

Moore Property Monitoring Report FINAL Year 4 (2014)

Johnston County, North Carolina

USGS HUC: 03020201

EEP Project ID #725

EEP Project Manager: Heather Smith



Submitted to:



NCDENR-Ecosystem Enhancement Program

1652 Mail Service Center

Raleigh, North Carolina 27699-1652

Submitted December 2014

TABLE OF CONTENTS

EXECUTIVE SUMMARY

APPENDIX A – PROJECT VICINITY AND BACKGROUND TABLES

FIGURE 1	PROJECT SETTING
TABLE 1	PROJECT COMPONENTS AND SUMMATIONS
TABLE 2	PROJECT ACTIVITY AND REPORTING HISTORY
TABLE 3	PROJECT CONTACTS TABLE
TABLE 4	PROJECT ATTRIBUTE TABLE

APPENDIX B – VISUAL ASSESSMENT DATA

FIGURE 2	CURRENT CONDITIONS PLAN VIEW
FIGURE 3	REFERENCE GAUGE LOCATIONS
TABLE 6	VEGETATION CONDITION ASSESSMENT

WETLAND PHOTO PAGES

VEGETATION PHOTO PAGES

APPENDIX C – VEGETATION PLOT DATA

TABLE 7	VEGETATION PLOT CRITERIA ATTAINMENT
TABLE 8	CVS VEGETATION PLOT METADATA
TABLE 9	PLANTED AND TOTAL STEM COUNTS (SPECIES BY PLOT WITH ANNUAL MEANS)

APPENDIX D – HYDROLOGIC DATA

TABLE 10A	REFERENCE GROUNDWATER WELL SUMMARY
TABLE 10B	RESTORATION GROUNDWATER WELL SUMMARY

GROUNDWATER DATA ANALYSIS

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. (Kimley-Horn) in March 2009, and Environmental Quality Resources, LLC (EQR) completed construction of the project in July 2011.

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, mapped by the Natural Resources Conservation Service (NRCS) Soil Survey of Johnston County as Wehadkee loam (shown on Figure 2 as 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, mapped by NRCS as Tomotely sandy loam (shown on Figure 2 as 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 Area	Mitigation Ratio
Riparian Wetland	51.5 acres	1:1
Riparian Buffer Restoration or Nutrient Offset	248,292 square feet	1:1

Kimley-Horn performed wetland monitoring in the fall of 2014 for this Year 4 Monitoring Report with site visits occurring on March 5, May 22, June 26, and November 11, 12, and 18. The Site was also visited on September 10 following a substantial rainfall event (5.6” in 24 hours on September 8) and the majority of the site was underwater. All but three wells were obscured by floodwaters and could not be located in the field. 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 2014 monitoring year.

Rainfall by Month for 2014 Monitoring Year (Year 4)							
Month	Year	Rainfall* (in)	Average Rainfall** (in)	Month	Year	Rainfall* (in)	Average Rainfall** (in)
November	2013	0.71	3.14	May	2014	4.25	3.76
December	2013	3.13	3.15	June	2014	2.48	3.74
January	2014	4.33	4.17	July	2014	5.07	5.04
February	2014	4.33	3.66	August	2014	12.4	4.56
March	2014	5.39	4.23	September	2014	10.7	4.35
April	2014	8.28	3.00	October	2014	3.67	3.14
Total for Monitoring Year = 64.72 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 analyzed as part of the Year 4 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 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. Based on the collected Year 4 Monitoring data, the required hydroperiod needed to meet minimum success criteria for the site wetlands is 12 days. As shown in Table 10b, 16 of the 21 gauges installed on the site met the required hydroperiod. The following observations were made regarding the hydrologic conditions during the Year 4 Monitoring site visit:

- As shown in the monthly rainfall totals for the site, 2014 had multiple high rainfall events throughout the growing season. Of particular note were April, August, and September, which saw peak flows in Swift Creek. The site was observed by Kimley-Horn staff in September following a 5.6" in 24 hour storm, and the majority of the site was found to be inundated with 1-3' of water. Only the upland ridge in the center of the site was not inundated. Sediment staining on vegetation throughout the site further indicates more frequent inundation through the site in MY4 than previous years.
- Ponded water was observed throughout the drainage swales and within the lower elevations of the site during each site visit in MY4. This indicates that water is remaining on the site for extended periods after significant rainfall or flooding events.
- The wetland appears to be continuing 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 at least two bankfull events in Swift Creek in the monitoring year. Once based on sediment deposits observed in the outlet ditch and noted in the Site Assessment Report submitted in June 2014, and at least once more as observed by Kimley-Horn staff in September (WP4) when the crest gauge was fully submerged by standing water. Due to the crest gauge's installation close to the bottom of the outlet ditch, the flow events evidenced through the site in MY3 and MY4 seem to be regularly overtopping the gauge, so the exact height of the crest is unknown.
- Beaver activity was again observed along the outlet ditch, but no beaver damage was found within the site itself. The primary culvert outlet from the site remains completely impounded by a beaver dam, holding water within the ditch (WP3).
- 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 gauge on Swift Creek were 13.7' in mid-May (5/17/2014) and 14.3' in early fall (9/9/2014). The May 2014 event matched the event occurring immediately after construction completed within the site and the September 2014 flow event was the highest crest within Swift Creek since before the site's construction. Two days following the September 2014 event, Kimley-Horn staff conducted a site visit and observed floodwaters flowing into the site from the roadside swale, from the northeast corner of the site (overtopping the berm),

and through two breaches in the berm along the eastern boundary of the site. There was also clear evidence that Swift Creek had overtopped the berm at the southern end of the site as well (large, recently created depositional sediment bars within the site itself).

- High flow events occurring within Swift Creek during MY4 created multiple breaches in the berm adjacent to the site. The original breach noted by NCEEP staff in July 2013 was again utilized by Swift Creek, further depositing sediment into the site, but two new breaches were observed by Kimley-Horn staff and are shown on the CCPV figure. A photo of the breach is included as WP5, WP6, and WP7.
- NC EEP installed five additional groundwater monitoring wells (N1, N2, N3, N4, and N5) in March 2014 (MY4) within potentially marginal areas of the site to complement data collection within the existing monitoring transects, taking the total number of wells in the site to 21. The CCPV figure shows the locations of these wells. Well N4 was placed in the field, however the data point collected at that location was corrupted, and N4 has not been located in the field due to heavy herbaceous coverage in the area. N4 will be located and re-logged during the winter months prior to MY5 when the herbaceous vegetation has died back.

Per the Natural Resource Conservation Service (NRCS) Soil Survey of Johnston County, the growing season in Johnston County is from March 21 until November 16 (241 total days). Sixteen of the twenty-one groundwater gauges indicate that the wetland is exceeding the minimum success wetland hydrology criteria for the site. Four of the gauges did not meet minimum success criteria for wetland hydrology (Gauges D2, E2, F2, and N1), and Gauge N4 could not be located in the field for data download. Two of the gauges that did not meet minimum criteria, D2 and N1, are located along the wetland fringe adjacent to upland areas in the northwestern quadrant of the site. Hydrology at these locations would be expected to be highly variable, both seasonally and year-to-year depending on rainfall and flood events from Swift Creek. (see Tables 10a and 10b for more detail). The remaining two gauges that did not meet minimum criteria, E2 and F2, are located at the upper end of the drainage swale carrying flood flows from Swift Creek. These gauges were inundated by flooding during September 2014 after Swift Creek breached the constructed berm. It is anticipated that with continued flooding events within Swift Creek and continued natural expansion of the berm breaches, Gauges E2 and F2 will see more regular and sustained wetland hydrology. In MY4, only three gauges (B3, C4, and N5) experienced failures resulting in data loss, and none of the failures were in locations that did not meet minimum success criteria. Gauges B3 and C4 experienced failures in the later months of the growing season, but still met success criteria between March 21 and late June. Gauge N5 failed in the early months of the growing season, but then met success criteria between September and October.

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. In addition, the minimum success criterion 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 years after initial planting. Similarly, in riparian buffers a minimum mean density of 260 native hardwood tree

species (planted and volunteer stems) per acre must be surviving for five years after initial planting. These minimum requirements are according to the North Carolina Administrative Code 15A NCAC 02B.0295 (Mitigation Program Requirements for Protection and Maintenance of Riparian Buffers). Based on MY4 data, 11 of the 16 vegetation plots are meeting minimum success criteria, with 8 of the 12 wetland plots and 3 of the 4 riparian buffer plots meeting the success criteria (one of the riparian buffer plots was not sampled in MY4, as described below).

This site was instituted prior to October 2007 and, therefore, will generate Riparian Buffer Restoration credit within the conservation easement where planted or volunteer native 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, Kimley-Horn conducted a CVS Level 2 assessment of sixteen 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 4 Monitoring site visit on November 11, 12, and 18, 2014:

- Currently three (VQ-11, VQ-14, and VQ-16) of the four riparian vegetation plots (VQ-11, VQ-12, VQ-14, and VQ-16) are meeting the minimum success criteria of 260 woody stems/acre.
- As noted in the MY3 report, unauthorized clearing activities impacted vegetation plot 12 (VQ-12), of which approximately half of the plot has been mowed, cleared, and re-seeded, destroying both the planted and naturally occurring vegetation within the plot. The rebar pins at both the origin (0,0) and the southeastern corner (0,10) have been removed or destroyed. Based on MY4 assessments, the unauthorized activity noted in MY3 does not appear to have been maintained. The mowed access road appears to be returning, and woody stems were observed throughout the road corridor. No evidence of unauthorized site access or hunting activities were found within the site. For MY4 data collection, Kimley-Horn attempted to reestablish VQ-12, however the remaining pins at (10,0) and (10,10) could not be located in the field. Using the GPS location of the previous pins, the remaining woody stems did not align with VQ-12's planting map, and the GPS-indicated plot location was entirely overtaken by blackberry due to the mechanized clearing with minimal woody stems present. Based on the limited access and inability to locate or reset the pins in the original position, VQ-12 was not sampled in MY4. A repeat attempt will be made prior to MY5.
- Eight (VQ-1, VQ-4, VQ-5, VQ-6, VQ-9, VQ-10, VQ-13, and VQ-15) of the twelve wetland vegetation plots (VQ-1, VQ-2, VQ-3, VQ-4, VQ-5, VQ-6, VQ-7, VQ-8, VQ-9, VQ-10, VQ-13, and VQ-15) are meeting the minimum success criteria of 260 woody stems/acre.
- Of the four vegetation plots that are not meeting the minimum success criteria, none are within 50 stems/acre of meeting the 260 stem/acre minimum success criteria. From visual observations, the plots that are not meeting the vegetation success criteria are

generally dominated by herbaceous vegetation or are typically inundated throughout the year.

- Based on the MY4 CVS assessment, the average woody stem count per acre for MY4 within the wetland area of the site is 297 stems/acre, and the total average for the riparian area of the site is 516 stems/acre.
- NC EEP contracted to have the supplemental planting of 1,220 woody stems conducted within seven targeted zones totaling 6.8 acres of the site on November 20, 2013. The planting was conducted after the conclusion of MY3 monitoring work, but the supplemental stems were marked with blue paint and they were assessed as part of the MY4 data collection. Multiple plots resulted with at least one supplemental stem in the plot, and a few had multiple supplemental stems. Of the planted stems, tulip poplar (*Liriodendron tulipifera*) appeared to be faring poorly when planted in areas with evidence of inundation. Most of the tulip poplar stems observed near vegetation plot VQ-9 appeared dead at the time of the site visits in May and November, while tulip poplar stems planted near vegetation plot VQ-14 were doing well in November 2014. Many of the other supplemental planting tree species appeared to be healthy other than occasional signs of deer browse. Despite the supplemental plantings, the four riparian plots are being overtaken with volunteer woody stems and naturally propagating vegetation that appears in many cases to be outcompeting the planted stems.
- NC EEP contracted to have additional supplemental planting done within the riparian area of the site in early December 2014, after the conclusion of the MY4 monitoring work. The supplemental stems will be assessed as part of the MY5 monitoring work.
- As shown on the Current Conditions Plan View, cattails (*Typha latifolia*) have continued to establish in the vicinity of the wetland seep, the constructed wetland swale, and in the historic agricultural ditch location. The cattail population has died back in the roadside swale entrance to the site as juncus continues to dominate and pines propagate into the swale.
- Lespedeza (*Lespedeza cantata*) remains established in the southwestern portion of the site, between vegetation plots 8 and 9, and small clusters of marsh dayflower (*Murdannia keisak*) continue to thrive at the northern inlet and southern outlet swales on the western half of the site. Chinese privet was observed in the riparian area in small numbers, likely resulting from flooding early in the growing season of MY4.
- Large numbers of Bradford pear (*Pyrus calleryana*) were observed throughout the site as individual stems. There are multiple large Bradford pear trees located along the southern border of the site that is a likely seed source. Bradford pear is a very capable invasive plant and can create dense thickets in early successional habitats. It is also tolerant of wet soils and most of the seedlings observed throughout the site are reaching 3' to 4' in height. Removal of the seed sources within the property may be needed along with hand removal of established seedlings before Bradford pear becomes fully established across the site.
- The herbaceous vegetation has continued to vigorously propagated throughout the project site, and is likely a result of the temporary or permanent seed mix planted throughout the site (with the exception of the invasive or unfavorable species previous discussed).

- Dog fennel (*Eupatorium capillifolium*) remains established throughout the upland areas of the site, and is propagating to the wetland areas, however due to the multiple flood events and generally wetter spring and fall in MY4, the dog fennel has died back and was not found within the drainage swale on the west side of the upland area. Vegetation plot 2 however, remains dominated by dog fennel.
- During the supplemental planting in early December 2014, NC EEP observed evidence of recent site access through the previous encroachment area, and the landowner indicated that this is a reoccurring trespass issue. To prevent further unauthorized site access, NC EEP installed seven steel posts in an attempt to block access into the site

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 as referenced in multiple groundwater monitoring wells.

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

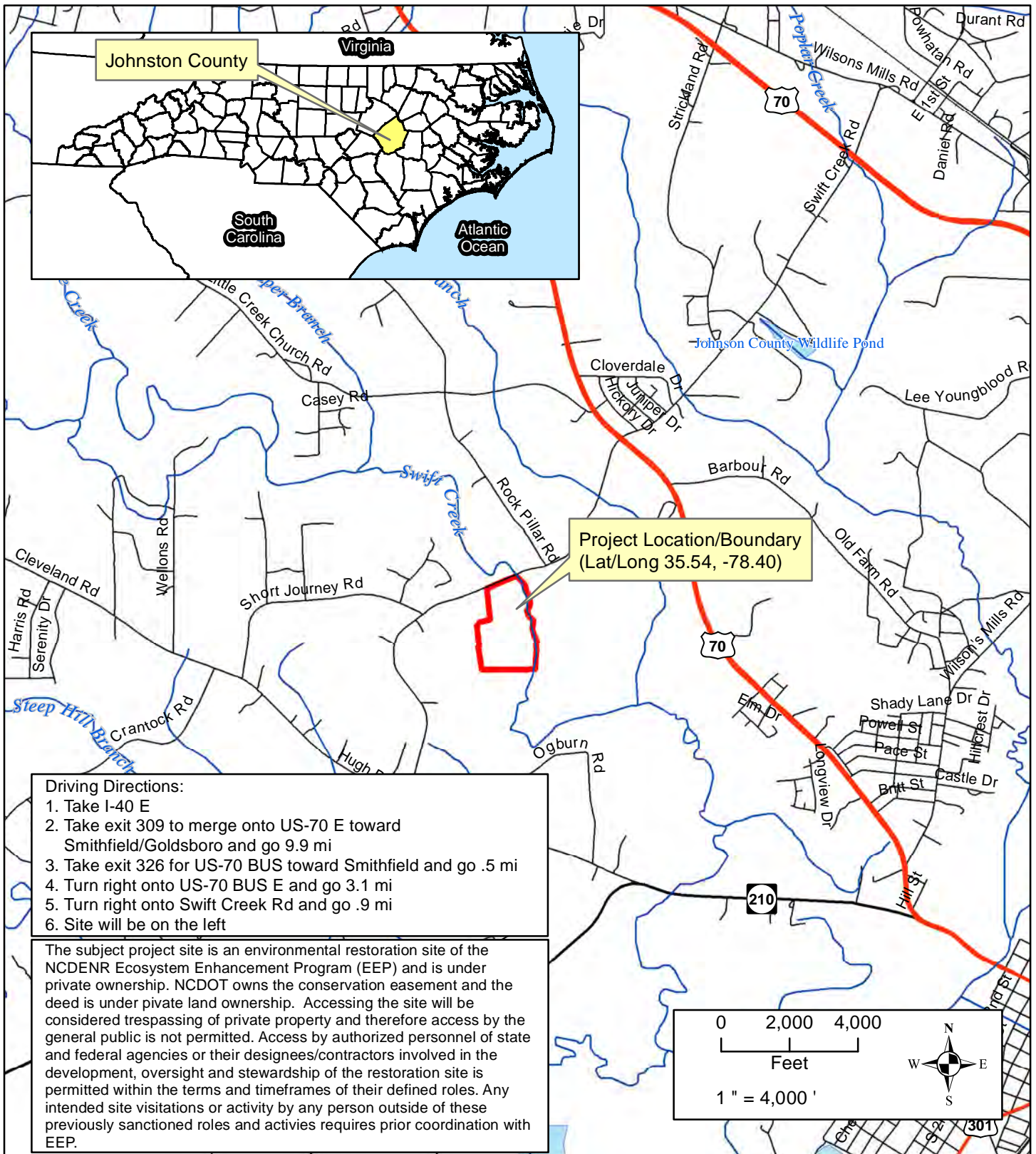
<http://www.nc-climate.ncsu.edu/cronos/?station=CLA2>

WETS Station CLAYTON 3 W, NC1820

Average Monthly Precipitation Data

http://www.wcc.nrcs.usda.gov/climate/wets_doc.html

APPENDIX A
PROJECT VICINITY
AND BACKGROUND TABLES




Title		Vicinity Map		
Prepared For: 	Project	Moore Property Monitoring (725) 2014 - Year 4 Johnston County, North Carolina		
		Date	KHA Project Number	Figure
		11/25/2014	011795033	1

Table 1. Project Components and Mitigation Credits

Moore Property/725

Mitigation Credits

Type	Stream		Riparian Wetland		Non-riparian Wetland		Neuse Riparian Buffer	Nitrogen Nutrient Offset	Phosphorous Nutrient Offset
	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
Monitoring Year 3	November 2013	December 2013
Monitoring Year 4	November 2014	December 2014

- 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	Jason Hartshorn (919) 678-4155
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	Wehadkee	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

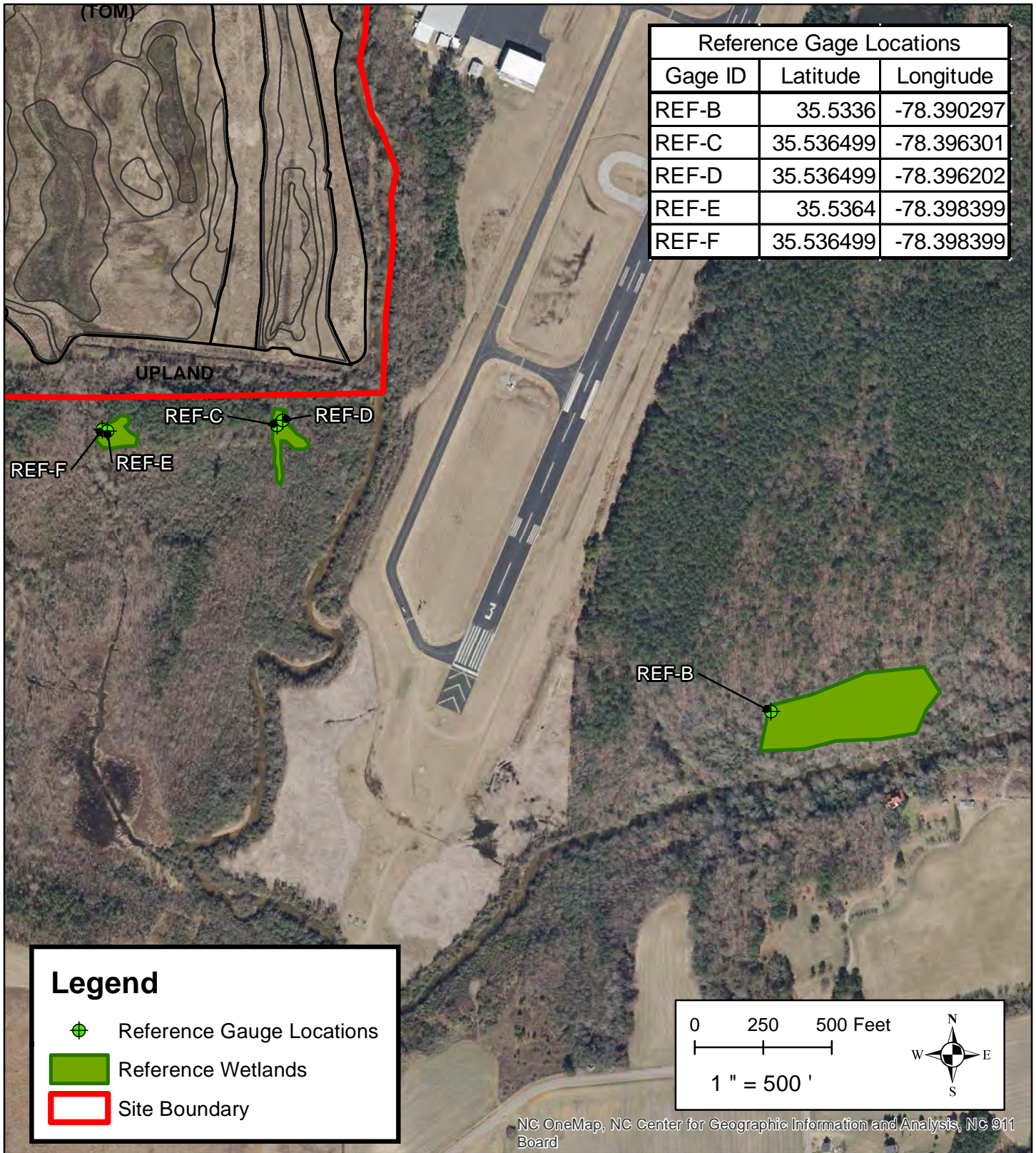
*There is no restoration of Swift Creek involved with this project

APPENDIX B
VISUAL ASSESSMENT DATA



VQ-12 was partially cleared in MY3 and reset was attempted in MY4 but was unsuccessful. VQ-12 was not sampled.

Title Current Conditions Plan View (2013 Aerial)				
Prepared For: 	Project	Moore Property Monitoring (725) 2014 - Year 4 Johnston County, NC		
		Date	KHA Project Number	Figure
		12/18/2014	011795033	2



Reference Gauge Locations		
Gage ID	Latitude	Longitude
REF-B	35.5336	-78.390297
REF-C	35.536499	-78.396301
REF-D	35.536499	-78.396202
REF-E	35.5364	-78.398399
REF-F	35.536499	-78.398399


Title		Reference Gauge Locations (2013 Aerial)		
Prepared For: 	Project	Moore Property Monitoring (725) 2014 - Year 4 Johnston County, North Carolina		
	Date	11/25/2014	KHA Project Number	011795033
			Figure	3

Table 6 **Vegetation Condition Assessment**

Planted Acreage¹

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	2	1.55	2.7%
Total				2	1.55	2.7%
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				2	1.55	2.7%

Easement Acreage²

84.4

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	3	0.65	0.8%
5. Easement Encroachment Areas ³	Areas or points (if too small to render as polygons at map scale).	none	Pattern and Color	1	1.94	3.4%

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 species 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 likely 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 early 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 symbolizing invasives polygons, particularly for situations where the condition 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 (November 11, 2014)



PP2 (November 11, 2014)



PP3 (November 11, 2014)



PP4 (November 11, 2014)



WP1 (November 11, 2014)
Reference wetland D



WP2 (November 11, 2014)
Sediment staining on trees near reference well C indicating inundation to depths of 4'.



WP3 (November 11, 2014)
Beaver impoundment blocking outlet culvert in outlet ditch to Swift Creek (top of photo).



WP4 (September 10, 2014)
Inundation in outlet ditch from Swift Creek flooding. Crest gauge is completely inundated.



WP5 (September 10, 2014)
Southern breach in berm from Swift Creek flooding. Photo is facing east towards Swift Creek.



WP6 (September 10, 2014)
Cross-sectional view of southern breach in berm from Swift Creek.. Photo is facing south.



WP7 (September 10, 2014)
Northern breach in berm from Swift Creek



WP8 (November 12, 2014)
Cypress establishing well in wetland swale in southeastern quadrant of site.



VQ1 (November 11, 2014)



VQ2 (November 11, 2014)



VQ3 (November 11, 2014)



VQ4 (November 18, 2014)



VQ5 (November 18, 2014)



VQ6 (November 18, 2014)



VQ7 (November 12, 2014)



VQ8 (November 12, 2014)



VQ9 (November 12, 2014)



VQ10 (November 12, 2014)



VQ11 (November 12, 2014)

VQ12 (Pins could not be located in field due to encroachment noted in MY3 report, plot was not sampled in MY4)



VQ13 (November 12, 2014)



VQ14 (November 18, 2014)



VQ15 (November 11, 2014)



VQ16 (November 11, 2014)

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%	Y	63%	Y	63%		
VQ2		N		N		Y		N			
VQ3		N		N		N		N			
VQ4		Y		Y		Y		Y			
VQ7		Y		N		N		N			
VQ9		N		N		N		Y			
VQ13		Y		Y		Y		Y			
VQ15		Y		N		Y		Y			
VQ5	Coastal Plain Brownwater Swamp	Y	100%	Y	75%	Y	75%	Y	75%		
VQ6		Y		Y		Y		Y			
VQ8		Y		Y		N		N			
VQ10		Y		N		Y		Y			
VQ11	Coastal Plain Brownwater Levee (Riparian)	N	50%	N	50%	N	25%	Y	75%		
VQ12		Y		Y		Not Surveyed		Not Surveyed			
VQ14		N		N		N		Y			
VQ16		Y		Y		Y		Y			

**Table 8. CVS Vegetation Plot Metadata
Moore Property/725**

Report Prepared By	Jason Hartshorn
Date Prepared	11/25/2014 16:55
database name	Moore Property_cvs-eep-entrytool-v2.3.1.mdb
database location	K:\RAL_Environmental\011795 Moore Property Monitoring\Vegetation Data
computer name	DL82758
file size	54837248

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)	341,718 (0.13 square miles)
Required Plots (calculated)	30
Sampled Plots	16*

* As approved by EEP

Table 9 Planted & Total Stem Counts

Scientific Name	Common Name	Species Type	Current Plot Data (MY4 2014)												
			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			1										
Betula nigra	river birch	Tree	1	1	1										
Callicarpa americana	American beautyberry	Shrub													1
Carpinus caroliniana	American hornbeam	Tree	1	1	1										
Carya aquatica	water hickory	Tree													
Carya illinoensis	pecan	Tree													
Celtis occidentalis	common hackberry	Tree													
Cephalanthus occidentalis	common buttonbush	Shrub													
Cercis canadensis	eastern redbud	Tree													
Cornus amomum	silky dogwood	Shrub													
Crataegus phaenopyrum	Washington hawthorn	Shrub Tree				2	2	2							
Diospyros virginiana	common persimmon	Tree	1	1	1										
Fraxinus pennsylvanica	green ash	Tree													
Lindera benzoin	northern spicebush	Shrub													
Liquidambar styraciflua	sweetgum	Tree			1										
Liriodendron tulipifera	tuliptree	Tree			1				1	1	1				
Nyssa aquatica	water tupelo	Tree													
Nyssa biflora	swamp tupelo	Tree													
Pinus taeda	loblolly pine	Tree			3										2
Platanus occidentalis	American sycamore	Tree													
Populus deltoides	eastern cottonwood	Tree													
Pyrus calleryana	Callery pear	Exotic													
Quercus laurifolia	laurel oak	Tree													
Quercus lyrata	overcup oak	Tree										6	6	6	
Quercus michauxii	swamp chestnut oak	Tree				1	1	1	1	1	1	2	2	2	
Quercus nigra	water oak	Tree													
Quercus pagoda	cherrybark oak	Tree													
Quercus phellos	willow oak	Tree													
Taxodium distichum	bald cypress	Tree													
Ulmus alata	winged elm	Tree			1										
Ulmus americana	American elm	Tree			1						1				
Totals	Stem count		3	3	11	3	3	3	2	2	3	8	8	11	
	size (ares)		1	1	1	1	1	1	1	1	1	1	1	1	
	size (ACRES)		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	
	Species count		3	3	9	2	2	2	2	2	3	2	2	4	
Stems per ACRE		121.4057	121.4057	445.1542	121.4057	121.4057	121.4057	80.93713	80.93713	121.4057	323.7485	323.7485	445.1542		
Riparian Buffer Success Criteria	Stem count		N/A			N/A			N/A			N/A			
	size (ares)		N/A			N/A			N/A			N/A			
	size (ACRES)		N/A			N/A			N/A			N/A			
	Species count		N/A			N/A			N/A			N/A			
Stems per ACRE		N/A			N/A			N/A			N/A				

***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%	

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

Current Plot Data (MY4 2014)

Scientific Name	Common Name	Species Type	000-01-0005			000-01-0006			000-01-0007			000-01-0008			000-01-0009			000-01-0010		
			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																		
Betula nigra	river birch	Tree																		
Callicarpa americana	American beautyberry	Shrub																		
Carpinus caroliniana	American hornbeam	Tree											1	1	1					
Carya aquatica	water hickory	Tree																		
Carya illinoensis	pecan	Tree																		
Celtis occidentalis	common hackberry	Tree																		
Cephalanthus occidentalis	common buttonbush	Shrub	6	6	6															
Cercis canadensis	eastern redbud	Tree																		
Cornus amomum	silky dogwood	Shrub																		
Crataegus phaenopyrum	Washington hawthorn	Shrub Tree											1	1	1					
Diospyros virginiana	common persimmon	Tree				9	9	9	1	1	1									
Fraxinus pennsylvanica	green ash	Tree											2	2	2					
Lindera benzoin	northern spicebush	Shrub																		
Liquidambar styraciflua	sweetgum	Tree																		
Liriodendron tulipifera	tuliptree	Tree															1	1	1	
Nyssa aquatica	water tupelo	Tree																		
Nyssa biflora	swamp tupelo	Tree											1	1	1	1	1	1	1	
Pinus taeda	loblolly pine	Tree																		
Platanus occidentalis	American sycamore	Tree																		
Populus deltoides	eastern cottonwood	Tree																		
Pyrus calleryana	Callery pear	Exotic							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 pagoda	cherrybark oak	Tree																		
Quercus phellos	willow oak	Tree											1	1	1	1	1	1	1	
Taxodium distichum	bald cypress	Tree	2	2	2															
Ulmus alata	winged elm	Tree																		
Ulmus americana	American elm	Tree																		
Totals	Stem count		8	8	8	9	9	9	2	2	2	0	0	0	8	8	8	9	9	9
	size (ares)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	size (ACRES)		0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
	Species count		2	2	2	1	1	1	2	2	2	0	0	0	6	6	6	4	4	4
Stems per ACRE		323.7485	323.7485	323.7485	364.2171	364.2171	364.2171	80.93713	80.93713	80.93713	0	0	0	323.7485	323.7485	323.7485	364.2171	364.2171	364.2171	
Riparian Buffer Success Criteria	Stem count		N/A			N/A			N/A			N/A			N/A			N/A		
	size (ares)		N/A			N/A			N/A			N/A			N/A			N/A		
	size (ACRES)		N/A			N/A			N/A			N/A			N/A			N/A		
	Species count		N/A			N/A			N/A			N/A			N/A			N/A		
Stems per ACRE		N/A			N/A			N/A			N/A			N/A			N/A			

***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%	

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

Current Plot Data (MY4 2014)

Scientific Name	Common Name	Species Type	000-01-0011			000-01-0012			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	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree																		
Betula nigra	river birch	Tree							3	3	3									
Callicarpa americana	American beautyberry	Shrub																		
Carpinus caroliniana	American hornbeam	Tree	1	1	7				2	2	2	2	2	12	3	3	3	1	1	1
Carya aquatica	water hickory	Tree									1									
Carya illinoensis	pecan	Tree																	1	
Celtis occidentalis	common hackberry	Tree															4	4	5	
Cephalanthus occidentalis	common buttonbush	Shrub																		
Cercis canadensis	eastern redbud	Tree			1															
Cornus amomum	silky dogwood	Shrub																		
Crataegus phaenopyrum	Washington hawthorn	Shrub Tree																		
Diospyros virginiana	common persimmon	Tree			1								1							
Fraxinus pennsylvanica	green ash	Tree										1	1	3						
Lindera benzoin	northern spicebush	Shrub												1						
Liquidambar styraciflua	sweetgum	Tree												1						
Liriodendron tulipifera	tuliptree	Tree	1	1	1															
Nyssa aquatica	water tupelo	Tree																		
Nyssa biflora	swamp tupelo	Tree																		
Pinus taeda	loblolly pine	Tree																	3	
Platanus occidentalis	American sycamore	Tree			3				2	2	2		4	2	2	2				
Populus deltoides	eastern cottonwood	Tree																		
Pyrus calleryana	Callery pear	Exotic																		
Quercus laurifolia	laurel oak	Tree																		
Quercus lyrata	overcup oak	Tree			1															
Quercus michauxii	swamp chestnut oak	Tree							1	1	1									
Quercus nigra	water oak	Tree																		
Quercus pagoda	cherrybark oak	Tree															3	3	3	
Quercus phellos	willow oak	Tree							3	3	3			3	3	3				
Taxodium distichum	bald cypress	Tree																		
Ulmus alata	winged elm	Tree															1	1	1	
Ulmus americana	American elm	Tree										2	2	5		1	1	1	1	
Totals	Stem count		N/A			N/A			11	11	12	N/A			8	8	12	N/A		
	size (ares)		N/A			N/A			1			N/A			1			N/A		
	size (ACRES)		N/A			N/A			0.02			N/A			0.02			N/A		
	Species count		N/A			N/A			5	5	6	N/A			3	3	5	N/A		
Stems per ACRE		N/A			N/A			445.1542	445.1542	485.6228	N/A			323.7485	323.7485	485.6228	N/A			
Riparian Buffer Success Criteria	Stem count		2	2	13	0	0	0	N/A			5	5	26	N/A			10	10	12
	size (ares)		1			1			N/A			1			N/A			1		
	size (ACRES)		0.02			0.02			N/A			0.02			N/A			0.02		
	Species count		2	2	5	0	0	0	N/A			3	3	6	N/A			5	5	6
Stems per ACRE		80.93713	80.93713	526.0913	0	0	0	N/A			202.3428	202.3428	1052.183	N/A			404.6856	404.6856	485.6228	

***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%	

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

Scientific Name	Common Name	Species Type	Annual Means														
			MY4 (2014)			MY3 (2013)			MY2 (2012)			MY1 (2012)			MY0 (2011)		
			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			1			7			3			
Betula nigra	river birch	Tree	4	4	4	4	4	4	16	16	40	11	11	17	23	23	23
Callicarpa americana	American beautyberry	Shrub			1	0	0	1	2	2	2	8	8	8	17	17	17
Carpinus caroliniana	American hornbeam	Tree	11	11	27						1						
Carya aquatica	water hickory	Tree			1			1									
Carya illinoensis	pecan	Tree			1	0	0	1									
Celtis occidentalis	common hackberry	Tree	4	4	5	4	4	5									
Cephalanthus occidentalis	common buttonbush	Shrub	12	12	12	12	12	12	31	31	41	8	8	8	36	36	36
Cercis canadensis	eastern redbud	Tree			1			1	3	3	10	6	6	6	6	6	6
Cornus amomum	silky dogwood	Shrub						0			4						
Crataegus phaenopyrum	Washington hawthorn	Shrub Tree	3	3	3							2	2	2	2	2	2
Diospyros virginiana	common persimmon	Tree	11	11	13	11	11	13	4	4	4	38	38	38	41	41	41
Fraxinus pennsylvanica	green ash	Tree	3	3	5	3	3	5			5						
Lindera benzoin	northern spicebush	Shrub			1	0	0	1	3	3	22	9	9	9	11	11	11
Liquidambar styraciflua	sweetgum	Tree			2				5	5	17						
Liriodendron tulipifera	tuliptree	Tree	3	3	4	3	3	4									
Nyssa aquatica	water tupelo	Tree										3	3	3	4	4	4
Nyssa biflora	swamp tupelo	Tree	2	2	2	2	2	2	8	8	9	10	10	10	17	17	17
Pinus taeda	loblolly pine	Tree			8	0	0	8	16	16	28	22	22	23	24	24	24
Platanus occidentalis	American sycamore	Tree	6	6	13			13	1	1	3						
Populus deltoides	eastern cottonwood	Tree				0	0	0	5	5	6						
Pyrus calleryana	Callery pear	Exotic	1	1	1												
Quercus laurifolia	laurel oak	Tree															
Quercus lyrata	overcup oak	Tree	6	6	7												
Quercus michauxii	swamp chestnut oak	Tree	5	5	5												
Quercus nigra	water oak	Tree															
Quercus pagoda	cherrybark oak	Tree	3	3	3												
Quercus phellos	willow oak	Tree	8	8	8												
Taxodium distichum	bald cypress	Tree	2	2	2	2	2	2	2	2	2						
Ulmus alata	winged elm	Tree	1	1	2												
Ulmus americana	American elm	Tree	3	3	9												
Totals	Stem count		71	71	88	80	80	107	96	96	204	117	117	127	181	181	181
	size (ares)		12			12			12			12			12		
	size (ACRES)		0.30			0.30			0.30			0.30			0.30		
	Species count		18	18	26	13	13	18	12	12	17	10	10	11	10	10	10
Stems per ACRE		239.4	239.4	296.8	269.8	269.8	360.8	320.0	320.0	680.0	390.0	390.0	423.3	603.3	603.3	603.3	
Riparian Buffer Success Criteria	Stem count		17	17	51	15	72	53	96	96	195	117	117	127	181	181	181
	size (ares)		4			4			4			4			4		
	size (ACRES)		0.10			0.10			0.10			0.10			0.10		
	Species count		10	10	17	9	9	12	12	12	15	10	10	11	10	10	10
Stems per ACRE		172.0	172.0	515.9742	150.0	720.0	530.0	960.0	960.0	1950.0	1170.0	1170.0	1270.0	1810.0	1810.0	1810.0	

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

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

APPENDIX D
HYDROLOGIC DATA

**Table 10a. 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	124'	34	29	44	2	35	53		Floodplain depression, depends on flood events from Swift Creek, which appears to have occurred multiple times during 2014. Sediment deposits on trees adjacent to the reference wells indicate inundation of 2-3' in the wetland interior, and the well was fully submerged at least once.
Consecutive days within range¹		14.11%	12.03%	18.26%	0.83%	14.52%	21.99%		
% of growing season²		Y	Y	Y	N	Y	Y		
Criteria met³?									
Groundwater Gauge REF-C	124'	35	30	45	2	33	53		Well was inundated through the end of 2013 until early May 2014. Overbank flooding from Swift Creek appears to have occurred at least 3 times during the 2014 growing season, and sediment staining on trees in the wetland indicate inundation of 4' in the wetland.
Consecutive days within range		14.52%	12.45%	18.67%	0.83%	13.69%	21.99%		
% of growing season		Y	Y	Y	N	Y	Y		
Criteria met?									
Groundwater Gauge REF-D	124'	43	--	--	22	62	91		Water table above the surface to close out 2013 and remained above through early June 2014. Water level fluctuates with small rainfall events through June and July before rising back above the ground surface through August and September.
Consecutive days within range		17.84%	--	--	9.13%	25.73%	37.76%		
% of growing season		Y	--	--	Y	Y	Y		
Criteria met?									
Groundwater Gauge REF-E	123'	33	--	--	22	19	49		Water table was at or above the surface from November 2013 through May 2014. Water was below monitoring depth through June and July, but recharged with high rainfall events in August and September.
Consecutive days within range		13.69%	--	--	9.13%	7.88%	20.33%		
% of growing season		Y	--	--	Y	Y	Y		
Criteria met?									
Groundwater Gauge REF-F	123'	34	27	39	23	28	49		Very similar to REF-E, the water table at REF-F was at or above the surface from November 2013 through May 2014. The water level fell below monitoring depth through June and July, but recharged with high rainfall events in August and September.
Consecutive days within range		14.11%	11.20%	16.18%	9.54%	11.62%	20.33%		
% of growing season		Y	Y	Y	Y	Y	Y		
Criteria met?									
Average reference hydroperiod		36	29	43	15	36	59		
Consecutive number of days needed to meet the deviation success criteria (50% for Years 1-3, 20% for Years 4+)		18	15	22	8	18	12		

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 10b. 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		50.00%	68.75%	68.75%	80.00%		
Groundwater Gauge B1							
Consecutive days within range ¹	124.1'	68	89	174	110		Gauge located in wet swale that receives runoff from upslope property and roadside drainage. Water level is sustained above the ground surface for much of 2014, but does drop below 12" for brief periods during June and July.
% of growing season ²		28.22%	36.93%	72.2%	45.6%		
Criteria met? ³		Y	Y	Y	Y		
Groundwater Gauge B2							
Consecutive days within range	124.0'	50	27	39	53		Water level correlates with rainfall events through May, but is below the upper 12" inches for most of June, July and early August. The water levels peaks with rainfall events three times through late August, September, and October, but closed out the growing season below 12".
% of growing season		20.75%	11.20%	16.2%	22.0%		
Criteria met?		Y	Y	Y	Y		
Groundwater Gauge C2							
Consecutive days within range	124.5'	47	28	91	51		Water levels are sustained above the ground surface through the spring, with a draw down occurring in late May. Water levels returned above the ground surface periodically between July and November, but were drawing down below the monitoring depth as of mid-November.
% of growing season		19.50%	11.62%	37.8%	21.2%		
Criteria met?		Y	Y	Y	Y		
Groundwater Gauge D2							
Consecutive days within range	125.7'	0	1	5	5		Located near the wetland boundary along the upland ridge. Water levels are within the upper 24" during the growing season and peak in response to rainfall events. The well was inundated with flood waters during a high rainfall event in September.
% of growing season		0.00%	0.41%	2.1%	2.1%		
Criteria met?		N/A	N	N	N		
Groundwater Gauge E2							
Consecutive days within range	124.8'	0	1	7	8		The water level at E2 responds quickly to rainfall events, and multiple events held the water table above the surface through May. The water level was drawn down by early June, and only came back into the upper 12" twice through the end of the growing season.
% of growing season		0.00%	0.41%	2.9%	3.3%		
Criteria met?		N/A	N	N	N		
Groundwater Gauge F2							
Consecutive days within range	124.2'	4	6	2	8		Gauge F2 indicates frequent and rapid variation in response to rainfall events, with three peaks recorded above the ground surface in May, August, and September.
% of growing season		1.66%	2.49%	0.8%	3.3%		
Criteria met?		N	N	N	N		
Groundwater Gauge A3							
Consecutive days within range	123.8'	103	93	231	237		Water levels sustained above the ground surface for the entire year.
% of growing season		42.74%	38.59%	95.9%	98.3%		
Criteria met?		Y	Y	Y	Y		
Groundwater Gauge B3							
Consecutive days within range	123.7'	45	21	25	48		Water level at gauge B3 was sustained at or above the ground surface through early-April, but was drawn down below monitoring depth by mid-June. The gauge then failed sometime after the June 2014 download and was replaced in November 2014.
% of growing season		18.67%	8.71%	10.4%	19.9%		
Criteria met?		Y	Y	Y	Y		
Groundwater Gauge A4							
Consecutive days within range	124.6'	20	23	42	22		Water level is at or above the ground surface through early-April. Water table draw down occurs during periods of low rainfall.
% of growing season		8.30%	9.54%	17.4%	9.1%		
Criteria met?		N	Y	Y	Y		
Groundwater Gauge B4							
Consecutive days within range	123.0'	75	82	178	241		Water level is above the ground surface throughout the growing season except for a draw down point in early-June, but water table remained close to surface during draw down.
% of growing season		31.12%	34.02%	73.9%	100.0%		
Criteria met?		Y	Y	Y	Y		
Groundwater Gauge C4							
Consecutive days within range	124.3'	20	8	10	15		Gauge C4 is very prone to fluctuations in water table level based on rainfall events. Gauge failed after the June 2014 download and was replaced in November 2014.
% of growing season		8.30%	3.32%	4.1%	6.2%		
Criteria met?		N	Y	N	Y		
Groundwater Gauge D4							
Consecutive days within range	123.3'	75	92	232	122		Water levels sustained above the ground surface for the entire growing season except for low rainfall periods in June and July.
% of growing season		31.12%	38.17%	96.3%	50.6%		
Criteria met?		Y	Y	Y	Y		
Groundwater Gauge E4							
Consecutive days within range	124.8'	4	3	8	17		The water table at gage F4 was in the upper 12" through the beginning of 2014, rising above the ground surface in May and September, corresponding with high rainfall events.
% of growing season		1.66%	1.24%	3.3%	7.1%		
Criteria met?		N	N	N	Y		
Groundwater Gauge F4							
Consecutive days within range	124.8'	4	1	18	16		Highly variable water levels were noted corresponding with rainfall. Draw down noted during June and July but rainfall quickly recharges water table closer to the ground surface.
% of growing season		1.66%	0.41%	7.5%	6.6%		
Criteria met?		N	N	Y	Y		
Groundwater Gauge G4							
Consecutive days within range	123.5'	11	8	25	25		Gauge G4 is heavily influenced by rainfall, and a significant water table drawn down was noted in late-May. Water levels did not return later in the growing season with a wet September, but water was at or above the ground surface through the spring.
% of growing season		4.56%	3.32%	10.4%	10.4%		
Criteria met?		N	Y	Y	Y		
Groundwater Gauge B5							
Consecutive days within range	123.4'	6	26	66	52		Water levels sustained near the ground surface for most of the year except for low rainfall periods in June. Peaks were noted during May and September with high rainfall events. Many smaller events kept water above the ground surface during the growing season.
% of growing season		2.49%	10.79%	27.4%	21.6%		
Criteria met?		N	Y	Y	Y		
Groundwater Gauge N1							
Consecutive days within range	126'	N1 installed spring MY4				4	Gauge N1 was installed in March 2014. Water levels were low throughout the year, with two peaks of surface water recorded after significant rainfall events. In addition to the two peaks, groundwater peaked into the upper 12" 5 other times during the growing season.
% of growing season						1.7%	
Criteria met?						N	
Groundwater Gauge N2							
Consecutive days within range	126.3'	N2 installed spring MY4				16	Gauge N2 was installed in March 2014. Water levels were highly variable with rainfall events, and rapid draw downs were noted after rainfall events.
% of growing season						6.6%	
Criteria met?						Y	
Groundwater Gauge N3							
Consecutive days within range	124'	N3 installed spring MY4				22	Gauge N3 was installed in March 2014. Water levels were sustained within 12" for much of the year, with a noticeable drawdown during the growing season due to low rainfall. N3 appears to fluctuate rapidly with rainfall events.
% of growing season						9.1%	
Criteria met?						Y	
Groundwater Gauge N4							
Consecutive days within range	124.8'	N4 installed spring MY4				N/A	Gauge N4 was installed in March 2014, but due to a GPS malfunction, the datapoint was unreadable. Attempts to locate N4 in the field were unsuccessful due to herbaceous growth. N4 will be located during winter 2014/2015 once herbaceous vegetation has died back.
% of growing season						N/A	
Criteria met?						N/A	
Groundwater Gauge N5							
Consecutive days within range	124'	N5 installed spring MY4				25	Gauge N5 was installed in March 2014 but appears to have malfunctioned after installation and data was not able to be downloaded. Well was replaced in September 2014, and still met success criteria prior to end of growing season.
% of growing season						10.4%	
Criteria met?						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.

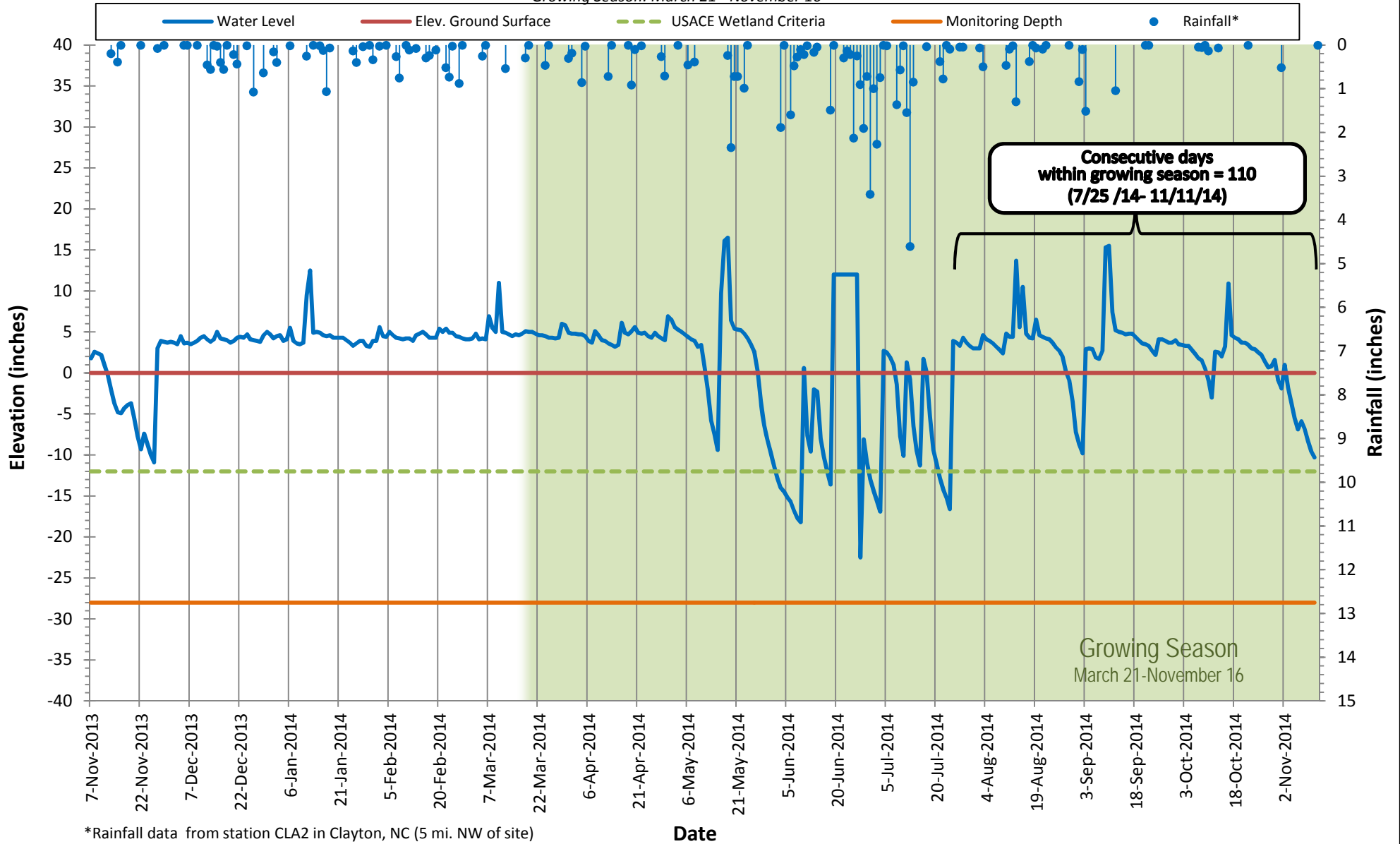
3- For years one (1) through three (3), minimum successful wetland hydrology is defined as less than or equal to 50% deviation in sustained water table levels near the surface, and for years 4

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

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

Shallow Water Table Gauge B1

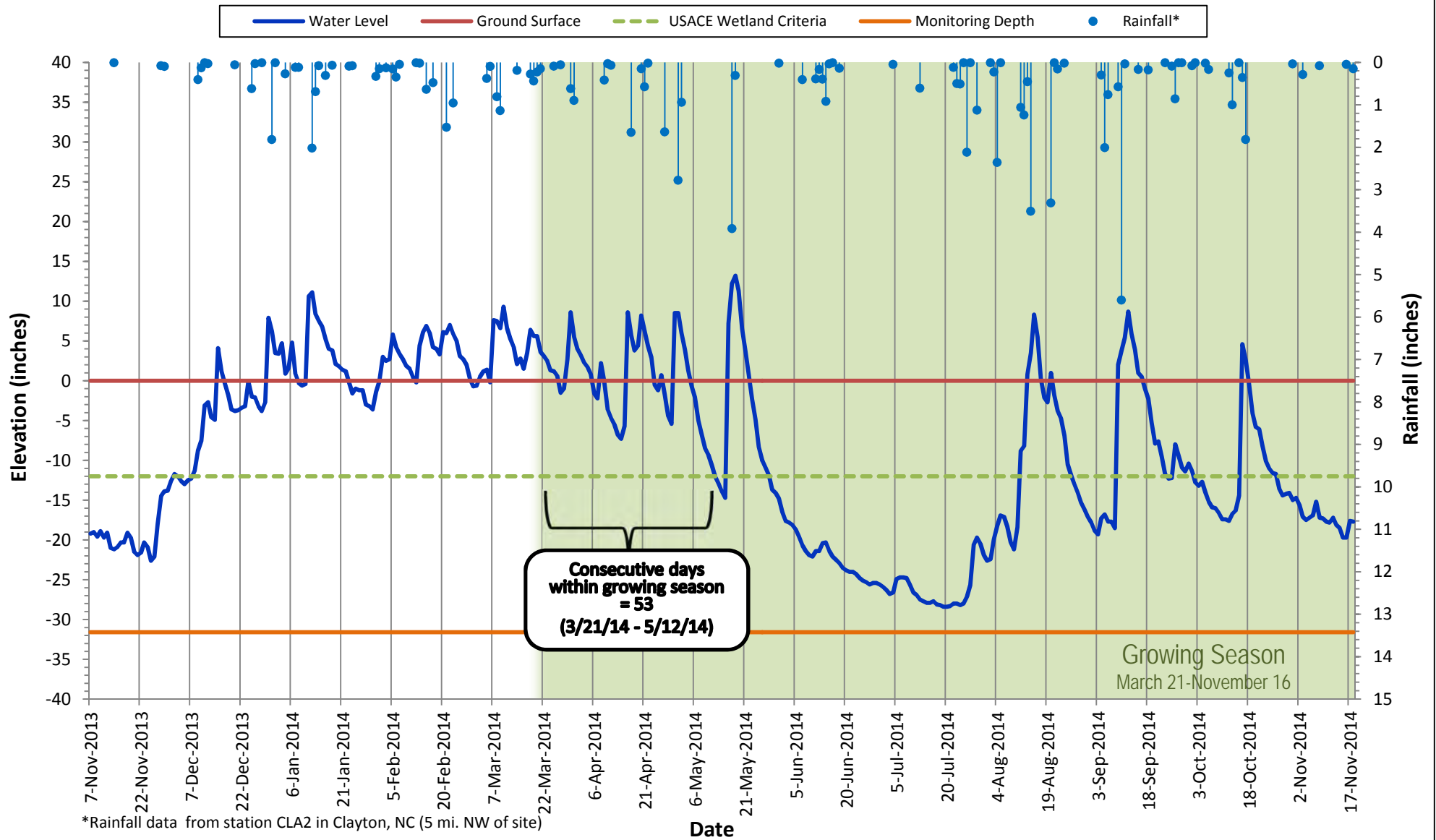
November 7, 2013 - November 11, 2014
 Growing Season: March 21 - November 16



*Rainfall data from station CLA2 in Clayton, NC (5 mi. NW of site)

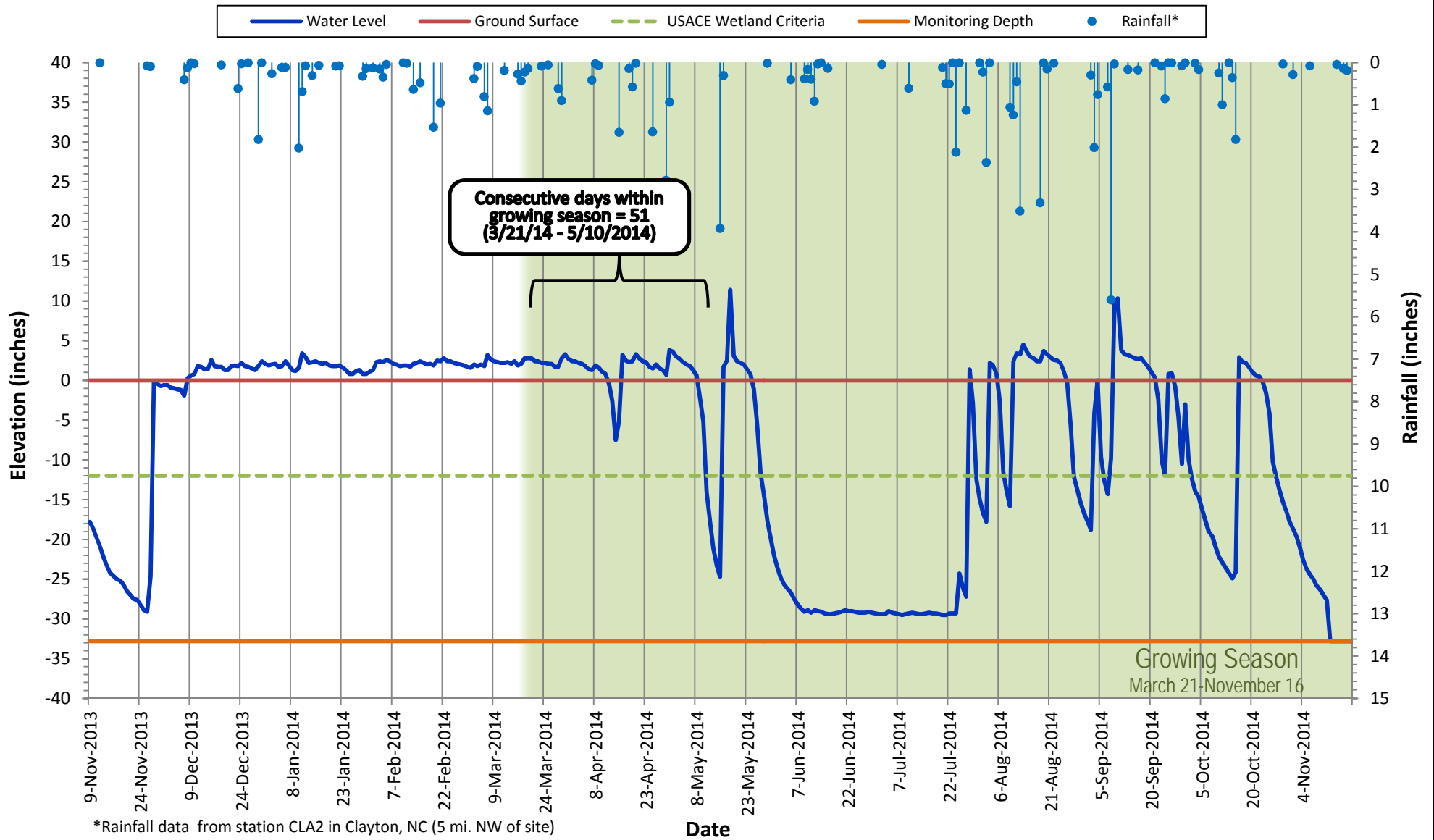
Shallow Water Table Gauge B2

November 7, 2013 - November 18, 2014
Growing Season: March 21 - November 16



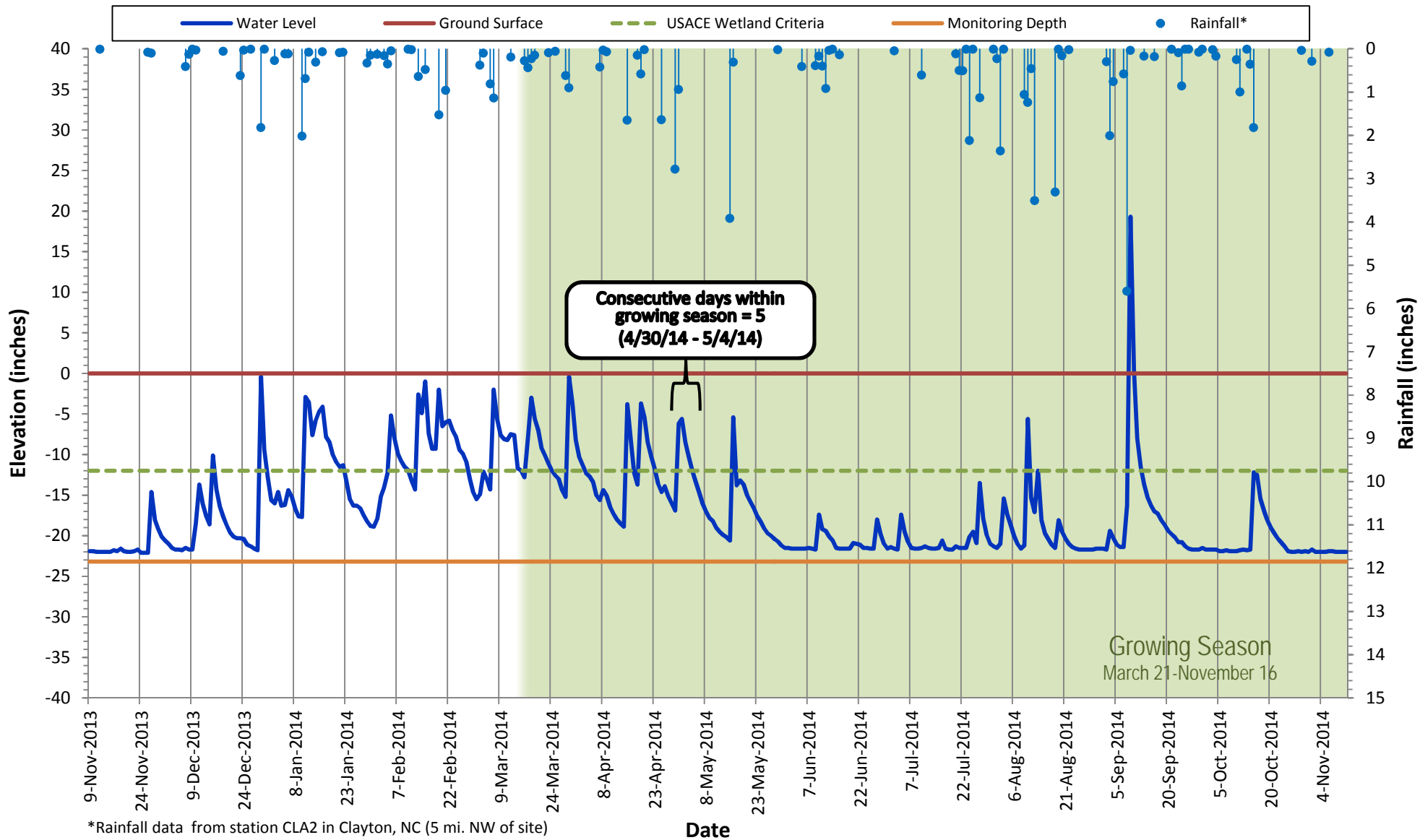
Shallow Water Table Gauge C2

November 9, 2013 - November 18, 2014
Growing Season: March 21 - November 16



Shallow Water Table Gauge D2

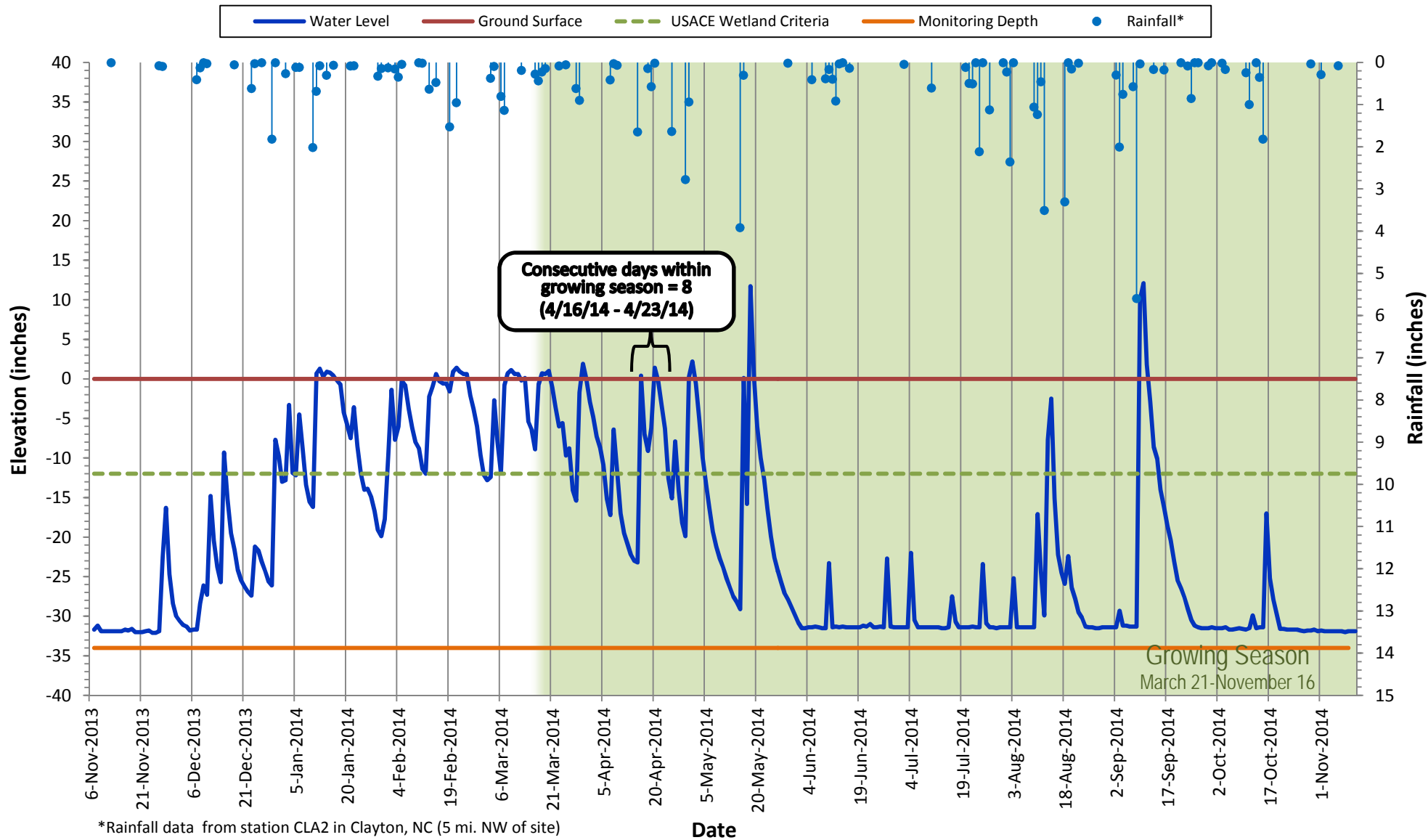
November 9, 2013 - November 11, 2014
 Growing Season: March 21 - November 16



*Rainfall data from station CLA2 in Clayton, NC (5 mi. NW of site)

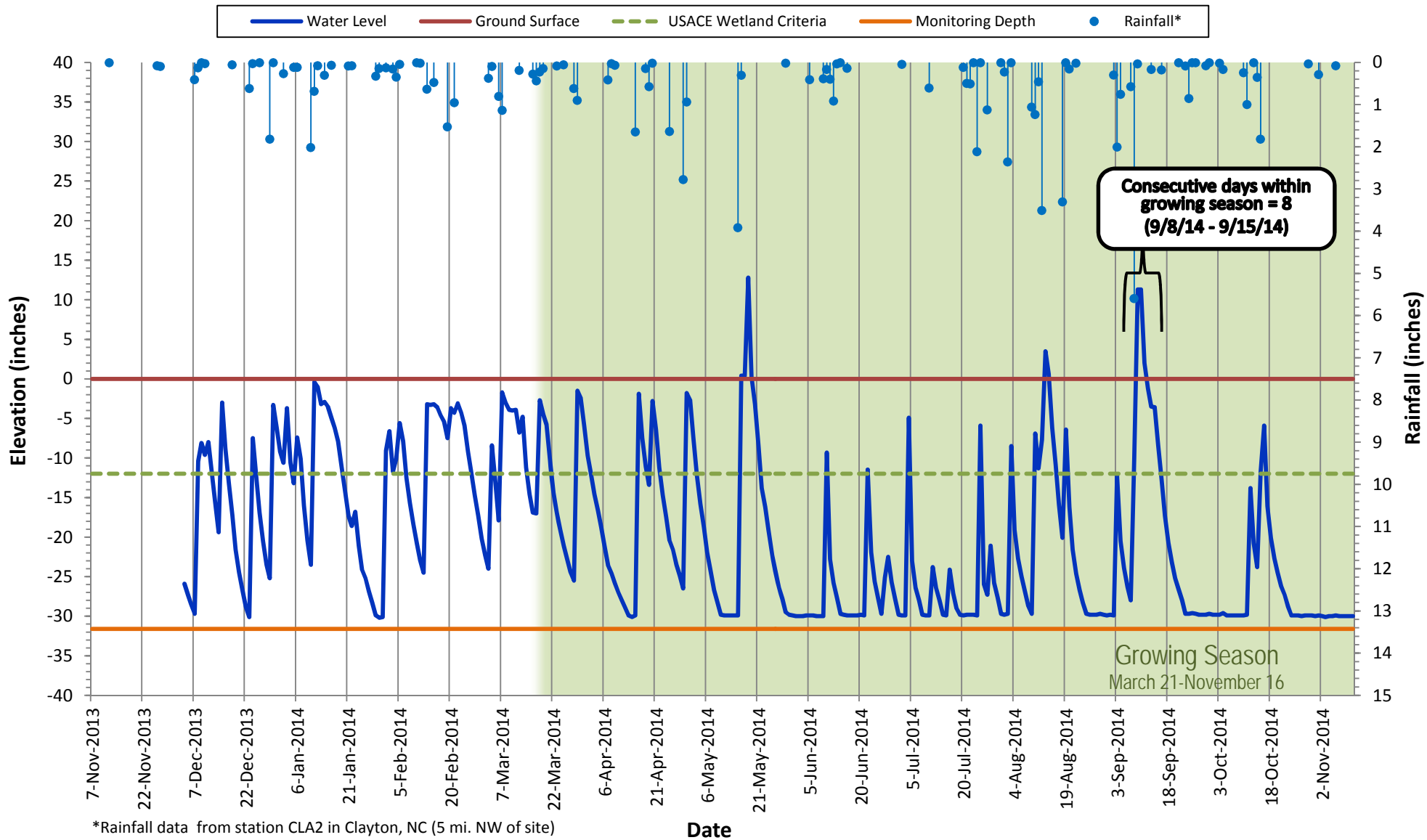
Shallow Water Table Gauge E2

November 7, 2013 - November 11, 2014
 Growing Season: March 21 - November 16



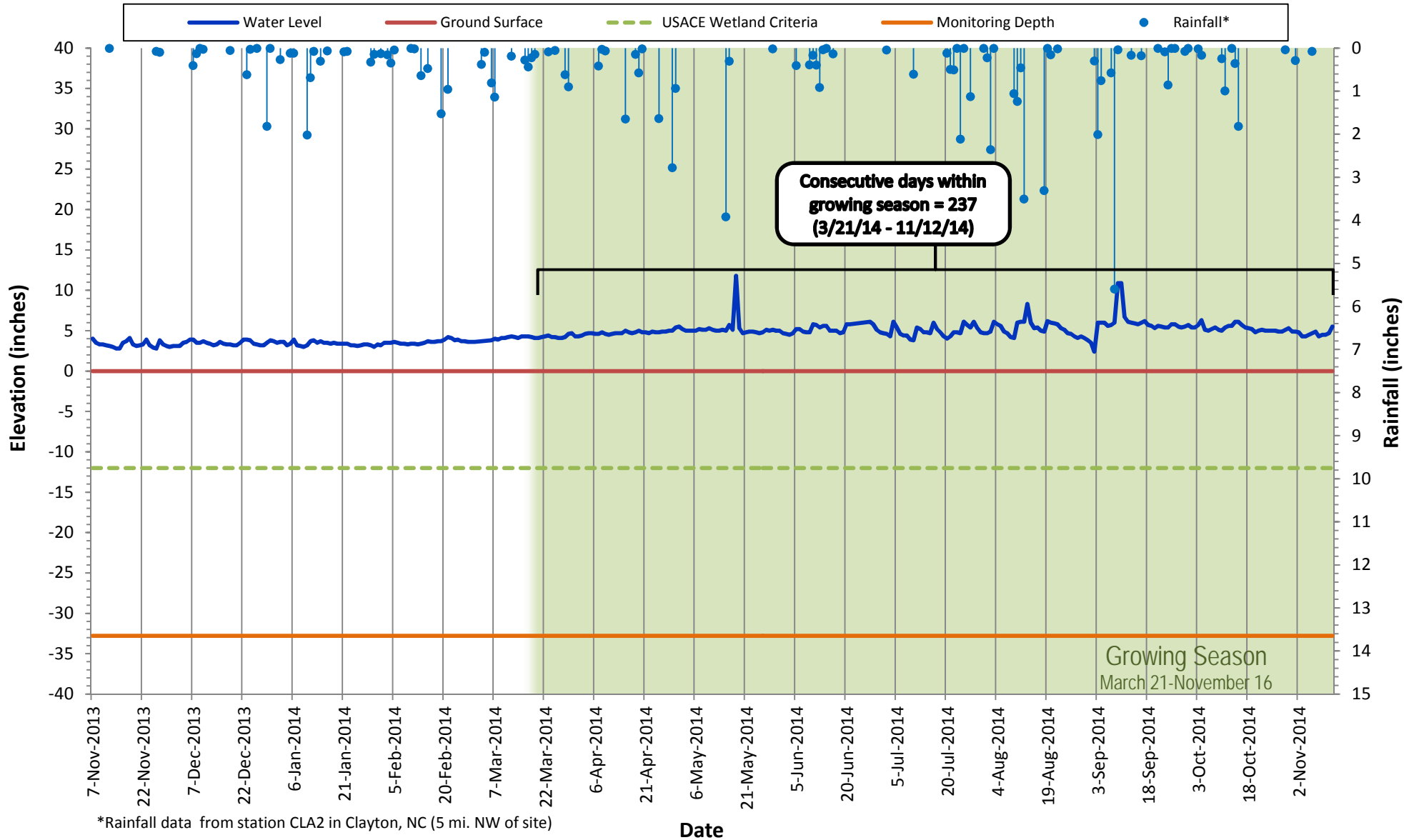
Shallow Water Table Gauge F2

November 7, 2013 - November 11, 2014
Growing Season: March 21 - November 16



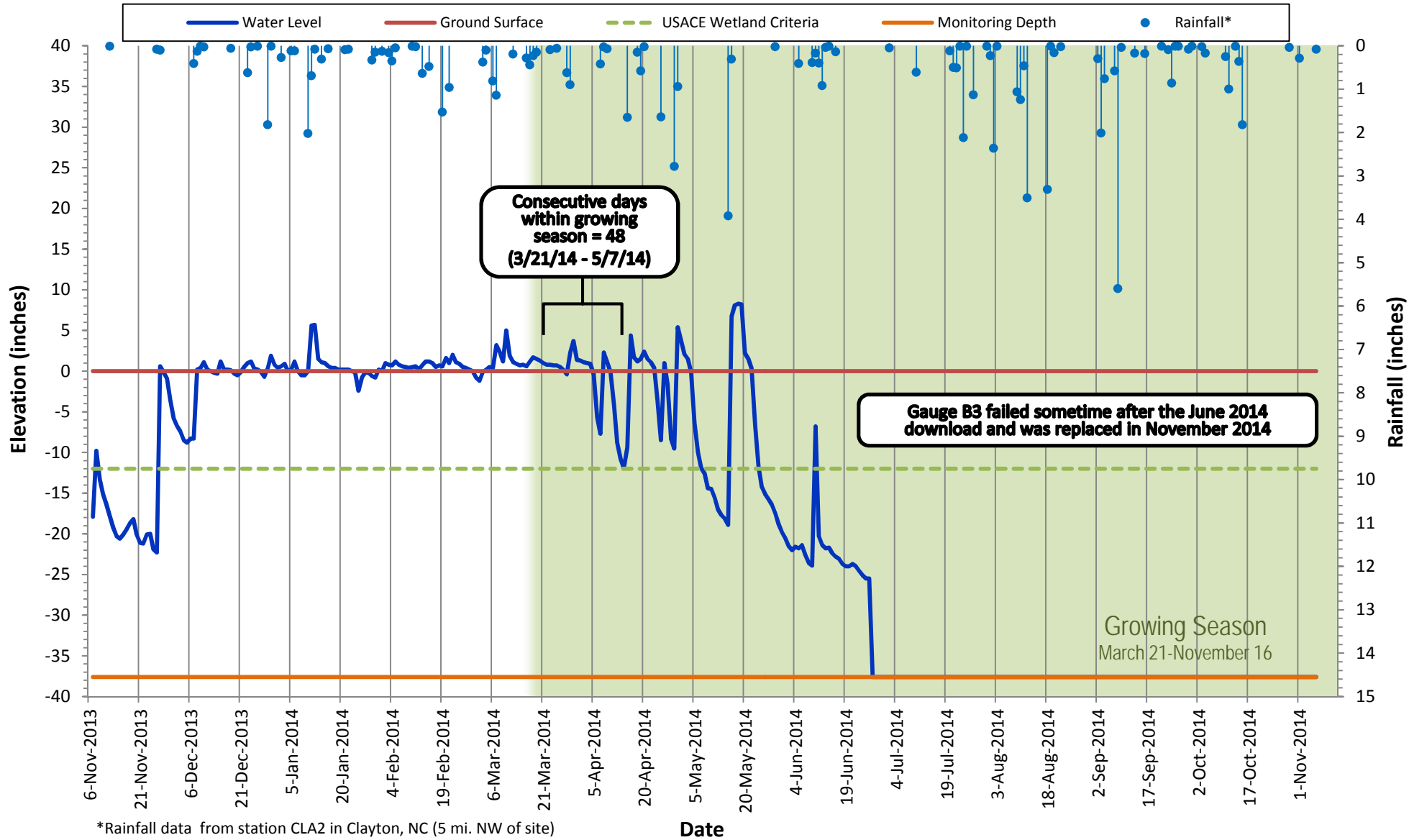
Shallow Water Table Gauge A3

November 7, 2013 - November 12, 2014
Growing Season: March 21 - November 16



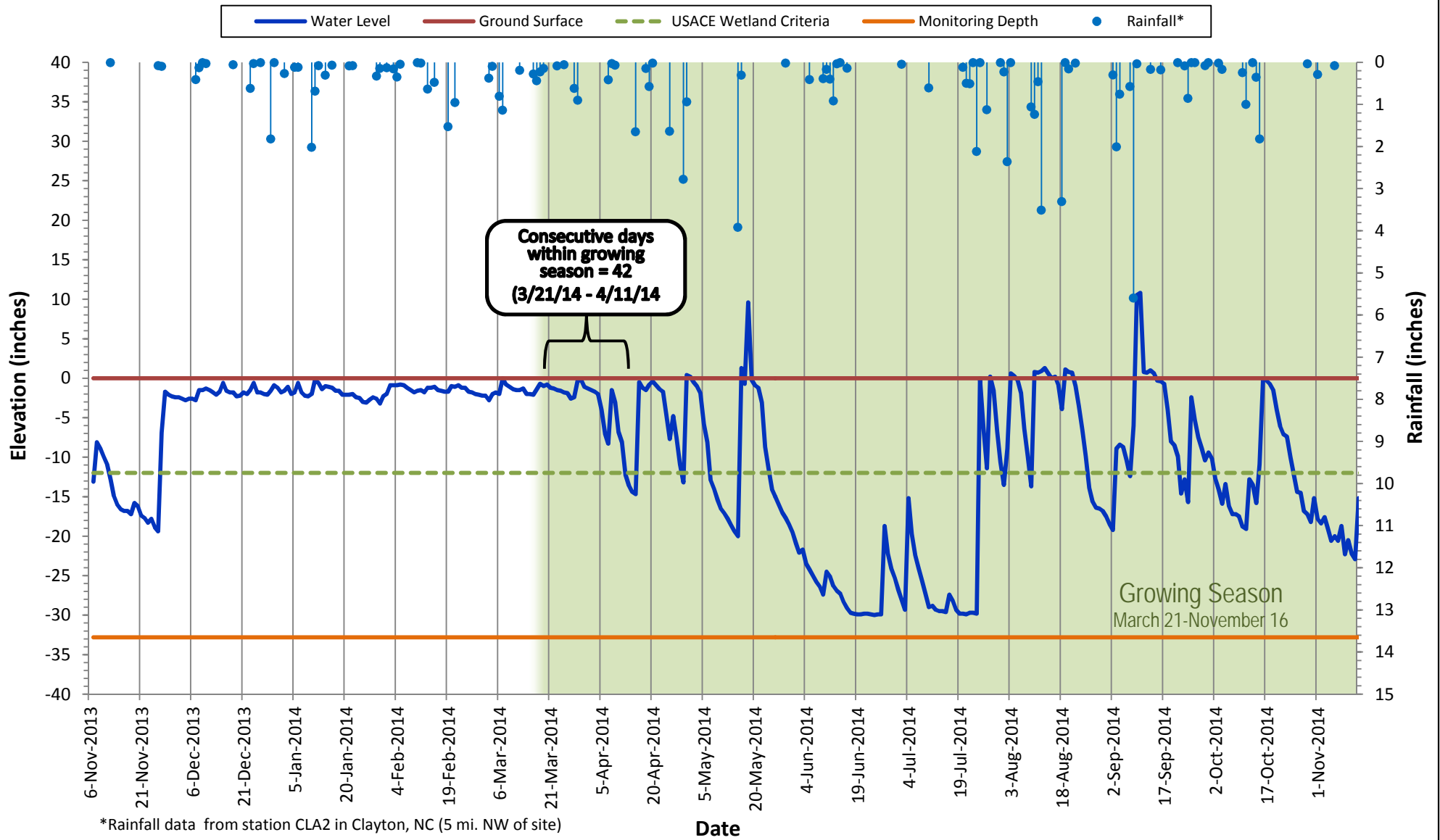
Shallow Water Table Gauge B3

November 7, 2013 - November 6, 2014
Growing Season: March 21 - November 16



Shallow Water Table Gauge A4

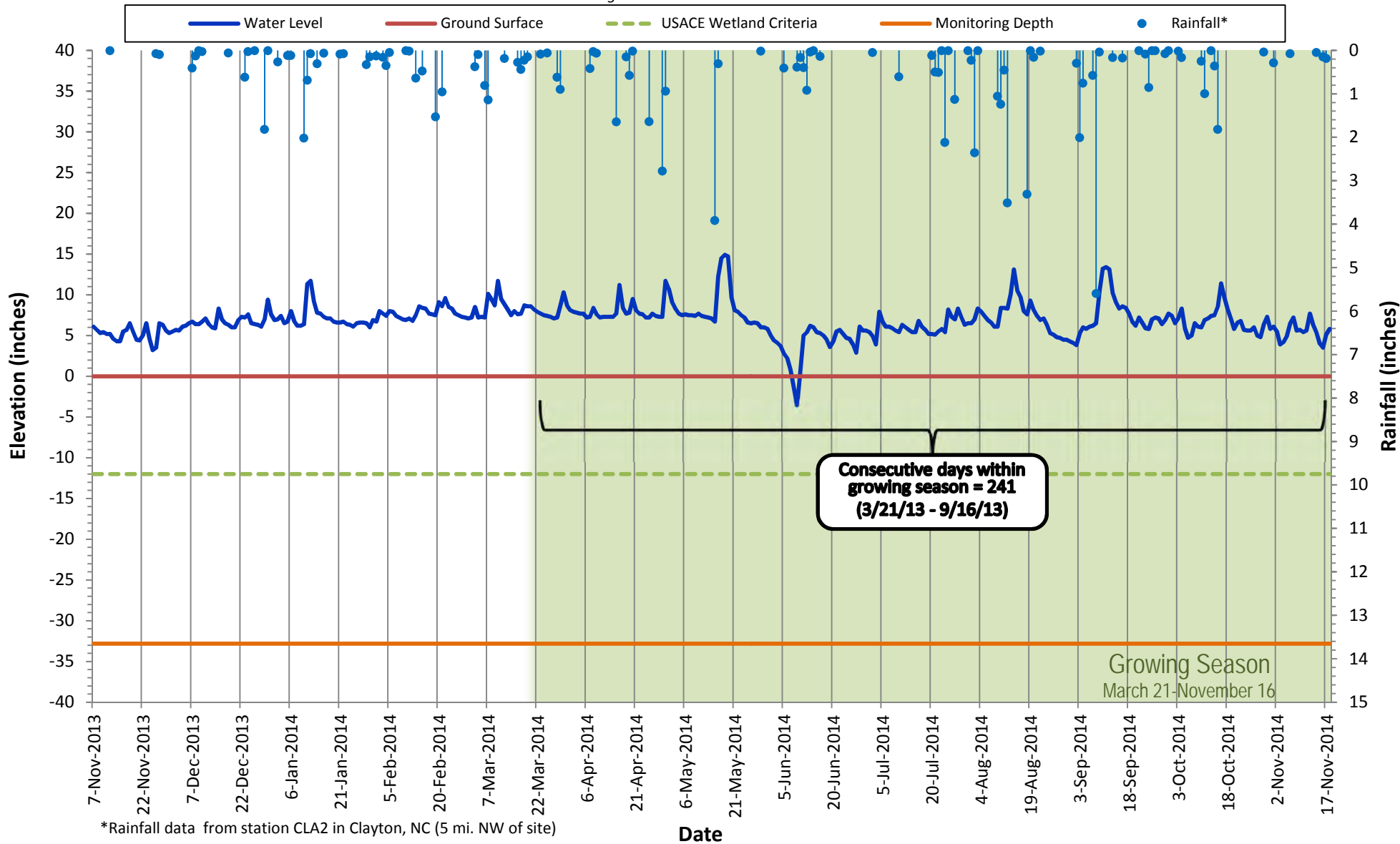
November 7, 2013 - November 18, 2014
Growing Season: March 21 - November 16



*Rainfall data from station CLA2 in Clayton, NC (5 mi. NW of site)

Shallow Water Table Gauge B4

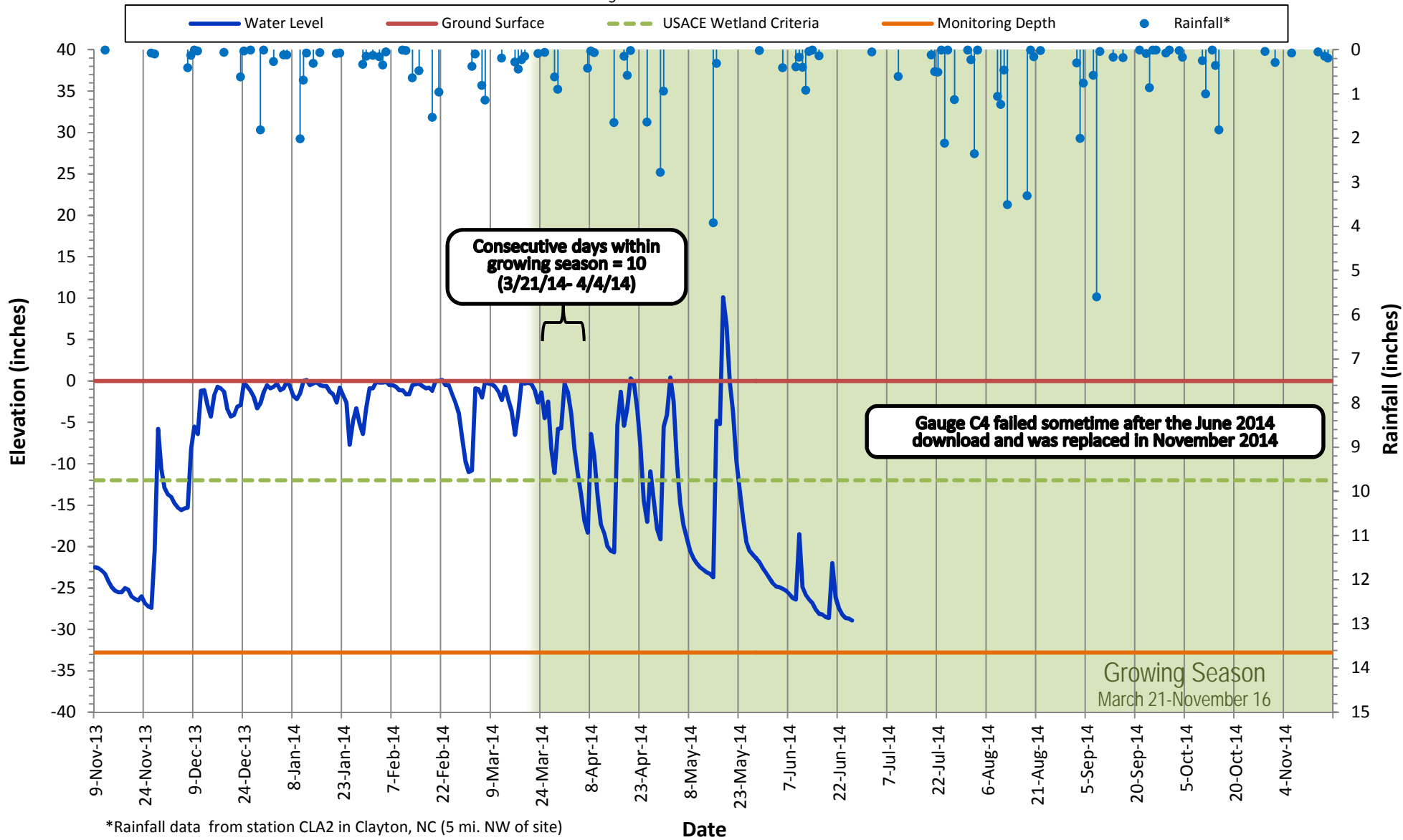
November 7, 2013 - November 18, 2014
Growing Season: March 21 - November 16



*Rainfall data from station CLA2 in Clayton, NC (5 mi. NW of site)

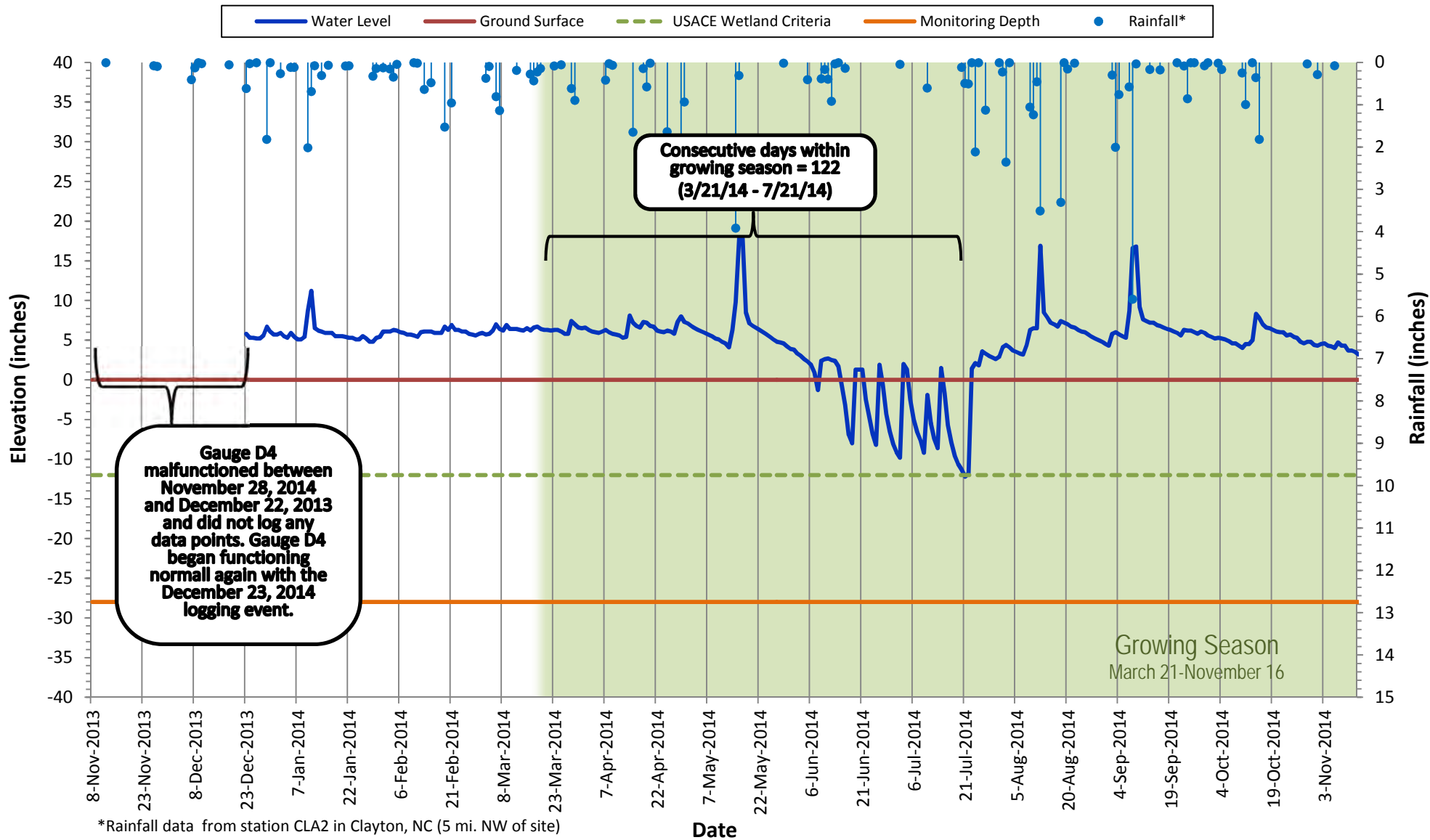
Shallow Water Table Gauge C4

November 9, 2013 - November 18, 2014
Growing Season: March 21 - November 16



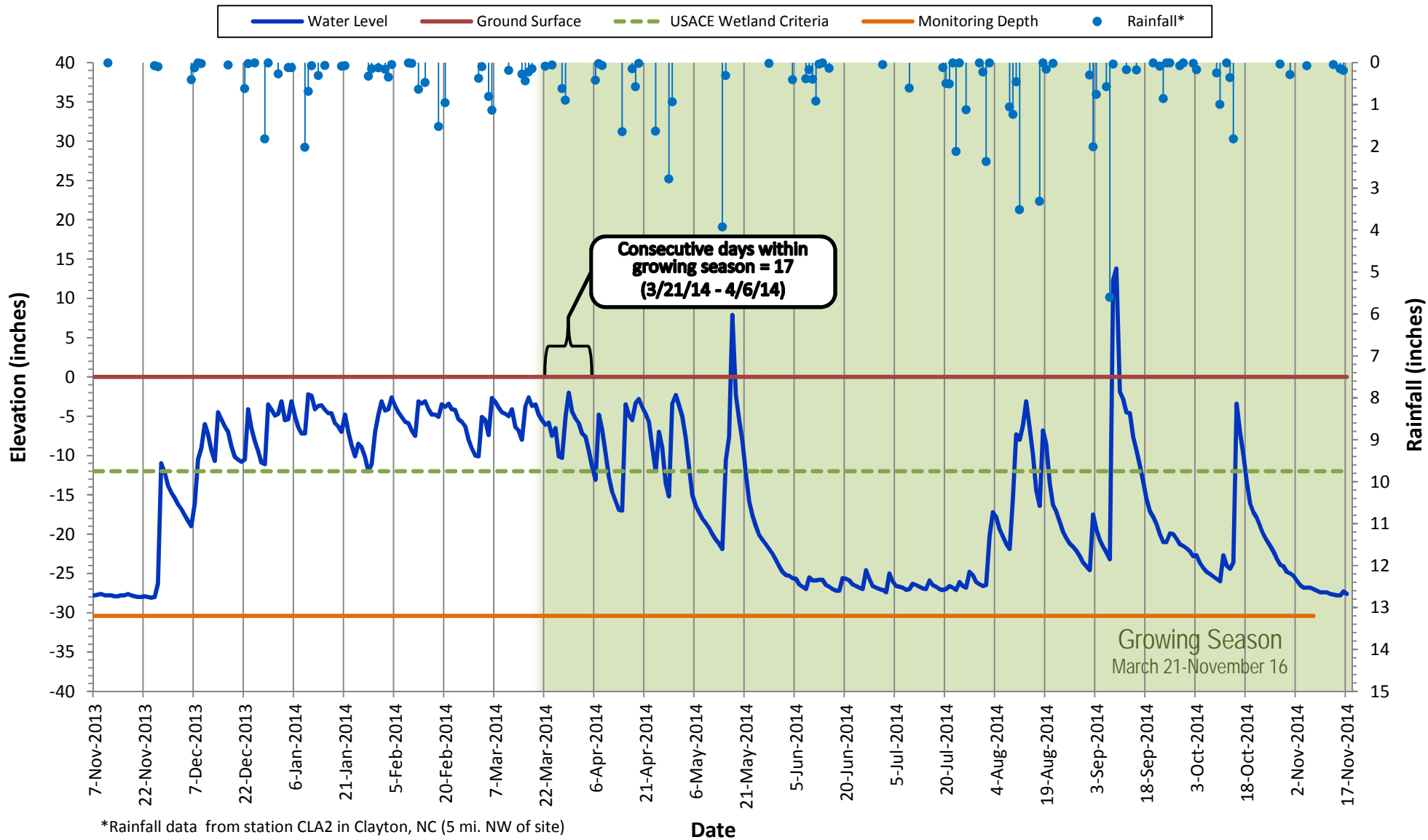
Shallow Water Table Gauge D4

November 8, 2014 - November 12, 2014
Growing Season: March 21 - November 16



Shallow Water Table Gauge E4

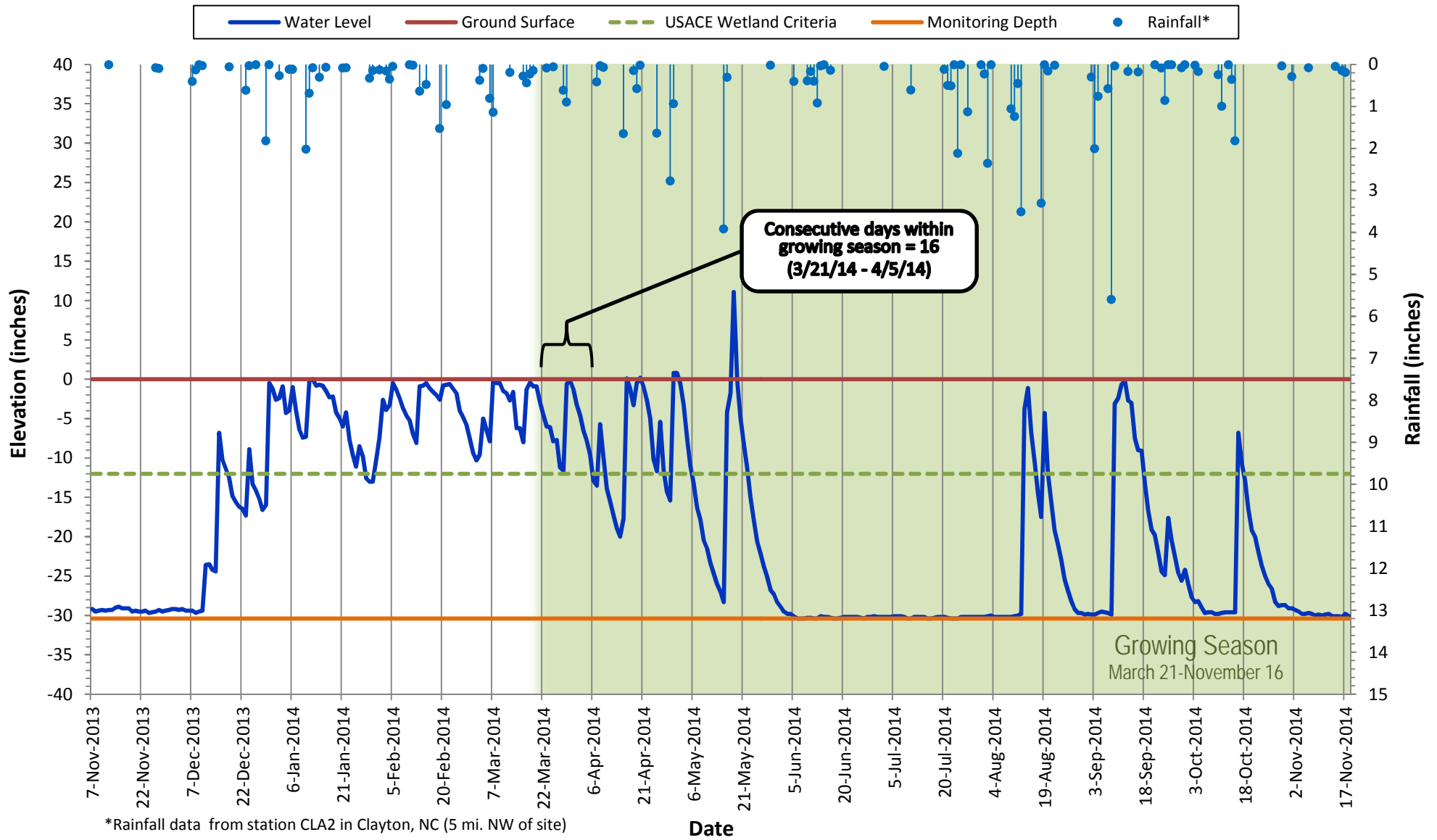
November 7, 2013 - November 18, 2014
Growing Season: March 21 - November 16



*Rainfall data from station CLA2 in Clayton, NC (5 mi. NW of site)

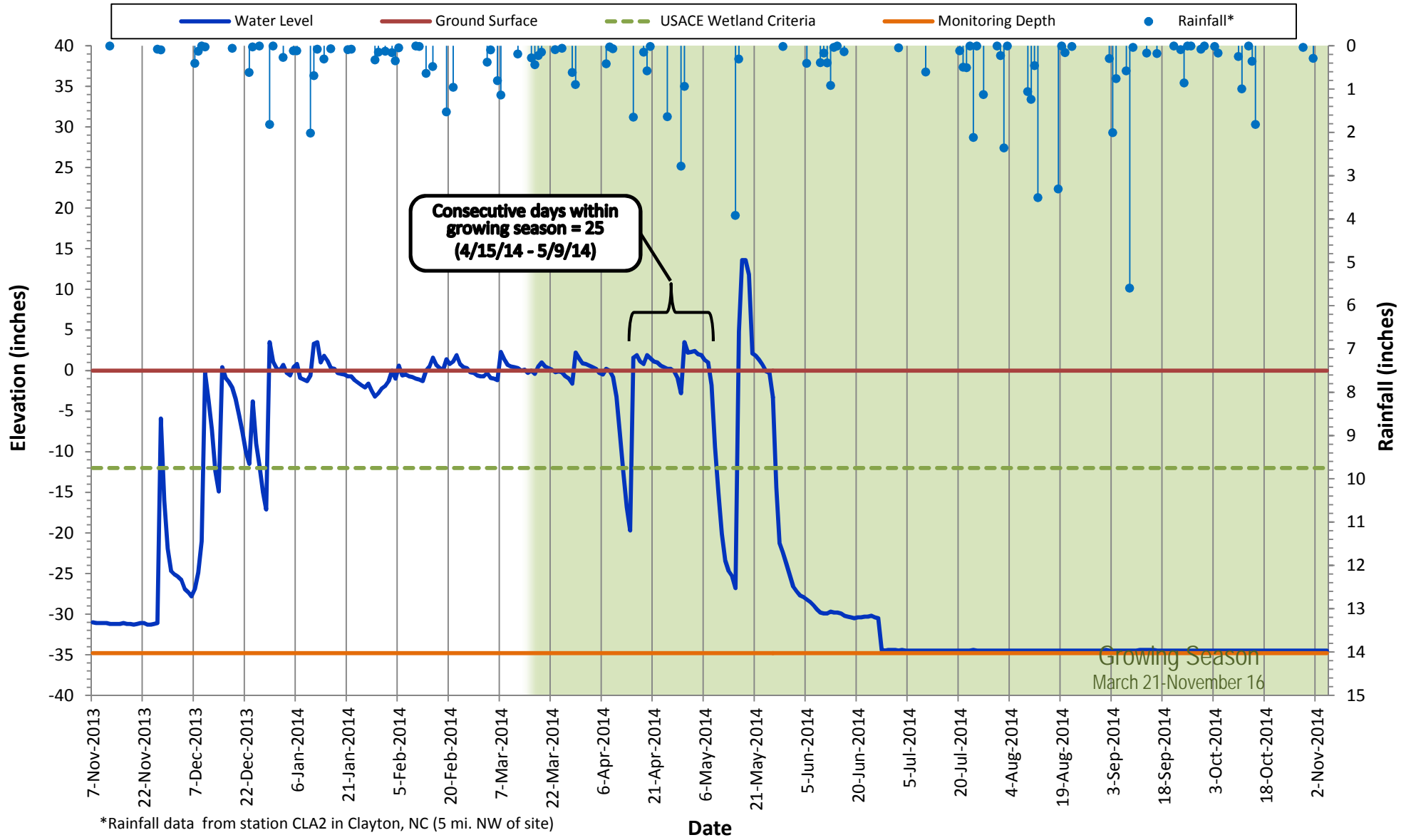
Shallow Water Table Gauge F4

November 7, 2013 - November 18, 2014
 Growing Season: March 21 - November 16



Shallow Water Table Gauge G4

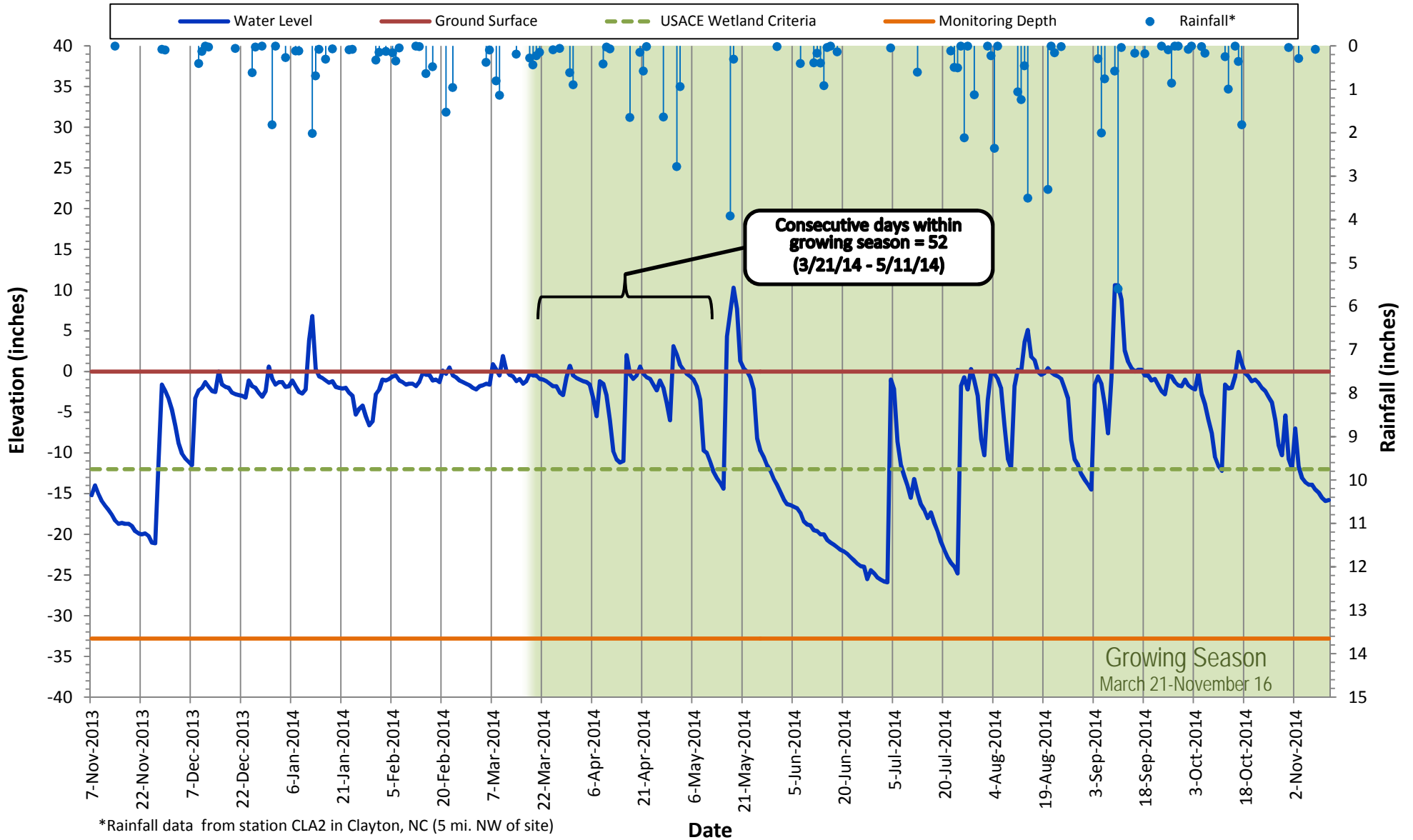
November 7, 2012 - November 5, 2014
Growing Season: March 21 - November 16



*Rainfall data from station CLA2 in Clayton, NC (5 mi. NW of site)

Shallow Water Table Gauge B5

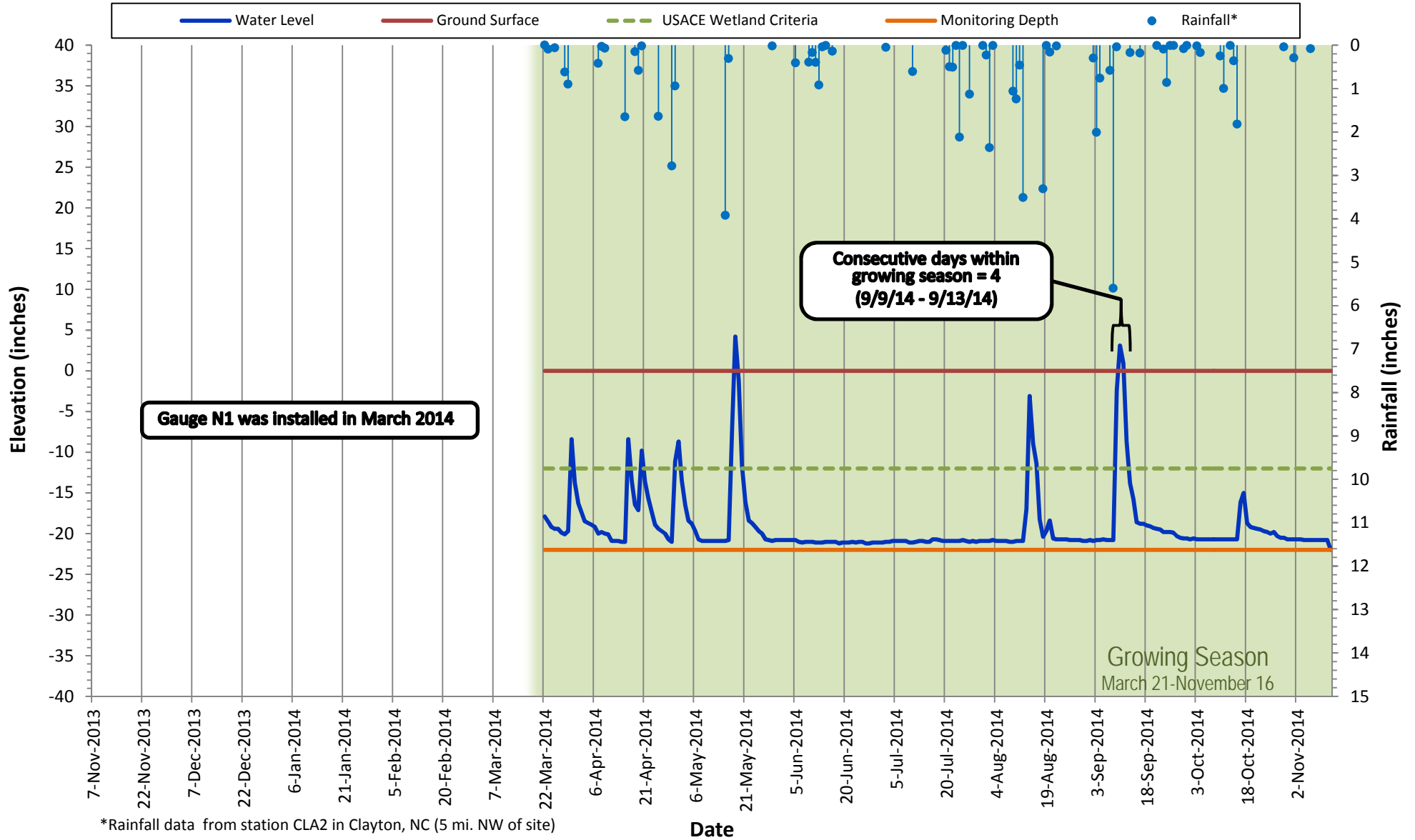
November 7, 2013 - November 12, 2014
Growing Season: March 21 - November 16



*Rainfall data from station CLA2 in Clayton, NC (5 mi. NW of site)

Shallow Water Table Gauge N1

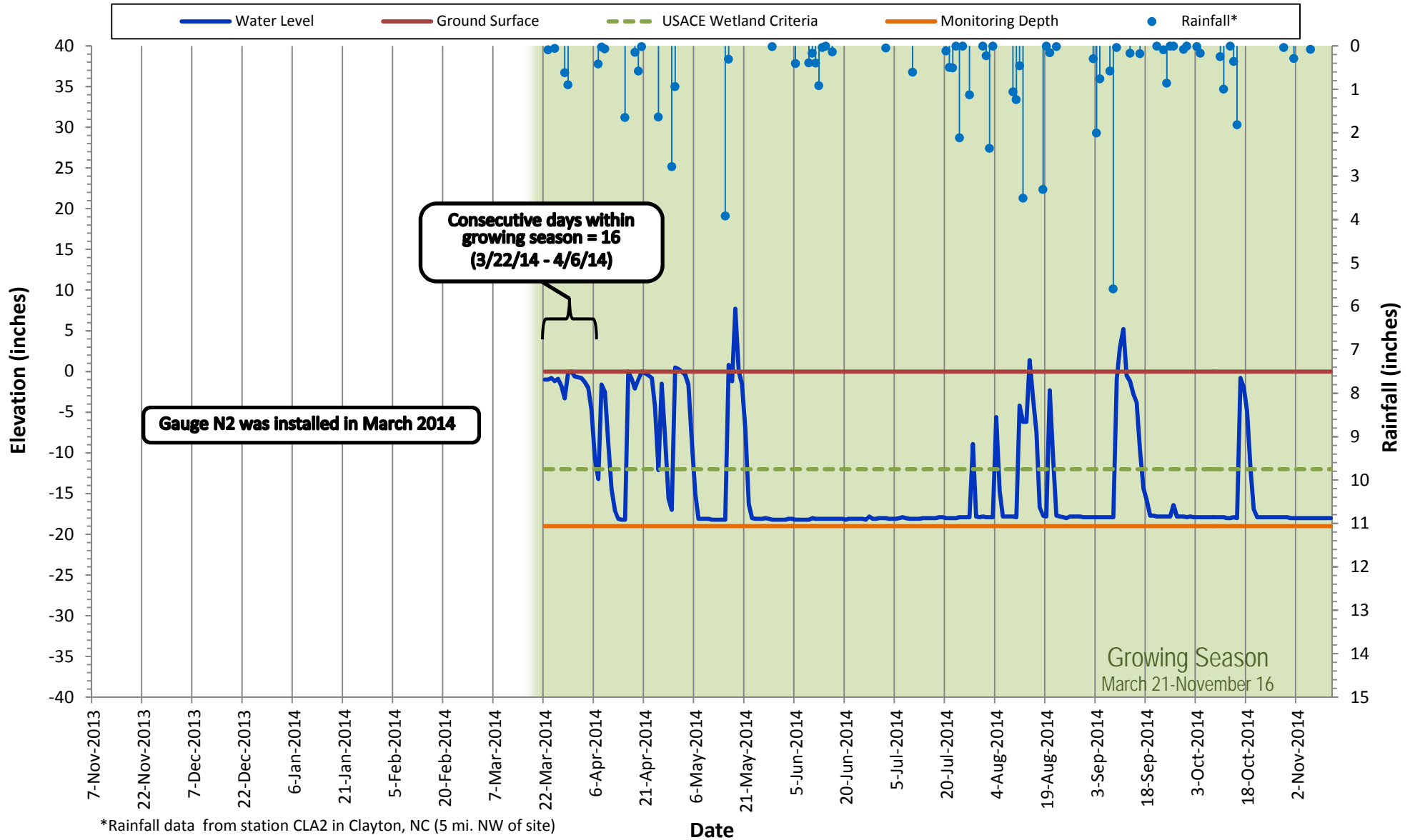
March 22, 2014 - November 12, 2014
Growing Season: March 21 - November 16



*Rainfall data from station CLA2 in Clayton, NC (5 mi. NW of site)

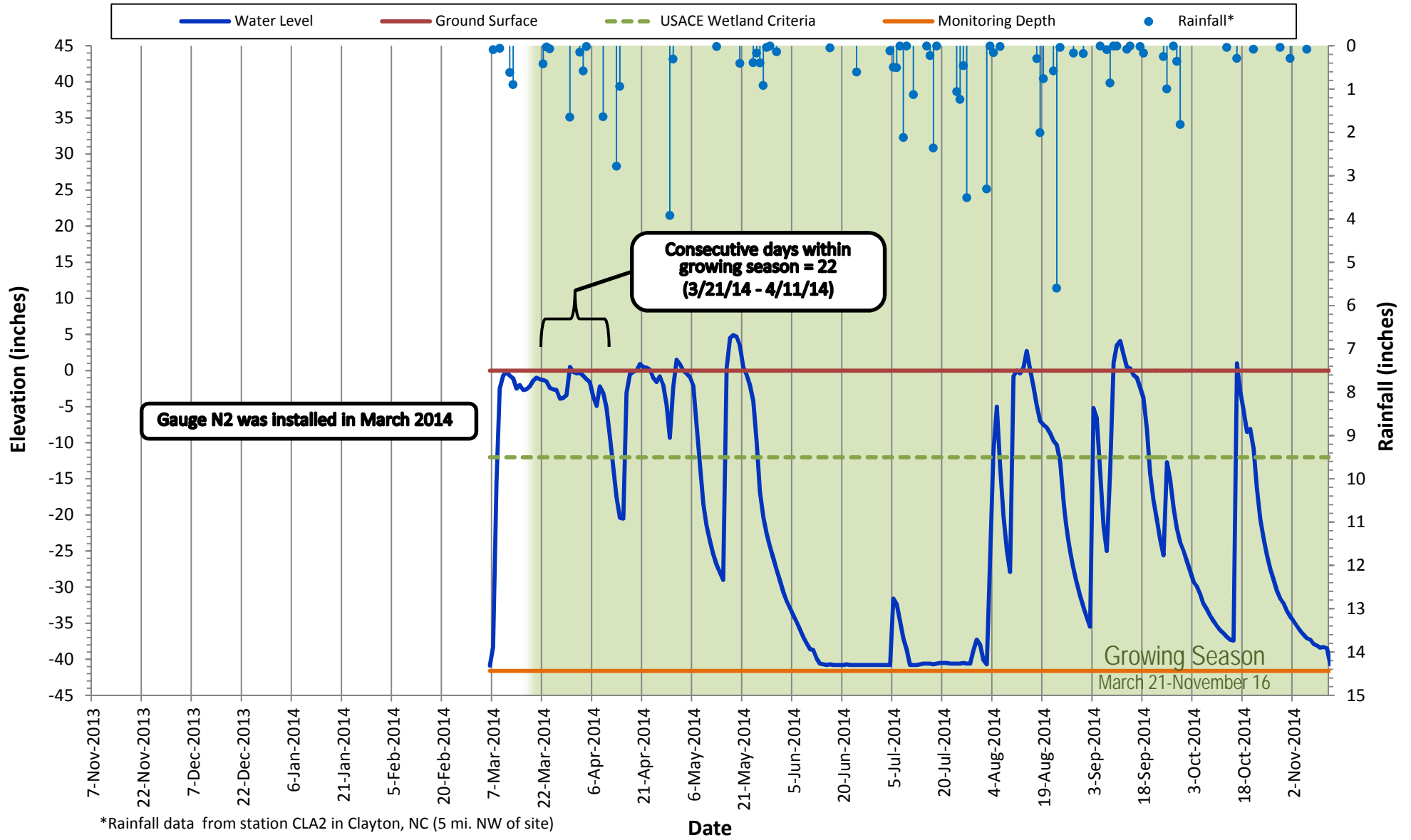
Shallow Water Table Gauge N2

March 22, 2014 - November 12, 2014
Growing Season: March 21 - November 16



Shallow Water Table Gauge N3

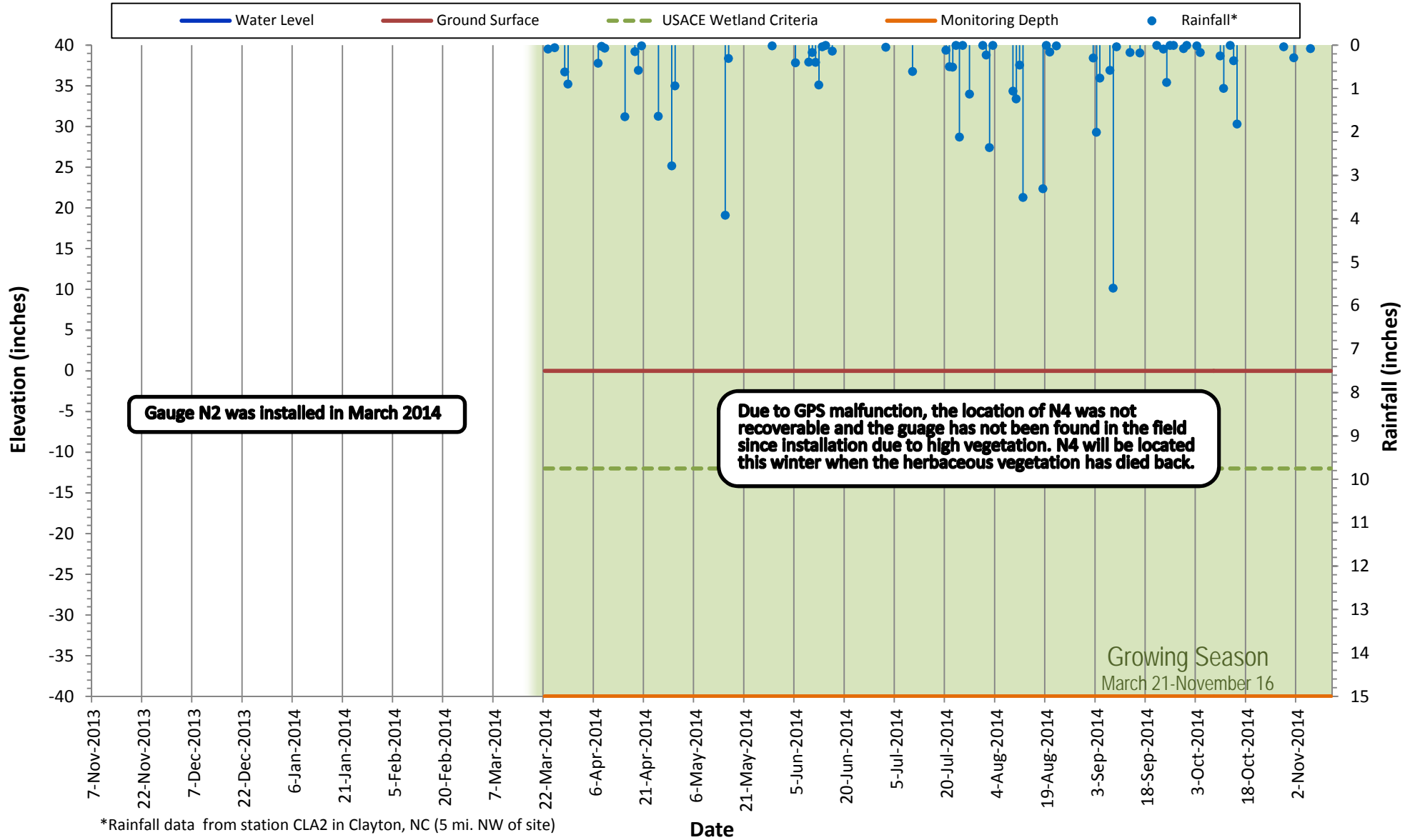
March 6, 2014 - November 18, 2014
Growing Season: March 21 - November 16



*Rainfall data from station CLA2 in Clayton, NC (5 mi. NW of site)

Shallow Water Table Gauge N4

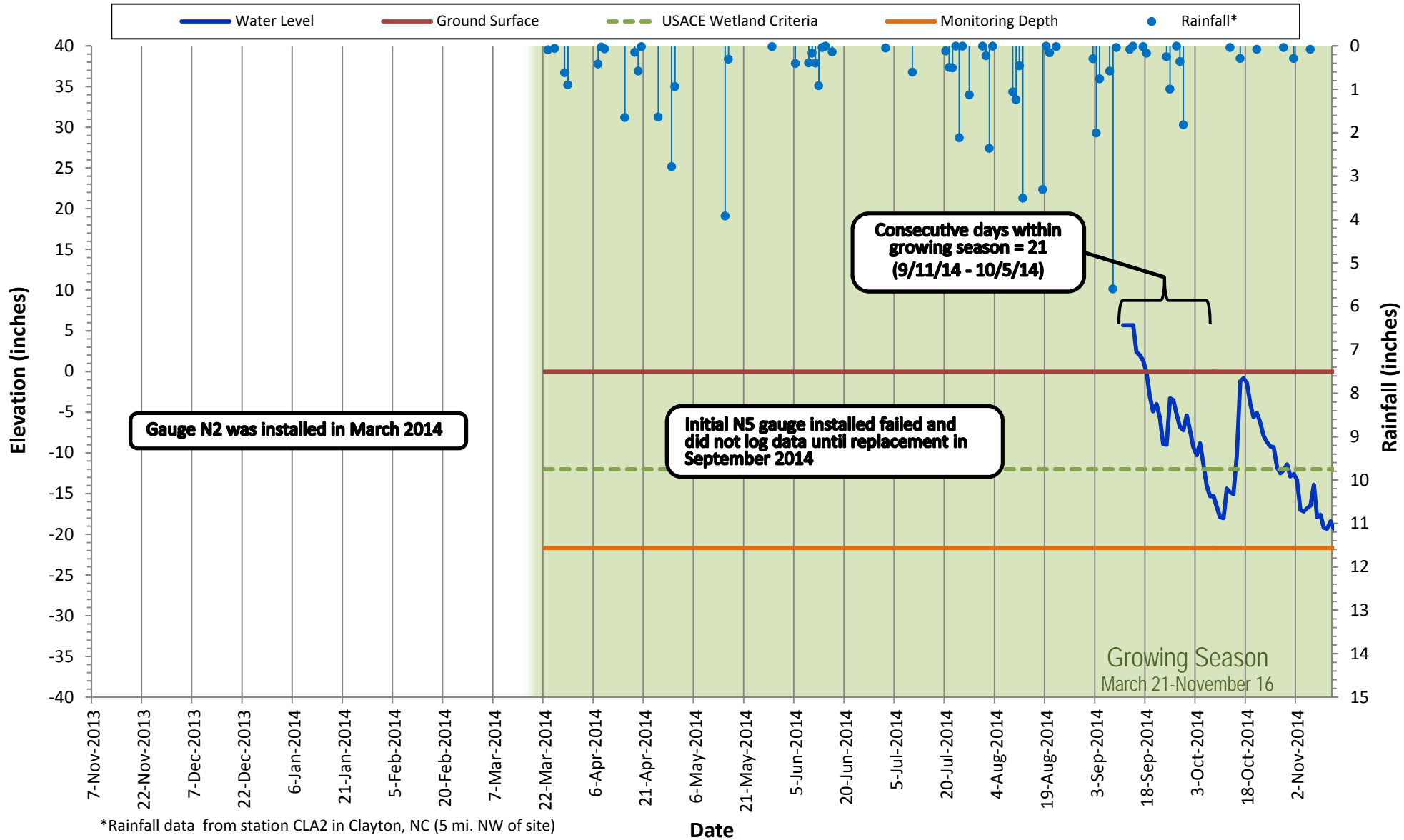
March 6, 2014 - November 12, 2014
Growing Season: March 21 - November 16



*Rainfall data from station CLA2 in Clayton, NC (5 mi. NW of site)

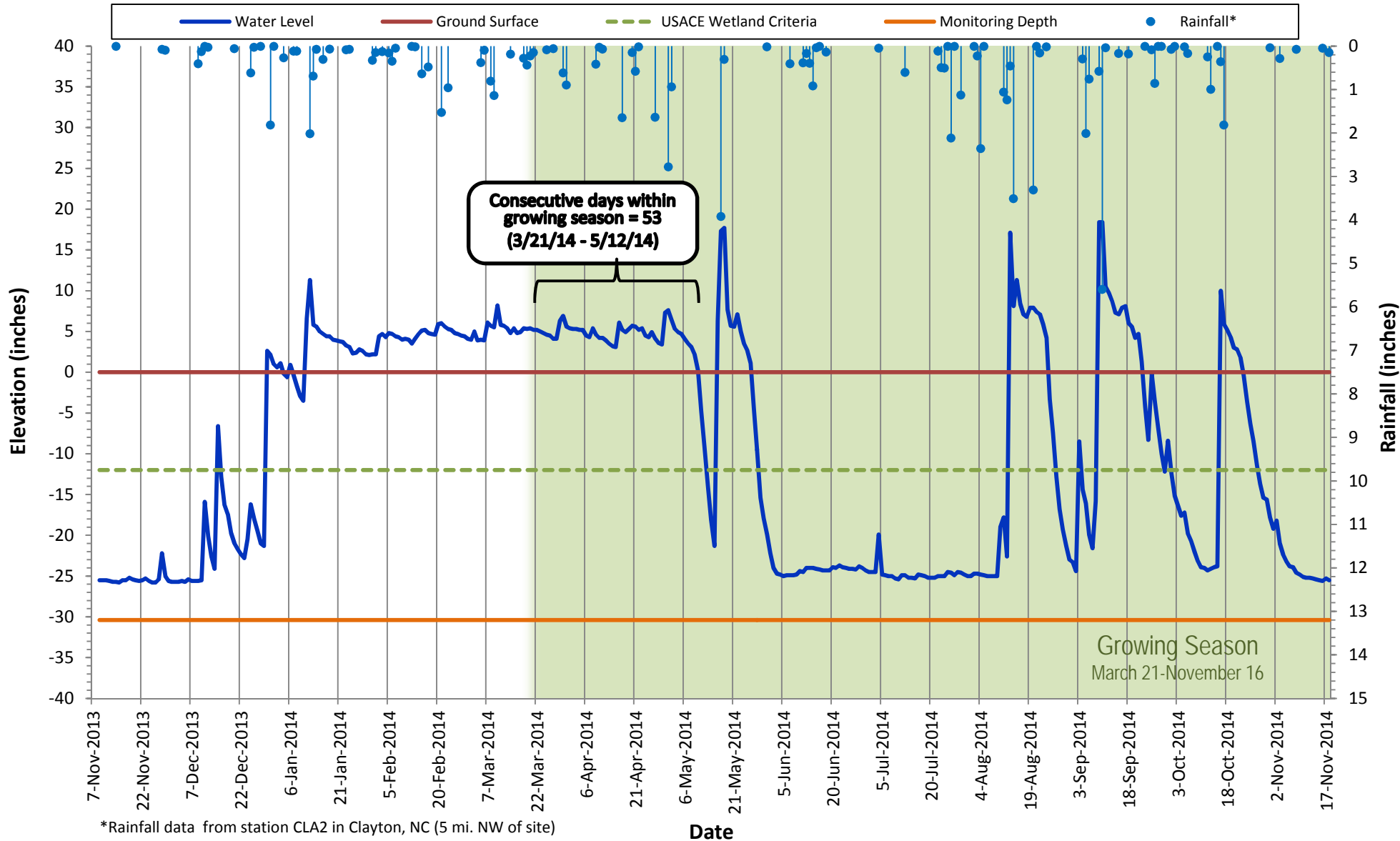
Shallow Water Table Gauge N5

March 22, 2014 - November 12, 2014
Growing Season: March 21 - November 16



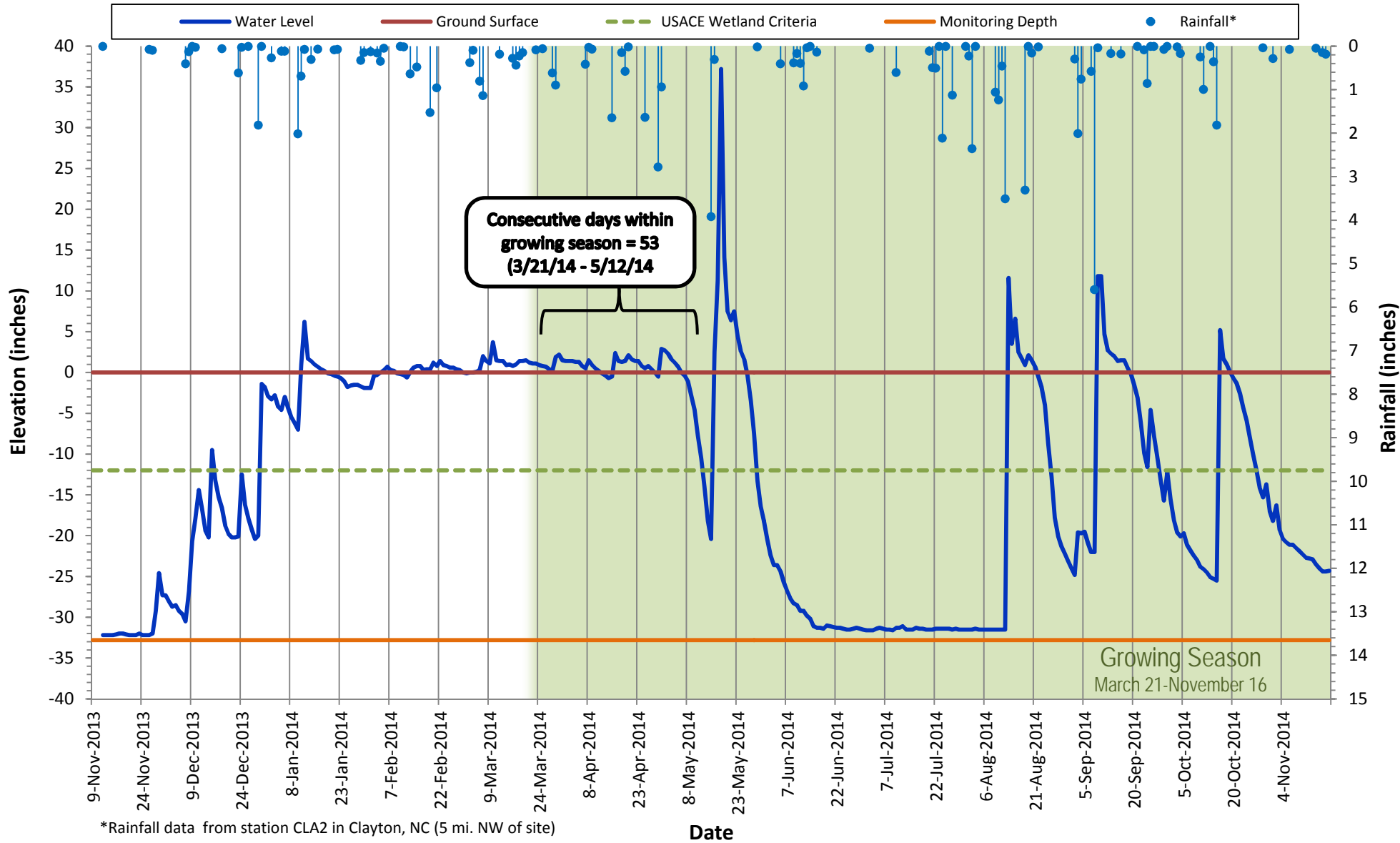
Shallow Water Table Gauge REF-B

November 7, 2013 - November 18, 2014
Growing Season: March 21 - November 16



Shallow Water Table Gauge REF-C

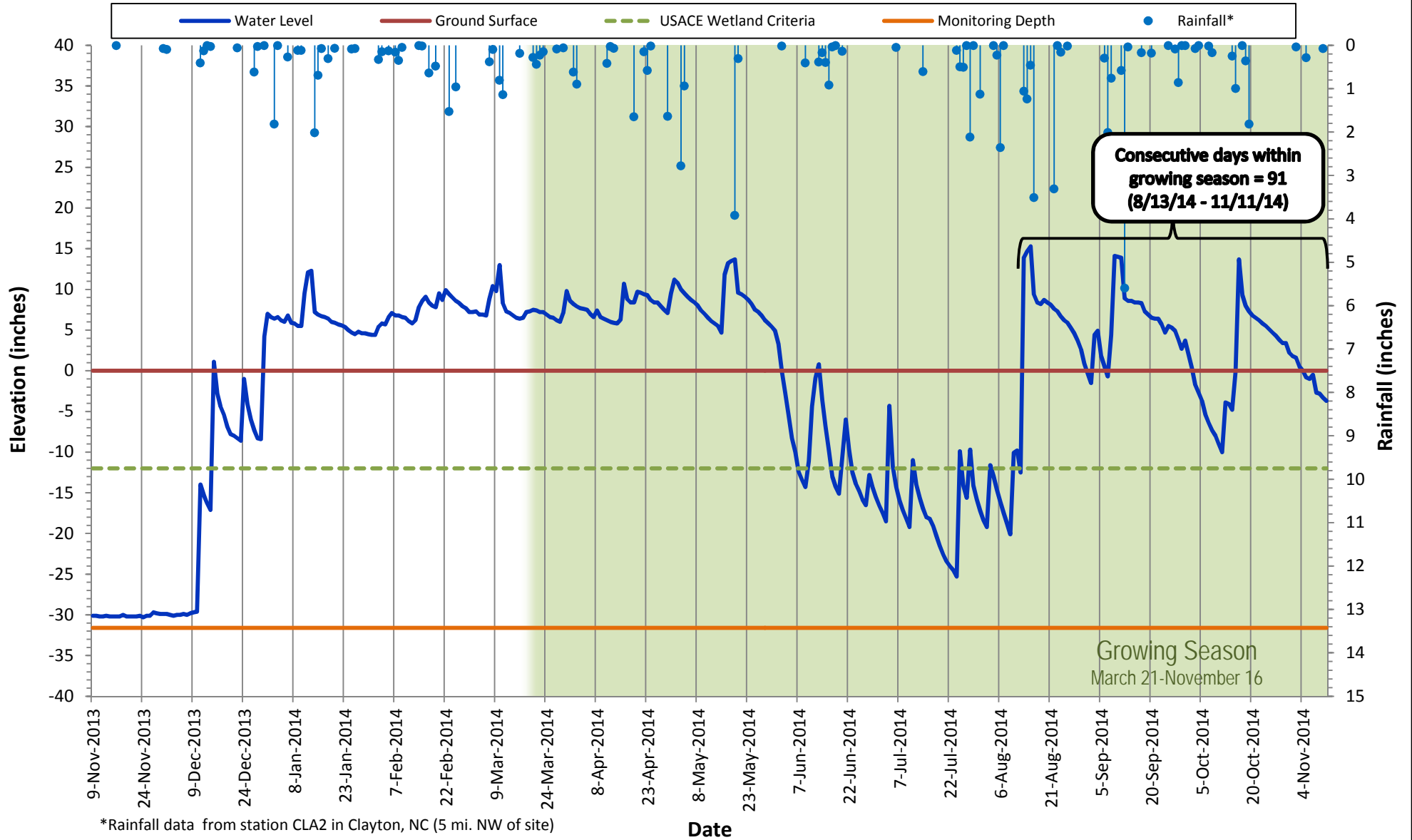
November 9, 2013 - November 18, 2014
Growing Season: March 21 - November 16



*Rainfall data from station CLA2 in Clayton, NC (5 mi. NW of site)

Shallow Water Table Gauge REF-D

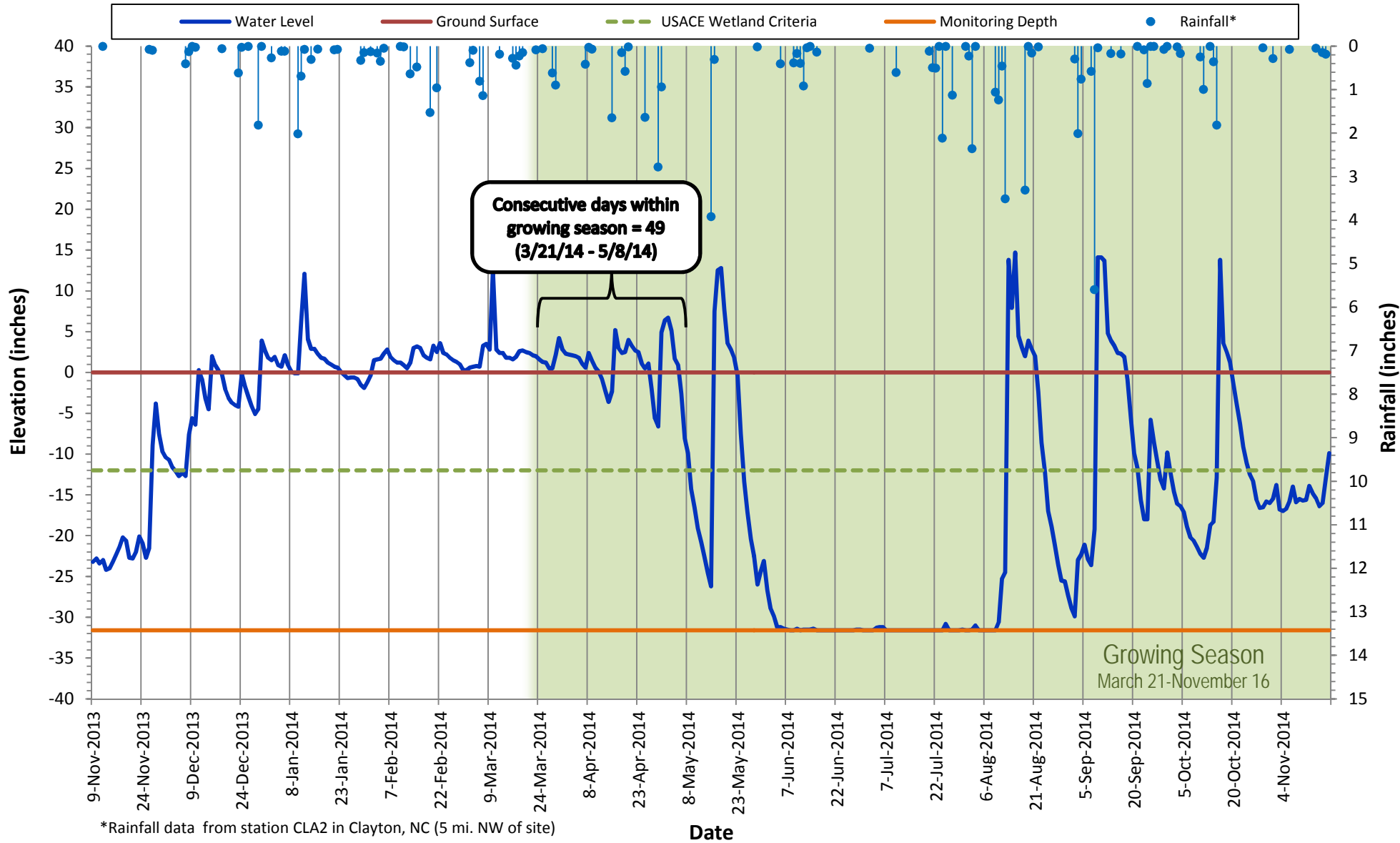
November 9, 2013 - November 11, 2014
 Growing Season: March 21 - November 16



*Rainfall data from station CLA2 in Clayton, NC (5 mi. NW of site)

Shallow Water Table Gauge REF-E

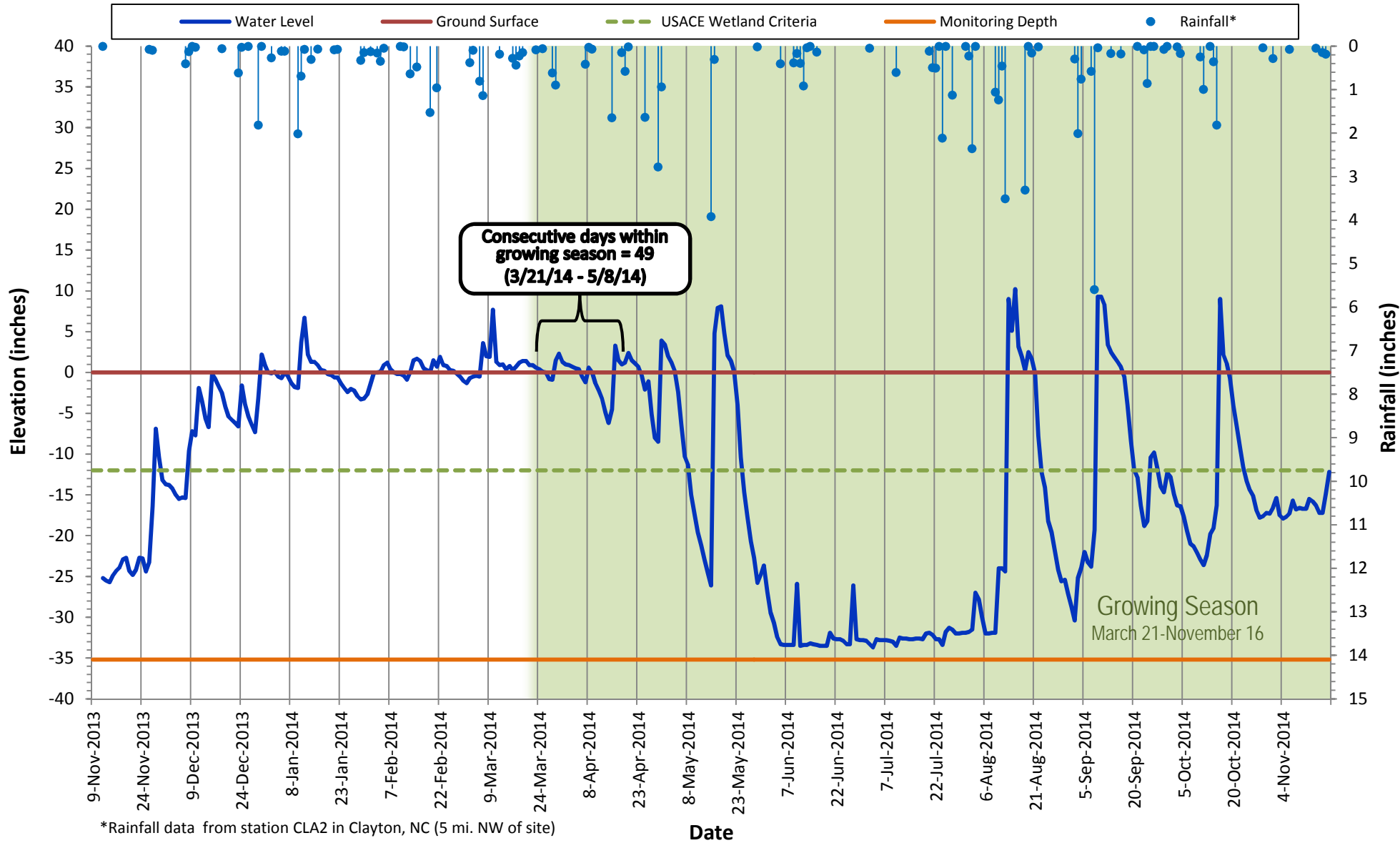
November 9, 2013 - November 18, 2014
Growing Season: March 21 - November 16



*Rainfall data from station CLA2 in Clayton, NC (5 mi. NW of site)

Shallow Water Table Gauge REF-F

November 9, 2013 - November 18, 2014
Growing Season: March 21 - November 16



*Rainfall data from station CLA2 in Clayton, NC (5 mi. NW of site)