**	Tree												
Nyssa biflora	**swamp tupelo**	Tree				3	3	3						
Pinus taeda	loblolly pine	Tree												
Platanus occidentalis	**American sycamore**	Tree									1	3	3	16
Populus deltoides	**eastern cottonwood**	Tree			2				2	2	4	2	2	3
Quercus laurifolia	**laurel oak**	Tree												
Quercus lyrata	**overcup oak**	Tree												
Quercus michauxii	**swamp chestnut oak**	Tree	3	3	3						8			2
Quercus nigra	**water oak**	Tree									1			
Quercus phellos	**willow oak**	Tree												
Taxodium distichum	**bald cypress**	Tree												
Ulmus alata	**winged elm**	Tree												
Totals		Stem count	4	4	6	7	7	8	2	2	18	10	10	34
		size (ares)	1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02		
		Species count	2	2	3	2	2	2	1	1	7	4	4	7
		Stems per ACRE	161.9	161.9	242.8	283.3	283.3	323.7	80.9	80.9	728.4	404.7	404.7	1375.9
Riparian Buffer Success Criteria		Stem count	4	4	6	7	7	8	2	2	18	10	10	34
		size (ares)	1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02		
		Species count	2	2	3	2	2	2	1	1	7	4	4	7
		Stems per ACRE	161.9	161.9	242.8	283.3	283.3	323.7	80.9	80.9	728.4	404.7	404.7	1375.9

Scientific Name	Common Name	Species Type	000-01-0013			000-01-0014			000-01-0015			000-01-0016		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	**red maple**	Tree						2						
Betula nigra	**river birch**	Tree				4	4	10				9	9	14
Carpinus caroliniana	**American hornbeam**	Tree	1	1	1									
Carya aquatica	**water hickory**	Tree												
Diospyros virginiana	**common persimmon**	Tree						2						2
Fraxinus pennsylvanica	**green ash**	Tree						4						1
Liquidambar styraciflua	sweetgum	Tree						1						
Nyssa aquatica	**water tupelo**	Tree												
Nyssa biflora	**swamp tupelo**	Tree												
Pinus taeda	loblolly pine	Tree			1						1			
Platanus occidentalis	**American sycamore**	Tree						4						1
Populus deltoides	**eastern cottonwood**	Tree			2						1			2
Quercus laurifolia	**laurel oak**	Tree												
Quercus lyrata	**overcup oak**	Tree							1	1	1			
Quercus michauxii	**swamp chestnut oak**	Tree	6	6	6			2	3	3	3			
Quercus nigra	**water oak**	Tree										1	1	2
Quercus phellos	**willow oak**	Tree	2	2	3				1	1	1			
Taxodium distichum	**bald cypress**	Tree												
Ulmus alata	**winged elm**	Tree						2						
Totals		Stem count	9	9	13	4	4	27	5	5	7	10	10	22
		size (ares)	1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02		
		Species count	3	3	5	1	1	8	3	3	5	2	2	6
		Stems per ACRE	364.2	364.2	526.1	161.9	161.9	1092.7	202.3	202.3	283.3	404.7	404.7	890.3
Riparian Buffer Success Criteria		Stem count	9	9	12	4	4	26	5	5	6	10	10	22
		size (ares)	1			1			1			1		
		size (ACRES)	0.02			0.02			0.02			0.02		
		Species count	3	3	4	1	1	7	3	3	4	2	2	6
		Stems per ACRE	364.2	364.2	485.6	161.9	161.9	1052.2	202.3	202.3	242.8	404.7	404.7	890.3

Annual Means

Scientific Name	Common Name	Species Type	MY2 (2012)			MY1 (2012)			MY0 (2011)		
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	**red maple**	Tree			7			3			
Betula nigra	**river birch**	Tree	16	16	40	11	11	17	23	23	23
Carpinus caroliniana	**American hornbeam**	Tree	2	2	2	8	8	8	17	17	17
Carya aquatica	**water hickory**	Tree			1						
Diospyros virginiana	**common persimmon**	Tree	31	31	41	8	8	8	36	36	36
Fraxinus pennsylvanica	**green ash**	Tree	3	3	10	6	6	6	6	6	6
Liquidambar styraciflua	sweetgum	Tree			4						
Nyssa aquatica	**water tupelo**	Tree				2	2	2	2	2	2
Nyssa biflora	**swamp tupelo**	Tree	4	4	4	38	38	38	41	41	41
Pinus taeda	loblolly pine	Tree			5						
Platanus occidentalis	**American sycamore**	Tree	3	3	22	9	9	9	11	11	11
Populus deltoides	**eastern cottonwood**	Tree	5	5	17						
Quercus laurifolia	**laurel oak**	Tree				3	3	3	4	4	4
Quercus lyrata	**overcup oak**	Tree	8	8	9	10	10	10	17	17	17
Quercus michauxii	**swamp chestnut oak**	Tree	16	16	28	22	22	23	24	24	24
Quercus nigra	**water oak**	Tree	1	1	3						
Quercus phellos	**willow oak**	Tree	5	5	6						
Taxodium distichum	**bald cypress**	Tree	2	2	2						
Ulmus alata	**winged elm**	Tree			3						
Totals		Stem count	96	96	204	117	117	127	181	181	181
		size (ares)	16			16			16		
		size (ACRES)	0.40			0.40			0.40		
		Species count	12	12	17	10	10	11	10	10	10
		Stems per ACRE	242.8	242.8	516.0	295.9	295.9	321.2	457.8	457.8	457.8
Riparian Buffer Success Criteria		Stem count	96	96	195	117	117	127	181	181	181
		size (ares)	16			16			16		
		size (ACRES)	0.40			0.40			0.40		
		Species count	12	12	15	10	10	11	10	10	10
		Stems per ACRE	242.8	242.8	493.2	295.9	295.9	321.2	457.8	457.8	457.8

***Bolded** hardwood tree species are counted toward riparian buffer success criteria

Color Key for Density
Exceeds requirements by 10%
Exceeds requirements, but by less than 10%
Fails to meet requirements, by less than 10%
Fails to meet requirements by more than 10%

APPENDIX D
HYDROLOGIC DATA

Table 12. Verification of Bankfull Events*			
Moore Property/725			
Date of Data Collection	Date of Occurrence	Method	Photo # (if available)
7/1/2011	N/A	Crest gauge indicated flow stage 1.00' over bankfull	SP1
11/1/2011	N/A	Crest gauge indicated flow stage 0.12' over bankfull	SP1
10/5/2012	N/A	Crest gauge indicated flow stage 0.74' over bankfull	WP1

Approximate Bankfull Elevation = 120.3'

* Bankfull Events are being monitored and recorded for the stream that receives the outlet waters from the Moore Property Wetland Restoration.

Note: Stage at crest gauge needs to reach 2.6' in order for Swift Creek floodwaters to flow into the wetland area.

Table 13a. Reference Groundwater Gauge Summary
Moore Property/725

	Ground Elevation*	2009	2010	MY1 2011	MY2 2012	MY3 2013	MY4 2014	MY5 2015	Notes
Groundwater Gauge REF-B									
Consecutive days within range[1]	124'	34	29	44	2				Floodplain depression, depends on flood events from Swift Creek, which does not appear to have occurred in 2012.
% of growing season[2]		14.11%	12.03%	18.26%	0.83%				
Criteria met[3]?		Y	Y	Y	N				
Groundwater Gauge REF-C									
Consecutive days within range	124'	35	30	45	2				Very dry after the end of 2011 and into the 2012 dormant season. Water table begins to recharge in January and March, but does not occur in the upper surface except for a brief period in late March. Water level drops below 2 feet throughout the rest of the growing season.
% of growing season		14.52%	12.45%	18.67%	0.83%				
Criteria met?		Y	Y	Y	N				
Groundwater Gauge REF-D									
Consecutive days within range	124'	43	--	--	22				Very dry after the end of 2011 and into the 2012 dormant season. Water table begins to recharge in January and March, but does not occur in the upper surface except for a brief period in late March. Water level drops below 2 feet throughout the rest of the growing season.
% of growing season		17.84%	--	--	9.13%				
Criteria met?		Y	--	--	Y				
Groundwater Gauge REF-E									
Consecutive days within range	123'	33	--	--	22				Very dry after the end of 2011 and into the 2012 dormant season. Water table begins to recharge in January and March, but does not occur in the upper surface except for a brief period in late March. Water level drops below 2 feet throughout the rest of the growing season.
% of growing season		13.69%	--	--	9.13%				
Criteria met?		Y	--	--	Y				
Groundwater Gauge REF-F									
Consecutive days within range	123'	34	27	39	23				Very dry after the end of 2011 and into the 2012 dormant season. Water table begins to recharge in January and March, but does not occur in the upper surface except for a brief period in late March. Water level drops below 2 feet throughout the rest of the growing season.
% of growing season		14.11%	11.20%	16.18%	9.54%				
Criteria met?		Y	Y	Y	Y				
Average reference hydroperiod	---	**36**	**29**	**43**	**15**				
Consecutive number of days needed to meet the 50% deviation success criteria	---	**18**	**15**	**22**	**8**				

1- The Army Corps of Engineers states that the range is within 12 inches of the ground surface
2- The growing season for the site is 241 days long.
3- The minimum success criteria states that the water table must be within the USACE range for at least 5% (12 days) of the growing season consecutively.

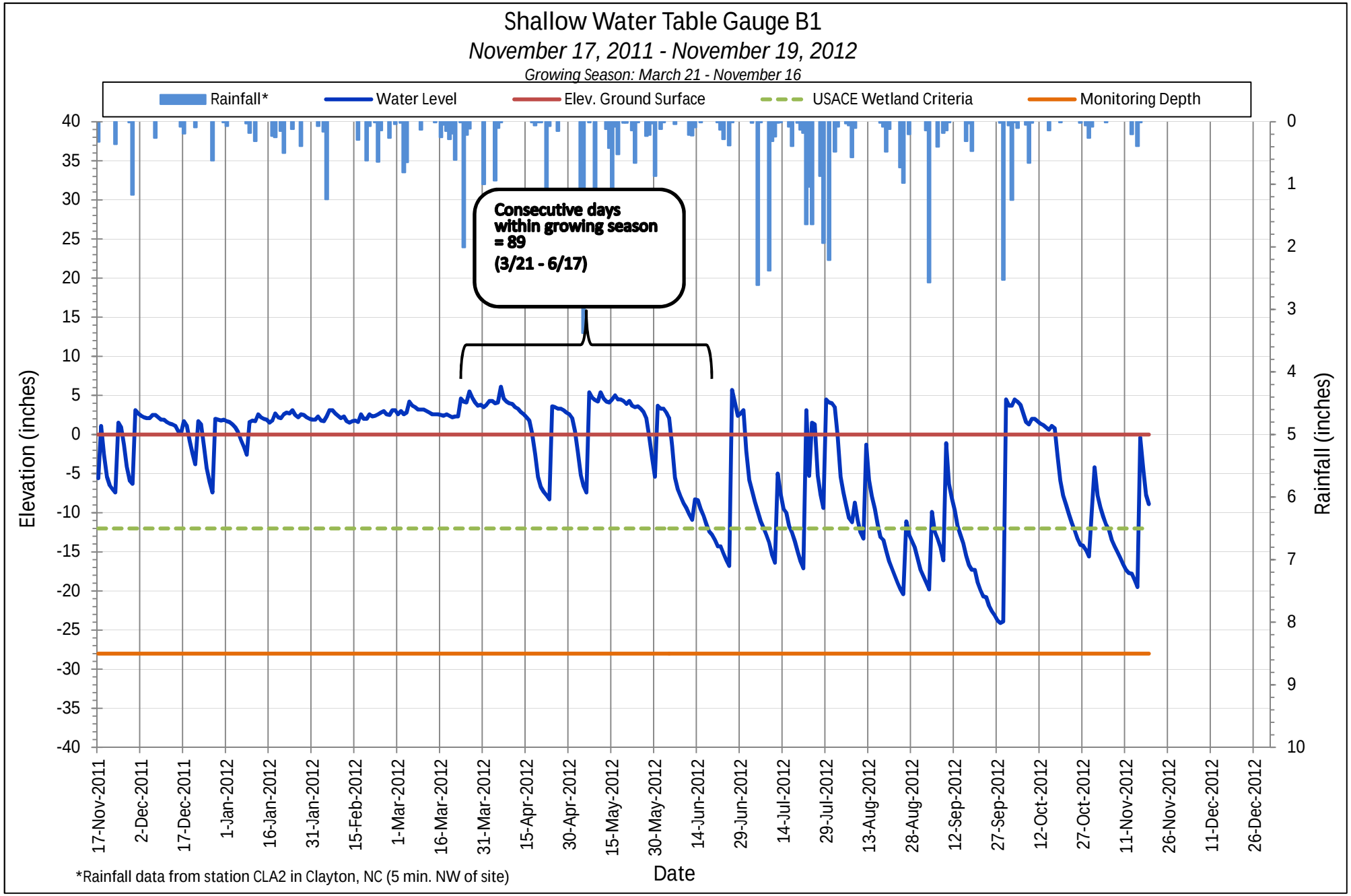
* Ground elevations recorded using county topographic GIS data.

Table 13b. Restoration Groundwater Gauge Summary
Moore Property/725

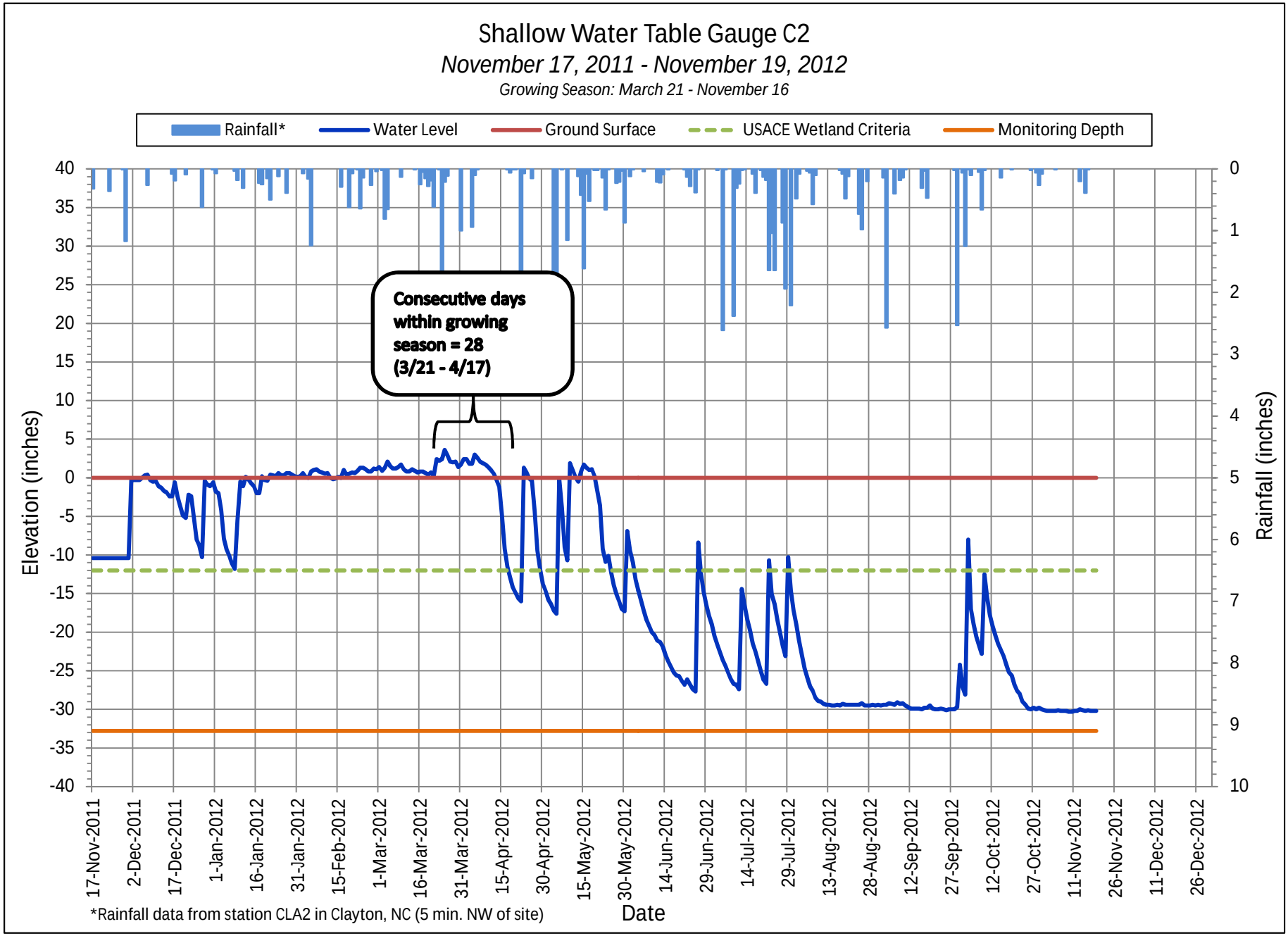
	Ground Elevation*	MY1 2011	MY2 2012	MY3 2013	MY4 2014	MY5 2015	Notes
Percentage of monitoring gauges with criteria met	---	**56.25%**	**68.75%**				
Groundwater Gauge B1	124.1'						Gauge located in wet swale that receives runoff from upslope property and roadside drainage. Water level is sustained above the ground surface during the dormant season and rises above the surface in response to storm events during the growing season.
Consecutive days within range[1]		68	89				
% of growing season[2]		28.22%	36.93%				
Criteria met[3]?		Y	Y				
Groundwater Gauge B2	124.0'						Water level at the surface at the end of the dormant season and the early growing season, but then is below the upper 12 inches for most of the remainder of the 2012 growing season.
Consecutive days within range		50	27				
% of growing season		20.75%	11.20%				
Criteria met?		Y	Y				
Groundwater Gauge C2	124.5'						Water levels are responding similarly to B2, however with a higher sustained water table during the dormant season in the beginning of 2012.
Consecutive days within range		47	28				
% of growing season		19.50%	11.62%				
Criteria met?		Y	Y				
Groundwater Gauge D2	125.7'						Located near the wetland boundary along the upland ridge. Water levels are within the upper 24 inches during the growing season in response to rainfall events, but does not occur within the upper 12 inches.
Consecutive days within range		0	1				
% of growing season		0.00%	0.41%				
Criteria met?		N/A	N				
Groundwater Gauge E2	124.8'						Similar to D2, however larger storm events in September and October do bring water levels into the upper 12 inches for brief periods.
Consecutive days within range		0	1				
% of growing season		0.00%	0.41%				
Criteria met?		N/A	N				
Groundwater Gauge F2	124.2'						Water levels show a high response to rainfall events throughout the year that brings the water table into the upper 12 inches for brief, unsustained periods.
Consecutive days within range		4	6				
% of growing season		1.66%	2.49%				
Criteria met?		N	N				
Groundwater Gauge A3	123.8'						Water levels sustained at or above the ground surface for most of the year except for a brief period at the peak of the growing season.
Consecutive days within range		103	93				
% of growing season		42.74%	38.59%				
Criteria met?		Y	Y				
Groundwater Gauge B3	123.7'						Water level is within the upper surface at the end of the dormant and early growing season, but then is lower through most of the growing season.
Consecutive days within range		45	21				
% of growing season		18.67%	8.71%				
Criteria met?		Y	Y				
Groundwater Gauge A4	124.6'						Water level is within the upper surface at the end of the dormant and early growing season, but then is lower through most of the growing season.
Consecutive days within range		20	23				
% of growing season		8.30%	9.54%				
Criteria met?		N	Y				
Groundwater Gauge B4	123.0'						Water level is within the upper surface at the end of the dormant and early growing season, but then is lower through most of the growing season.
Consecutive days within range		75	82				
% of growing season		31.12%	34.02%				
Criteria met?		Y	Y				
Groundwater Gauge C4	124.3'						Water level at the surface at the end of the dormant season and the early growing season, but then is below the upper 12 inches for most of the remainder of the 2012 growing season.
Consecutive days within range		20	8				
% of growing season		8.30%	3.32%				
Criteria met?		N	Y				
Groundwater Gauge D4	123.3'						Water levels sustained at or above the ground surface for most of the year except for a brief period at the peak of the growing season.
Consecutive days within range		75	92				
% of growing season		31.12%	38.17%				
Criteria met?		Y	Y				
Groundwater Gauge E4	124.8'						Located on the wetland fringe and does not meet minimum success criteria, however water levels are active between 12 to 30 inches throughout most of the year. This location is wetter compared to D2.
Consecutive days within range		4	3				
% of growing season		1.66%	1.24%				
Criteria met?		N	N				
Groundwater Gauge F4	124.8'						Located on the wetland fringe, with water levels below the monitoring depth for most of the year.
Consecutive days within range		4	1				
% of growing season		1.66%	0.41%				
Criteria met?		N	N				
Groundwater Gauge G4	123.5'						Mostly dry at the beginning and end of the year except for a brief period at the beginning of the growing season. This gauge is dependent on flood events, which create ponding in the Wedhakhee area.
Consecutive days within range		11	8				
% of growing season		4.56%	3.32%				
Criteria met?		N	Y				
Groundwater Gauge B5	123.4'						Water levels sustained at or above the ground surface for most of the year except for a brief period at the peak of the growing season.
Consecutive days within range		6	26				
% of growing season		2.49%	10.79%				
Criteria met?		N/A	Y				

1- The Army Corps of Engineers states that the range is within 12 inches of the ground surface
2- The growing season for the site is 241 days long.
3- For year's one (1) through three (3), minimum successful wetland hydrology is defined as less than or equal to 50% deviation in sustained water table levels near the surface compared to the reference wetlands (see Table 10a).

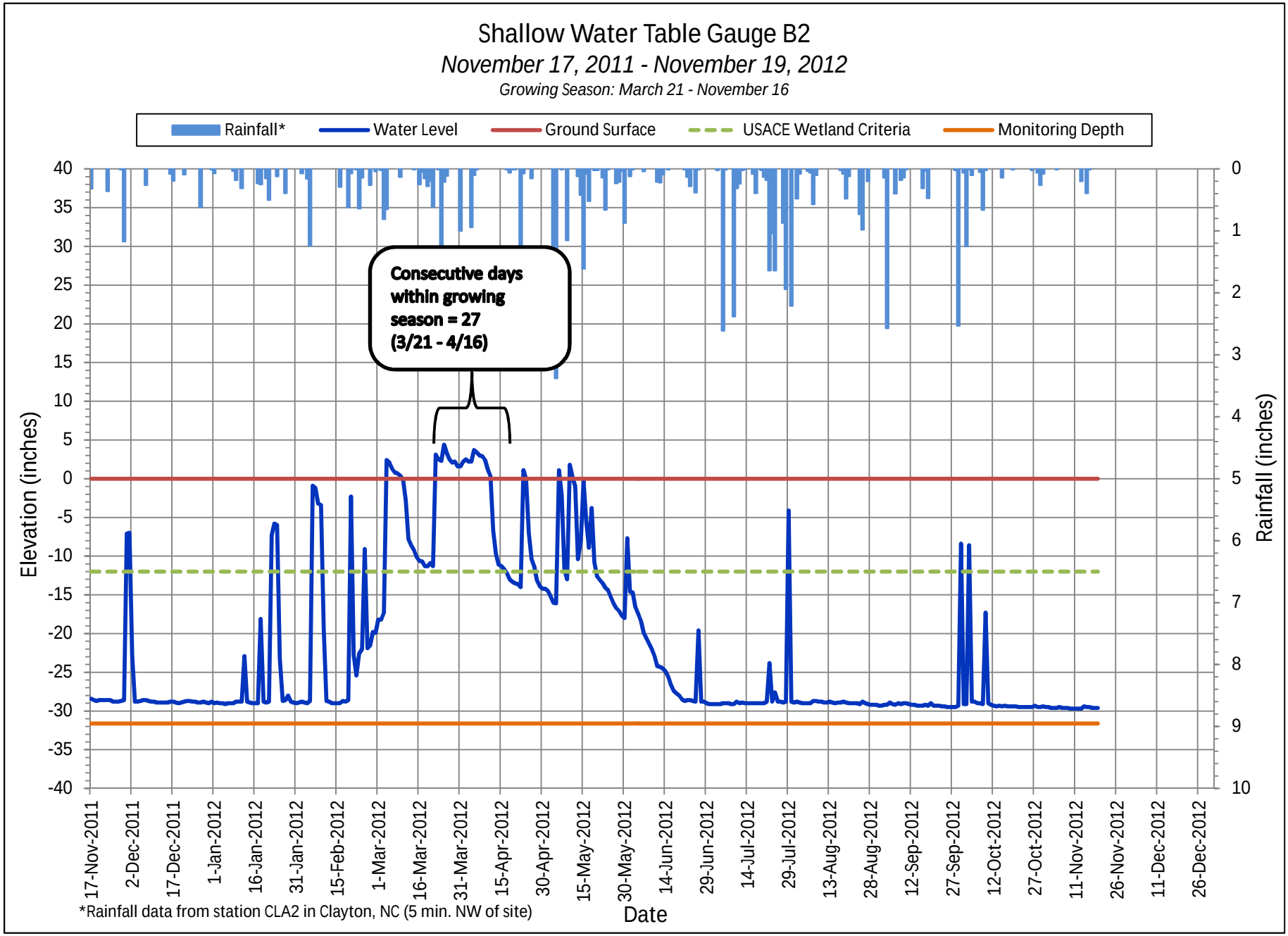
* Ground elevations recorded by KHA using a Trimble VRS unit. Elevations are not certified by a professional surveyor.



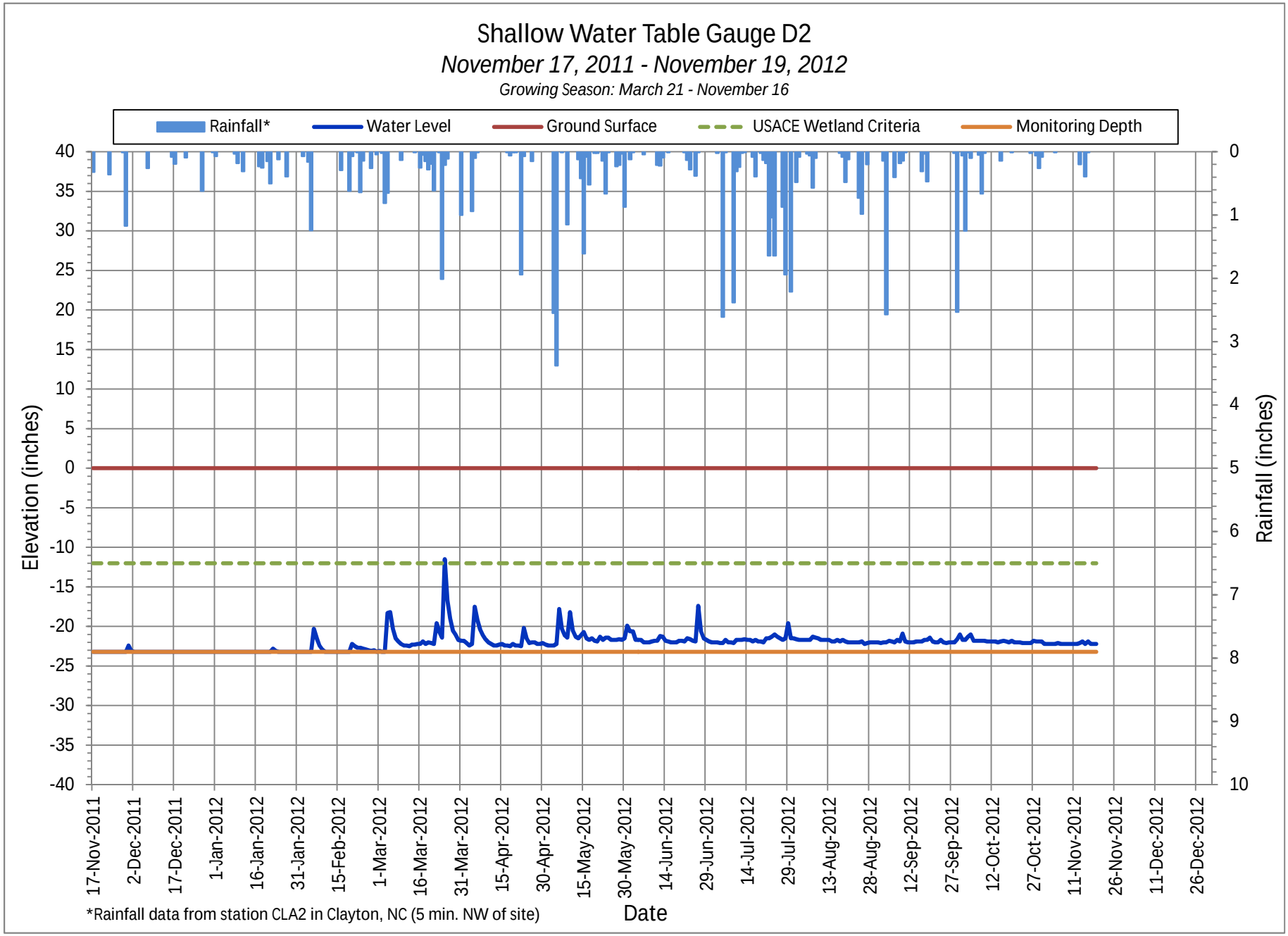
Kimley-Horn and Associates, Inc.



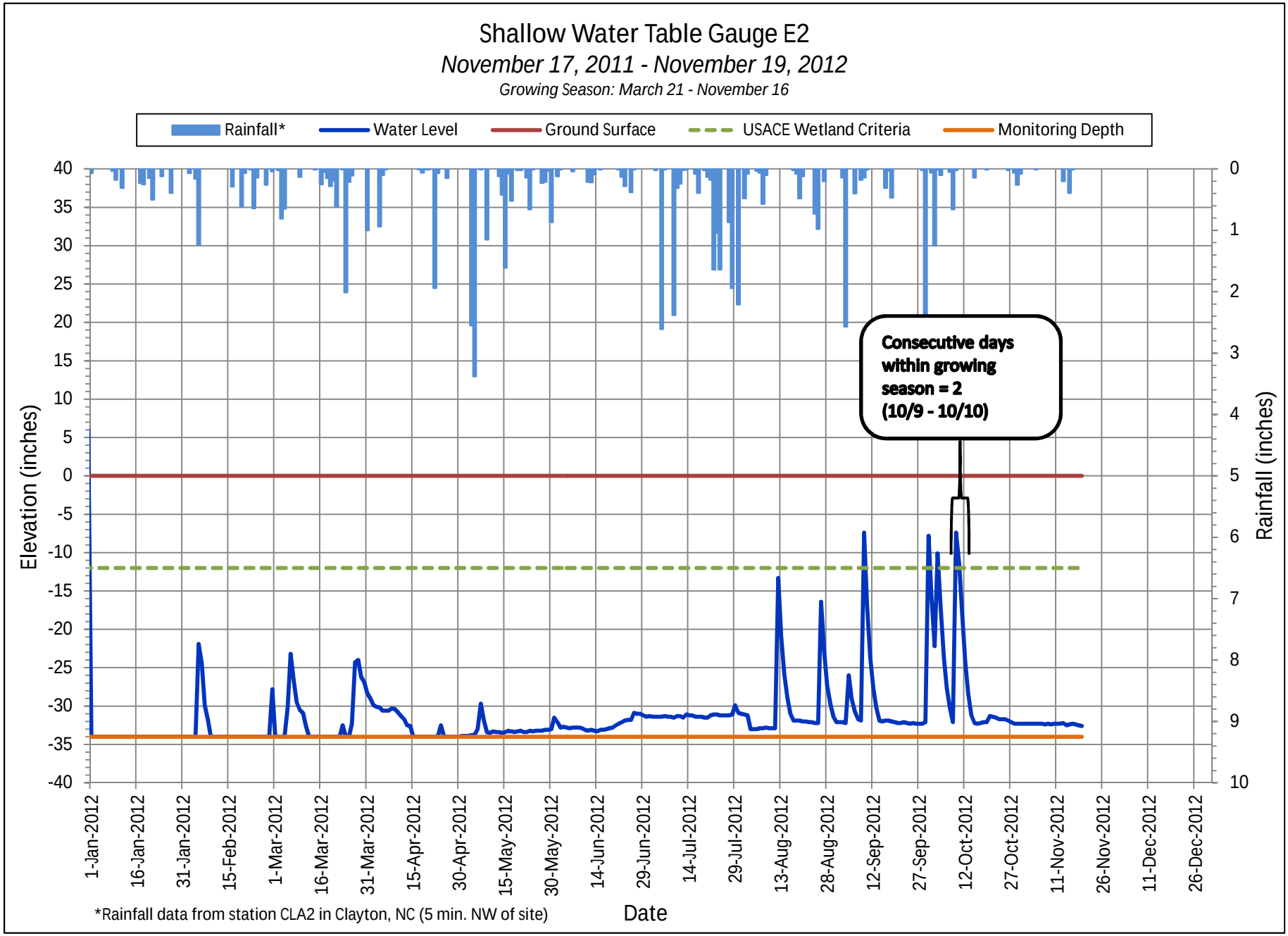
Kimley-Horn and Associates, Inc.



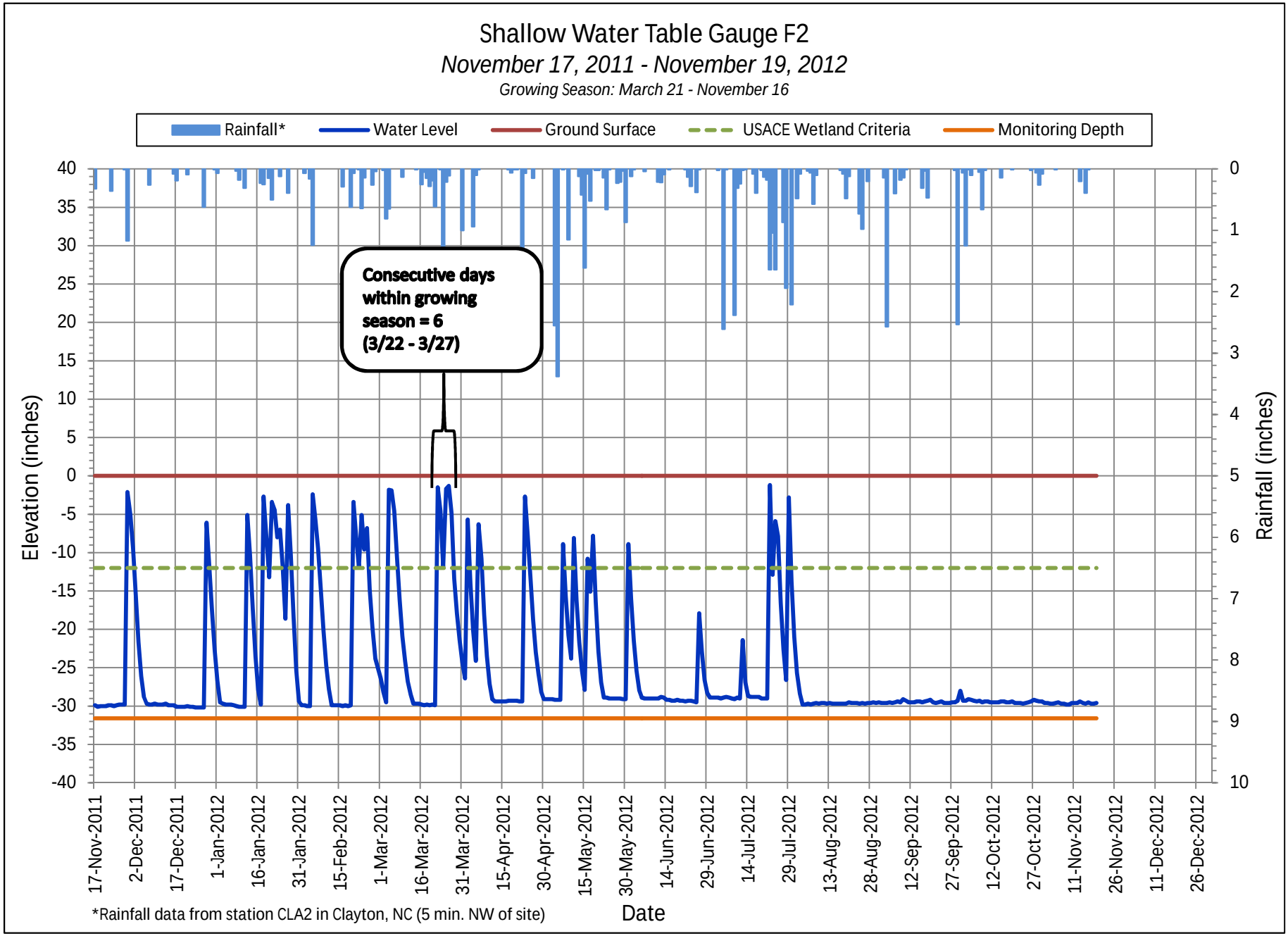
Kimley-Horn and Associates, Inc.



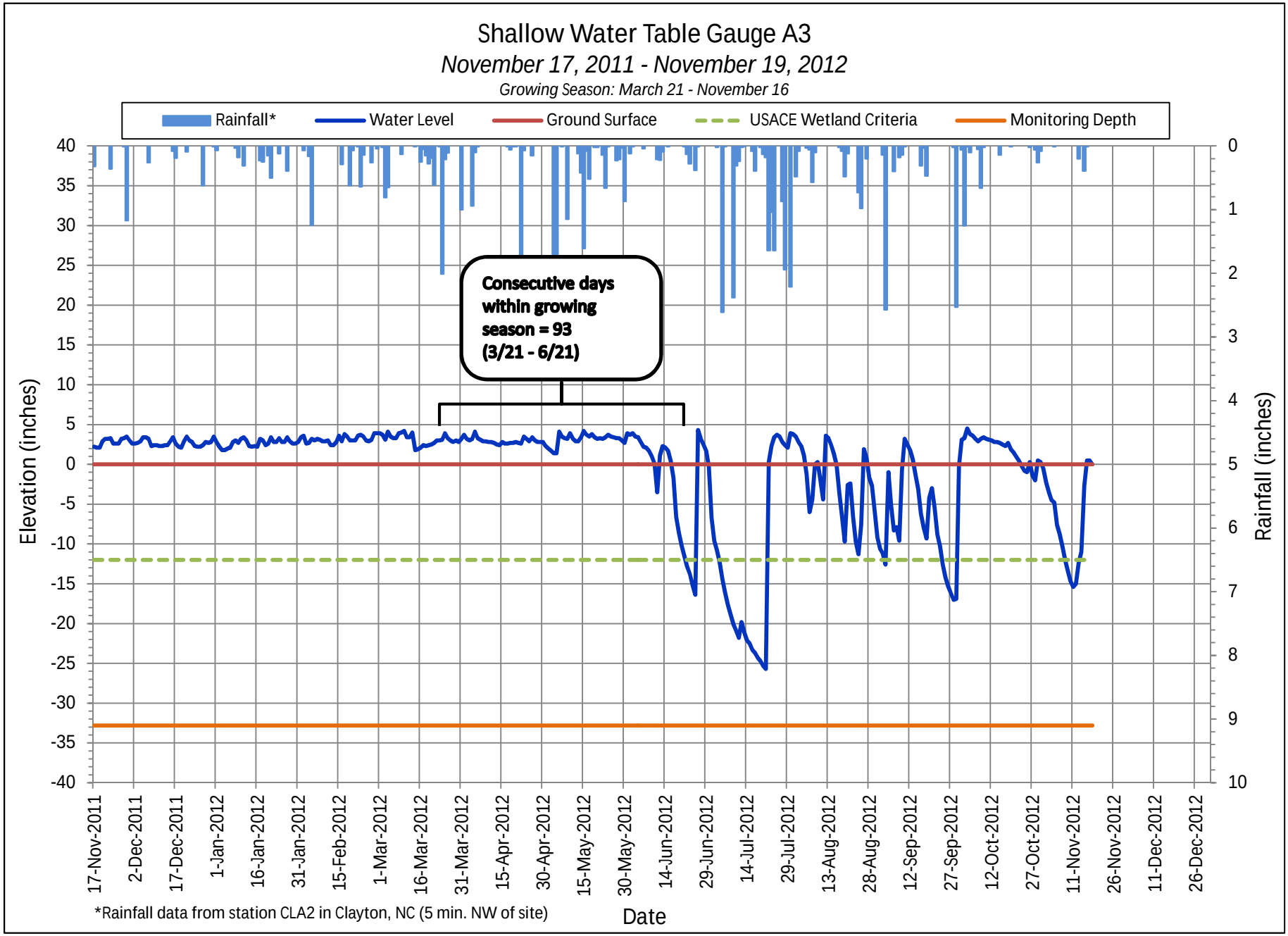
Kimley-Horn and Associates, Inc.



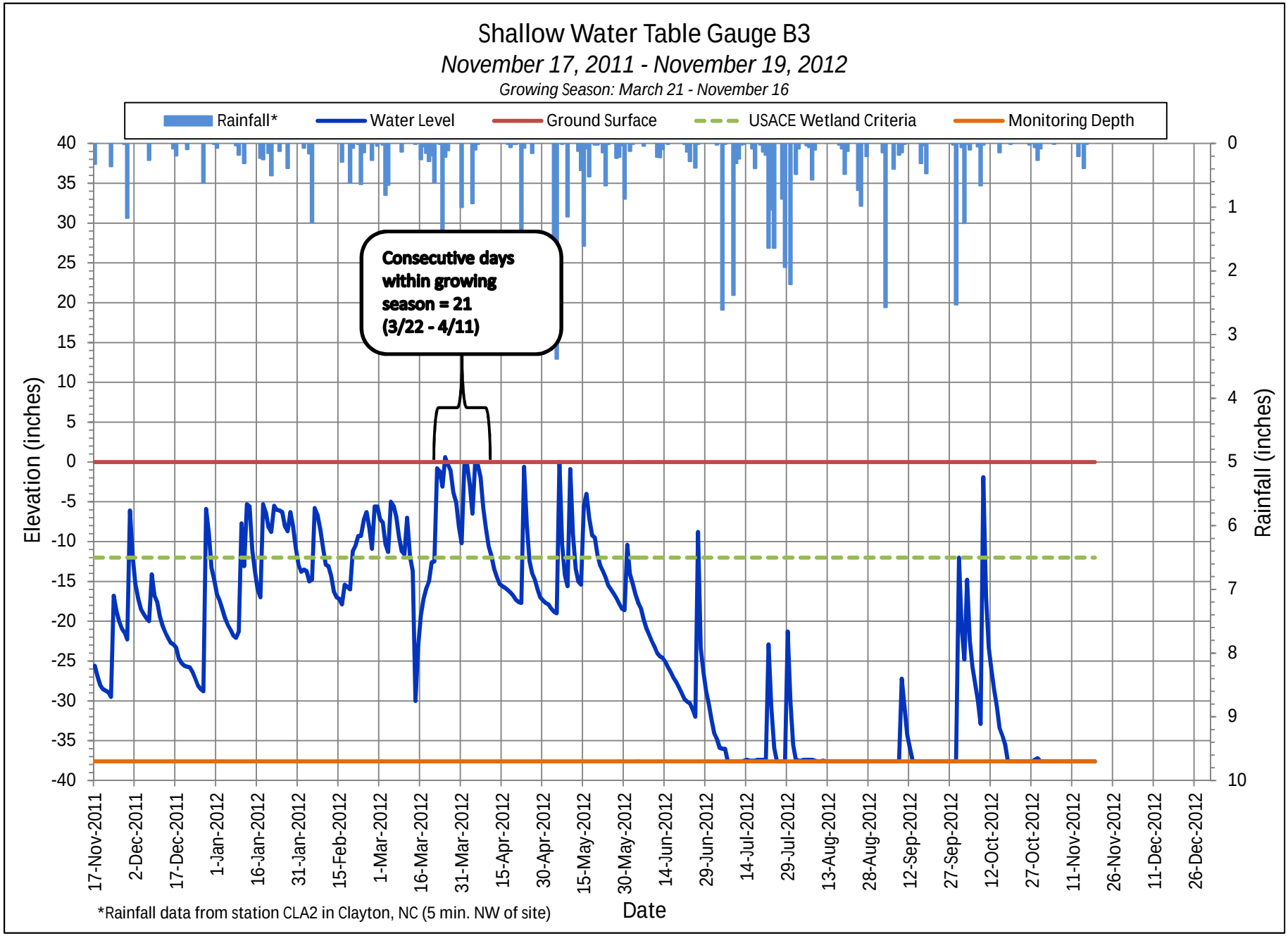
Kimley-Horn and Associates, Inc.



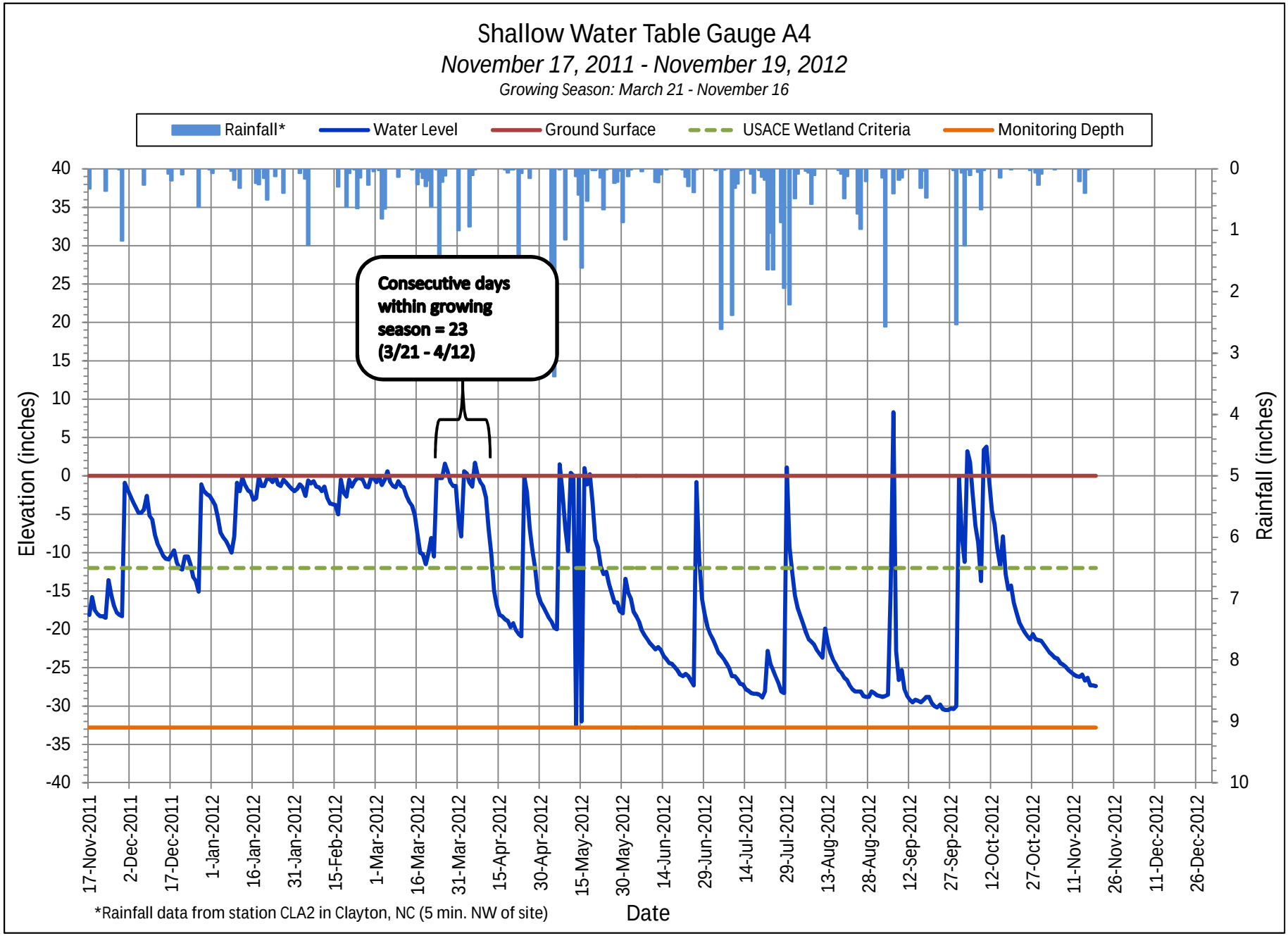
Kimley-Horn and Associates, Inc.



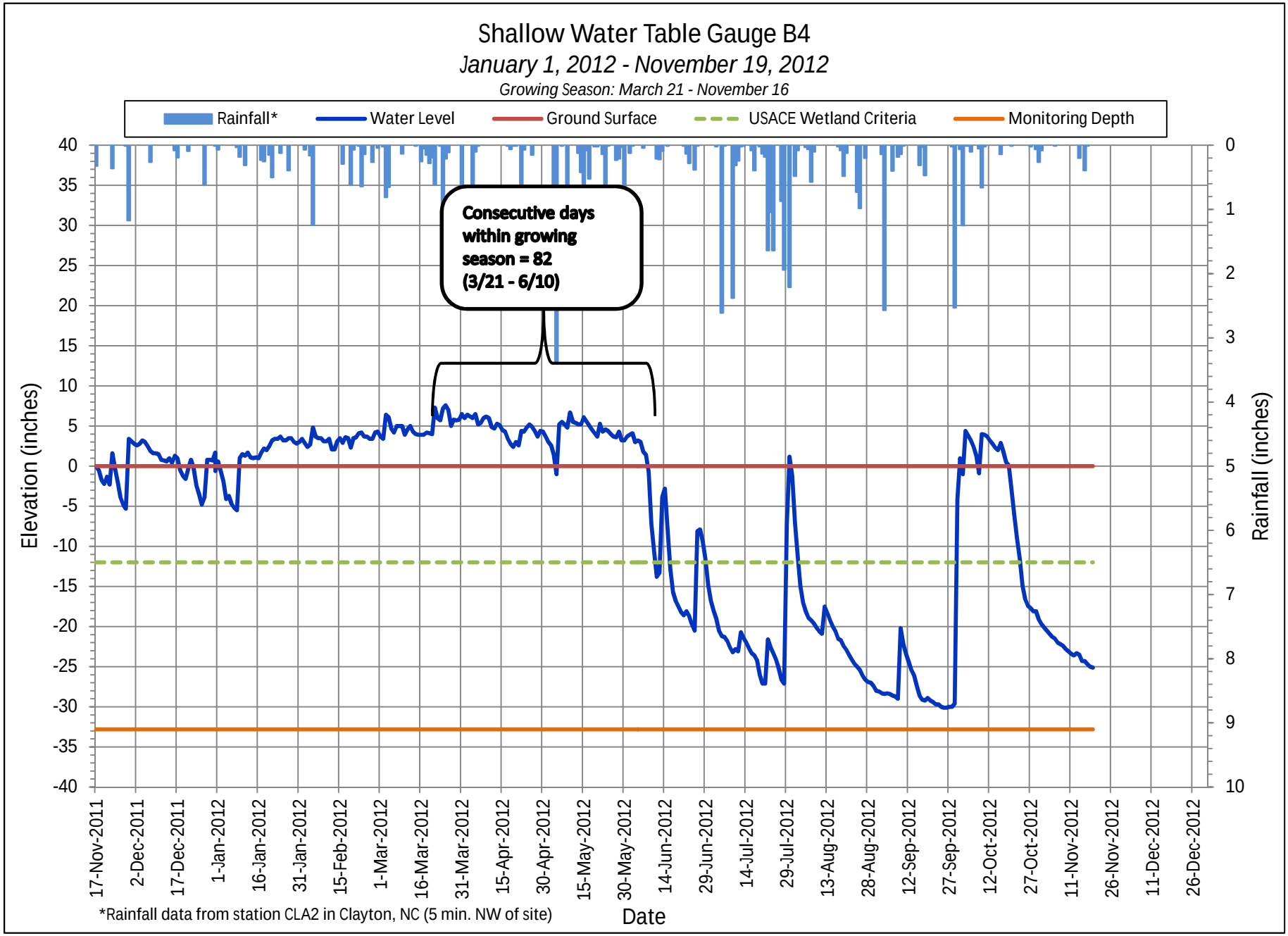
Kimley-Horn and Associates, Inc.



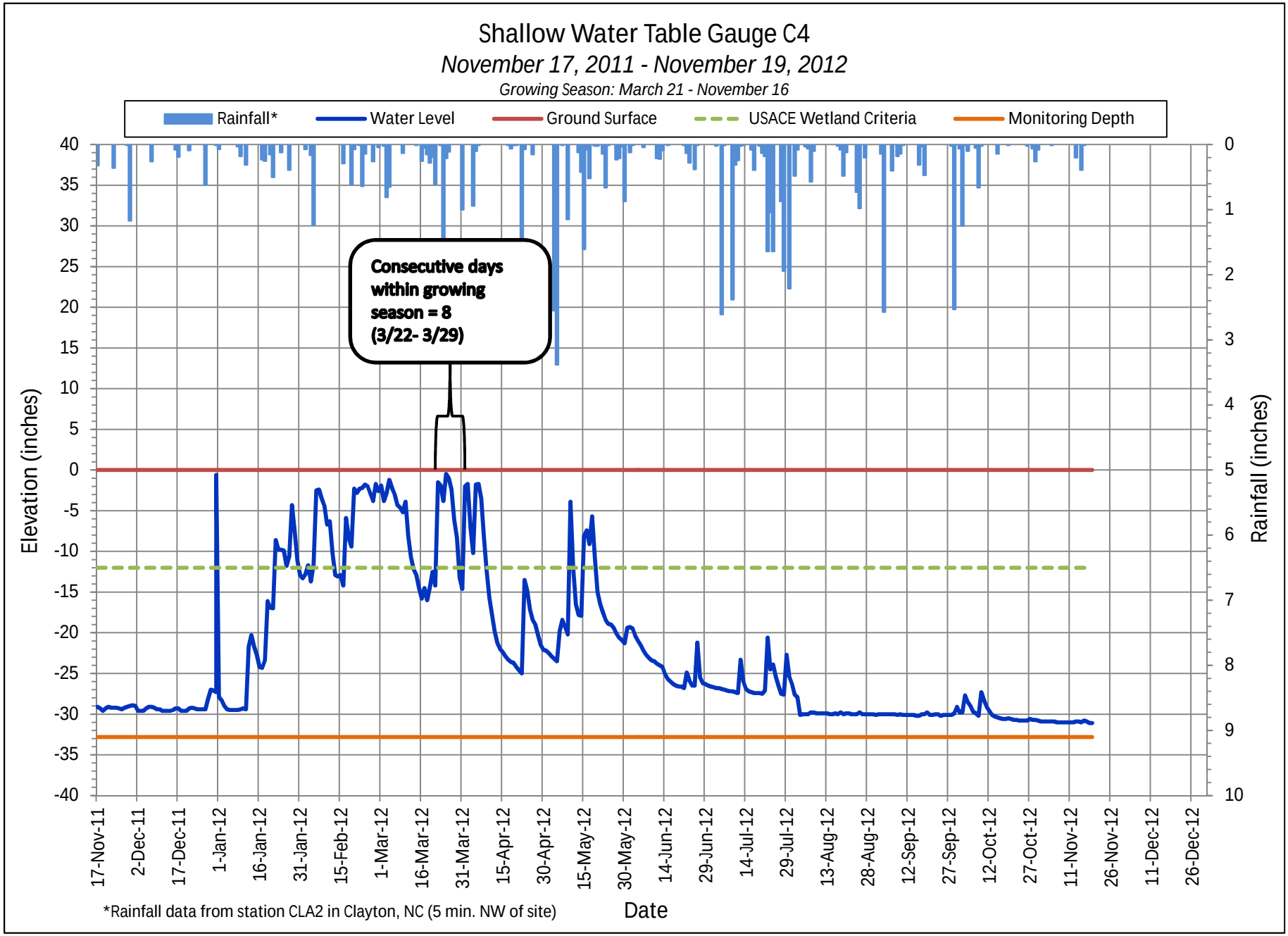
Kimley-Horn and Associates, Inc.



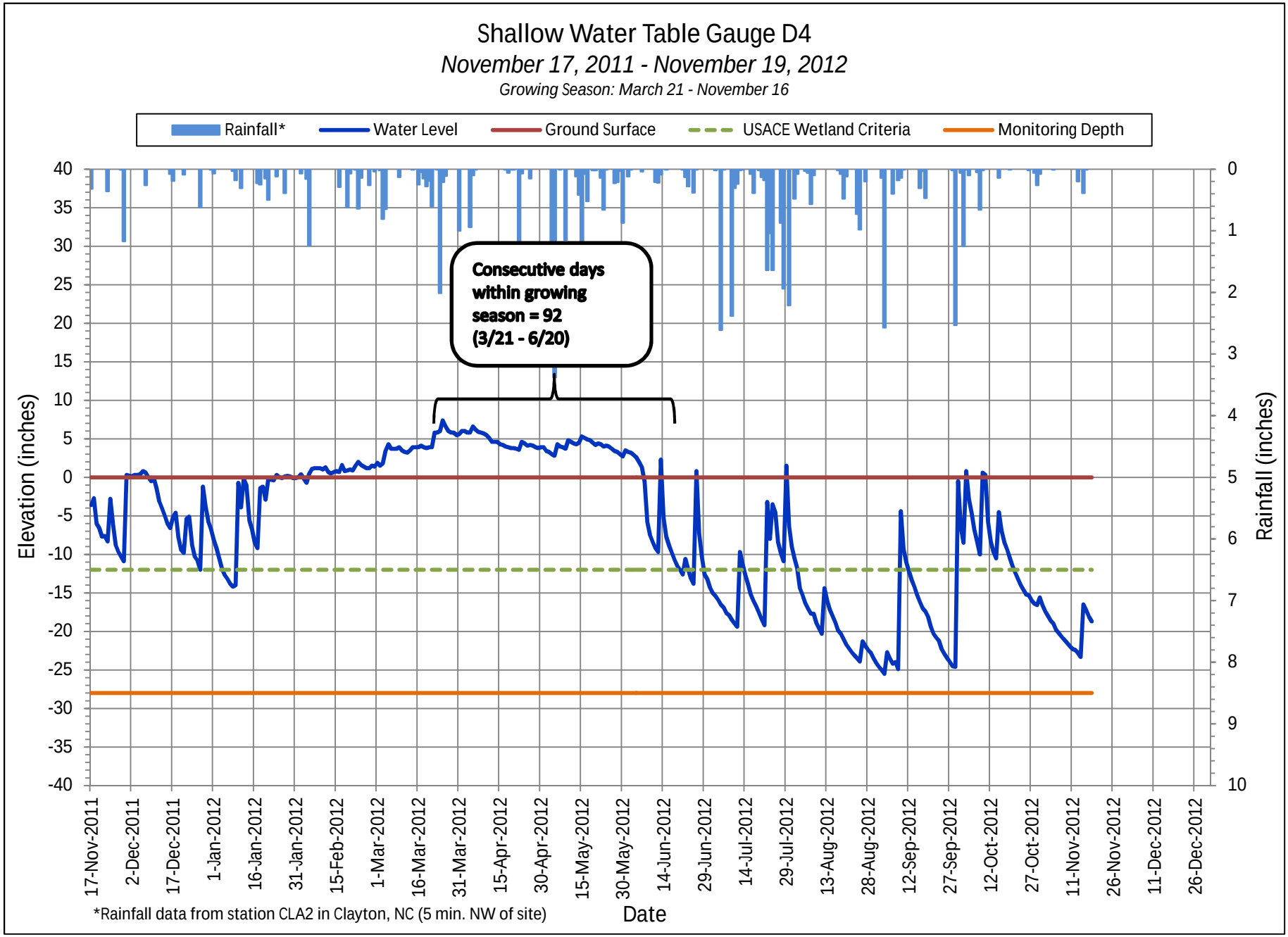
Kimley-Horn and Associates, Inc.



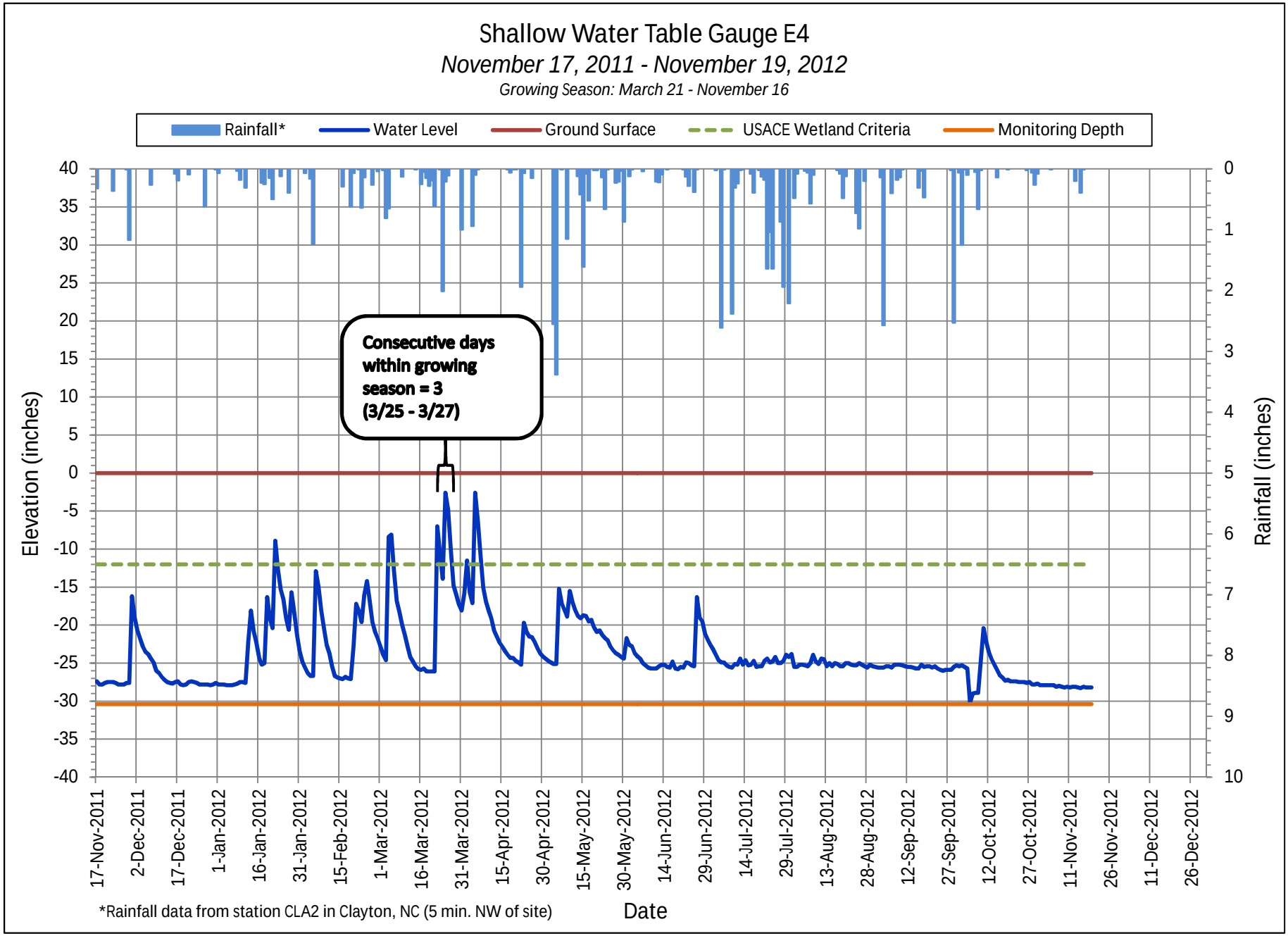
Kimley-Horn and Associates, Inc.



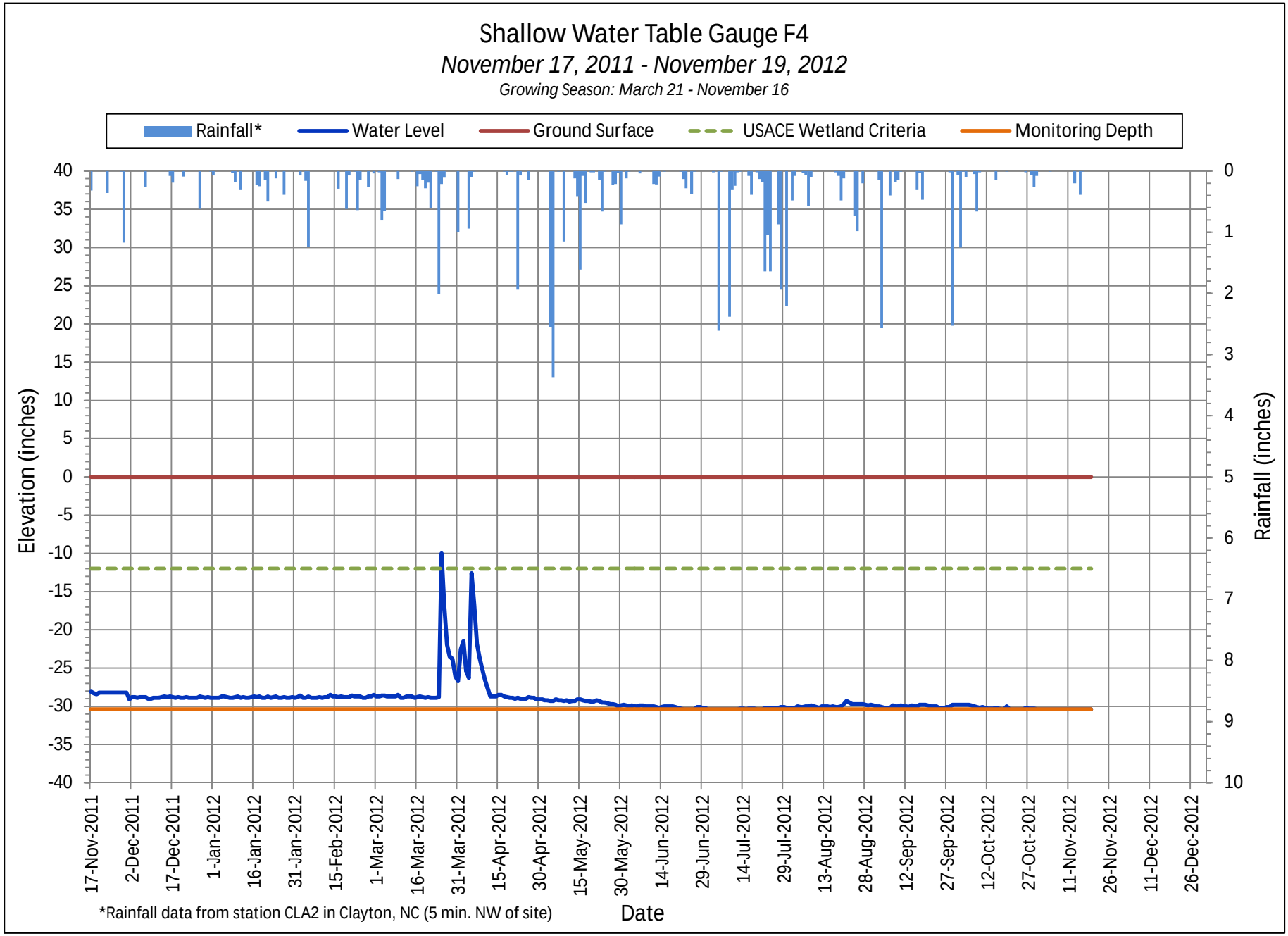
Kimley-Horn and Associates, Inc.



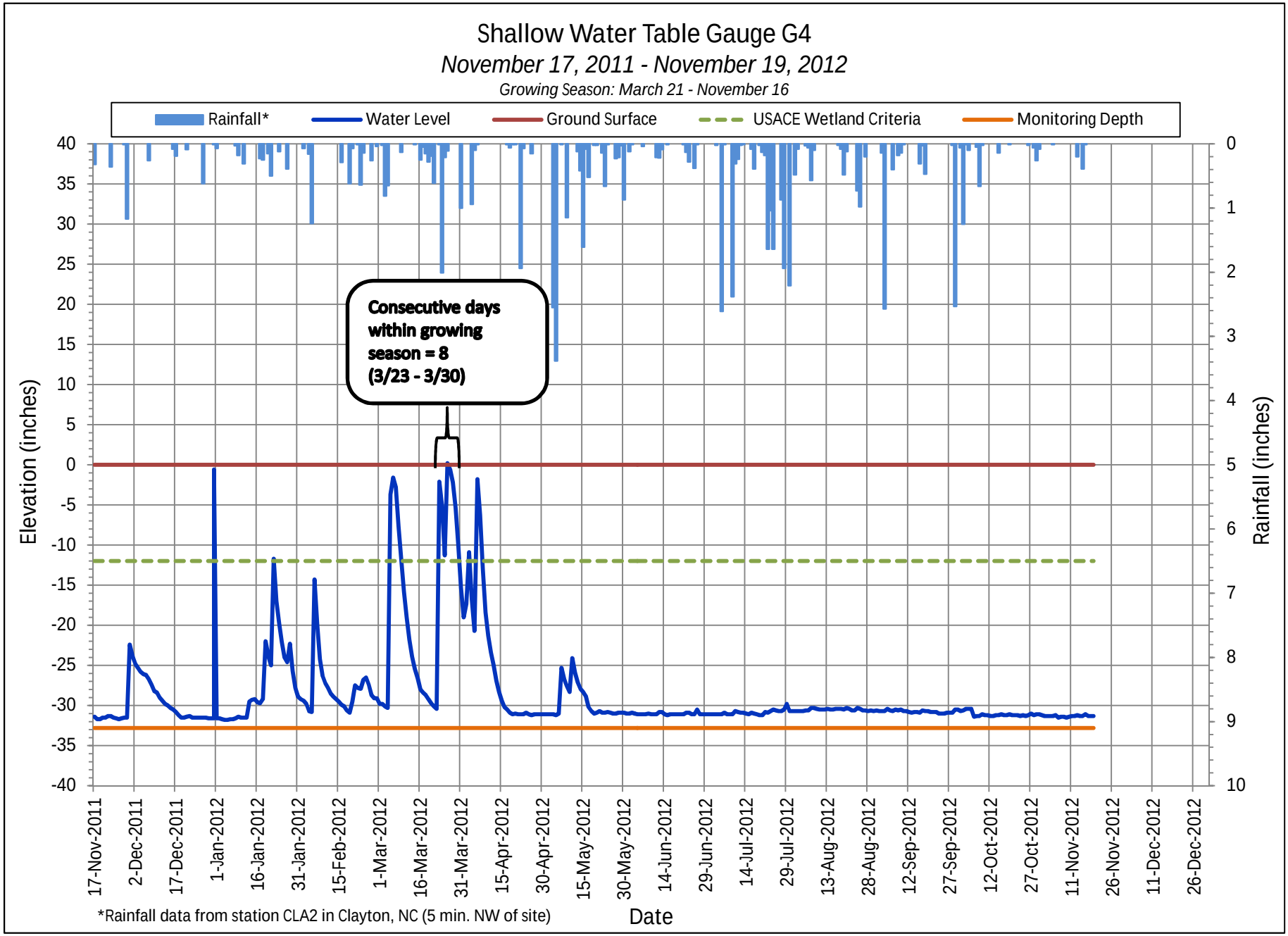
Kimley-Horn and Associates, Inc.



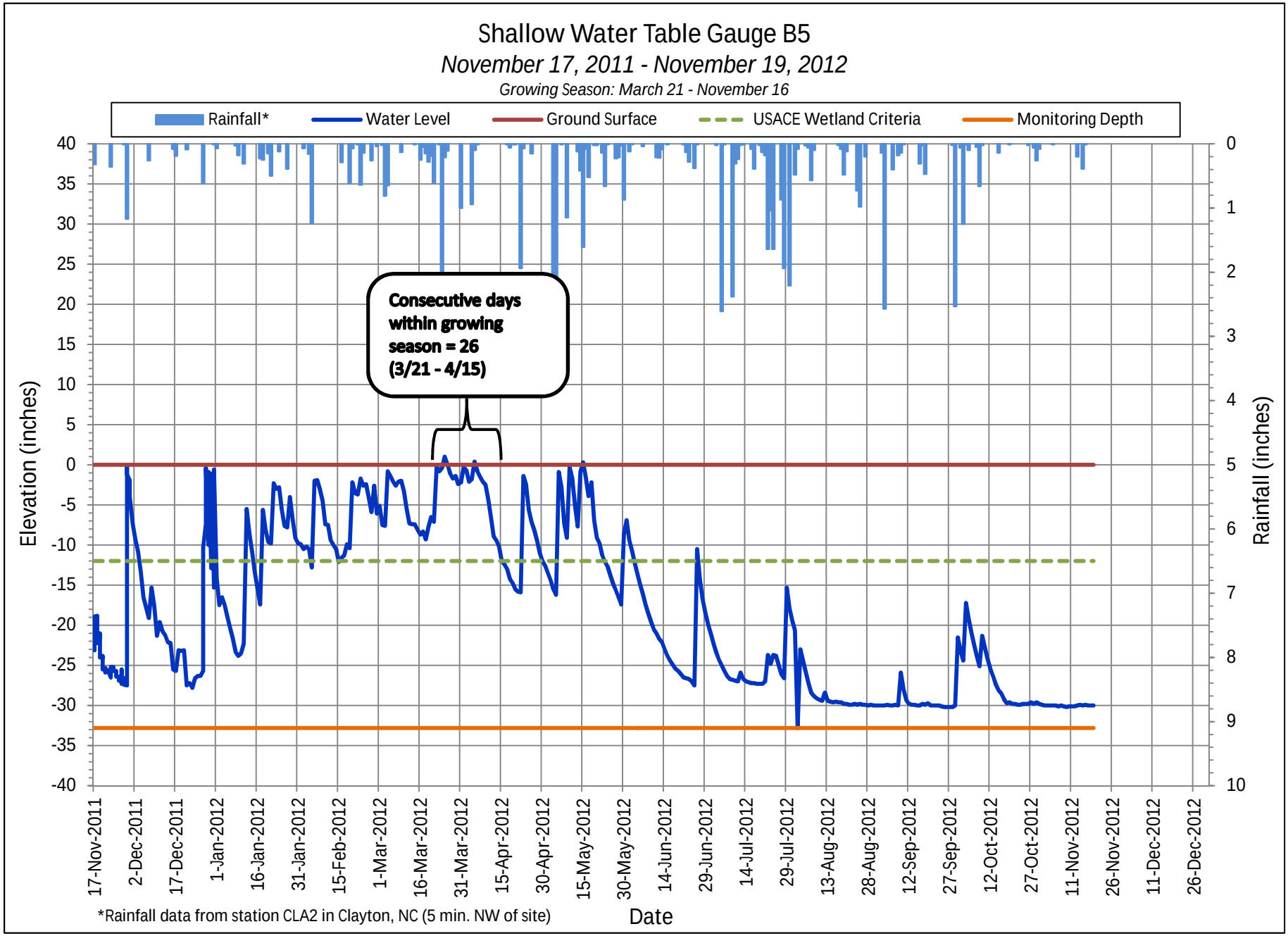
Kimley-Horn and Associates, Inc.



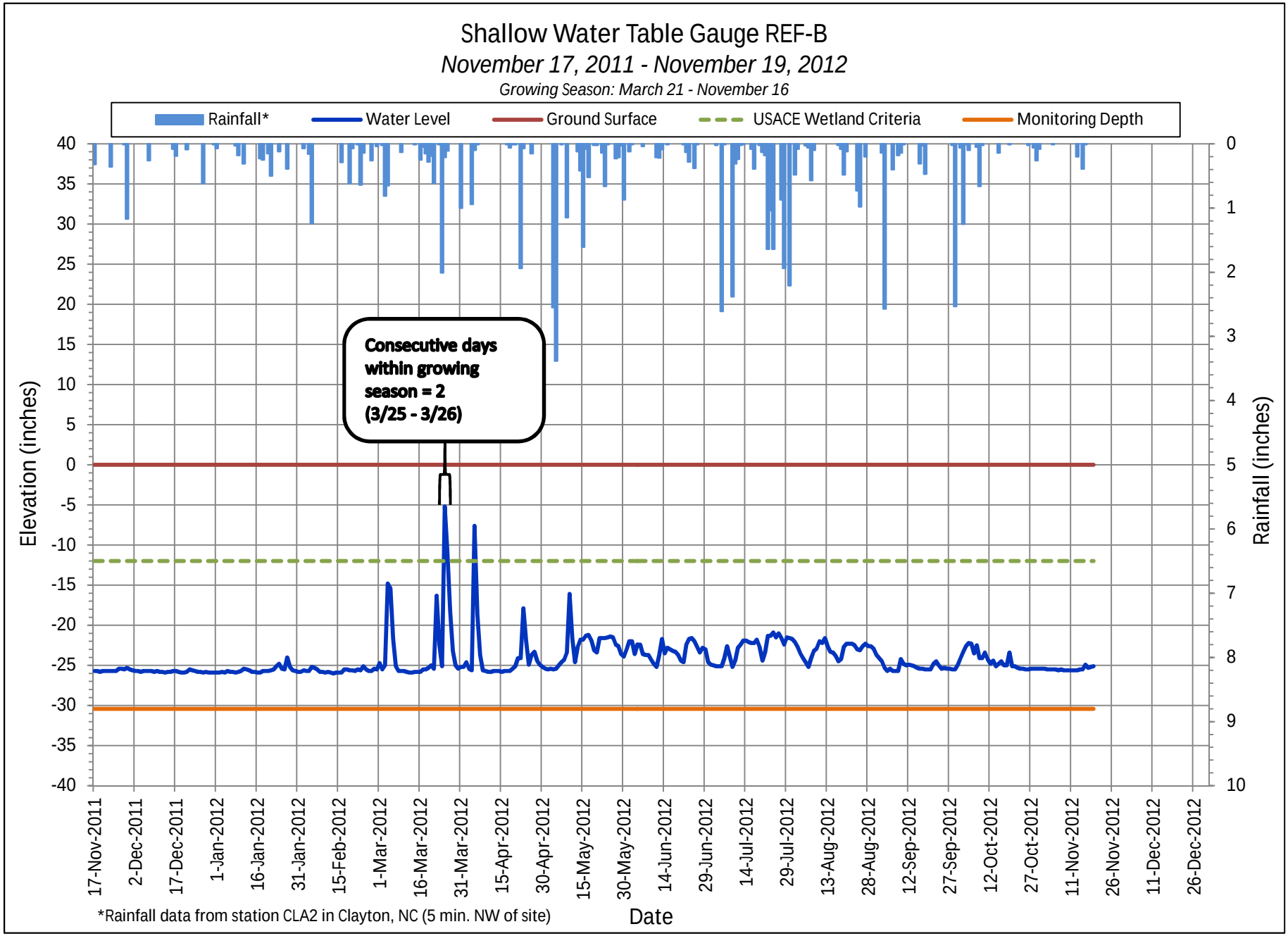
Kimley-Horn and Associates, Inc.



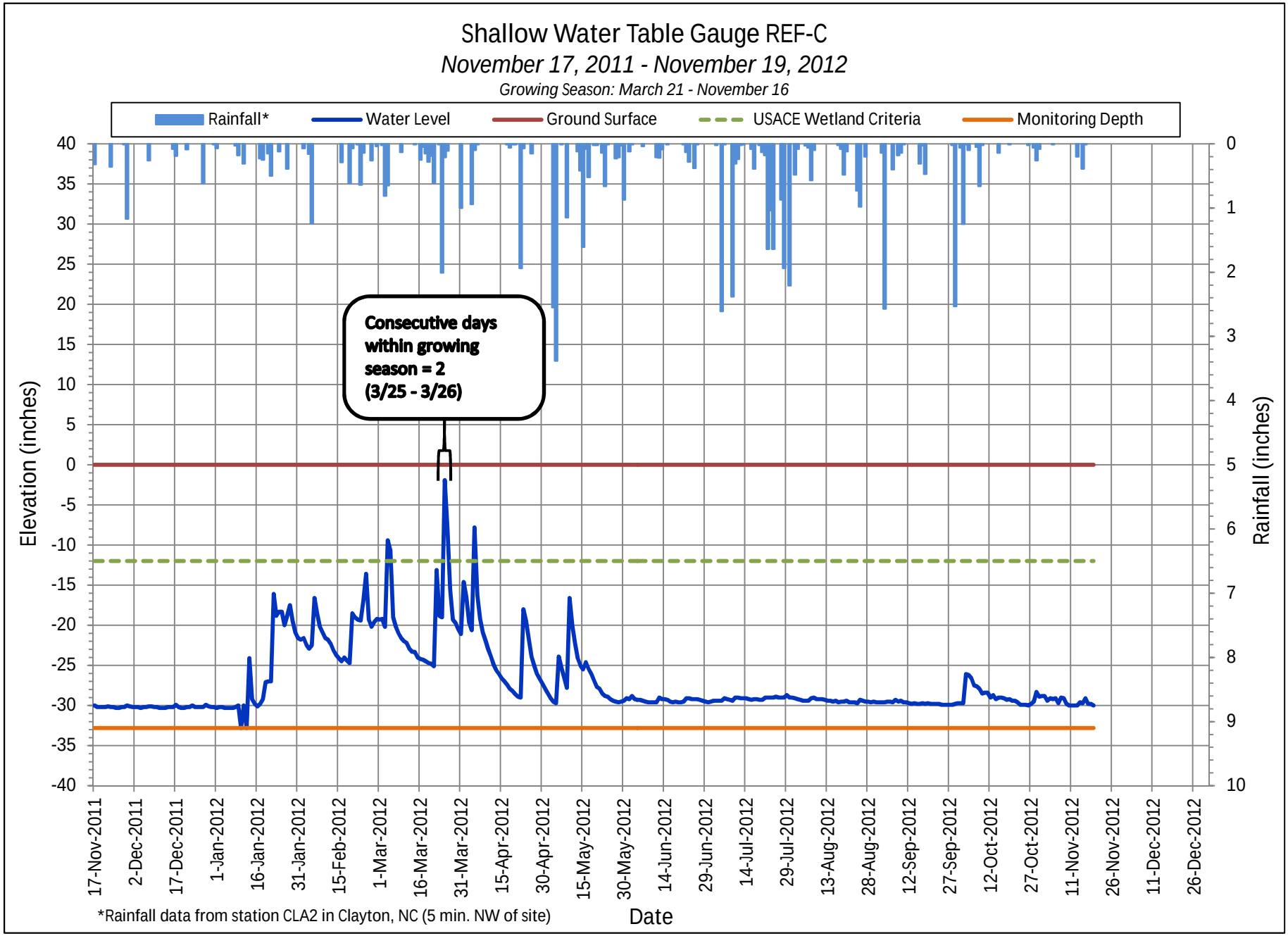
Kimley-Horn and Associates, Inc.



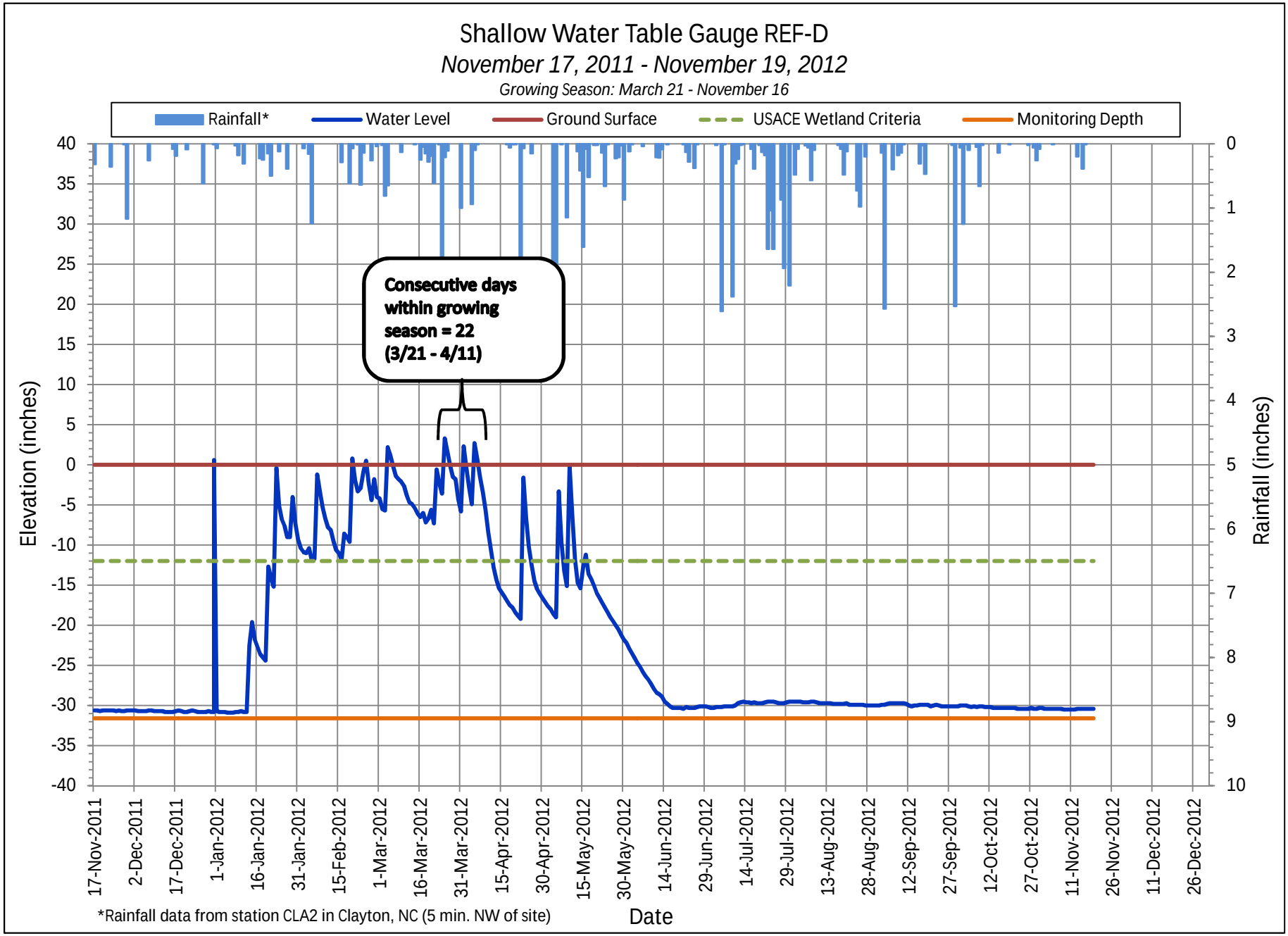
Kimley-Horn and Associates, Inc.



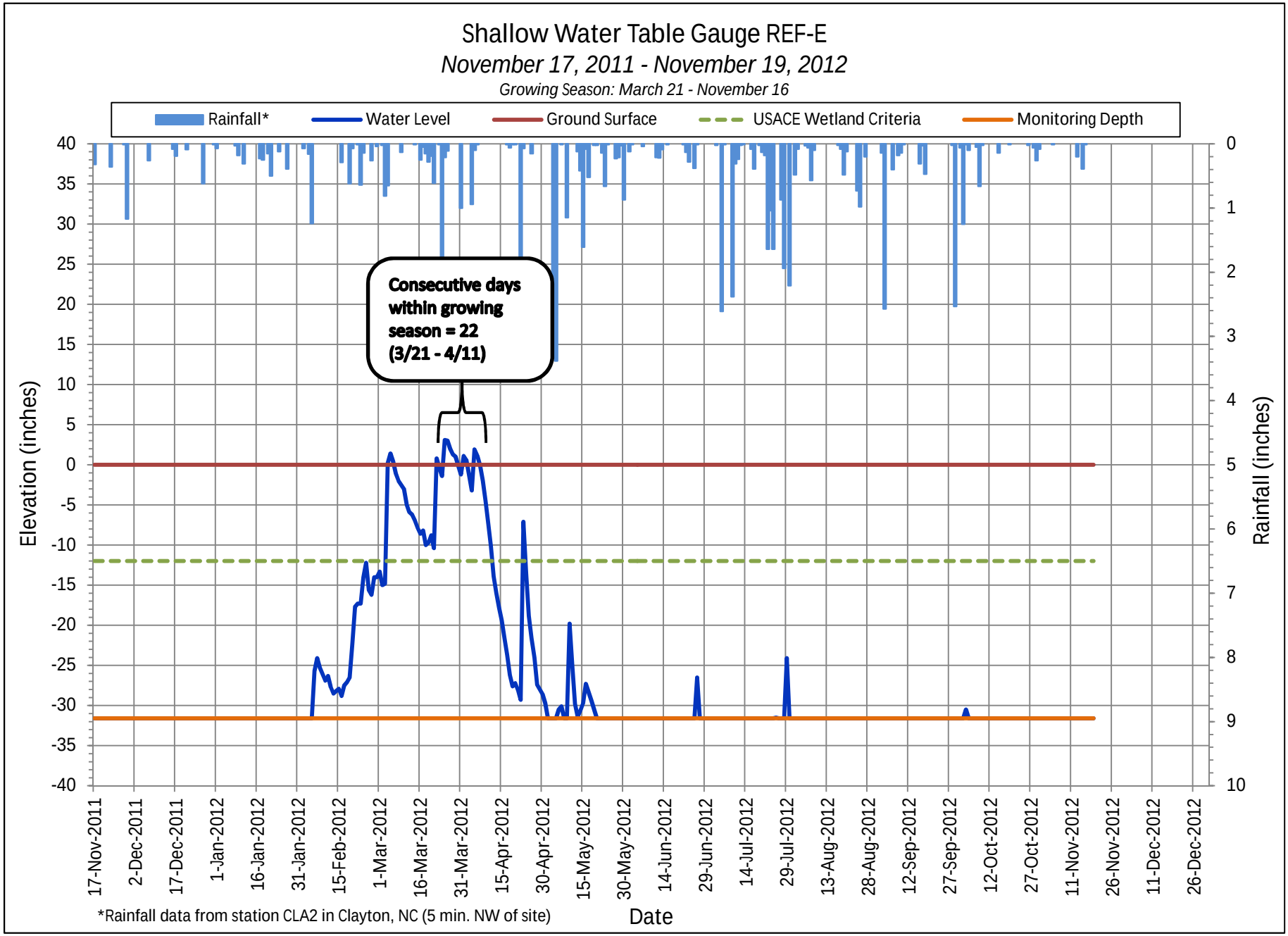
Kimley-Horn and Associates, Inc.



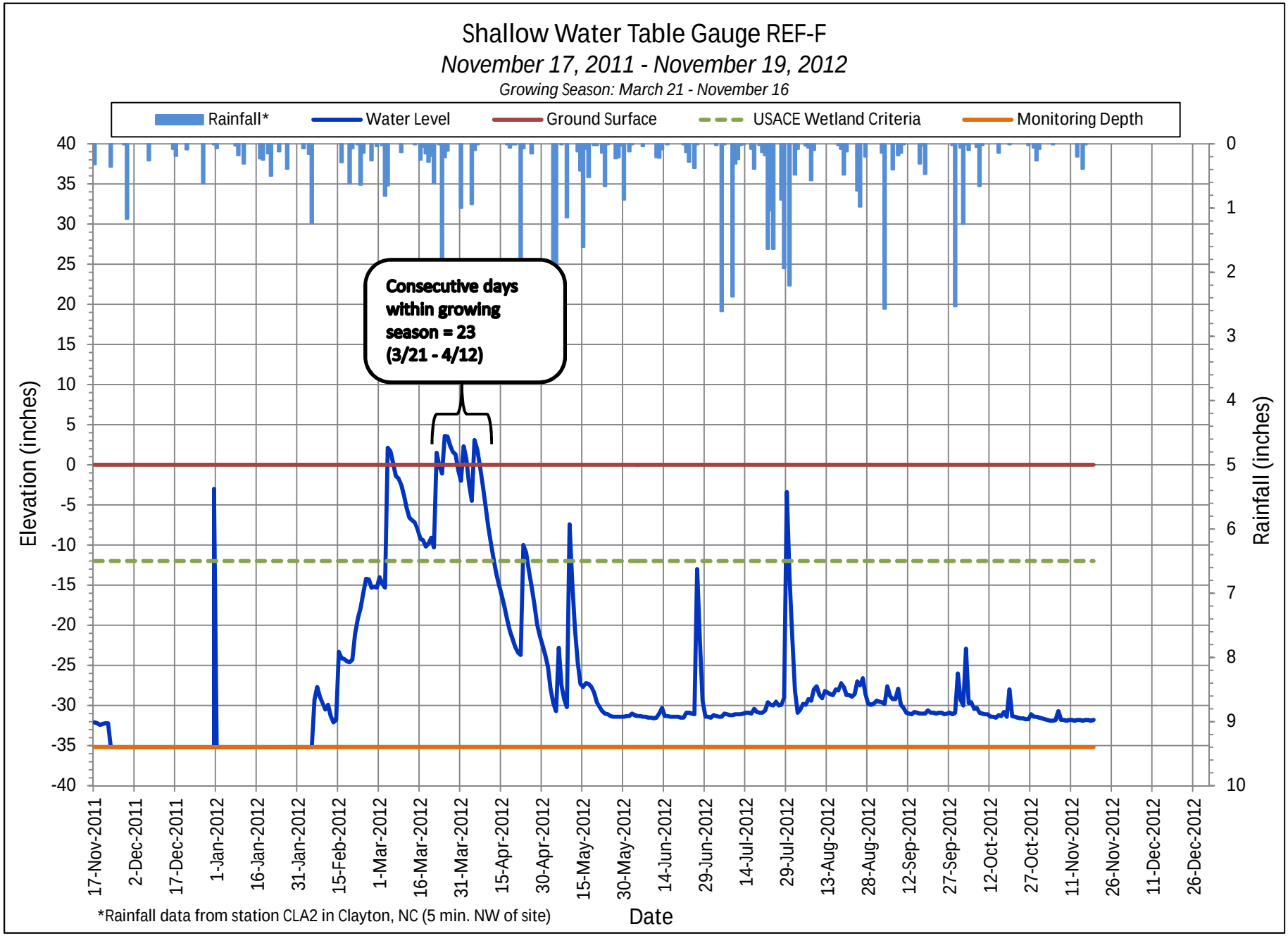
Kimley-Horn and Associates, Inc.



Kimley-Horn and Associates, Inc.



Kimley-Horn and Associates, Inc.



Kimley-Horn and Associates, Inc.