

Year 3 Monitoring Report

FINAL

BAREFOOT SITE

NCDMS Project # 100044 (Contract # 7418)
USACE Action ID: SAW-2018-00433
DWR Project # 2018-0235

Sampson County, North Carolina
Neuse River Basin
HUC 03020201



Provided by:



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For Environmental Banc & Exchange, LLC
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January 2023



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January 12, 2023

Lindsay Crocker
NC DEQ Division of Mitigation Services
217 West Jones Street
Raleigh, NC 27604

RE: Barefoot, Project ID #100044, DMS Contract #7418

Listed below are comments provided by DMS on December, 2022 regarding the Barefoot Site: Year 3 Monitoring Report and RES' responses.

Comments:

1. DMS understands that RES does not feel the cattails need to be identified in the invasive areas of concern because RES interprets that the cattails are native. Please add the area (acres) of the cattails in the vegetation narrative or put it on the CCPV legend for context. [The total area of cattails is 7.43 acres. This information has been added to the CCPV and the monitoring report in Section 1.7.](#)
2. Page 18 + shows monitoring photos. Confirm these are MY3 and update header. Mitigation Plan shows "digital monitoring stations" will be added for visual assessments. Confirm that the General site photos indicate these digital photos or provide justification. [Monitoring photos are from MY3 and headers for the monitoring photos have been updated to reflect that. General site photos are the digital monitoring stations.](#)
3. Suggest that RES/EBX provide drought status or index for the 2021-22 dormant season and/or run Corps antecedent rain tool to justify the low gage results. [Drought conditions for the 2021-2022 dormant season and the 2022 growing season have been added to Section 1.7 and Table 10B in Appendix D.](#)

Electronic Comments:

1. The vegetation data submitted appeared to indicate fixed veg plot 6 was duplicated and no data submitted for veg plot 7. The data indicates the title of veg plot 7 was simply an error. Please note this for next vegetation data submission; no need to re-submit MY3 data. [This has been noted and will be corrected in future submissions.](#)

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1.0 Project Summary

1.1 Project Location and Description

The Barefoot Project (“Project”) is located within a rural watershed in Sampson County, North Carolina approximately two miles west of Newton Grove and six miles southeast of Peacocks Crossroads. The Project lies within the Neuse River Basin, North Carolina Division of Water Resources (NCDWR) sub-basin 03-04-04 and United States Geological Survey (USGS) 8-digit hydrologic unit code (HUC) 03020201. The Project proposes to re-establish 23.23 acres of non-riparian wetlands within a 123-acre drainage area. The Project is located in the Rolling Coastal Plain level IV ecoregion within the Southeastern Plains level III ecoregion.

The Project area is comprised of a 33.29-acre easement involving a drained mineral flat wetland area, which eventually drains into Mill Creek and later the Neuse River. The wetland mitigation components are summarized in **Table 1**. The Project is located west of Warren Mill Road (SR 1647) and north of Harnett Dunn Highway (Hwy 55) and is accessible from Warren Mill Road. Coordinates for the Project areas are as follows: 35.253742, -78.392667.

The Project area is comprised of one contiguous non-riparian wetland area, that drains to Mill Creek and ultimately to the Neuse River. The total drainage area for the Project is 123 acres (0.19 mi²). Primary land use within the drainage area consists of approximately 73 percent forest and 27 percent agricultural land. Impervious area is not present in the drainage area of the Project. Within the agricultural land use, row crops make up 100 percent of the area. Although the project watershed is primarily forested, the majority of the agricultural areas within the watershed are in close proximity to the Project and are drained via ditches and drain tiles, which plays a significant role in the past degradation of the Project wetlands. Historic land use within the immediate project area was primarily crop production and silviculture. These activities negatively impacted both water quality and habitat within the project area.

The primary wetland re-establishment activities included:

- The plugging and backfilling of ditches in and around the cultivated field,
- Removing/plugging all of the drain tiles within the agricultural field,
- Plugging and backfilling the ditches on two sides of the cut-over,
- Removal of spoil berms to reconnect the Project to its historical watershed,
- Creation of shallow depressional features typical of the community type, and
- Regraded areas of cut and fill along interior ditches to create a continuous wetland flat system.

The Site is to be monitored on a regular basis throughout the seven-year post-construction monitoring period, or until performance standards are met. Upon approval for closeout by the Interagency Review Team (IRT), the Site will be transferred to the NCDEQ Stewardship Program. The NCDEQ Stewardship Program will be responsible for periodic inspection of the Site to ensure that restrictions required in the Conservation Easement, or the deed restriction document(s) are upheld.

1.2 Project Goals and Objectives

The Barefoot Wetland Restoration Project was identified as a wetland restoration opportunity to improve water quality, habitat, and hydrology within the Neuse 01 River Basin. Specific, attainable goals and objectives were realized by the Project. These goals clearly address the degraded water quality and nutrient

input from farming that were identified as major watershed stressors in the 2010 Neuse River RBRP (amended in 2018). The Project addresses outlined RBRP Goal 2.

The project goals are:

- Reduce sediment and nutrient input into downslope receiving streams by limited runoff and sediment into connecting ditches,
- Improve filtration of runoff in project drainage area,
- Re-establish a historical aquatic resource into a functioning non-riparian wetland, and
- Improve aquatic and terrestrial habitat.

The project goals were addressed through the following project objectives:

- Convert active row crop land to a nonriverine hardwood forest,
- Plug, fill, and stabilize existing ditches and drainage tiles,
- Treat exotic invasive species,
- Provide habitat and hydrologic connectivity to a larger wetland community, and
- Establish a permanent conservation easement on the Project.

The Project brings functional uplift, benefits, and improvements to the project area and adjacent forests. Restoration of wetland hydrology and reconnection with the supplying watershed has re-established wetlands lost to past agricultural practices, and conversion of agricultural lands has reduced sediment and nutrients contributed to downstream systems. Planting of native species and control of invasives has restored terrestrial habitat, and reconnection of the project area with the adjacent forested wetlands has provided a source of native flora and fauna for the project area.

1.3 Project Success Criteria

The success criteria for the Project follows the 2016 USACE Wilmington District Stream and Wetland Compensatory Mitigation Update and subsequent agency guidance. Vegetation plot data will be reported in Monitoring Years 0, 1, 2, 3, 5, and 7. Wetland hydrology and visual monitoring will be reported annually. Specific success criteria components are presented below.

Wetland Restoration Success Criteria

Wetland Hydrology

The NRCS provides a current WETS table for Sampson County upon which to base a normal rainfall amount and average growing season. The closest comparable data station was determined to be WETS station Clinton 2 NE in Clinton NC (NRCS, n.d.). This station is located off Faison Highway near the Timberlake Golf Club approximately 17 miles south-southeast of the proposed mitigation project. The growing season for Sampson County is 254 days long, extending from March 13 to November 22, and is based on a daily minimum temperature greater than 28 degrees Fahrenheit occurring in five of ten years.

Because of the surface roughing and shallow depressions, a range of hydroperiods with areas of seasonal inundation is expected. The target hydroperiod is ten percent (approximately 26 days) for the duration of the monitoring period.

Digital Image Stations

The visual assessments include vegetation density, vigor, invasive species, and easement encroachments. Visual assessments of wetland success include an area walkthrough and structure and gauge inspection.

Digital images will be taken at fixed representative locations to record each monitoring event, as well as any noted problem areas or areas of concern. Results of visual monitoring will be presented in a plan view exhibit with a brief description of problem areas and digital images. A series of images over time should indicate successional maturation of wetland vegetation.

Vegetation Success Criteria

Specific and measurable success criteria for plant density within the wetland areas on the Project will follow IRT Guidance. The interim measures of vegetative success for the Project will be the survival of at least 320 planted three-year old trees per acre at the end of Year 3, five-year old trees at seven feet in height at the end of Year 5, and the final vegetative success criteria will be 210 trees per acre with an average height of ten feet at the end of Year 7. Volunteer trees will be counted, identified to species, and included in the yearly monitoring reports, and may be counted towards the success criteria of total planted stems if appropriate for the community type. Moreover, any single species can only account for up to 50 percent of the required number of stems within any vegetation plot. Any stems in excess of 50 percent will be shown in the monitoring table but will not be used to demonstrate success.

1.4 Project Components

The Project presents 23.238 acres of proposed non-riparian wetland re-establishment, generating 19.942 Wetland Mitigation Units (WMU) (**Table 1**). This is derived from the mitigation plan, which was consistent with the February 22, 2018, Post Contract IRT Meeting Minutes and IRT response emails.

Wetland ID	Mitigation Approach	Acres	Ratio	Non-Riparian Wetland Mitigation Units
Wetland 1	Re-establishment	16.645	1:1	16.645
Wetland 2	Re-establishment	6.593	2:1	3.297
Total		23.238		19.942

1.5 Wetland Design/Approach

The Barefoot Mitigation Project provides 19.94 wetland mitigation units through wetland re-establishment. The existing agricultural fields and clear-cut on the Project were re-established by restoring the hydrology, restoring vegetation in the agricultural field, and providing long-term protection. Wetland restoration design activities included: plugging the interior ditches and all ditches surrounding the agricultural fields, removing/plugging the drain tiles, removing spoil along the ditches, and limited grading of the area to reconstruct historical contours that include shallow depressions in the nearly level topography. Additionally, the ditch to the north of W1 was designed to be relocated approximately 95 feet north of the present location to allow continued use of the agricultural fields north of the Project, but to also limit drainage effect on the restored area. The field was planted with trees and a permanent seed mix. No additional plantings within the clear-cut were anticipated to be necessary. A ratio of 1:1 is used within re-established area of W1, which totals 16.64 acres. Within W2, wetland re-establishment at a ratio of 2:1 is used as hydrology is being re-established through the plugging of ditches, but existing vegetation is being left undisturbed. An additional buffer of 50 feet around the area of wetland re-establishment may achieve wetland hydrology at a lower hydroperiod. The remaining area between that and the easement edge is not expected to achieve wetland hydrology but will act as additional buffer between the wetland area and agricultural practices outside the easement. Plan views are provided in **Figure 2** and in **Appendix D**.

1.6 Construction and As-Built Conditions

Wetland construction and planting was completed in January 2020. Overall, the Barefoot Site was built to design plans and guidelines. A few minor adjustments, however, were made to the plans during construction. The ditch directly north of the easement was constructed about 45 feet closer to the easement than proposed, to ensure appropriate farm access. This makes the new ditch about 100 feet from the wetland area. A berm was added in the upland area inside the northwest corner of the easement to limit surface draining from the wetland into the new ditch. Also, the ditch directly to the east (outside of the easement) was not filled as proposed due to the discovery of drain tiles draining from the east into it and due to landowner negotiations. If there are any hydrologic effects to the wetland area it will be evident in the hydroperiods of the groundwater wells on the northern and eastern edges. Lastly, a path of forest was cleared in the southwestern portion of the easement. This was done to allow access for plugging the ditch on the southern edge of W2. This area was planted the same as W1. RES does not anticipate any changes to wetland crediting despite these minor field adjustments. As for the planting plan, a few minor adjustments were made due to tree availability. Laurel oak, sweet bay, and Atlantic white cedar were not planted, and water oak, green ash, silky dogwood, buttonbush, yellow poplar, southern crabapple, and sugarberry were planted instead. The rest of the planting plan was carried out as proposed. A redline version of the as-built survey and as-built condition drone photos included in the As-Built Report.

1.7 Baseline Monitoring Performance (MY3)

The Barefoot Year 3 Monitoring activities were performed in May, August, and November 2022. All Baseline Monitoring data is present below and in the appendices. The Site is on track to meeting vegetation and wetland interim success criteria.

Vegetation

Monitoring of the 10 fixed vegetation plots and six random vegetation plots was completed in early August 2022. Vegetation data are in **Appendix C**, associated photos are in **Appendix B**, and plot locations are in **Appendix B**. MY3 monitoring data indicates that all plots are exceeding the interim success criteria of 320 planted stems per acre. Planted stem densities ranged from 567 to 1,093 planted stems per acre with a mean of 696 planted stems per acre across the fixed plots. A total of 16 native species were documented within the fixed plots. Total stems per acre ranged from 607 to 1295 with a mean of 906 total stems per acre. The average stem height in the fixed vegetation plots was 3.91 feet. Five of the six random plots were in planted stem areas, and one was in the wooded section of W2 (as requested by the IRT). The stem densities in the random plots located in planted areas ranged from 607 to 1,133 with an average height of 3.9 feet. The stem density of the random plot in the wooded section of W2 was 3,197 with an average height of 24.4 feet.

Visual assessment of vegetation outside of the monitoring plots indicates that the herbaceous vegetation is becoming well established throughout the project where standing water is not present. In February 2021, RES supplemental planted the eastern portion of the site with laurel oak and sweet bay magnolia (**Appendix B**). This supplemental planting included about 250 trees and the goal was to increase diversity on site. Additionally, RES supplemental planted the southwest portion of the project with 50 buttonbush and laurel oak bareroots and 75 black willow and silky dogwood lifestakes (**Appendix B**).

During Year 3 monitoring, RES documented cattails onsite. RES continued to observe a noticeable amount of cattail mortality. The area of cattails has decreased approximately by 2.2 acres since MY2 and is now 7.43 acres (**Figure 2**). As the vegetation data shows, the cattails are not negatively affecting the planted trees and eventually the planted stems will shade out the cattails and lead to cattail mortality. Additionally, RES concludes that the cattails on the site are the native species, broadleaf cattails (*Typha latifolia*), due to the site location being in Sampson County. The invasive species of cattail, narrowleaf cattail (*Typha angustifolia*) has not been recorded in Sampson County or any other inland county in North Carolina

(Vascular Plants of North Carolina, 2019 and USDA Plants, 2014). RES will continue to monitor the cattail patches in the future.

Wetland Hydrology

There are 17 groundwater wells at the Barefoot Site to monitor wetland hydrology. Eleven of the wells are in W1 and four are in W2. Two of the wells (16 & 17) do not have success criteria because they are outside of the wetland crediting area. In MY3, one of the eleven wells in W1 and zero of the four wells in W2 met success criteria. Well hydroperiods ranged from zero to 23 percent. Groundwater wells 1, 3, 5, 6, 7, 8, 9, and 11, had a hydroperiod of between 5-9%. Groundwater Wells 2 and 14 both had to be replaced on May 17th due to an animal destroying the entire well. Groundwater wells 4, 8, and 13 had to have their caps replaced on May 17th due to an animal destroying the string and caps. Groundwater well 10 suffered damage from an animal and was replaced November 16th. Therefore, the lower hydroperiods in well 2, 4, 8, 10, 13, and 14 could be due to the period when data was compromised. Going forward RES will install animal proof caps to try to prevent so much damage to the wells.

The generally lower hydroperiods than MY2 across the site was due to a very low rainfall year, with five months of the growing season having below average rainfall. Additionally, during the dormant season (12/24/2021 – 3/12/2022), 69% of the total weeks had at least moderate drought conditions in Sampson County. During the growing season (3/13/2022 – 11/23/2022), 76% of the total weeks had at least moderate drought conditions in Sampson County. Exact well locations can be found on **Figure 2** and associated data is in **Appendix D**.

2.0 Methods

Vegetation success is being monitored at 10 permanent monitoring plots and six random monitoring plots. Vegetation plot monitoring follows the CVS-EEP Level 2 Protocol for Recording Vegetation, version 4.2 (Lee et al. 2008) and includes analysis of species composition and density of planted species. Data are processed using the CVS data entry tool. In the field, the four corners of each plot were permanently marked with PVC at the origin and metal conduit at the other corners. Photos of each plot are to be taken from the origin during vegetation monitoring. Additionally, the six random monitoring plots are to be surveyed, in different locations, during each vegetation monitoring event. One of the six random plots is to be in the wooded section of W2 to document the change in community after the hydrologic uplift. The random plots will be 100 square meters with varying dimensions. The species and height of the trees as well as the location of the plot will be recorded during each monitoring event.

Wetland hydrology is monitored to document groundwater levels in the wetland restoration areas (Groundwater Wells 16 and 17 are located outside of the crediting areas). This is accomplished with 17 automatic pressure transducer gauges (located in groundwater wells) that record daily groundwater levels. One automatic pressure transducer is installed above ground for use as a barometric reference. Gauges are downloaded quarterly and wetland hydroperiods are calculated during the growing season. Gauge installation followed current regulatory guidance. Visual observations of primary and secondary wetland hydrology indicators are also recorded during quarterly site visits.

3.0 References

- Griffith, G.E., J.M.Omernik, J.A. Comstock, M.P. Schafale, W.H.McNab, D.R.Lenat, T.F.MacPherson, J.B. Glover, and V.B. Shelburne. (2002). Ecoregions of North Carolina and South Carolina, (color Poster with map, descriptive text, summary tables, and photographs): Reston, Virginia, U.S. Geological Survey (map scale 1:1,500,000).
- Lee Michael T., Peet Robert K., Roberts Steven D., and Wentworth Thomas R., 2008. *CVS-EEP Protocol for Recording Vegetation Level*. Version 4.2
- National Drought Mitigation Center at the University of Nebraska-Lincoln, the United States Department of Agriculture, and the National Oceanic and Atmospheric Administration. (2023). *Percent Area in U.S. Drought Monitor*. Data Tables | U.S. Drought Monitor.
- Peet, R.K., Wentworth, T.S., and White, P.S. (1998), *A flexible, multipurpose method for recording vegetation composition and structure*. *Castanea* 63:262-274
- Resource Environmental Solutions (2019). Barefoot Site Final Mitigation Plan.
- Schafale, M.P. 2012. Classification of the Natural Communities of North Carolina, Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, NCDENR, Raleigh, NC.
- USACE. (2016). Wilmington District Stream and Wetland Compensatory Mitigation Update. NC: Interagency Review Team (IRT).
- Vascular Plants of North Carolina. (2019). Narrowleaf Cattail - *Typha angustifolia* L.

Appendix A

Background Tables

Table 1. Barefoot (ID-100044) - Mitigation Assets and Components

Project Segment	Existing Footage or Acreage	Mitigation Plan Footage or Acreage	Mitigation Category	Restoration Level	Priority Level	Mitigation Ratio (X:1)	Mitigation Plan Credits		As-Built Footage or Acreage	Comments
No Stream Mitigation										
Wetland W1	0	16.645	NR	Re-establishment		1.000	16.645		16.645	Hydrologic restoration via plugging ditches and drainage tiles, planting
Wetland W2	0	6.593	NR	Re-establishment		2.000	3.297		6.593	Hydrologic restoration via plugging ditches

Project Credits

Restoration Level	Stream			Riparian Wetland		Non-Rip Wetland	Coastal Marsh
	Warm	Cool	Cold	Riverine	Non-Riv		
Restoration							
Re-establishment						19.942	
Rehabilitation							
Enhancement							
Enhancement I							
Enhancement II							
Creation							
Preservation							
TOTAL						19.942	

**Table 2. Project Activity and Reporting History
Barefoot Site (ID-100044)**

Elapsed Time Since grading complete: 2 year 10 months
Elapsed Time Since planting complete: 2 year 10 months
Number of reporting Years¹: 3

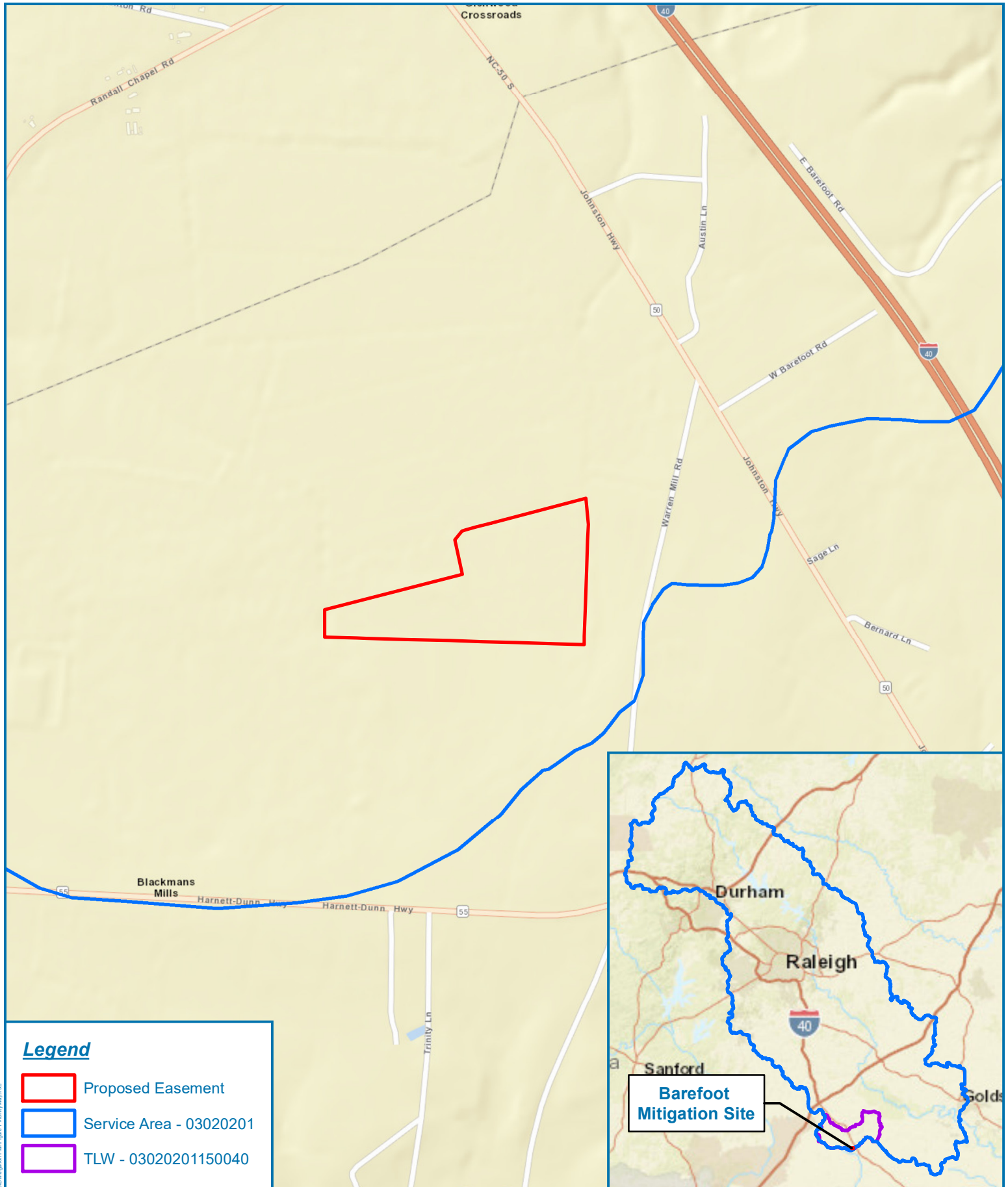
Activity or Deliverable	Data Collection Complete	Completion or Delivery
Restoration Plan	NA	Jul-19
Final Design – Construction Plans	NA	Nov-19
Wetland Construction	NA	Jan-20
Site Planting	NA	Jan-20
As-built (Year 0 Monitoring – baseline)	Jan-20	Apr-20
Cattail Seed Head Removal	NA	Oct-20
Year 1 Monitoring	Nov-20	Dec-20
Supplemental Planting	NA	Feb-21
Cattail Seed Head Removal	NA	Jul-21
Year 2 Monitoring	Aug-21	Nov-21
Year 3 Monitoring	Nov-22	Nov-22
Year 4 Monitoring		
Year 5 Monitoring		
Year 6 Monitoring		
Year 7 Monitoring		

¹ = The number of reports or data points produced excluding the baseline

**Table 3. Project Contacts Table
Barefoot (ID-100044)**

Designer	RES / 3600 Glenwood Ave., Suite 100, Raleigh, NC 27612
Primary project design POC	Sam Fasking
Construction Contractor	RES / 3600 Glenwood Ave., Suite 100, Raleigh, NC 27612
Construction contractor POC	Paul Dunn
Survey Contractor	Matrix East, PLLC / 906 N. Queen St., Suite A, Kinston, NC 28501
Survey contractor POC	Chris Paderick, PLS
Planting Contractor	H&J Forestry
Planting contractor POC	Matt Hitch
Seeding Contractor	RES / 3600 Glenwood Ave., Suite 100, Raleigh, NC 27612
Contractor point of contact	Paul Dunn
Seed Mix Sources	Green Resource
Nursery Stock Suppliers	Arborgen
Monitoring Performers	RES / 3600 Glenwood Ave., Suite 100, Raleigh, NC 27612
Wetland Monitoring POC	Ryan Medric (919) 741-6268
Vegetation Monitoring POC	

Table 4. Project Background Information				
Project Name		Barefoot		
County		Sampson		
Project Area (acres)		32.29		
Project Coordinates (latitude and longitude)		Latitude: 35.4754 N Longitude: -78.3117 W		
Planted Acreage (Acres of Woody Stems Planted)		22.94		
Project Watershed Summary Information				
Physiographic Province		Coastal Plain		
River Basin		Neuse		
USGS Hydrologic Unit 8-digit	03020201	USGS Hydrologic Unit 14-digit	03020201150040	
DWR Sub-basin		03-04-04		
Project Drainage Area (Acres and Square Miles)		123 ac (0.19 sqmi)		
Project Drainage Area Percentage of Impervious Area		0%		
CGIA Land Use Classification		Forest (73%) Agriculture (27%)		
Wetland Summary Information				
Parameters		Wetland 1	Wetland 2	
Size of Wetland (acres)		16.64	6.59	
Wetland Type (non-riparian, riparian riverine or riparian non-riverine)		non-riparian	non-riparian	
Mapped Soil Series		Rains/Foreston	Rains	
Drainage class		Poor	Poor	
Soil Hydric Status		Hydric/Nonhydric	Hydric	
Source of Hydrology		Groundwater	Groundwater	
Restoration or enhancement method (hydrologic, vegetative etc.)		Hydrologic & vegetative restoration	Hydrologic restoration	
Regulatory Considerations				
Parameters		Applicable?	Resolved?	Supporting Docs?
Water of the United States - Section 404		Yes	Yes	SAW-2018-00433
Water of the United States - Section 401		No	N/A	N/A
Endangered Species Act		Yes	Yes	USFWS (Corr. Letter)
Historic Preservation Act		Yes	Yes	SHPO (Corr. Letter)
Coastal Zone Management Act (CZMA or CAMA)		No	N/A	N/A
FEMA Floodplain Compliance		No	N/A	N/A
Essential Fisheries Habitat		No	N/A	N/A



Legend

- Proposed Easement
- Service Area - 03020201
- TLW - 03020201150040

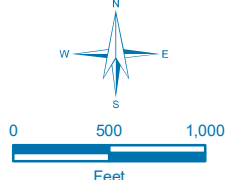
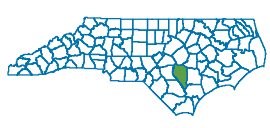


Figure 1 - Vicinity Map
Barefoot Mitigation Site
 Sampson County, North Carolina

Date: 2/27/2019
Drawn by: SCF
Checked by: JRM
1 inch = 1,000 feet



Appendix B

Visual Assessment Data

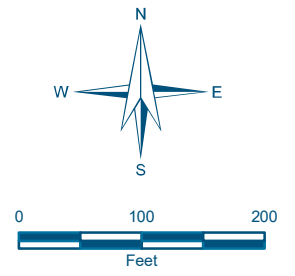


Figure 2
Current Conditions Plan View
MY3 2022
Barefoot Mitigation Site
Sampson County, NC

Date: 12/29/2022 Drawn by: HRG
 Lat: 35.255825 Long: -78.390648

LEGEND

- Conservation Easement
- Random Veg Plot >320 stems/ac
- Fixed Veg Plot >320 Stems/ac
- Cattail Area (7.43 Acres)
- Shallow Depression
- Wetland Treatment**
- Re-establishment (1:1)
- Re-establishment (2:1)
- Constructed Ditch
- Filled Ditch
- Plugged Drain Tile
- No Treatment
- Flow Attenuation Structure
- MY3 Wells**
- >10%
- 5-9%
- <5%

Vegetation Condition Assessment

Invasive Species	Target Community		
	Present	Marginal	Absent
Absent	No Fill		
Present			



Table 5

Vegetation Condition Assessment

Date Assessed: Nov 2022

Planted Acreage¹

22.94

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Planted Acreage
1. Bare Areas		0.1 acres	Red Simple Hatch	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	Orange Simple Hatch	0	0.00	0.0%
Total						0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Orange Simple Hatch	0	0.00	0.0%
Cumulative Total						0.0%

Easement Acreage²

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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	Yellow Crosshatch	0	0.00	0.0%
5. Easement Encroachment Areas ³	Areas or points (if too small to render as polygons at map scale).	none	Red Simple Hatch	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 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.

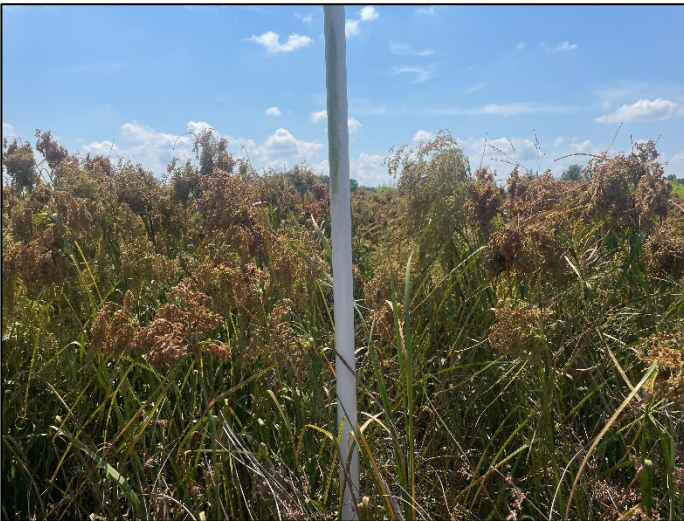
Barefoot MY3 Fixed Vegetation Monitoring Plot Photos



Vegetation Plot 1 (08/04/22)



Vegetation Plot 2 (08/04/22)



Vegetation Plot 3 (08/04/22)



Vegetation Plot 4 (08/04/22)



Vegetation Plot 5 (08/04/22)



Vegetation Plot 6 (08/04/22)



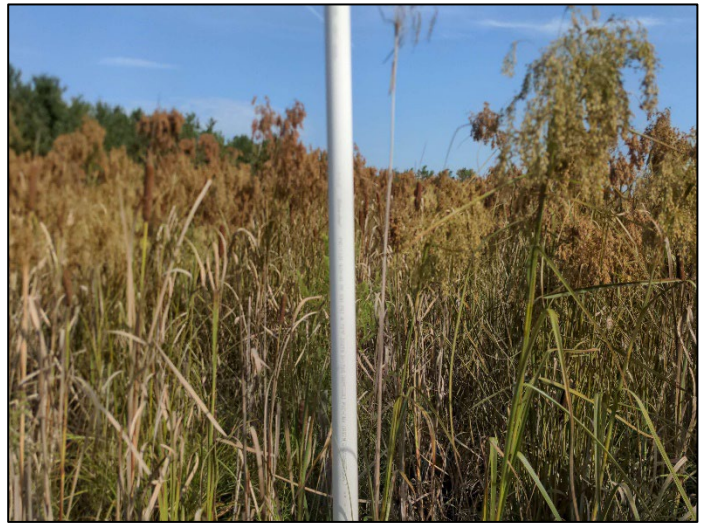
Vegetation Plot 7 (08/04/22)



Vegetation Plot 8 (08/04/22)



Vegetation Plot 9 (08/04/22)



Vegetation Plot 10 (08/04/22)

Barefoot MY2 Random Vegetation Monitoring Plot Photos



Random Vegetation Plot 1 (08/04/22)



Random Vegetation Plot 2 (08/04/22)



Random Vegetation Plot 3 (08/04/22)



Random Vegetation Plot 4 (08/04/22)



Random Vegetation Plot 5 (08/04/22)



Random Vegetation Plot 6 (08/04/22)

Barefoot MY3 General Site Photos



Site Overview (11/16/22)



Growing Buttonbush (08/04/22)

Barefoot MY3 Groundwater Well Photos



Groundwater Well 1 (08/04/22)



Groundwater Well 2 (08/04/22)



Groundwater Well 3 (08/04/22)



Groundwater Well 4 (08/04/22)



Groundwater Well 5 (08/04/22)



Groundwater Well 6 (08/04/22)



Groundwater Well 7 (08/04/22)



Groundwater Well 8 / Vegetation Plot 8 (08/04/22)



Groundwater Well 9 (08/04/22)



Groundwater Well 10 (08/04/22)



Groundwater Well 11 (08/04/22)



Groundwater Well 12 (08/04/22)



Groundwater Well 13 (08/04/22)



Groundwater Well 14 (08/04/22)



Groundwater Well 15 (08/04/22)



Groundwater Well 16 (08/04/22)



Groundwater Well 17 (08/04/22)



Groundwater Well 2 Reinstall (05/19/22)



Broken Groundwater Well 14 (05/12/22)



Groundwater Well 14 Reinstall (05/19/22)

Appendix C

Vegetation Plot Data

Table 6. Planted Species Summary

Common Name	Scientific Name	Total Stems Planted
Swamp Chestnut Oak	<i>Quercus michauxii</i>	6,000
Baldcypress	<i>Taxodium distichum</i>	5,000
Wax Myrtle	<i>Morella cerifera</i>	4,320
Willow Oak	<i>Quercus phellos</i>	4,000
Cherrybark Oak	<i>Quercus pagoda</i>	3,000
Water Oak	<i>Quercus nigra</i>	2,500
Green Ash	<i>Fraxinus pennsylvanica</i>	2,400
Silky Dogwood	<i>Cornus amomum</i>	2,000
Buttonbush	<i>Cephalanthus occidentalis</i>	2,000
Yellow Poplar	<i>Liriodendron tulipifera</i>	1,000
Southern Crab Apple	<i>Malus angustifolia</i>	800
Sugarberry	<i>Celtis laevigata</i>	350
Blackgum	<i>Nyssa sylvatica</i>	40
Total		33,410
Planted Area		22.94
As-built Planted Stems/Acre		1,456

Table 7. Vegetation Plot Mitigation Success Summary

Plot #	Planted Stems/Acre	Volunteer Stems/Acre	Total Stems/Acre	Success Criteria Met?	Avg Stem Height (ft)
1	1093	0	1093	Yes	3.3
2	769	526	1295	Yes	5.2
3	931	162	1093	Yes	5.1
4	850	81	931	Yes	3.3
5	567	162	728	Yes	4.1
6	1052	243	1295	Yes	2.2
7	850	121	971	Yes	3.0
8	607	0	607	Yes	4.4
9	728	121	850	Yes	4.2
10	769	0	769	Yes	4.3
R1	971	0	971	Yes	5.0
R2	607	0	607	Yes	3.8
R3	1133	0	1133	Yes	3.8
R4	647	0	647	Yes	5.0
R5	607	0	607	Yes	2.2
R6*	3197	0	3197	Yes	24.4
Project Avg	812	142	906	Yes	3.9

*Random Plot 6 is forested and is not included in the Project Average

Table 8. Stem Count Total and Planted by Plot Species

			Current Plot Data (MY3 2022)																																	
Scientific Name	Common Name	Species Type	100044-01-0001			100044-01-0002			100044-01-0003			100044-01-0004			100044-01-0005			100044-01-0006			100044-01-0007			100044-01-0008			100044-01-0009			100044-01-0010						
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T				
Acer rubrum	red maple	Tree										1																	1							
Celtis laevigata	sugarberry	Tree	4	4	4																															
Cephalanthus occidentalis	common buttonbush	Shrub							5	5	5			1	1	1	2	2	2																	
Cornus amomum	silky dogwood	Shrub				4	4	4																			3	3	3							
Fraxinus pennsylvanica	green ash	Tree				2	2	2	5	5	6	12	12	12	6	6	6																			
Liquidambar styraciflua	sweetgum	Tree																																		
Liriodendron tulipifera	tuliptree	Tree																						3	3	3										
Malus angustifolia	southern crabapple	Tree	2	2	2																															
Morella cerifera	wax myrtle	shrub	1	1	1									1	4	4	4	2	2	2																
Quercus	oak	Tree																																		
Quercus michauxii	swamp chestnut oak	Tree	9	9	9	1	1	1									14	14	14	3	3	5														
Quercus nigra	water oak	Tree				1	1	1				1	1	1			1	1	1																	
Quercus pagoda	cherrybark oak	Tree	1	1	1															8	8	9														
Quercus phellos	willow oak	Tree	10	10	10						3				4	3	3	3	7	7	7															
Salix nigra	black willow	Tree						13											1	1	7															
Taxodium distichum	bald cypress	Tree				11	11	11	13	13	13	8	8	8	3	3	3											10	10	10	15	15	16	18	18	18
	Stem count		27	27	27	19	19	32	23	23	27	21	21	23	14	14	18	26	26	32	21	21	24	15	15	15	18	18	21	19	19	19				
	size (ares)		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						
	Species count		6	6	6	5	5	6	3	3	4	3	3	5	4	4	5	7	7	7	4	4	4	2	2	2	2	2	4	2	2	2				
	Stems per ACRE		1093	1093	1093	769	769	1295	931	931	1093	850	850	931	567	567	728	1052	1052	1295	850	850	971	607	607	607	728	728	850	769	769	769				

			Current Plot Data (MY3 2022)															Annual Means																
Scientific Name	Common Name	Species Type	R1			R2			R3			R4			R5			MY3 (2022)			MY2 (2021)			MY1 (2020)			MY0 (2020)							
			PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T					
Acer rubrum	red maple	Tree																2																
Celtis laevigata	sugarberry	Tree																4	4	4	5	5	5	7	7	7								
Cephalanthus occidentalis	common buttonbush	Shrub	5	5	5				3	3	3	6	6	6	4	4	4	32	14	14	14	14	14	14	14	14	8	8	8					
Cornus amomum	silky dogwood	Shrub							2	2	2	1	1	1				13	10	10	11	11	11	15	15	15	24	24	24					
Fraxinus pennsylvanica	green ash	Tree	4	4	4				11	11	11							40	25	26	26	26	26	27	27	27	33	33	33					
Liquidambar styraciflua	sweetgum	Tree																																
Liriodendron tulipifera	tuliptree	Tree																3	3	3	4	4	4	13	13	13	15	15	15					
Malus angustifolia	southern crabapple	Tree																2	2	2	2	2	2	2	2	2	10	10	10					
Morella cerifera	wax myrtle	shrub				2	2	2										9	7	8	11	11	13	12	12	12	36	36	36					
Quercus	oak	Tree																									20	20	20					
Quercus michauxii	swamp chestnut oak	Tree				2	2	2										29	27	29	28	28	28	37	37	37	29	29	29					
Quercus nigra	water oak	Tree																3	3	3	4	4	4	5	5	5	3	3	3					
Quercus pagoda	cherrybark oak	Tree				2	2	2										11	9	10	11	11	11	8	8	8	4	4	4					
Quercus phellos	willow oak	Tree	4	4	4	9	9	9	1	1	1							34	20	27	21	21	21	35	35	35	41	41	41					
Salix nigra	black willow	Tree										3	3	3				4	1	20														
Taxodium distichum	bald cypress	Tree	11	11	11				11	11	11	6	6	6	11	11	11	117	78	79	78	78	78	78	78	78	78	78	78	78	78	78	78	
	Stem count		24	24	24	15	15	15	28	28	28	16	16	16	15	15	15	301	203	238	215	215	251	253	253	253	299	299	299					
	size (ares)		1			1			1			1			1			15			10			10			10							
	size (ACRES)		0.02			0.02			0.02			0.02			0.02			0.37			0.25			0.25			0.25							
	Species count		4	4	4	4	4	4	5	5	5	4	4	4	2	2	2	13	13	15	12	12	14	12	12	12	12	12	12	12	12	12		
	Stems per ACRE		971	971	971	607	607	607	1133	1133	1133	647	647	647	607	607	607	812	548	642	870	870	1016	1024	1024	1024	1210	1210	1210					

Table 9. Random Vegetation Plot 6 Data

Random Plot 6		
#	Species	Height (cm)
1	<i>Cyrilla racemiflora</i>	600
2	<i>Quercus michauxii</i>	140
3	<i>Cyrilla racemiflora</i>	650
4	<i>Liquidambar styraciflua</i>	800
5	<i>Pinus taeda</i>	500
6	<i>Pinus taeda</i>	600
7	<i>Pinus taeda</i>	400
8	<i>Pinus taeda</i>	550
9	<i>Pinus taeda</i>	750
10	<i>Pinus taeda</i>	700
11	<i>Pinus taeda</i>	700
12	<i>Pinus taeda</i>	600
13	<i>Pinus taeda</i>	400
14	<i>Pinus taeda</i>	400
15	<i>Pinus taeda</i>	450
16	<i>Quercus michauxii</i>	300
17	<i>Cyrilla racemiflora</i>	300
18	<i>Quercus michauxii</i>	150
19	<i>Acer rubrum</i>	200
20	<i>Liquidambar styraciflua</i>	700
21	<i>Pinus taeda</i>	900
22	<i>Pinus taeda</i>	800
23	<i>Pinus taeda</i>	850
24	<i>Pinus taeda</i>	850
25	<i>Pinus taeda</i>	900
26	<i>Pinus taeda</i>	900
27	<i>Pinus taeda</i>	700
28	<i>Pinus taeda</i>	750
29	<i>Pinus taeda</i>	750
30	<i>Pinus taeda</i>	700
31	<i>Ilex opaca</i>	50
32	<i>Ilex opaca</i>	50
33	<i>Ilex opaca</i>	100
34	<i>Acer rubrum</i>	1000
35	<i>Acer rubrum</i>	1200
36	<i>Cyrilla racemiflora</i>	150
37	<i>Ilex opaca</i>	50
38	<i>Acer rubrum</i>	1000
39	<i>Acer rubrum</i>	700

Random Plot 6		
#	Species	Height (cm)
40	<i>Cyrilla racemiflora</i>	300
41	<i>Liquidambar styraciflua</i>	300
42	<i>Nyssa sylvatica</i>	1000
43	<i>Acer rubrum</i>	400
44	<i>Pinus taeda</i>	500
45	<i>Liquidambar styraciflua</i>	800
46	<i>Ilex opaca</i>	100
47	<i>Acer rubrum</i>	1500
48	<i>Acer rubrum</i>	1000
49	<i>Clethra alnifolia</i>	300
50	<i>Clethra alnifolia</i>	40
51	<i>Clethra alnifolia</i>	50
52	<i>Pinus taeda</i>	1000
53	<i>Pinus taeda</i>	12000
54	<i>Pinus taeda</i>	2000
55	<i>Pinus taeda</i>	800
56	<i>Pinus taeda</i>	700
57	<i>Pinus taeda</i>	800
58	<i>Pinus taeda</i>	800
59	<i>Pinus taeda</i>	900
60	<i>Pinus taeda</i>	150
61	<i>Pinus taeda</i>	900
62	<i>Magnolia virginiana</i>	600
63	<i>Pinus taeda</i>	1500
64	<i>Liquidambar styraciflua</i>	200
65	<i>Acer rubrum</i>	100
66	<i>Quercus michauxii</i>	50
67	<i>Pinus taeda</i>	1000
68	<i>Pinus taeda</i>	700
69	<i>Pinus taeda</i>	900
70	<i>Pinus taeda</i>	800
71	<i>Pinus taeda</i>	950
72	<i>Pinus taeda</i>	600
73	<i>Pinus taeda</i>	500
74	<i>Pinus taeda</i>	500
75	<i>Pinus taeda</i>	600
76	<i>Pinus taeda</i>	400
77	<i>Pinus taeda</i>	400
78	<i>Cyrilla racemiflora</i>	300
79	<i>Acer rubrum</i>	120
Stems/Acre		3197
Average Height (cm)		745
Average Height (ft)		24.4
Plot Size (m)		25 x 4

Appendix D

Hydrology Data

Table 10A. Rainfall Summary.

Month	Average	Normal Limits		Goldsboro Station Precipitation
		30 Percent	70 Percent	
January	3.62	2.47	4.32	5.20
February	3.23	2.18	3.86	1.62
March	3.66	2.61	4.34	2.13
April	3.24	2.08	3.91	3.03
May	3.99	2.64	4.79	1.63
June	4.84	3.37	5.76	1.66
July	6.01	4.25	7.12	8.78
August	6.00	4.12	7.15	4.29
September	6.51	3.63	7.94	5.10
October	3.38	1.91	4.12	0.90
November	3.37	1.90	4.10	1.23
December	3.39	2.30	4.05	---
Total	51.24	33.46	61.46	35.57
Above Normal Limits	Below Normal Limits			

Table 10B. U.S. Drought Monitor: 2021-2022 Drought Conditions.

	Dormant Season (11/24/21 - 3/12/22)	Growing Season (3/13/22 - 11/23/22)
Drought Condition Weeks	12	28
Total Weeks	17	37
Percent Drought Conditions	69%	76%

Table 11. 2022 Max Hydroperiod.

2022 Max Hydroperiod (Growing Season 13-Mar through 22-Nov, 254 days)							
Success Criterion 10%							
Well ID	Wetland ID	Elevation (ft)	Consecutive		Cumulative		Occurrences
			Days	Hydroperiod (%)	Days	Hydroperiod (%)	
GW1	W1	193.62	14	6	16	7	2
GW2	W1	193.36	0	0	0	0	0
GW3	W1	193.50	21	8	26	11	2
GW4	W1	193.35	0	0	0	0	0
GW5	W1	193.25	21	8	28	12	3
GW6	W1	193.25	19	7	25	11	3
GW7	W1	193.40	14	6	20	9	4
GW8	W1	192.80	12	5	12	5	1
GW9	W1	193.16	21	8	31	13	4
GW10	W1	192.85	58	23	59	25	2
GW11	W1	193.42	16	6	22	9	4
GW12	W2	194.22	0	0	0	0	0
GW13	W2	193.82	0	0	0	0	0
GW14	W2	193.32	1	0	6	3	5
GW15	W2	193.61	4	2	4	2	1
GW16	UPL	193.73	10	4	11	5	2
GW17	UPL	193.82	5	2	5	2	1

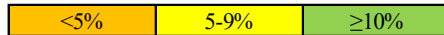
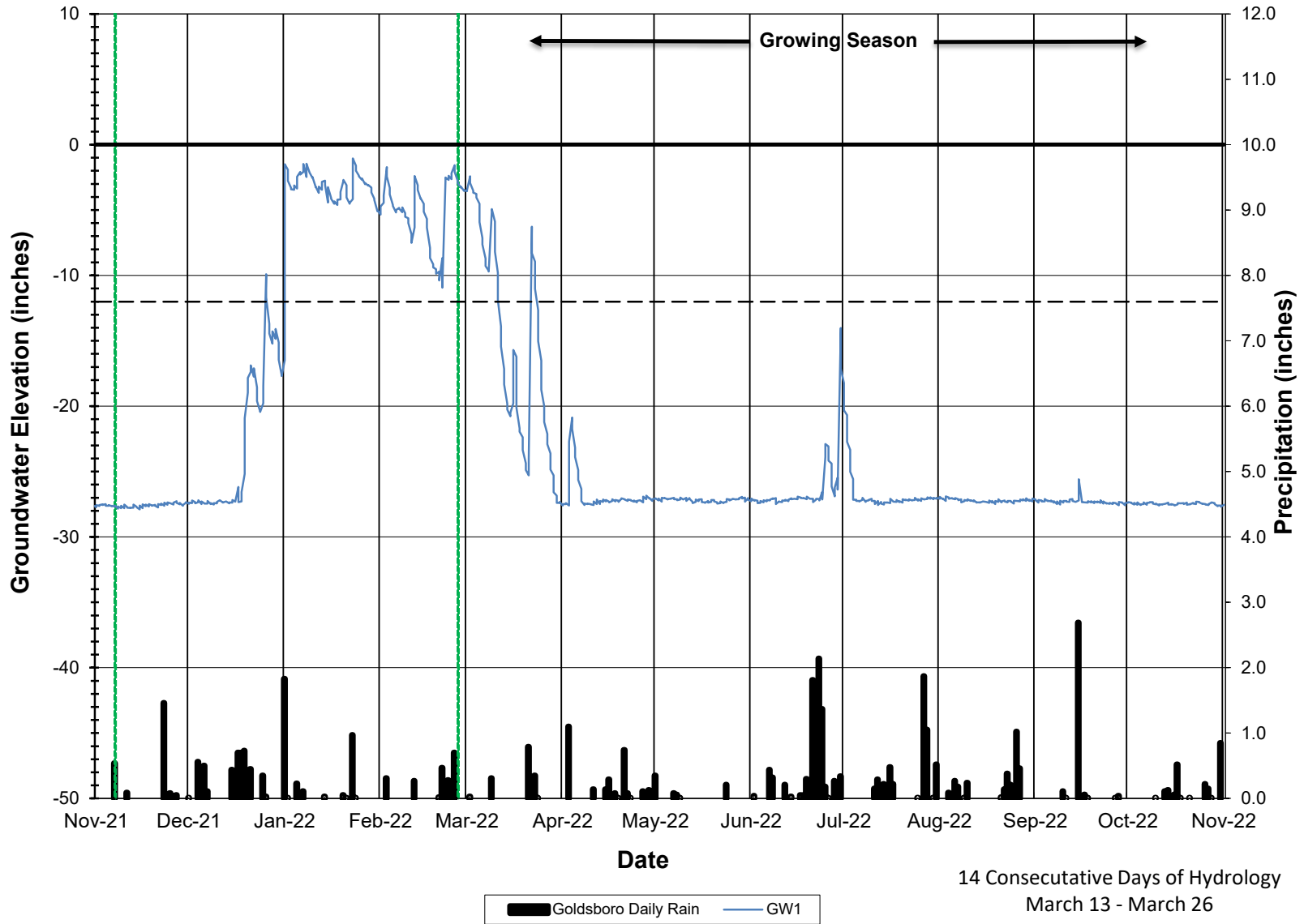


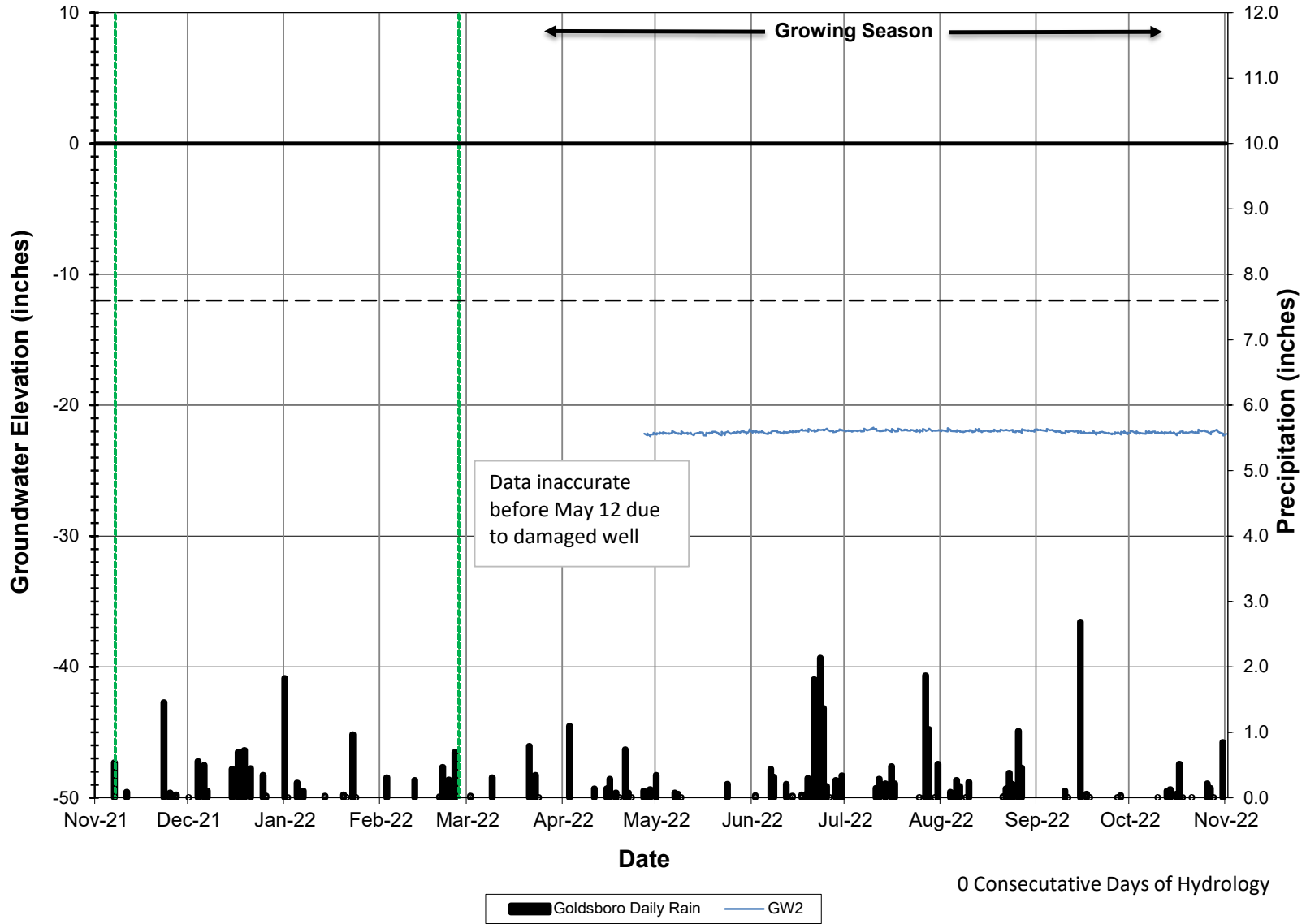
Table 12. Summary of Groundwater Monitoring Results.

Summary of Groundwater Monitoring Results											
Barefoot											
Well ID	Wetland ID	Elevation (ft)	Hydroperiod (%); Success Criterion 10%								
			Pre-Con (2018)	Pre-Con (2019)	Year 1 (2020)	Year 2 (2021)	Year 3 (2022)	Year 4 (2023)	Year 5 (2024)	Year 6 (2025)	Year 7 (2026)
GW1	W1	193.62	---	---	9	9	6				
GW2	W1	193.36	---	---	24	16	0				
GW3	W1	193.50	3	1	41	34	8				
GW4	W1	193.35	2	0	26	25	0				
GW5	W1	193.25	2	1	41	32	8				
GW6	W1	193.25	---	---	41	34	7				
GW7	W1	193.40	---	---	26	24	6				
GW8	W1	192.80	---	---	54	40	5				
GW9	W1	193.16	---	---	41	34	8				
GW10	W1	192.85	---	---	54	40	23				
GW11	W1	193.42	---	---	41	32	6				
GW12	W2	194.22	---	5	10	9	0				
GW13	W2	193.82	---	---	39	18	0				
GW14	W2	193.32	---	0	50	32	0				
GW15	W2	193.61	---	---	26	16	2				
GW16	UPL	193.73	1	0	26	16	4				
GW17	UPL	193.82	3	1	3	3	2				

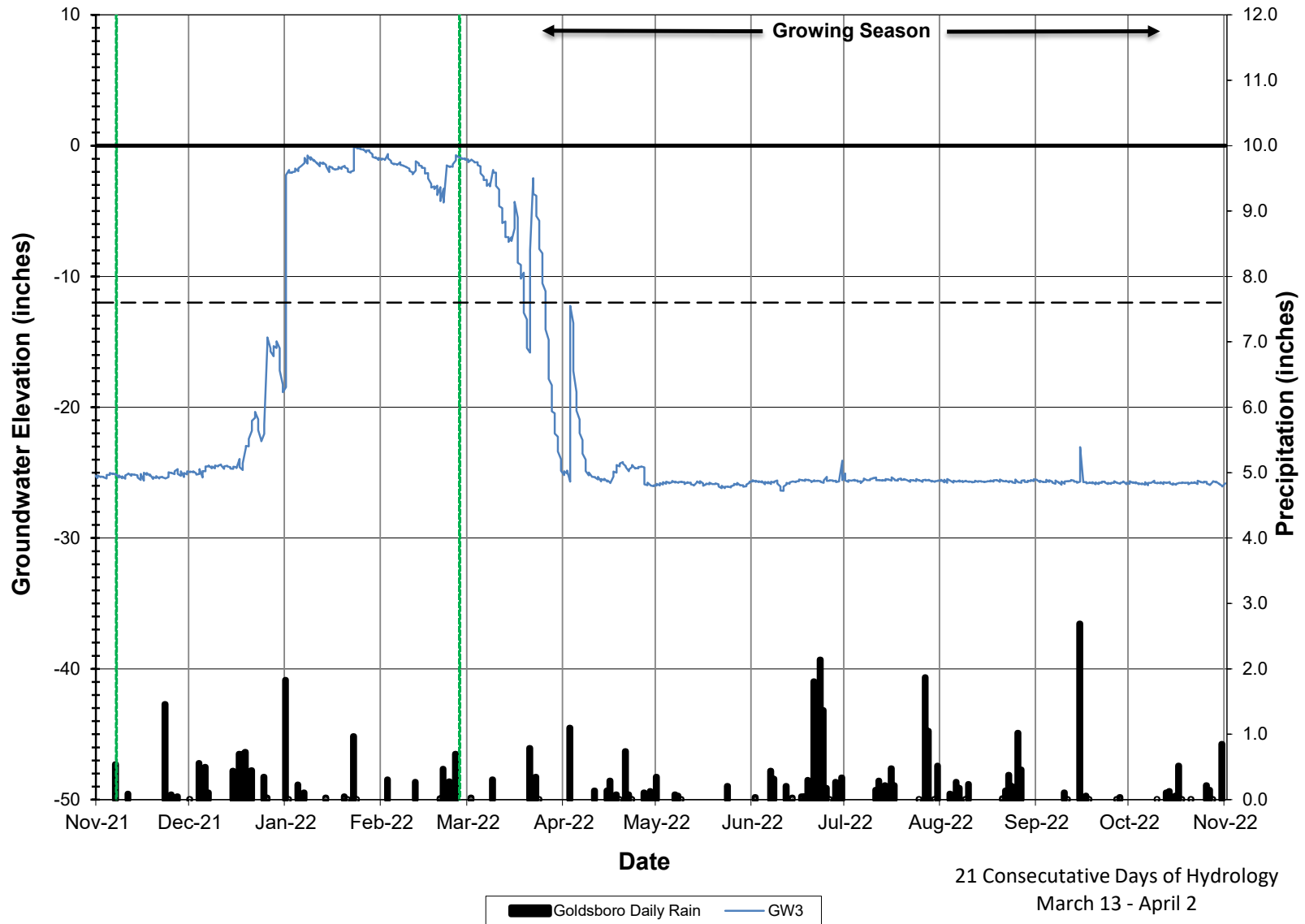
2022 Barefoot GW1



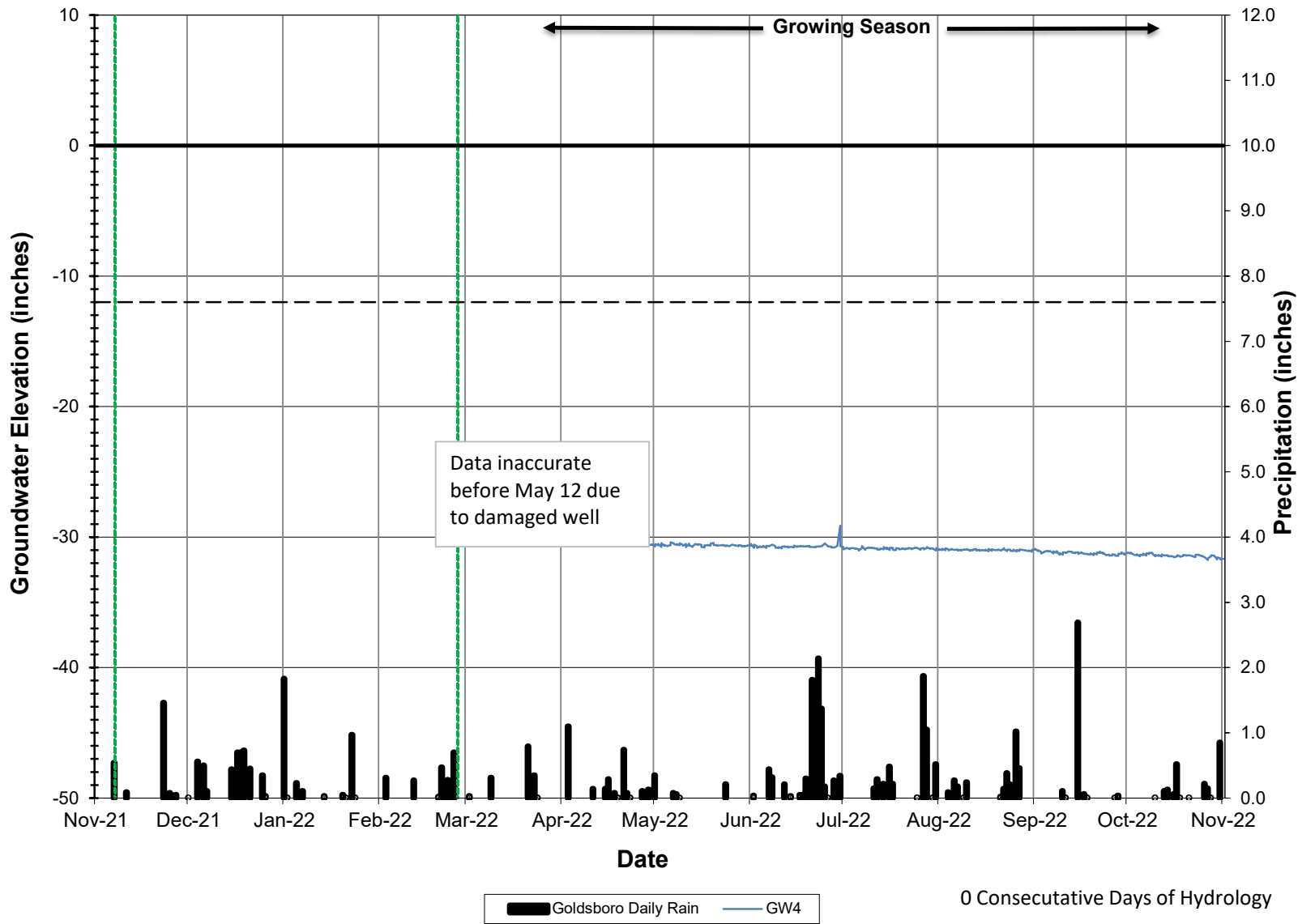
2022 Barefoot GW2



2022 Barefoot GW3

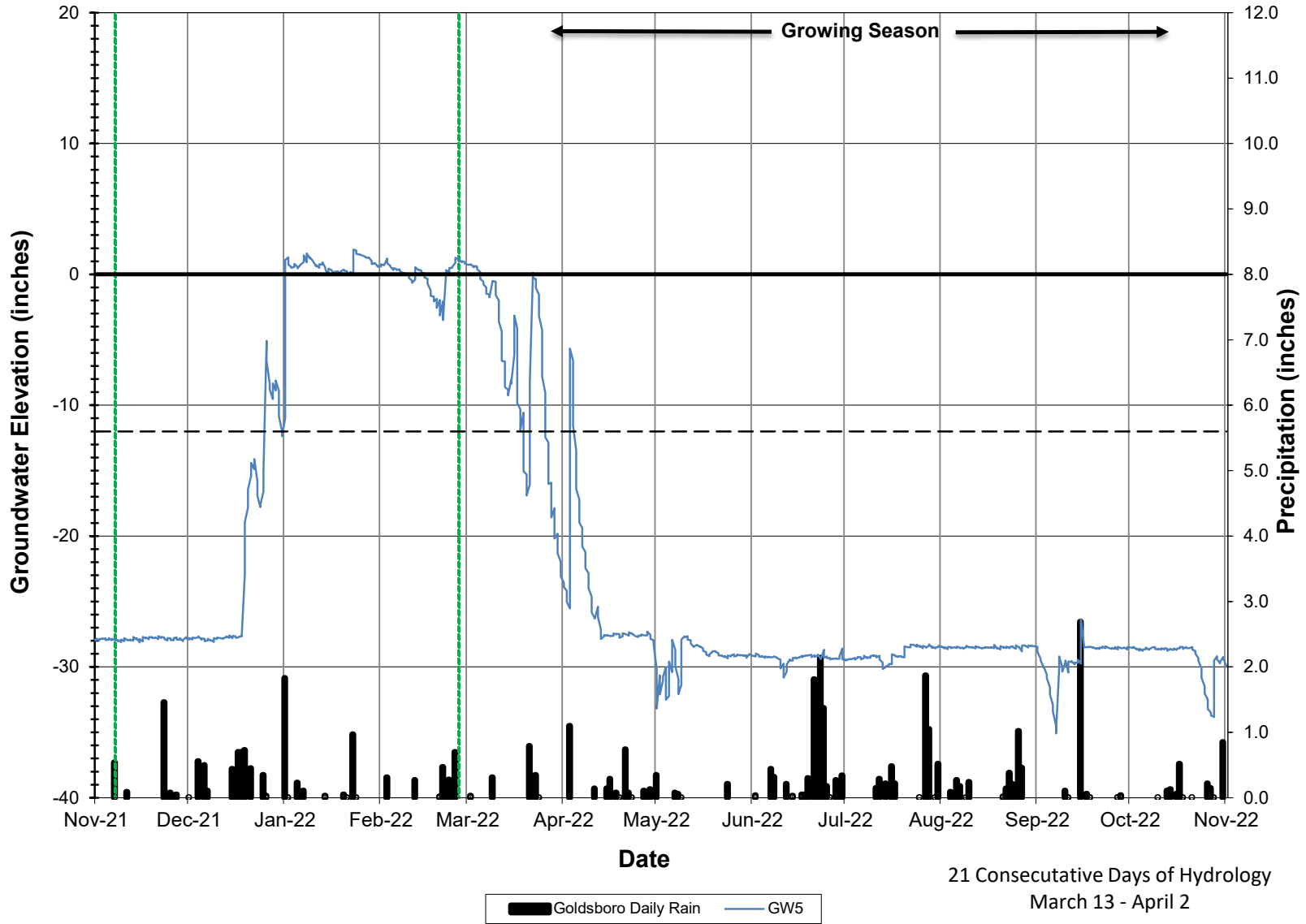


2022 Barefoot GW4

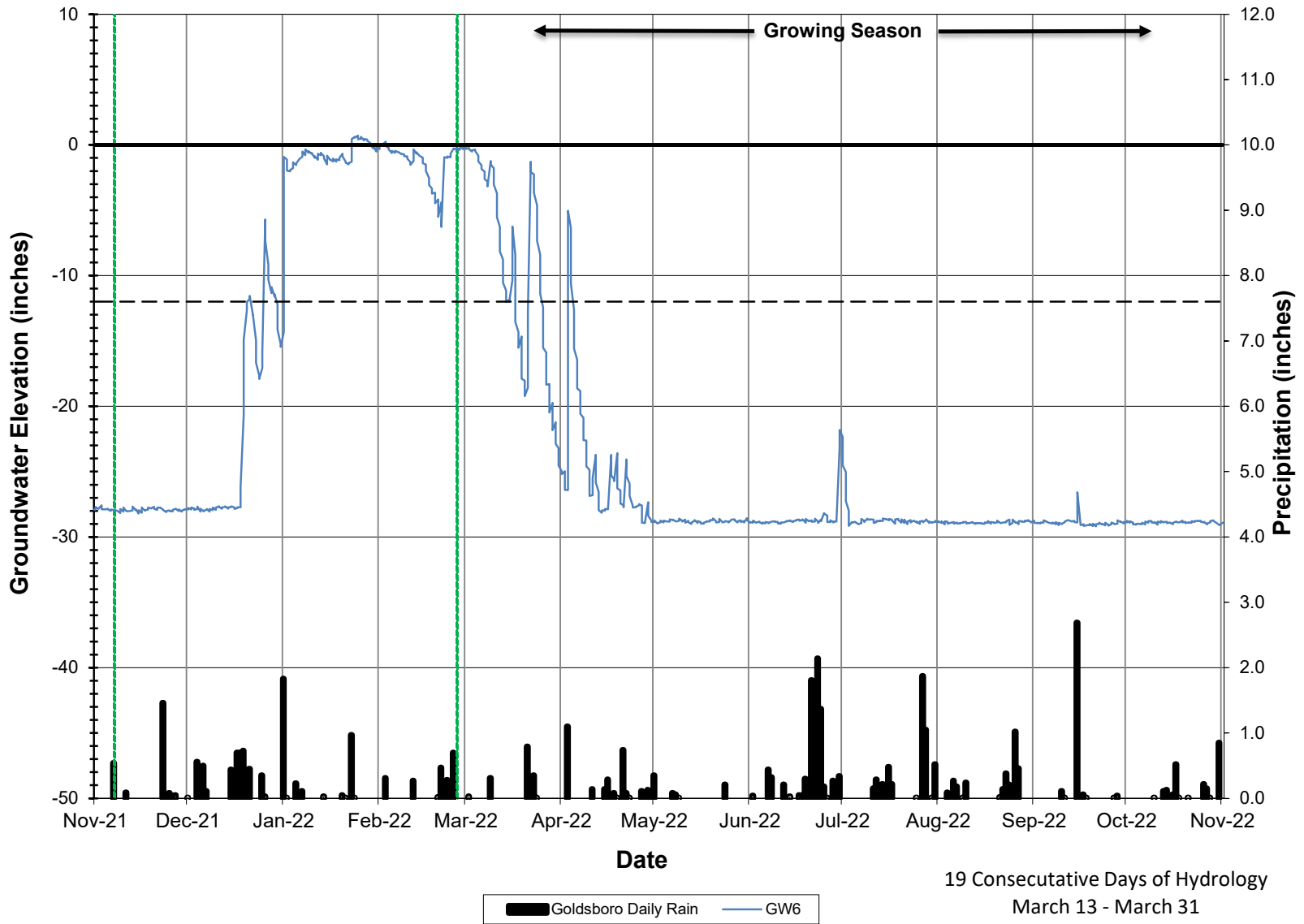


0 Consecutive Days of Hydrology

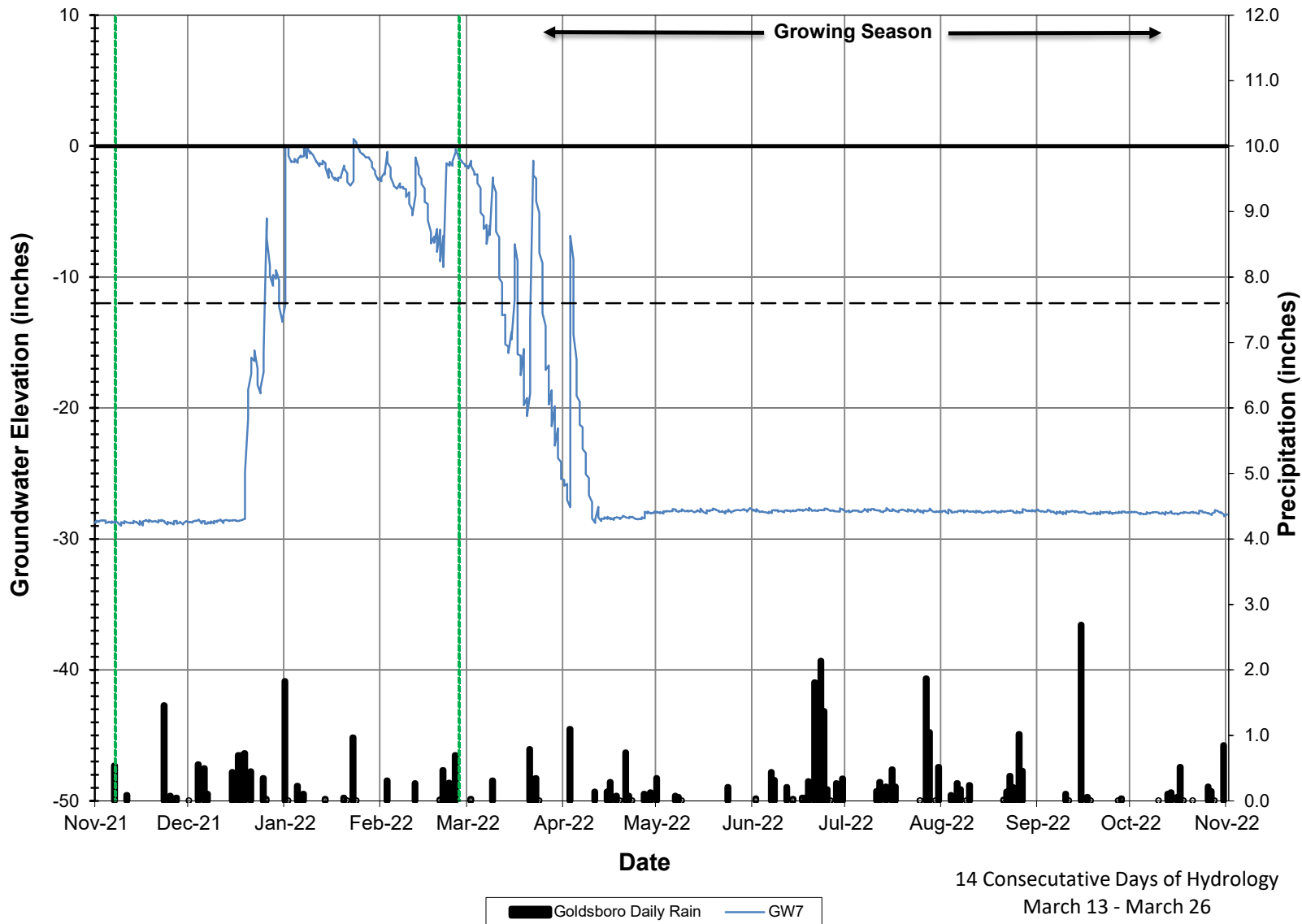
2022 Barefoot GW5



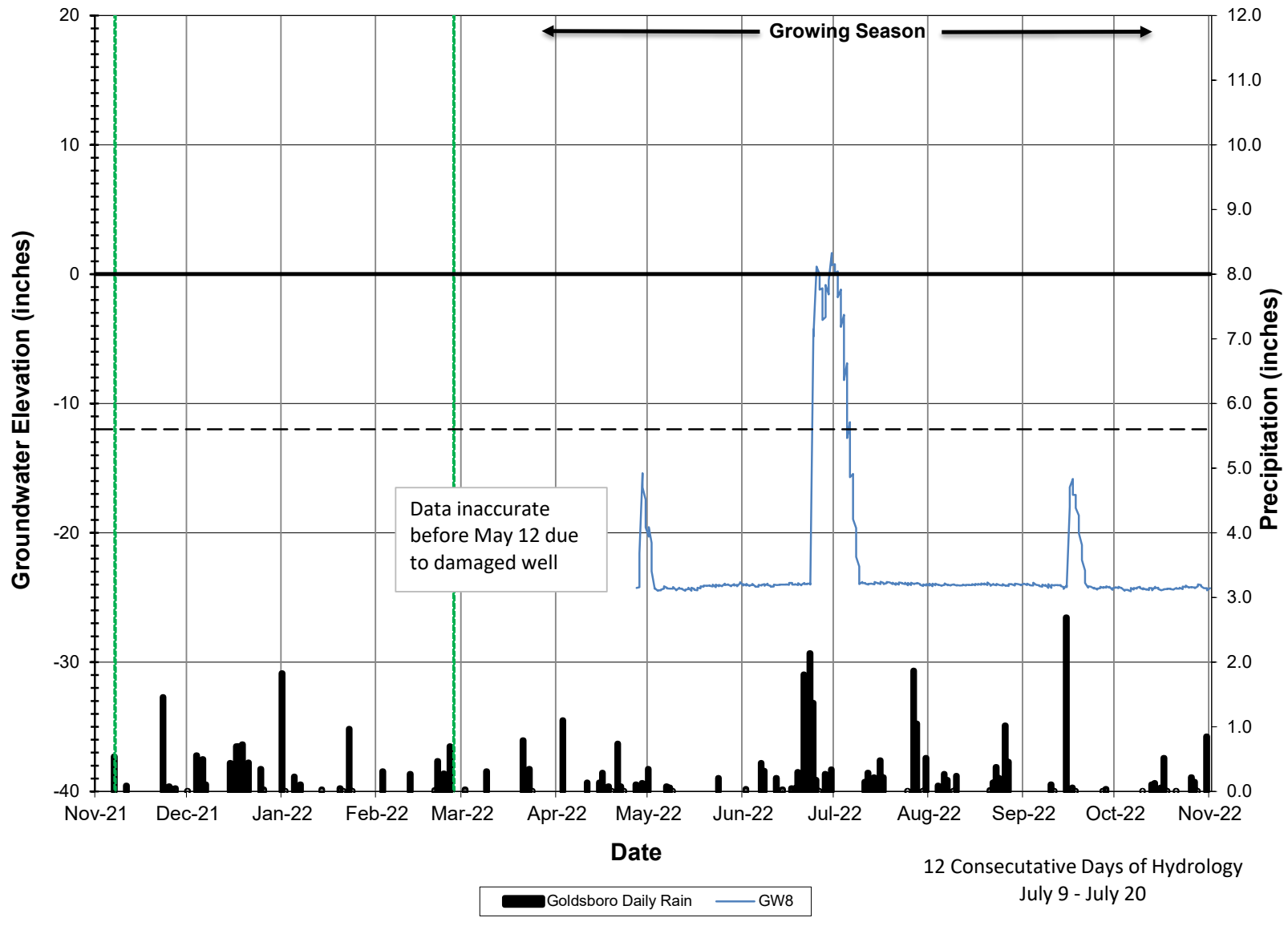
2022 Barefoot GW6



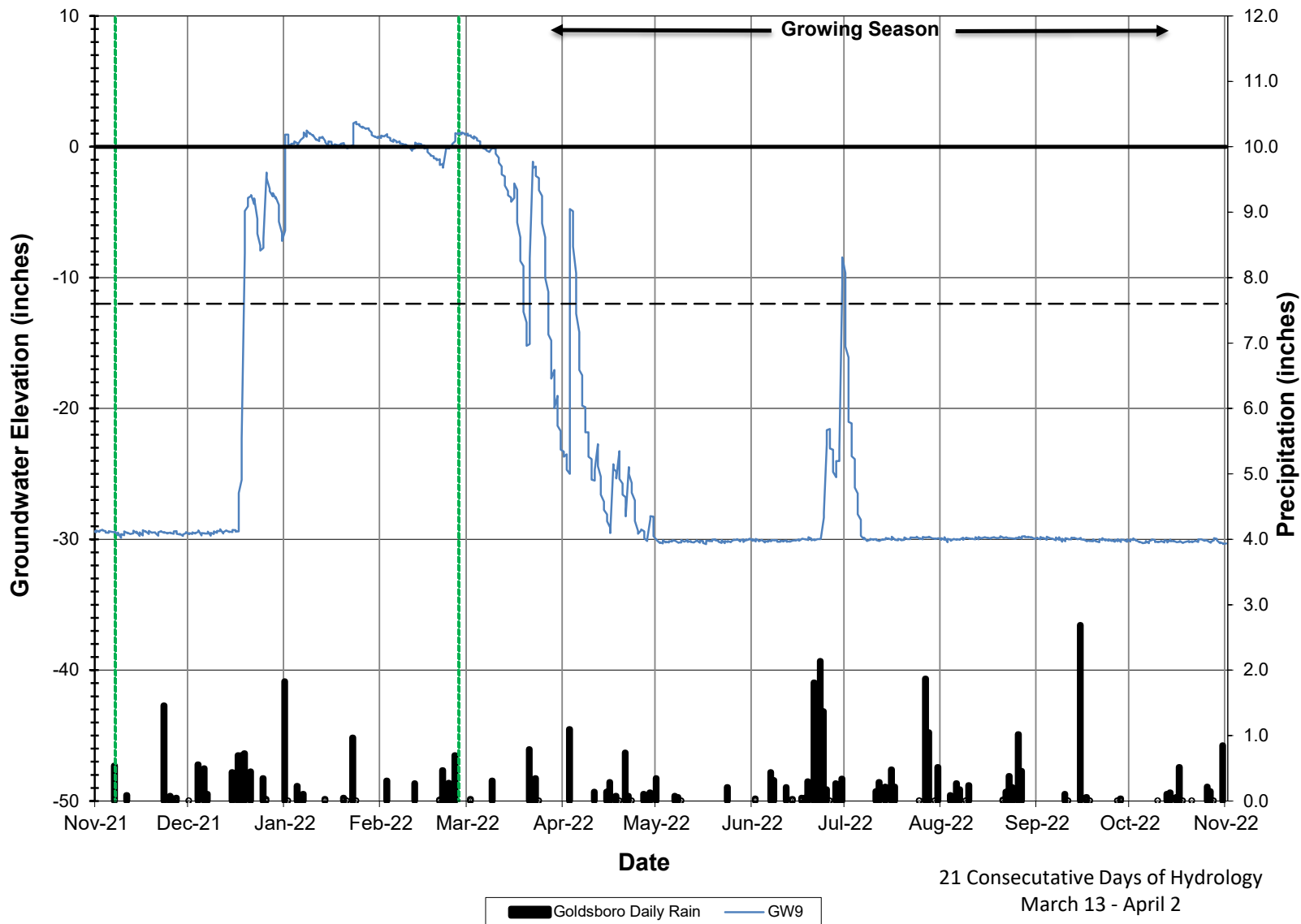
2022 Barefoot GW7



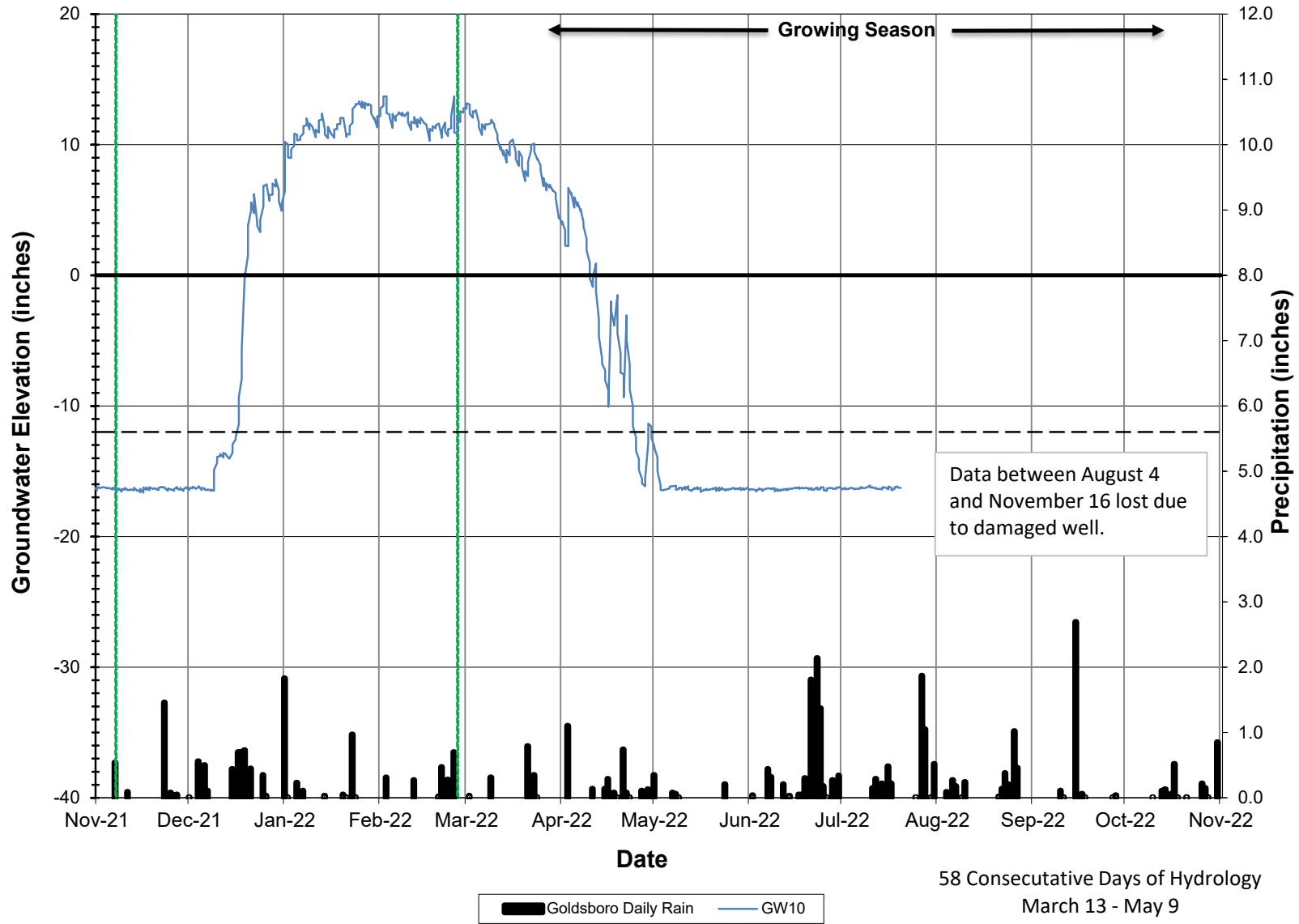
2022 Barefoot GW8



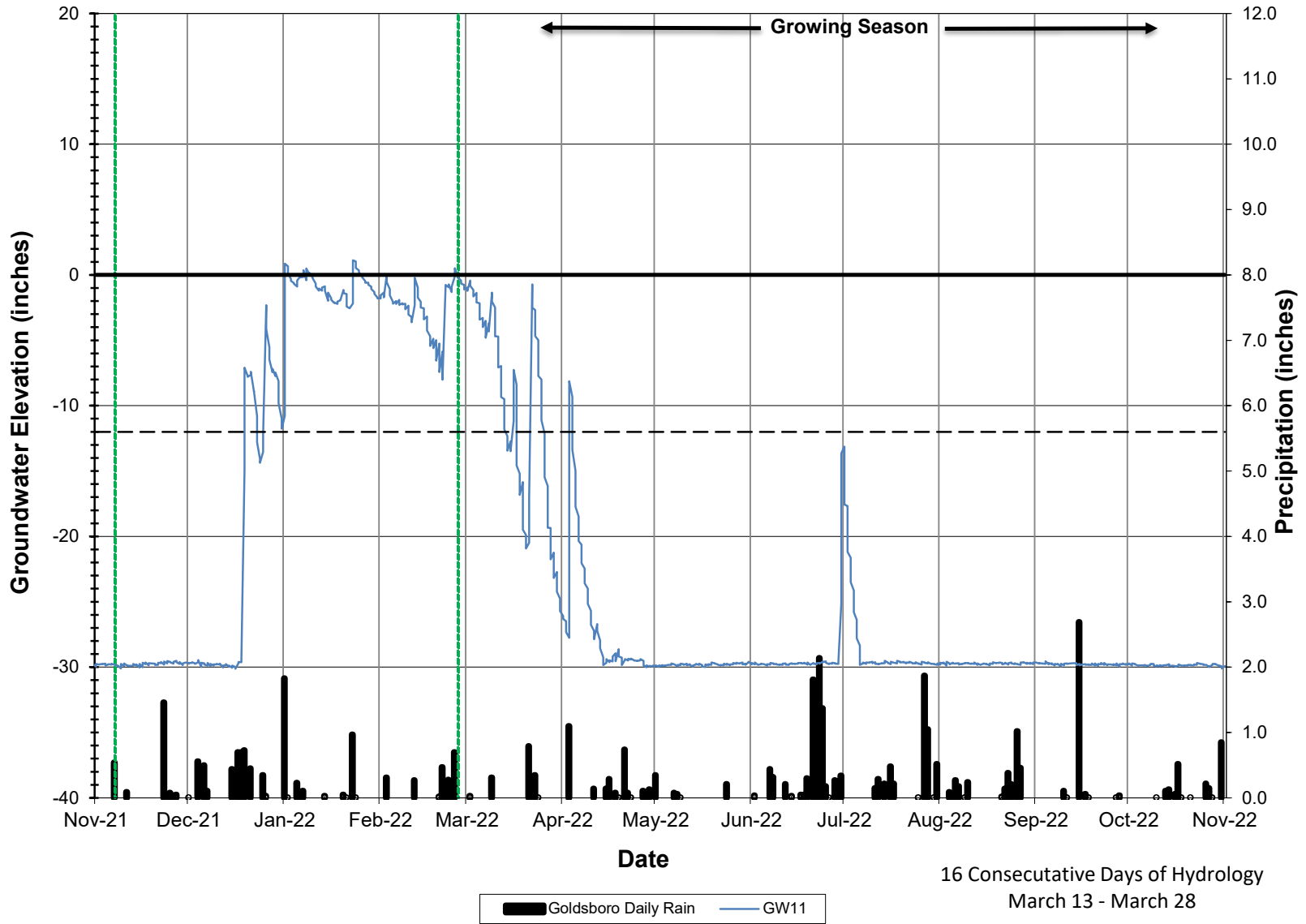
2022 Barefoot GW9



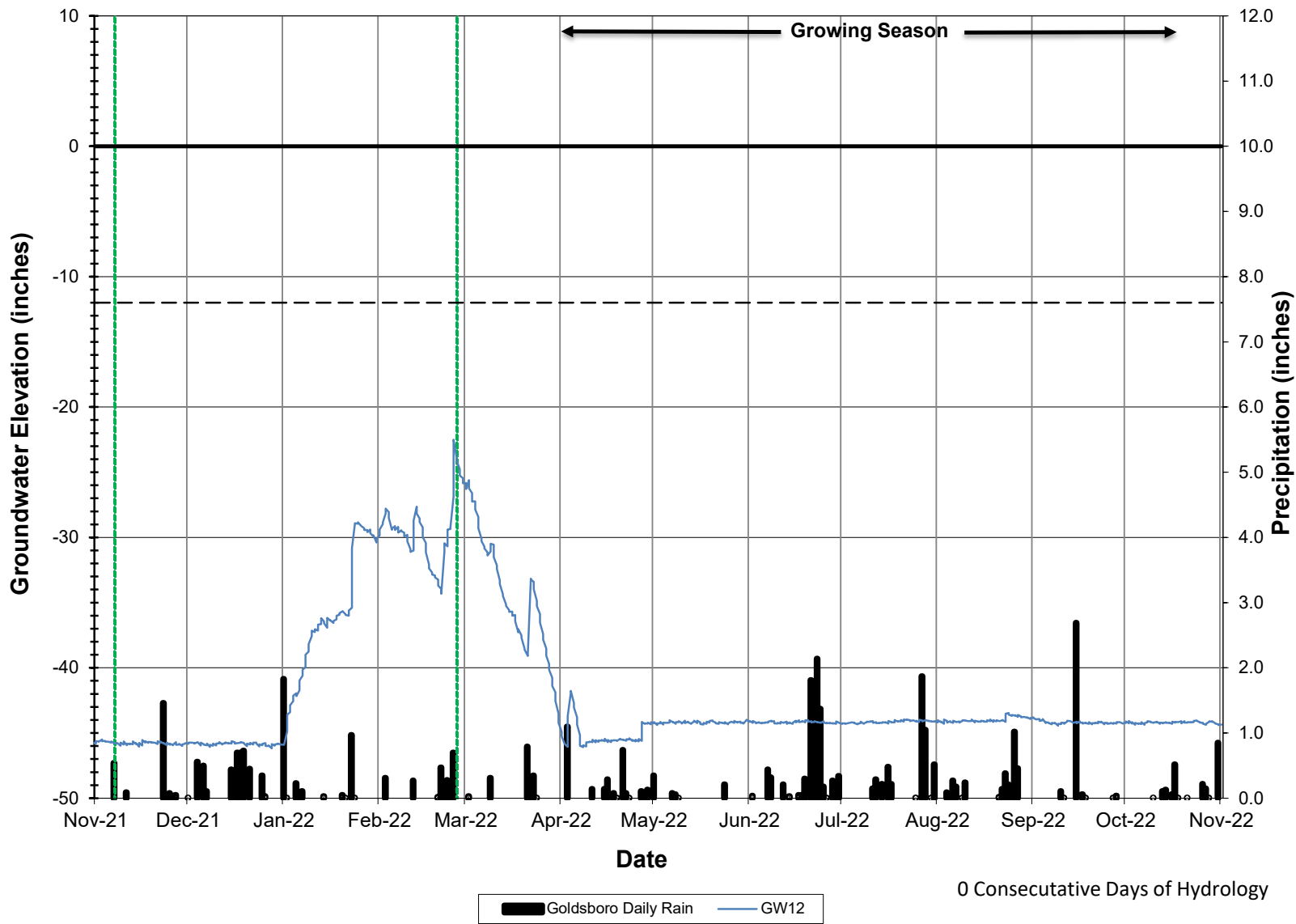
2022 Barefoot GW10



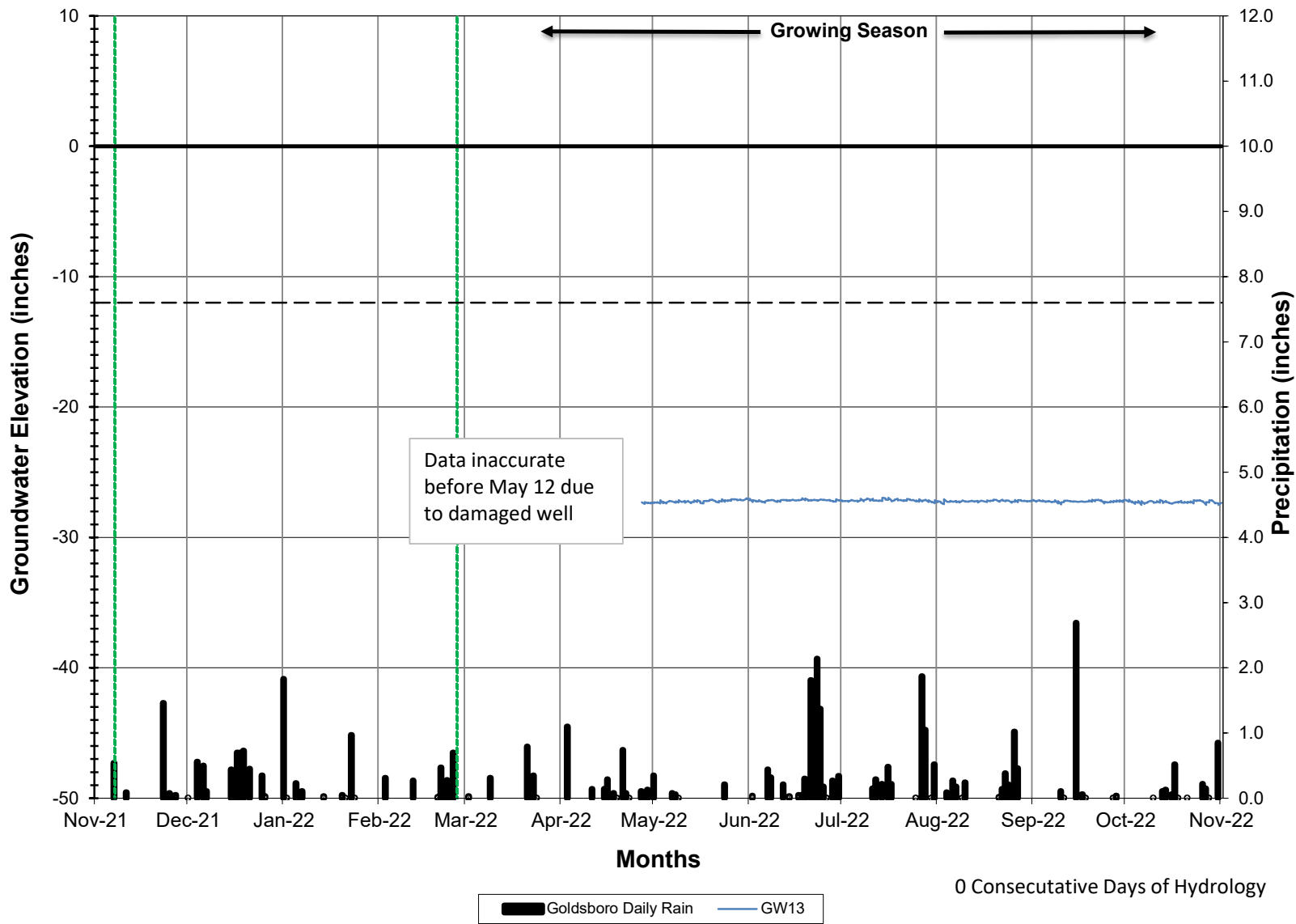
2021 Barefoot GW11



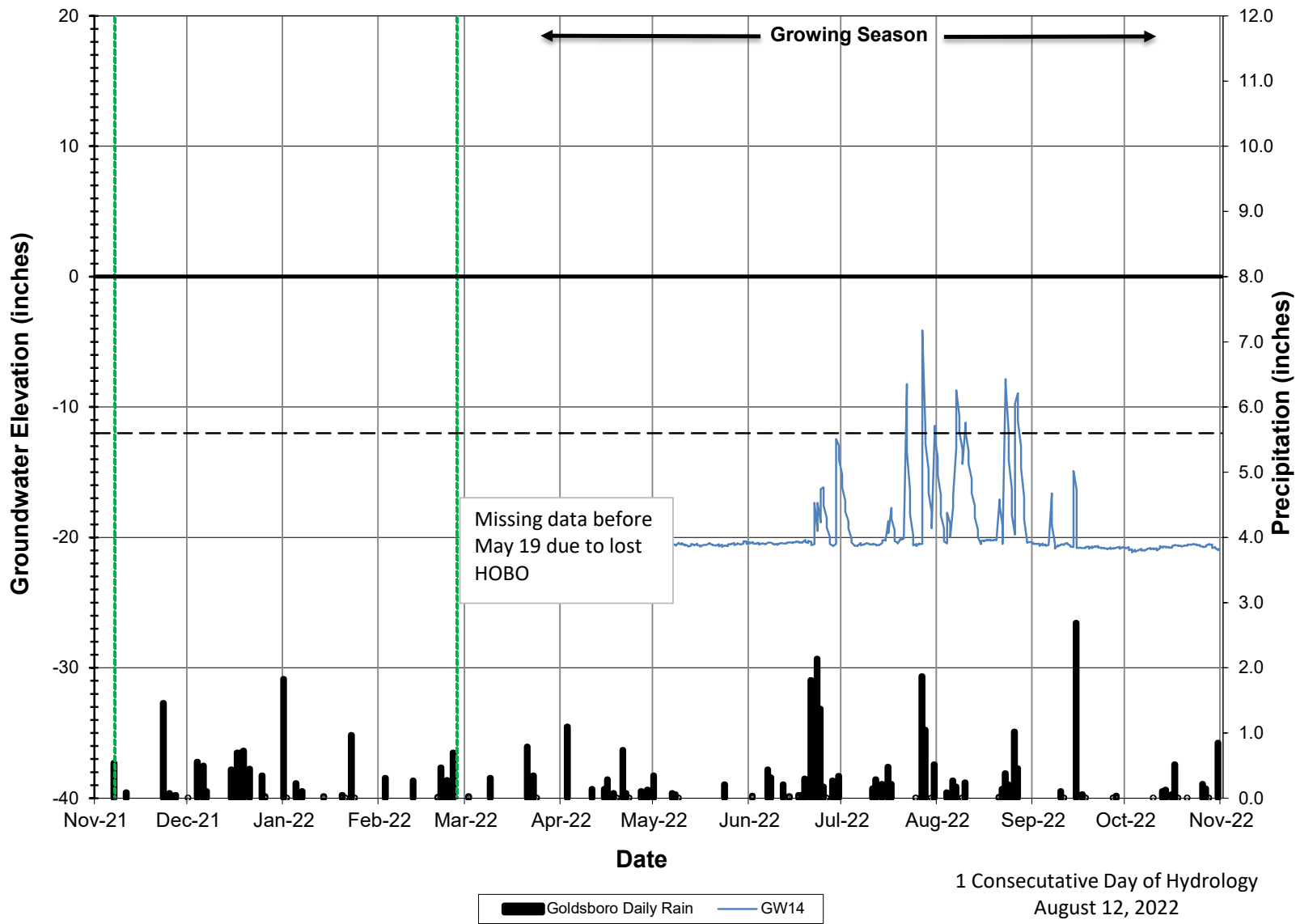
2022 Barefoot GW12



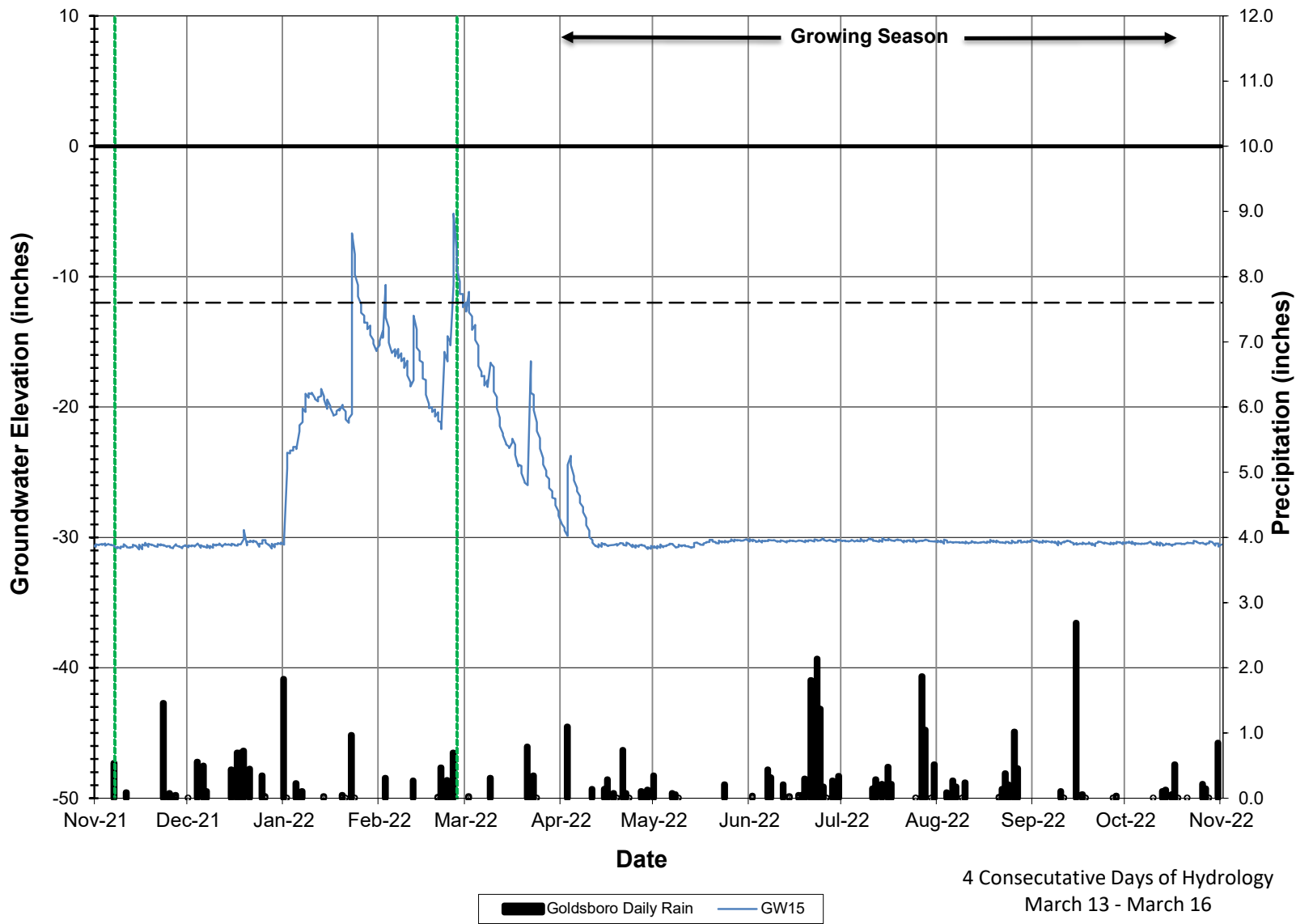
2022 Barefoot GW13



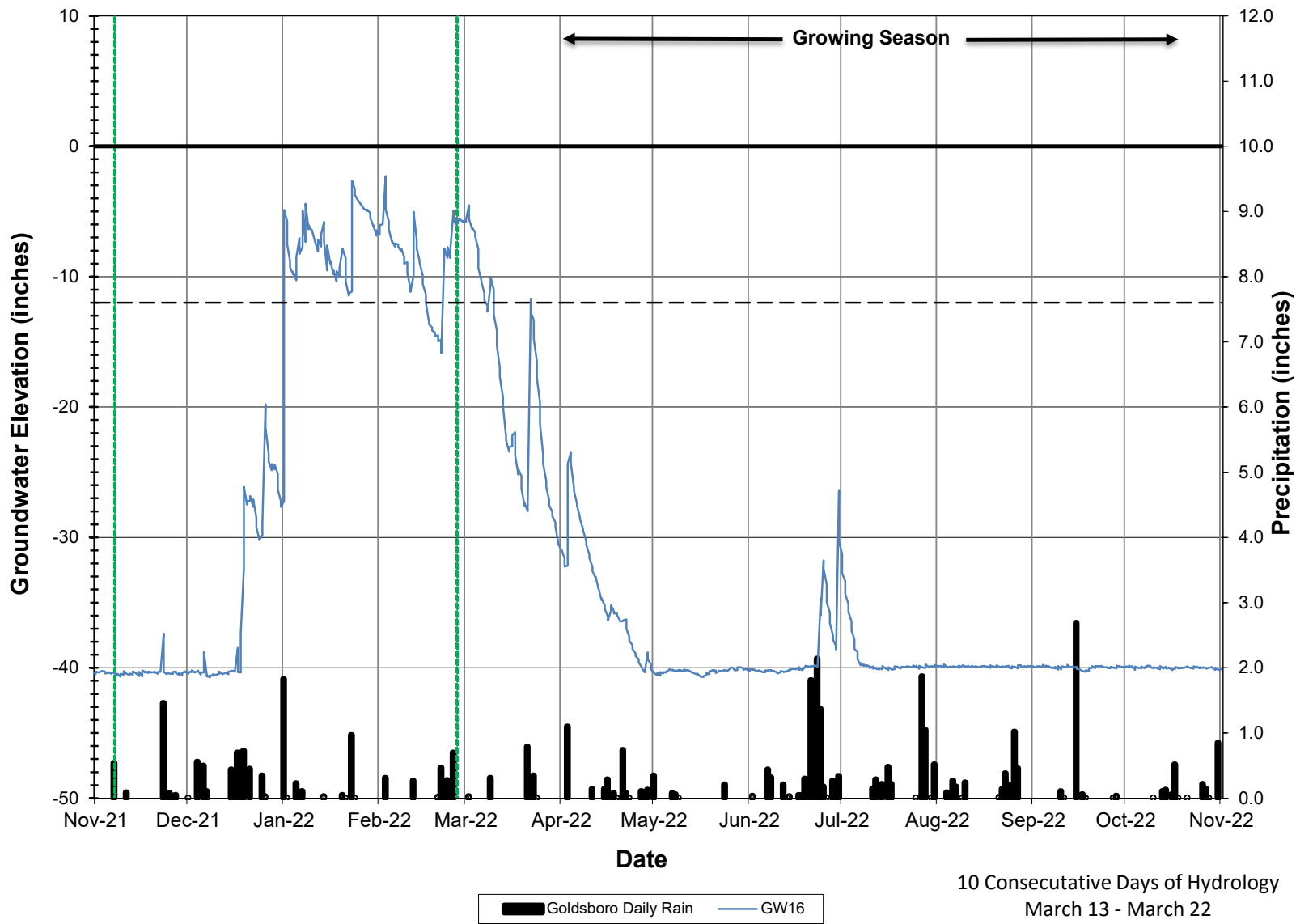
2022 Barefoot GW14



2022 Barefoot GW15



2022 Barefoot GW16



2022 Barefoot GW17

