Year 3 Monitoring Report

FINAL

LITTLE SEBASTIAN SITE

NCDMS Project # 100027 (Contract # 7187) | RFP 16-006993 (Issued 9/16/2016)
USACE Action ID: SAW-2017-01507 | DWR Project # 2017-1041

Surry County, North Carolina
Yadkin River Basin
HUC 03040101

Provided by:

Resource Environmental Solutions, LLC
For Environmental Banc & Exchange, LLC

Provided for:
NC Department of Environmental Quality
Division of Mitigation Services

February 2024

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February 26, 2024

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RE: Little Sebastian, Project ID #100027, DMS Contract #7187

Listed below are comments provided by DMS on February, 8th 2024 regarding the Little Sebastian Site: Year 3 Monitoring Report and RES' responses.

Comments:
1. Section 1.2 Project Goals and Objectives – DMS recommends updating this section to include the "Table 2: Summary: Goals, Performance and Results" from the current monitoring table guidance (October 2020); this table is very helpful in showing how project performance is tying into the goals and summarizing cumulative monitoring results. This is available on the DMS website at:
https://www.deq.nc.gov/about/divisions/mitigation-services/vendors/templates-guidelines-tools-projects
A "Summary: Goals, Performance, and Results" table has been added after Section 1.3.

2. Section 1.7 Monitoring Performance (MY3) _Vegetation: In the revised report text, please additionally include the common species names for the 3-gallon container trees planted in March 2023 or provide a supplemental table in the report appendices with the common names, relative quantities of each species planted, and the overall planting density.
The following statement has been added to Section 1.7 "The roughly 0.83-acre area has been replanted with 270 native 3-gallon container trees (54 trees per species), in March 2023. The tree species planted included willow oak (*Quercus phellos),* northern red oak *(Quercus rubra),* sugarberry *(Celtis laevigata),* tulip poplar *(Liriodendron tulipifera), persimmon (Diospyros virginiana),* and American sycamore (*Platanus occidentalis).*"

3. Section 1.7 Monitoring Performance (MY3) _Vegetation: During the November 7, 2023, DMS site visit, Fescue was observed at the outer extent of portions of the conservation easement. Is existing Fescue considered a project vegetation concern within the conservation easement? Are any ring sprays around planted vegetation proposed in future monitoring years? Please address in the comment responses and update the report text accordingly.

RES will treat fescue accordingly if problems with tree survival am vigor arise.

4. Section 1.7 Monitoring Performance (MY3) _Vegetation: Fencing removal and boundary marking updates are discussed in the Vegetation Section of 1.7 Monitoring Performance. DMS recommends breaking out this discussion into a new sub-section entitled "Conservation Easement Boundary" or similar. RES should also mention the recent DMS boundary inspection conducted with RES on 11/7/2023 and briefly summarize: A) what actions have been taken since that meeting/s, B) the approximate timeline to rectify the rest of the action items moving forward, and C) the survey plat and monument issues currently being resolved with RES's surveyor and DEQ/DMS/State Property.
A section titled "Conservation Easement Boundary" has been added to Section 1.7 that discusses actions taken, approximate timeline, and survey plat issues.
A) RES has communicated and scoped work with Ascension Land Surveying. Our survey team has installed more easement signage on parts of the easement boundary. RES has submitted a maintenance request to our internal maintenance team.
B) RES plans to have maintenance and survey issues completed within 2024.
C) RES has communicated and scoped the work for Ascension Land Surveying to replace all the #4 rebar with #5, 30" rebar and submit a Report of Survey documenting the work.

5. Section 1.7 Monitoring Performance (MY3) _Stream Geomorphology: Based on the report text, morphological surveys were completed in June 2023. Please consider collecting morphological data later in the growing season so it represents the full monitoring year. If collected earlier, data collection dates should be consistent each year to allow a full year between surveys.
RES tries to get the survey and vegetation monitoring events as close to one full year apart as possible.

6. Section 1.7 Monitoring Performance (MY3) _Stream Geomorphology: Please correct the spelling error on page 8 – "rifle".
This spelling error has been corrected.

7. Table 2. Project Activity and Reporting History: Please include all MY3 (2023) maintenance activities in the table including any beaver dam removals and/or project invasive treatments.
Table 2 has been updated with 2023 maintenance activities.

8. Section 1.7 Monitoring Performance (MY3) _Stream Geomorphology: The text reports that "Overall the MY3 cross sections and profile relatively match the proposed design.". Cross Section 2 is briefly discussed. In addition, two riffle cross sections (Reach JN2-C - Cross Section 3 and Reach JN2-D - Cross Section 4) show significant downcutting. RES indicates that they will investigate potential causes of this issue in early 2024 and will report findings in the future. Please discuss/assess this area in the current report, as it occurred in MY3 (2023). If RES feels the profile matches the design, please discuss how the profile was assessed? Visually?
The text in Section 1.7 has been changed to state that "Overall the MY3 cross sections relatively match the as-built conditions". RES investigated cross section 3 and 4 (stream problem area #4

and #5) on February 22nd, 2024, and it appears that the downcutting seen is the riffle material moving downstream. RES will add material to lift the channel bed back to the proposed depth, the new material will be sized to be less mobile. This maintenance work will be scheduled to happen in 2024. The cross sections were accessed visually in the field and also using past monitoring data.

9. Section 1.7 Monitoring Performance (MY3) _Stream Geomorphology: An area of erosion is noted at Right Bank Erosion BS1-C and mapped on the CCPV, and "caused by a failed log sill causing the stream flow to erode away at the right bank". It is noted that matting and live staking will be completed to stabilize this area in early 2024; however, the photo shows a vertical, eroding bank. Is RES confident that matting and staking can rectify and stabilize the apparently actively eroding bank? Please review and discuss in the report text.
After RES investigated BS1-C on February 22nd, 2024, the plan for stream problem area #2 and #3 is to rebuild the piping log sill and add riffle material upstream of that log sill to convert the step-pool feature into more of a cascade feature and rebuild the left bank above that sill with a soil lift. Also, to notch the log sill above the piping log sill to give the low flow a preferential path that isn't under the left bank. Furthermore, RES will rebuild the right bank below the last log sill with a stone toe.

10. Section 1.7 Monitoring Performance (MY3) _Stream Geomorphology: An area of erosion is noted at Right Bank Erosion MC1-C and mapped on the CCPV, and "caused by a brush toe failing during a major storm event"; however, a photo of this area was not included. Is this an area RES also intends to address with matting and live staking, and is RES confident that this approach will stabilize the area? Does RES have an idea which storm event caused this? Please add additional information in the report text to detail the project issue and proposed resolution.
The photo of the brush toe failure was previously mislabeled with the wrong reach and has been updated. The CCPV and report now also refer to the stream problem areas by station numbers. RES can not confirm what storm event caused the brush tow to fail but feels confident that the matting, packing with coir logs, and live staking will stabilize the area.

11. Visual Stream Stability Assessment Tables: Please ensure that visual assessment tables are updated annually to reflect problem areas as they arise; for example, the visual assessment table for Reach BS1 reflects one grade control structure failure but does not indicate any bank failure as shown in the report photo. Please review and update the report and table/s accordingly.
The bank failure section has been updated for MC1-C and BS1.

12. General/ Problem Area Photos/ CCPV Maps/ Visual Stream Stability Assessment Tables: It would be helpful if RES could add station numbers to the stream problem area photos and discuss in the report text accordingly by station numbering. Ideally, the CCPVs should show station numbers for reference. If there are multiple areas along the same reach or if these areas are discussed in the future, this helps guide the discussion on their exact locations. Any structure issues reported in the Visual Stream Stability Assessment Tables, or the project photos should be documented on the CCPV Maps. Please review and update the report and maps accordingly.

The photos, CCPV, visual stream stability assessment, and monitoring report have all been updated based on the comments through out this report. The stream problem areas have also been given station numbers which can be seen in the photo log, CCPV, and the monitoring report.

13. Table 6. Vegetation Condition Assessment Table & CCPV: DMS observed multiple areas of invasives during a November 11, 2023, site visit. Chinese Privet was the prevalent invasive species observed. Please review and confirm that the invasive areas observed on the site are below the mapping threshold (1,000 sq. ft.). Please continue to actively treat invasives on the project site through the monitoring term and report treatments in Table 2. Project Activity and Reporting History.
One area that is approximately 4,500 square feet has been added. The RES maintenance team will treat this area and spot check the whole site during MY4 (2024). Areas that have been treated will be included in the MY4 report.

14. MY3 Little Sebastian GW1 Graph: The report text indicates that GW1 recorded a consecutive hydroperiod of 100 percent of the growing season; however, the graph shows several instances where the water level drops below -12 inches during the growing season. Please review the data and update the report and graph accordingly.
The groundwater level does drop below the 12-inch mark during the 210-day stretch; however, the groundwater gauge reads twice a day, and each of the instances where the level drops below 12 inches, it is only for one reading that day, not both. RES determines a consecutive streak by beginning with at least two days of readings above 12 inches, and then at least one reading a day above the 12-inch mark, until there are two readings in a row under 12-inches, ending the consecutive day count. Please reference the GW1 raw data in the digital files (5. Hydrology Data) to see where the determinations come from.

15. MY3 Little Sebastian JN3-B Stage Recorder Graph: The legend for the graph is incomplete. Please update the legend accordingly. Please review and confirm that the Max Event reported is correct based on the Stage (ft) scale. It is difficult to determine with limited Stage (ft) lines shown on the graph. Please review the graph and MY3 project data in detail and confirm the reported information is accurate.
The legend has been updated accordingly. JN3-B graph and data have been reviewed and confirm that the information is accurate.

16. MY3 Little Sebastian BS1-E Stage Recorder Graph: Please review and confirm that the Max Event reported is correct based on the Stage (ft) scale. It is difficult to determine with limited Stage (ft) lines shown on the graph. Please review the graph and MY3 project data in detail and confirm the reported information is accurate.
BS1-E stage recorder has been reviewed and RES confirms that the max event on June 20th, 2023, was .02 feet above the top of bank.

17. MY3 Little Sebastian Flow Gauge Graphs (all): The Longest Period of Consecutive Flow callouts shown have numerous instances where the water line drops below the Downstream

Riffle Elevation Line. Please review and revise the report as necessary. Please explain why consecutive flow data reported includes instances when the waterline drops below the downstream riffle elevation.
All of the flow gauges drop below the downstream riffle elevation during the longest period of consecutive flow; however, the gauge reads 24 times a day and for the instances that where the water level drops below the downstream rifle it is less than 24 hours in a row. The consecutive day count does not stop until there is 24 hours in a row where there is flow less than the downstream rifle. Please reference the flow gauge raw data in the digital files (5. Hydrology Data) to see where the determinations come from.

18. General: Please continue to provide photo documentation of overbank events in MY4 (2024) and future monitoring reports.
RES will continue to provide photo documentation of overbank events in MY4 and future monitoring reports.

19. General: While cross sections are not typically required during MY4(2024), please consider providing cross sections for Reach JN2-C - Cross Section 3 and Reach JN2-D - Cross Section 4 in MY4(2024), in an effort to keep tracking their trend due to the sudden changes reported in MY3(2023).
RES will provide cross section data for XS 3 and 4 for MY4 (2024).

November 7, 2023: DMS Property Boundary Inspection Observations & Required Action Items:
1. Prior to moving forward, please discuss all property and survey issues with DMS, SPO and DEQ Stewardship to determine the next steps for resolution. DMS will set up a meeting for discussion. Update: Meetings were held on 1/5/2024 & 1/19/2024 with RES, DMS, and SPO staff.
Meetings were held on 1/5/2024 and 1/19/2024 with RES, DMS, and SPO staff. Issues will be resolved using a combination of RES survey and maintenance teams as well as the recorded conservation easement surveyor, Ascension Land Surveying.

2. Install in-line marking at a frequency of 200' spacing or less. Shorter segments should have the signs installed equidistant from the corners, but signs must be installed at a spacing no greater than 200'.
Our survey team is working on this issue, and it will be completed in 2024.

3. Remove fallen trees from the exclusion fencing.
Our maintenance team is working on this issue, and it will be completed in 2024.

4. Monitor the site boundary and maintain compliance throughout the monitoring period. Continue discussions with the landowner and maintain compliance at historic encroachment areas and monitor for any new encroachment.
The site boundary will continue to be monitored for compliance and encroachment areas.

5. Remove the tubular bull gates located within the CE area.

Our maintenance team is working on this issue, and it will be completed in 2024.

6.Rectify plat corner number duplications and install any missing corner monuments.
Ascension Land Surveying is working on this and will have it completed in 2024.

7.Recommend replacement of all tree sign fasteners with aluminum nails. Examples were provided during recent inspections. The 3 ½ inch by 0.177 inch by 11/32-inch head aluminum nails were purchased from Kaiser Aluminum 800-633-3156. Recommend watching this DMS instructional video before attempting to correct the signage https://youtu.be/7dE7edd3V5M. It is a five-minute video originally created during the NC Ecosystem Enhancement Program era. It will help them visualize what our expectation looks like.
This recommendation will be passed along to our survey team.

8.Upgrade cable tie configuration, tension, and trim. DMS is available if you have any questions.
Our maintenance team is working on this issue, and it will be completed in 2024.

9.Old fencing inside of CE needs to be removed. See the provided .KML and descriptions for specific areas.
Our maintenance team is working on this issue, and it will be completed in 2024.

10.Determine status of the Sprint telephone utility located in the easement and rectify as appropriate. Accurate mapping of the utility and any associated easements must be described along with the proposed solution and/ or mitigation credit implications.
Found documentation from 2018 that the line associated with that identified Sprint pedestal was abandoned. RES coordinated this work and the construction of a new line that goes along the driveway and up to the house. The title RES acquired during land due diligence nor the landowner were unaware of any associated easements but RES will continue to research this subject.

11. Determine the out-of-spec #4 rebar length. Replacement with #5 rebar 30" in length is required.
Ascension Land Surveying is working on this issue, and it will be completed in 2024.

12. Repair damaged fencing and attend to other items as noted on the provided. KML file.
Our maintenance team is working on this issue, and it will be completed in 2024.

Electronic Comments:
1. None.
Noted, thank you.

Table of Contents

1.0 Project Summary

1.1 Project Location and Description

The Little Sebastian Mitigation Site ("the Project") is located in Surry County, approximately 10 miles north of Elkin. The Project presents 4,554.300 Cool Stream Mitigation Units (SMU) along Mill Creek and three unnamed tributaries.

The Project's total easement area is approximately 25.91 acres within the overall drainage area of 3,261 acres. The Project has two separate portions and in between those portions is the Gideon Mitigation Site. The Gideon Mitigation Site has a total easement area that is approximately 11.23 ac and presents 4,782 linear feet of stream restoration, enhancement, and preservation. Therefore, a total 37.14 ac and 12,887 LF of stream are protected in perpetuity. Grazing livestock historically had access to all stream reaches within the Project. The lack of riparian buffer vegetation, deep-rooted vegetation, and unstable channel characteristics contributed to the degradation of stream banks throughout the Project area.

The Project will be monitored on a regular basis throughout the seven-year post-construction monitoring period, or until performance standards are met. The Project will be transferred to the NCDEQ Stewardship Program. This party shall serve as conservation easement holder and long-term steward for the property and will conduct periodic inspection of the site to ensure that restrictions required in the conservation easement are upheld.

1.2 Project Goals and Objectives

Through the comprehensive analysis of the Project's maximum functional uplift using the Stream Functions Pyramid Framework, 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 2009 Upper Yadkin Pee-Dee River RBRP. The Project will address outlined RBRP Goals 2, 4, and 6 (**Mitigation Plan**). Specific project goals and objectives are presented in the project summary: goals, performance and results seen below.

1.3 Project Success Criteria

The success criteria for the Project follows the 2016 USACE Wilmington District Stream and Wetland Compensatory Mitigation Update, the Little Sebastian Final Mitigation Plan, and subsequent agency guidance. Cross section and vegetation plot monitoring takes place in Years 0, 1, 2, 3, 5, and 7. Stream hydrology, wetland hydrology, and visual monitoring takes place annually. Specific success criteria components are presented in the project summary: goals, performance and results seen below.

Project Summary Goals, Performance, and Results

Goal	Objective/Treatment	Monitoring Metric	Performance Criteria	Measurement	Cumulative Monitoring Results
Improve water transport from watershed to the channel in a non-erosive manner in a stable channel Improve flood flow attenuation on site and downstream by allowing for overbanks flows and connection to the active floodplain Indirectly support the goals of the 2009 Upper Yadkin Pee-Dee RBRP to improve water quality and to reduce sediment and nutrient loads Improve instream habitat	Permanently excluded livestock from stream channels and their associated buffers Added in-stream structures and bank stabilization measures to protect restored and enhanced streams Installed habitat features such as brush toes, constructed riffles, woody materials, and pools of varying depths to restored and enhanced streams Reduced bank height ratios and increased entrenchment ratios to reference reach conditions Implemented one agricultural BMP in order to limit inputs of sediment, nutrients, and fecal coliform to streams from surrounding farming operations	As-built stream profile	N/A	N/A	Survey conduced
		Flow Gauges: Inspected quarterly	Minimum of 30 consecutive days of flow	Flow gauges on BS1-A, JN7, and JN2-B	2/2 passed - MY1 3/3 passed - MY2 3/3 passed - MY3
		Stage recorders: Inspected quarterly	Four bankfull events occurring in separate years	Stage recorders on JN3-B and BS1-E	0/2 Bankfull events - MY1 1/2 Bankfull events - MY2 2/2 Bankfull events - MY3
		Cross sections: Surveyed in MY 1, 2, 3, 5, and 7	Bank height ratio shall not exceed 1.2	12 Cross sections	12/12 with BHR ≤ 1.2 - MY0 10/12 with BHR ≤ 1.2 - MY1 10/12 with BHR ≤ 1.2 - MY2 11/12 with BHR ≤ 1.2 - MY3
		Visual monitoring: Preformed at least semiannually	Identify and document significant stream problem areas; i.e. erosion, degradation, aggradation, etc.	Visual assessment conducted	No problem areas - MY0 No problem areas - MY1 No problem areas - MY2 3 stream problem areas - MY3
Restore and enhance native floodplain vegetation	Permanently excluded livestock from stream channels and their associated buffers Treat exotic invasive species Established a permanent conservation easement on the Project Increased forested riparian buffers to at least 30 feet on both sides of the channel along the Project reaches with a hardwood riparian plant community	Vegetation plots: Surveyed in MY 1, 2, 3, 5, and 7	MY1-3: 320 trees/acre MY5: 260 trees/acre (6ft. tall) MY7: 210 trees/acre (8ft. tall)	Six fixed and three random vegetation plots	9/9 passed - MY0 9/9 passed - MY1 9/9 passed - MY2 9/9 passed - MY3
		Visual assessment of fencing and conservation signage: Preformed at least semiannually	Inspect fencing and signage. Identify and document any damaged or missing fencing and/or signs.	Visual assessment conducted	Fencing/signage are in place - MY0 Fencing/signage are in place - MY1 Encroachment/low stem density area found - MY2 Fencing/signage needs maintenance - MY3

1.4 Project Components

The project streams were significantly impacted by livestock production, agricultural practices, and a lack of riparian buffer. Improvements to the Project help meet the river basin needs expressed in the 2009 Upper Yadkin Pee-Dee River Basin Restoration Priorities (RBRP) as well as ecological improvements to riparian corridor within the easement.

Through stream restoration, enhancement, and preservation, the Project presents 4,554.300 Cool Stream Mitigation Units (SMU) (**Table 1**).

Mitigation Approach	Linear Feet	Ratio	Cool Base SMU
Restoration	2,758	1	2,721
Enhancement I	597	1.5	398
Enhancement II	1,898	2.5	759.2
Enhancement II	1,372	5	274.4
Enhancement II	819	7.5	109.2
Enhancement II	243	10	24.3
Preservation	418	10	41.8
Total	**8,068**		**4,327.9**
		Credit Loss in Required Buffer	**-278.7**
		Credit Gain for Additional Buffer	**505.1**
		Total Adjusted SMUs	**4,554.300**

1.5 Stream Mitigation Approach

The Project includes priority I stream restoration, enhancement I, enhancement II, and preservation. Priority I stream restoration incorporates the design of a single thread meandering channel, with parameters based on data taken from reference sites, published empirical relationships, regional curves developed from existing project streams, and NC Regional Curves. Analytical design techniques also were a crucial element of the project and were used to determine the design discharge and to verify the design as a whole.

Reach JN2-A - Preservation activities included improving the existing livestock exclusion fencing and buffers greater than 30 feet. The easement was extended to provide preservation beyond the origin point of the stream as per the PJD.

Reach JN2-B - Enhancement activities included improving habitat through supplemental buffer plantings and livestock exclusion fencing. Minimal bank grading and buffer re-establishment was done along the downstream end. In-stream structures such as log sills and one log cross vane were installed for stability and to improve habitat. The restoration of the riparian areas at the downstream end filters runoff from adjacent pasture, reduce sediment loads, and provide wildlife corridors throughout the Project area.

Reach JN2-C - Enhancement activities included improving habitat through supplemental buffer plantings and livestock exclusion fencing. Minimal bank grading and buffer re-establishment were done along the downstream end. The restoration of the riparian areas at the downstream end filters runoff from adjacent pasture, reduce sediment loads, and provide wildlife corridors throughout the Project area.

Reach JN2-D - Enhancement activities included some channel relocation, bed, and bank stabilization, removing an existing ford crossing and access road, improving habitat through supplemental buffer plantings, and livestock exclusion fencing. The restoration of the riparian areas at the downstream end filters runoff from adjacent pasture, reduce sediment loads, and provide wildlife corridors throughout the Project area.

Reach JN3-A –Enhancement II activities at a 7.5:1 ratio included improving habitat through supplemental buffer plantings and livestock exclusion fencing. The widening and restoration of the riparian areas along the right bank filters runoff from adjacent pasture and reduce sediment loads.

Reach JN3-B - Restoration activities included constructing a new channel within the natural valley to the north with appropriate dimensions and pattern and backfilling the abandoned channel. In-stream structures such as log sills, brush toes, and log vanes were installed for stability and to improve habitat. Habitat was further improved through buffer plantings and livestock exclusion. Buffer activities improved riparian areas that filter runoff from adjacent pastures, thereby reducing nutrient and sediment loads to the channel. Also, the reach was built through two small jurisdictional wetlands that are currently on the right bank floodplain and degraded from cattle access and pasture-use. While this project is not claiming any wetland credit, the raised channel bed enhances the wetlands' hydrology by reconnecting the floodplain wetlands to the stream. Two groundwater wells were installed on the right floodplain to monitor the wetland hydrology and will be reported in the yearly monitoring reports.

Reach MC1-A - Enhancement activities included improving habitat through supplemental buffer plantings and livestock exclusion fencing. The widening and restoration of the riparian areas along the right bank filters runoff from adjacent pasture and reduce sediment loads.

Reach MC1-B - Enhancement activities included improving habitat through supplemental buffer plantings and livestock exclusion fencing. The widening and restoration of the riparian areas along the left bank filters runoff from adjacent pasture, reduce sediment loads, and provide wildlife corridors throughout the Project area.

Reach MC1-C - Restoration activities included using log structures to provide vertical stability, assist in maintaining riffle, run and pool features and to provide habitat features. Cut and fill was balanced in an effort to raise the channel bed to provide regular inundation of the adjacent floodplain. Habitat was improved through supplemental buffer plantings and livestock exclusion fencing. The Gideon Mitigation Bank was constructed with the Project.

Reach MC3-A - Enhancement activities included improving habitat through supplemental buffer plantings and livestock exclusion fencing. The widening and restoration of the riparian areas along the right bank filters runoff from adjacent pasture and reduce sediment loads.

Reach MC3-B - Enhancement activities included reshaping the left bank, install coir matting and livestakes, and improving habitat through supplemental buffer plantings and livestock exclusion fencing. The widening and restoration of the riparian areas along the left bank filters runoff from adjacent pasture, reduce sediment loads, and provides wildlife corridors throughout the Project area. A ford crossing was installed on this reach.

Reach MC3-C - Enhancement activities included reshaping the left bank, install coir matting and livestakes, and improving habitat through supplemental buffer plantings and livestock exclusion fencing. The widening and restoration of the riparian areas along the left bank filters runoff from adjacent pasture, reduce sediment loads, and provide wildlife corridors throughout the project area.

Reach MC3-D - Enhancement activities includes improving habitat through supplemental buffer plantings and livestock exclusion fencing. The widening and restoration of the riparian areas along the left bank filters runoff from adjacent pasture, reduce sediment loads, and provide wildlife corridors throughout the Project area.

Reach BS1-A - Restoration activities included using log and rock structures to provide vertical stability, assist in maintaining riffle, run and pool features and to provide habitat features. Cut and fill were balanced in an effort to raise the channel bed to provide small floodplain benches where topography allows. Habitat was further improved through supplemental buffer plantings and livestock exclusion fencing. An engineered sediment pack was installed at the top of this reach.

Reach BS1-B - Enhancement activities included improving habitat through supplemental buffer plantings and livestock exclusion fencing. The widening and restoration of the riparian areas along the left bank filters runoff from adjacent pasture, reduce sediment loads, and provide wildlife corridors throughout the project area.

Reach BS1-C - Restoration activities included using log and rock structures to provide vertical stability, assist in maintaining riffle, run and pool features and to provide habitat features. Cut and fill was balanced in an effort to raise the channel bed to provide small floodplain benches where topography allows. Habitat was further improved through supplemental buffer plantings and livestock exclusion fencing.

Reach BS1-D - Enhancement activities included improving habitat through supplemental buffer plantings and livestock exclusion fencing. The widening and restoration of the riparian areas along the left bank filters runoff from adjacent pasture, reduce sediment loads, and provide wildlife corridors throughout the Project area.

Reach BS1-E - Restoration activities included using log structures to provide vertical stability, assist in maintaining riffle, run and pool features and to provide habitat features. Cut and fill were

balanced in an effort to raise the channel bed to provide small floodplain benches where topography allows. Habitat was further improved through supplemental buffer plantings and livestock exclusion fencing.

1.6 Construction and As-Built Conditions

Stream construction was completed in February 2021 and planting was completed in March 2021. Additionally, five-strand high tensile electric fencing was installed for cattle exclusion. The Little Sebastian Site was built to design plans and guidelines. Two minor changes were made during construction: a log sill was added on JN2-B for extra grade control and log sills were removed from BS1 due to bedrock. Additionally, JN7 was added between Final Mitigation Plan approval and construction. This reach has a 30-acre drainage area and includes a pond located about 150 linear feet upstream of the easement area. Historically, this pond drained through a short ditch into JN3-B but due to the relocation of JN3-B, a channel was constructed in order to connect the pond back to JN3-B. The restored JN7 includes 37 linear feet within the easement. A photo of JN7 is in **Appendix B**. RES proposed the addition of JN7 for credit; however, this request was denied by IRT. A flow gauge was installed along JN7 in February 2022. RES will monitor the stability and hydrology of this reach and if back-up credits are needed at closeout there is the potential to use the 19.660 SMUs from JN7.

Planting plan changes included replacing blackgum (*Nyssa sylvatica*) and elderberry (*Sambucus canadensis*) with sugarberry (*Celtis laevigata*) and buttonbush (*Cephalanthus occidentalis*). These changes were based on bare root availability. A planted species summary is included in **Appendix C**. Minor monitoring device location changes were made during as-built installation due to site conditions. The only monitoring devices not installed were the stage recorders proposed for MC1-C and BS1-C due to the reach being less than 1,000 linear feet and there being two stage recorders proposed for the same reach, respectively.

1.7 Monitoring Performance (MY3)

The Little Sebastian Year 3 monitoring activities were performed in June and October 2023. All Year 3 monitoring data is present below and in the appendices. The Project is on track to meeting vegetation and stream interim success criteria.

Vegetation

Monitoring of six fixed vegetation plots and three random vegetation plots was completed on October 31, 2023. Vegetation data can be found in **Appendix C**, associated photos are in **Appendix B,** and plot locations are in **Appendix B**. MY3 data indicates that all plots are exceeding the interim success criteria of 320 planted stems per acre. Planted stem densities ranged from 526 to 1,133 planted stems per acre with a mean of 796 planted stems per acre across all plots. A total of 16 species were documented within the plots. Volunteer species were noted in all of the fixed vegetation plots ranging from 81 stems to 202 volunteer stems. The average stem height in the plots was 4.2 feet.

Visual assessment of vegetation outside of the monitoring plots indicates that the herbaceous vegetation is becoming well established throughout the project. An area of approximately 0.1 acres was found that included Chinese privet (*Ligustrum sinense*) and Japanese honeysuckle (*Lonicera japonica*). This area can be seen in **Figure 2** as a simple yellow hatch. This area will be treated during 2024 and the site will be spot treated throughout where necessary. Two areas of mowing encroachment along the eastern boundary of the Project, adjacent to BS1, were observed during Year 2 monitoring. The roughly 0.83-acre area has been replanted with 270 native 3-gallon container trees (54 trees per species), in March 2023. The tree species planted included willow oak (*Quercus phellos),* northern red oak *(Quercus rubra),* sugarberry *(Celtis laevigata),* tulip poplar *(Liriodendron tulipifera), persimmon (Diospyros virginiana)*, and American sycamore (*Platanus occidentalis)*. Additional signage and horse tape (in areas where visibility between markers may be limited) have been installed along this side of the easement to mark a clear boundary to prevent further mowing. All areas of supplemental planting (as a result of the encroachment) can be seen in **Figure 2** as green simple hatch. The eastern parcel has been sold where the previous encroachment took place and RES has been in communication with the new landowner.

Stream Geomorphology

Cross section and geomorphology data collection for MY3 was collected on June 27, 2023. Summary tables and cross section plots are in **Appendix D**. Overall the MY3 cross sections relatively match the as-built conditions. The current conditions show that shear stress and velocities have been reduced for all restoration/enhancement reaches. The reaches were designed as gravel/cobble bed channels and remain classified as gravel/cobble bed channels post-construction.

One cross section displayed notable changes for Bankfull Bank Height Ratio between MY1 and MY3 and are discussed below.

- Cross Section 2- because this is an Enhancement I section with steeper, uneven slopes, choosing the same location to call top of bank, year to year, is difficult; therefore, minor changes are expected in bank height ratios.

Visual assessment of the stream channel was performed to document signs of instability, such as eroding banks, structural instability, or excessive sedimentation (**Table 5**, **Appendix B**). There is one erosion area on the right bank along MC1-C (stream problem area #1) and two areas on BS1-C (stream problem area #2 & #3). The erosion on MC1-C was caused by a brush toe failing during a major storm event. The area erosion on BS1-C was caused by a failed log sill causing the stream flow to erode away at the right bank. These are localized areas of erosion and not a sign of systematic failure, RES plans to stabilize stream problem area #1 with matting, coir logs, and livestakes in 2024. For stream problem area #2 RES will rebuild the right bank with a stone toe. For stream problem area #3 RES plans to rebuild the piping log sill and add riffle material upstream of that log sill to convert the step-pool feature into more of a cascade feature and rebuild the left bank above that sill with a soil lift. Also, to notch the log sill above the piping log sill to give the low flow a preferential path that isn't under the left bank. Cross sections three (stream problem

area #4) and four (stream problem area #5) are experiencing some unusual downcutting for a riffle, it appears that the downcutting seen is the riffle material moving downstream. RES will add material to lift the channel bed back to the proposed depth, the new material will be sized to be less mobile. This maintenance work will be scheduled to happen in 2024. Pictures of these areas can be found in **Appendix B** and locations can be found on **Figure 2**. The channel is transporting sediment as designed and will continue to be monitored for aggradation and degradation.

Stream Hydrology

Two stage recorders and two flow gauges were installed in March 2021 and document bankfull events and flow days, respectively. Both gauge types record readings at a frequency of once per hour, 24 hours per day. The stage recorder on JN3-B documented six bankfull events in total with the maximum bankfull event on June 20, 2023, measuring 0.46 feet above the top of bank. The stage recorder along BS1-E documented one bankfull event with the maximum bankfull event on June 20, 2023, measuring 0.02 feet above the top of bank. Photo documentation of an overbank event can be found in **Appendix B**. The flow gauge on BS1-A recorded one flow event, with the flow lasting 303 consecutive days. The gauge on JN2-B recorded 4 flow events with the maximum consecutive flow lasting 113 consecutive days. The flow gauge on JN7 recorded 3 flow events, with the maximum consecutive flow lasting 186 consecutive days. All recorded streams are on track to pass hydrology metrics. Stream hydrology data is included in **Appendix E**. Gauge locations can be found on **Figure 2** and photos are in **Appendix B**.

Wetland Hydrology

Two groundwater wells with automatic recording pressure transducers were installed in March 2021. The goal of the groundwater wells is to track the hydrology of the jurisdictional wetlands on site post-stream construction. There is no hydroperiod success criteria for these groundwater wells. In MY3, GW1 recorded a consecutive hydroperiod of 100 percent of the growing season and GW2 recorded a consecutive hydroperiod of 100 percent of the growing season. Wetland hydrology data is included in **Appendix E**. Groundwater well locations can be found on **Figure 2**.

Conservation Easement Boundary

There was a recent DMS boundary inspection conducted on November 7th, 2023. Based on the boundary inspection there are several action items that are going to be addressed including one area of old fencing found along MC1-C which will be removed in early 2024. There was one area of fencing adjacent to reach MC3-D that needs to be relocated which will be done in early 2024. Along the easement near JN2-B there are a few trees that fell down on the fence which will be removed, and the fence will be fixed in 2024. Along JN3-B and MC1-C the top strand of fencing is loose and will be fixed in 2024. Additional easement signage was put along the easement boundary since the boundary inspection along reach MC1-B, JN2-A, JN2-B, and JN2-C. Additional easement signage is still needed near reach MC3-A, KN3-A, and JN2-A and will be completed in 2024. The cable tie fastening on easement boundary signs will be upgraded in 2024. There is also

an old tubular bull gate within the easement, and it will be removed in 2024. Approximate locations of conservation easement boundary issues or completed maintenance can be found in **Figure 2, Appendix B.**

Ascension Land Surveying is working on rectifying plat corner number duplications and installing any missing corner monuments. As well as replacing #4 rebar length will be with #5 rebar 30" in length. These issues will be completed in 2024 and will be discussed within the MY4 report.

2.0 Methods

Stream cross section monitoring was conducted using a Topcon GTS-312 Total Station. Three-dimensional coordinates associated with cross-section data were collected in the field (NAD83 State Plane feet FIPS 3200). Morphological data were collected at 12 cross-sections. Survey data were imported into CAD, ArcGIS®, and Microsoft Excel® for data processing and analysis. The stage recorders include an automatic pressure transducer placed in PVC casing in a pool. The elevation of the bed and top of bank at each stage recorder are used to detect bankfull events. The flow gauges also include an automatic pressure transducer placed in a PVC casing in a pool. The elevations of the bed, water surface, and immediate downstream riffle are used to determine stream flow.

Vegetation success is being monitored at six fixed monitoring plots and three 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 is 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 each monitoring year. The random plot is to be collected in locations where there are no permanent vegetation plots. Random plots will most likely be collected in the form of 100 square meter belt transects with variable dimensions. Tree species and height will be recorded for each planted stem and the transects will be mapped and new locations will be monitored in subsequent years.

Wetland hydrology is monitored to track the hydrology of the jurisdictional wetlands on site post-stream construction. This is accomplished with two 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.

Fixed digital image locations are established at each cross section, vegetation plot, stage recorder, flow gauge, and the upstream and downstream side of each crossing.

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

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 (2018). Little Sebastian Final Mitigation Plan.

Schafale, M.P. 2012. Guide to the Natural Communities of North Carolina, Fourth 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).

Appendix A

Background Tables

Table 1. Little Sebastian (ID-100027) - Mitigation Assets and Components

Project Segment	Existing Footage or Acreage	Mitigation Plan Footage or Acreage	Migitation Category	Restoration Level	Priority Level	Mitigation Ratio (X:1)	Mitigation Plan Credits		As-Built Footage or Acreage	Comments
JN2-A	418	418	Cool	P	NA	10.00000	41.800		418	Livestock exclusion
JN2-B	187	187	Cool	EI	NA	1.50000	124.667		187	Buffer planting and livestock exclusion
JN2-C	307	307	Cool	EII	NA	2.50000	122.800		307	Buffer planting and livestock exclusion; 31-foot crossing
JN2-C	837	837	Cool	EII	NA	2.50000	334.800		837	Buffer planting and livestock exclusion
JN2-D	39	43	Cool	EI	NA	1.50000	28.667		43	Channel relocation, bed and bank stabilization, crossing relocation, buffer plantings, and livestock exclusion; 62-foot crossing
JN2-D	150	153	Cool	EI	NA	1.50000	102.000		153	Channel relocation, bed and bank stabilization, crossing relocation, buffer plantings, and livestock exclusion
JN3-A	350	350	Cool	EII	NA	7.50000	46.667		350	Buffer planting and livestock exclusion
JN3-B	900	781	Cool	R	I	1.00000	781.000		781	Channel relocation in the natural valley, improved stream structures, buffer planting, and livestock exclusion; 43-foot crossing
JN3-B	224	262	Cool	R	I	1.00000	262.000		262	Channel relocation, bed and bank stabilization, crossing relocation, buffer plantings, and livestock exclusion
JN7*	0	0	Cool	R	I	1.00000	0.000		37	Channel construction, bed and bank stabilization, buffer plantings, and livestock exclusion; No Credit
MC1-A	469	469	Cool	EII	NA	7.50000	62.533		469	Buffer planting and livestock exclusion
MC1-B	717	717	Cool	EII	NA	5.00000	143.400		717	Buffer planting and livestock exclusion; 41-foot utility line crossing
MC1-B	260	260	Cool	EII	NA	5.00000	52.000		260	Buffer planting and livestock exclusion
MC1-C	545	555	Cool	R	I	1.00000	555.000		555	Channel bed raised, improved stream structures, buffer planting, and livestock exclusion
MC3-A	243	243	Cool	EII	NA	10.00000	24.300		243	Buffer planting and livestock exclusion
MC3-B	402	402	Cool	EII	NA	2.50000	160.800		402	Buffer planting and livestock exclusion; 41-foot crossing
MC3-C	214	214	Cool	EI	NA	1.50000	142.667		214	Bank stabilization, improved stream structures, buffer planting, and livestock exclusion
MC3-D	395	395	Cool	EII	NA	5.00000	79.000		395	Buffer planting and livestock exclusion
BS1-A	205	214	Cool	R	I	1.00000	214.000		214	Channel bed raised, improved stream structures, buffer planting, and livestock exclusion
BS1-B	190	175	Cool	EII	NA	2.50000	70.000		175	Buffer planting and livestock exclusion
BS1-C	580	541	Cool	R	I	1.00000	541.000		541	Channel bed raised, improved stream structures, buffer planting, and livestock exclusion
BS1-D	185	177	Cool	EII	NA	2.50000	70.800		177	Buffer planting and livestock exclusion
BS1-E	278	274	Cool	R	I	1.00000	274.000		274	Channel bed raised, improved stream structures, buffer planting, and livestock exclusion; 45-foot crossing
BS1-E	94	94	Cool	R	I	1.00000	94.000		94	Channel bed raised, improved stream structures, buffer planting, and livestock exclusion

*Added between Final Mitigation Plan and Construction; no credit but potential to add credits if reach meets success criteria and back-up credits are needed

Note: all crossings and utility easements have been removed from credit calculations.

Project Credits

Restoration Level	Stream			Riparian Wetland	Non-rip Wetland	Coastal Marsh
	Warm	Cool	Cold			
Restoration		2721.000				
Re-establishment						
Rehabilitation						
Enhancement						
Enhancement I		398.000				
Enhancement II		1167.100				
Creation						
Preservation		41.800				
NSBW		226.400				
TOTALS		**4,554.300**				

Table 2. Project Activity and Reporting History
Little Sebastian

Elapsed Time Since grading complete: **2 yr, 9 mo**
Elapsed Time Since planting complete: **2 yr, 8 mo**
Number of reporting Years[1]: **3**

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Mitigation Plan	NA	Nov-18
Final Design – Construction Plans	NA	Sep-20
Stream Construction	NA	Feb-21
Site Planting	NA	Mar-21
Beaver Dam Removal	NA	NA
As-built (Year 0 Monitoring – VP, XS, Hydro, Visual)	Mar-21	Oct-21
Year 1 Monitoring	Stream: Nov-21 Vegetation: Nov-21	Dec-21
Initial Invasive Treatment	NA	Dec-21
Fence Relocation	NA	May-22
Year 2 Monitoring	Stream: July-22 Vegetation: Nov-22	Nov-22
Supplemental Planting	NA	Mar-23
Year 3 Monitoring	Stream: June-23 Vegetation: Oct-23	Dec-23
Additional Signage Added	NA	Dec-23
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 Little Sebastian	
Designer	RES / 3600 Glenwood Ave., Suite 100, Raleigh, NC 27612
Primary project design POC	Frasier Mullen, PE
Construction Contractor	KBS Earthwork Inc. / 5616 Coble Church Rd., Julian, NC 27283
Construction contractor POC	Kory Strader
Survey Contractor	Acension Land Surveying, PC / 116 Williams Road, Mocksville, NC 27028
Survey contractor POC	Chris Cole, PLS
Planting Contractor	Shenandoah Habitats
Planting contractor POC	David Coleman
Monitoring Performers	RES / 3600 Glenwood Ave, Suite 100, Raleigh, NC 27612
Project Manager POC	Ryan Medric (703) 424-6313
Monitoring POC	Hannah Gadai (704)-516-5170

Table 4. Project Background Information					
Project Name	Little Sebastian				
County	Surry				
Project Area (acres)	25.91				
Project Coordinates (latitude and longitude)	36.40, -80.86				
Planted Acreage (Acres of Woody Stems Planted)	10.7				
Project Watershed Summary Information					
Physiographic Province	45e - Northern Inner Piedmont				
River Basin	Yadkin				
USGS Hydrologic Unit 8-digit	03040101	USGS Hydrologic Unit 14-digit	03040101080020		
DWR Sub-basin	03-04-01				
Project Drainage Area (Acres and Square Miles)	3,261 acres (5.1 sq mi)				
Project Drainage Area Percentage of Impervious Area	<1%				
Reach Summary Information					
Parameters	**JN2-A**	**JN2-B**	**JN2-C**	**JN2-D**	**JN3-A**
Length of reach (linear feet)	418	187	1114	189	350
Valley confinement (Confined, moderately confined, unconfined)	UC	MC	MC	MC	UC
Drainage area (Acres)	10	17	37	38	956
Perennial, Intermittent, Ephemeral	I	P	P	P	P
Parameters	**JN3-B**	**MC1-A**	**MC1-B**	**MC1-C**	**MC3-A/B/C**
Length of reach (linear feet)	1043	469	977	555	859
Valley confinement (Confined, moderately confined, unconfined)	C	UC	UC	UC	UC
Drainage area (Acres)	999	1862	1915	2921	3225
Perennial, Intermittent, Ephemeral	P	P	P	P	P
Parameters	**MC3-D**	**BS1-A/C/E**	**BS1-B/D**	**JN7**	
Length of reach (linear feet)	395	1029	352	37	
Valley confinement (Confined, moderately confined, unconfined)	UC	C	C	UC	
Drainage area (Acres)	3262	12-29	14-28	30	
Perennial, Intermittent, Ephemeral	P	I/P	P	I	

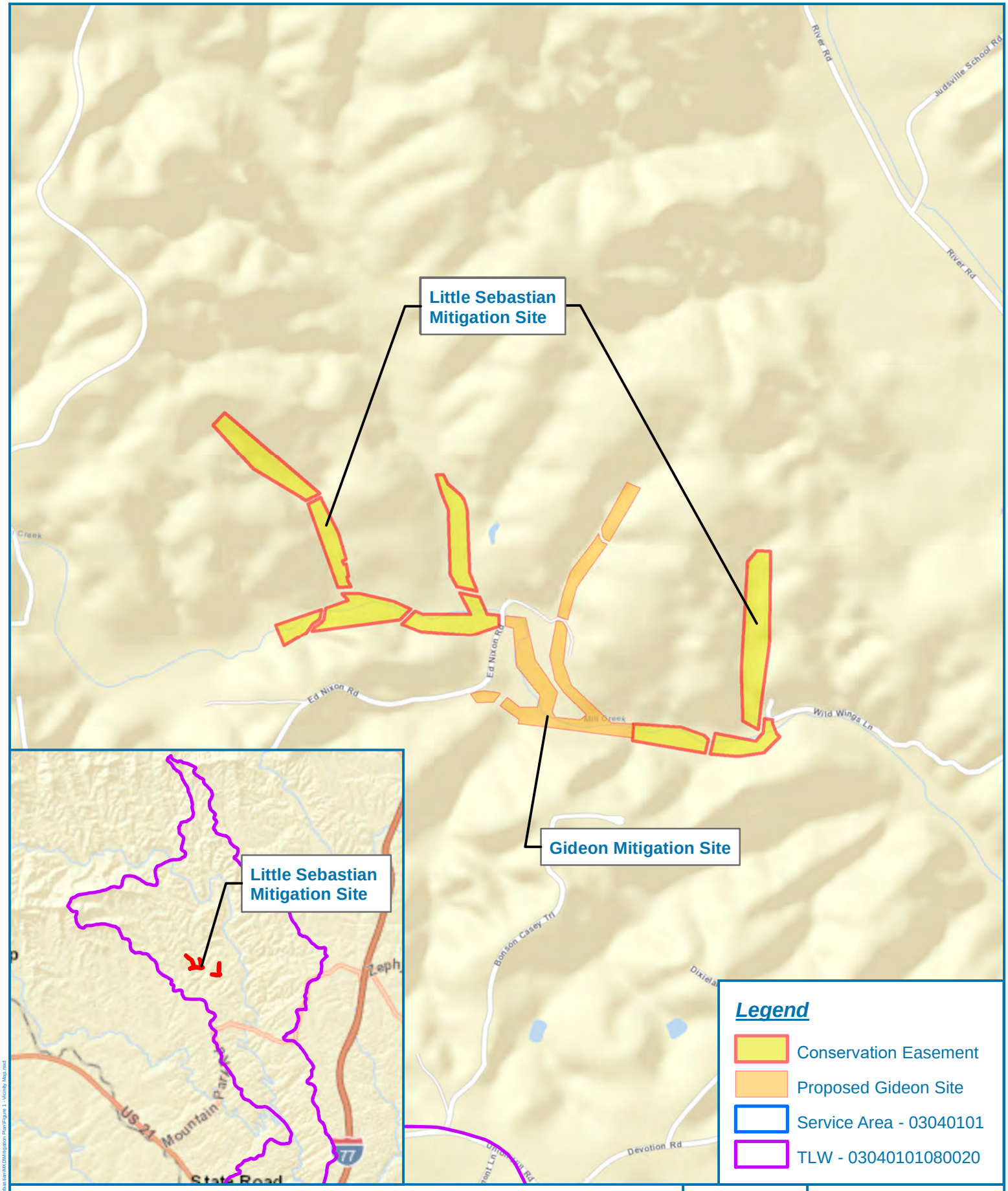


Figure 1 - Site Location Map

Little Sebastian Mitigation Site

Surry County, North Carolina

Date: 10/30/2018

Drawn by: MDE

Checked by: ATP

res

Document Path: S:\IBRES GIS\Projects\NC\Little Sebastian\MXD\Mitigation Plan\Figure 1 - Vicinity Map.mxd

Appendix B

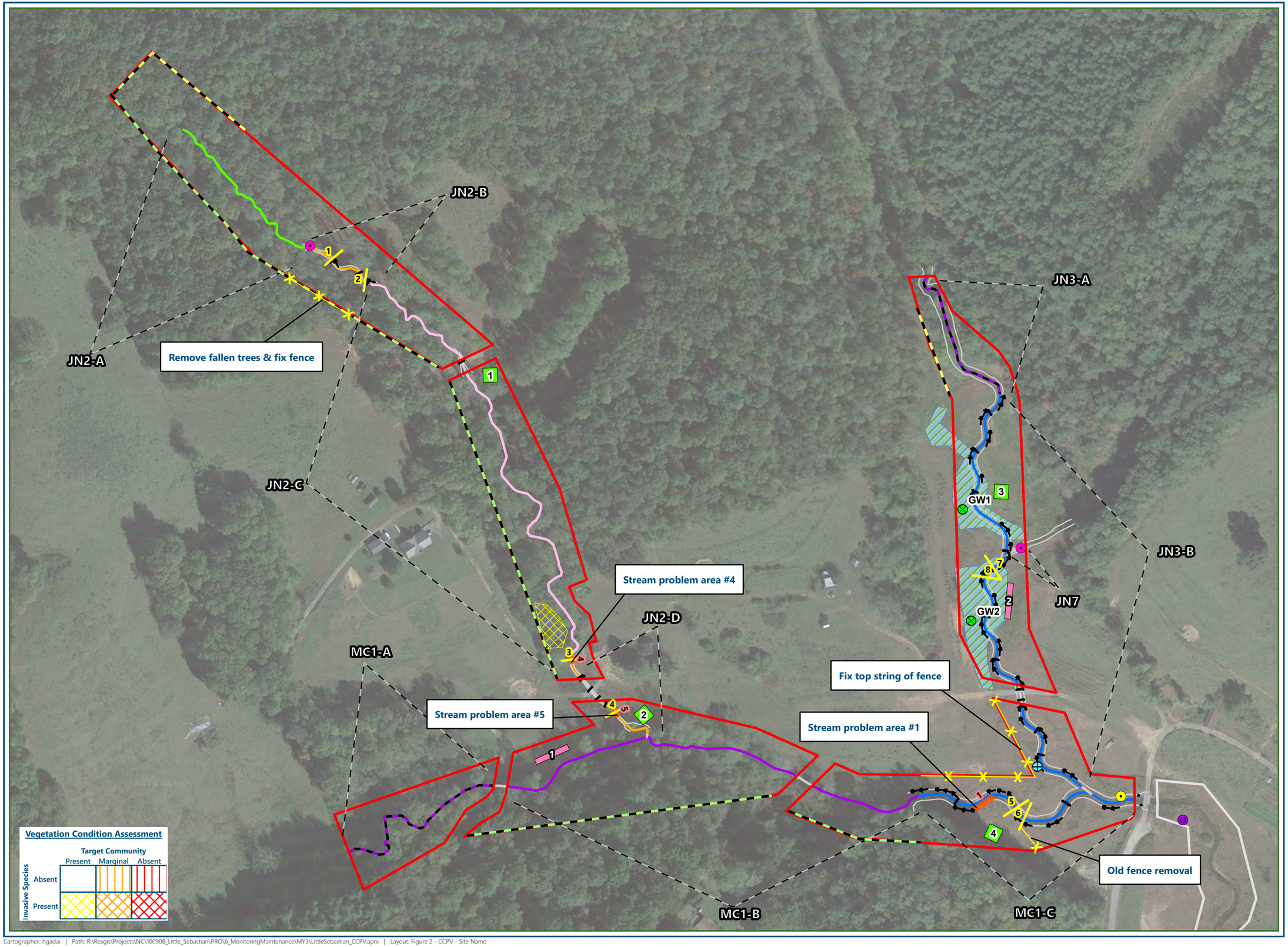
Visual Assessment

Data

Figure 2
Current Conditions Plan View

MY3 2023

Little Sebastian
Surry County, North Carolina
80.8623°W 36.3987°N



- Conservation Easement
- Gideon Bank Site
- Fixed Veg Plot >320 Stems/Ac.
- Random Vegetation Plot
- Supplemental Planting (March 2023)
- Invasive Area
- Existing Wetland
- Cross Section
- Stream Repair Needed (2023)
- Fence Maintenance Needed

Stream Mitigation
- Restoration
- Enhancement I
- Enhancement II
- Enhancement II (5:1)
- Enhancement II (7.5:1)
- Enhancement II (10:1)
- Preservation
- No Credit
- Structure

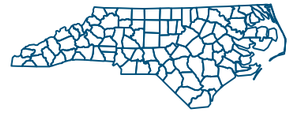
Easement Signage
- Additional Signage Added (2023)
- Needs Additional Signage (2023)
- Groundwater Well
- Stage Recorder
- Flow Camera
- Flow Gauge
- Ambient

N

1 in = 200 ft
when printed at 11x17"

0 100 200
Feet

Reference: This information is not to be used as final legal boundaries.
Imagery Source: Google Maps,
Spatial Reference:
NAD 1983 StatePlane North Carolina FIPS 3200 Feet
Date Exported: 2/26/2024



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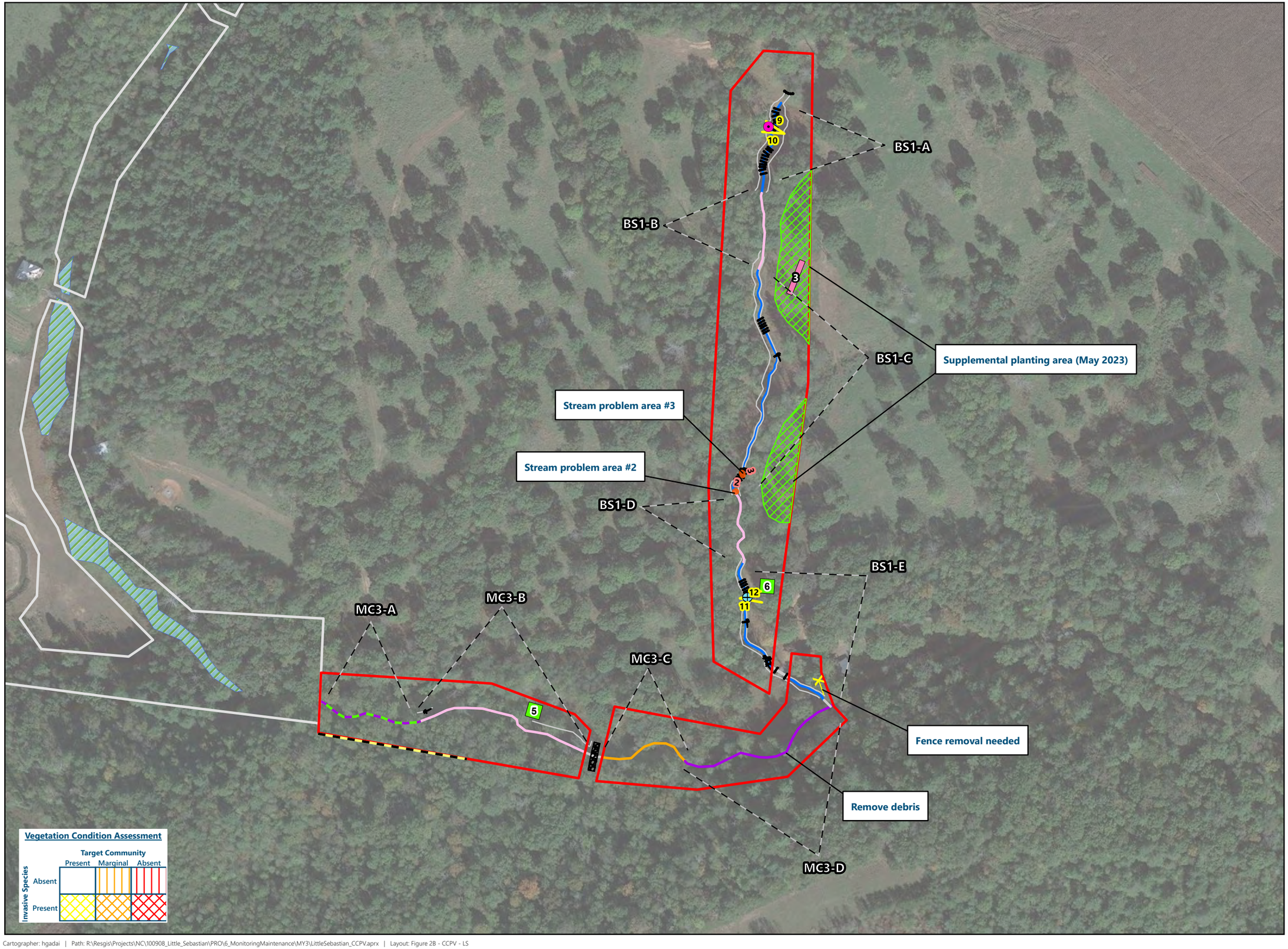
www.res.us

Figure 2
Current Conditions Plan View
MY3 2023

Little Sebastian
Surry County, North Carolina
80.8523°W 36.3958°N



- Conservation Easement
- Gideon Bank Site
- Fixed Veg Plot >320 Stems/Ac.
- Random Vegetation Plot
- Supplemental Planting (March 2023)
- Existing Wetland
- Cross Section
- Stream Repair Needed (2023)
- Fence Maintenance Needed

Stream Mitigation
- Restoration
- Enhancement I
- Enhancement II
- Enhancement II (5:1)
- Enhancement II (7.5:1)
- Enhancement II (10:1)
- Preservation
- No Credit
- Structure

Easement Signage
- Additional Signage Added (2023)
- Needs Additional Signage (2023)

LS Stream Gauges
- Stage Recorder
- Flow Camera
- Flow Gauge

N

1 in = 1,460,000 ft
when printed at 11x17"

0 100 200
Feet

Reference: This information is not to be used as final legal boundaries.
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Spatial Reference:
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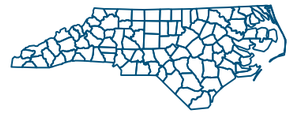
Date Exported: 2/26/2024



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Visual Stream Stability Assessment

Assessment Date: 10/31/2023

Reach JN3

Assessed Stream Length 1043

Assessed Bank Length 2086

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
Totals					0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	10	10		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	18	18		100%

Visual Stream Stability Assessment

Assessment Date: 10/31/2023

Reach	MC1-C
Assessed Stream Length	555
Assessed Bank Length	1110

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			10	99%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			10	99%
Totals					20	98%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	2	2		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	6	7		86%

Visual Stream Stability Assessment

Assessment Date: 10/31/2023

Reach	BS1
Assessed Stream Length	1123
Assessed Bank Length	2246

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			10	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			10	100%
Totals					20	99%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	7	8		88%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	3	3		100%

Visual Stream Stability Assessment

Assessment Date: 10/31/2023

Reach	JN2
Assessed Stream Length	383
Assessed Bank Length	766

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
Totals					0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	9	9		100%
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	2	2		100%

Visual Stream Stability Assessment

Assessment Date: 10/31/2023

Reach	MC3
Assessed Stream Length	214
Assessed Bank Length	428

Major Channel Category		Metric	Number Stable, Performing as Intended	Total Number in As-built	Amount of Unstable Footage	% Stable, Performing as Intended
Bank	**Surface Scour/Bare Bank**	Bank lacking vegetative cover resulting simply from poor growth and/or surface scour			0	100%
	Toe Erosion	Bank toe eroding to the extent that bank failure appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	100%
	Bank Failure	Fluvial and geotechnical - rotational, slumping, calving, or collapse			0	100%
Totals					0	100%
Structure	**Grade Control**	Grade control structures exhibiting maintenance of grade across the sill.	0	0		NA
	Bank Protection	Bank erosion within the structures extent of influence does not exceed 15%. (See guidance for this table in DMS monitoring guidance document)	0	0		NA

Table 6 Vegetation Condition Assessment

Assessment Date: 10/31/2023

Planted Acreage[1] **10.7**

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	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		0.00	0.0%
3. Areas of Poor Growth Rates or Vigor	Areas with woody stems of a size class that are obviously small given the monitoring year.	0.25 acres	Orange Simple Hatch	0	0.00	0.0%
			Cumulative Total		0.00	0.0%

Easement Acreage[2] **25.91**

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	1	0.10	0.4%
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 spcies are those with the potential to directly outcompete native, young, woody stems in the short-term (e.g. monitoring period or shortly thereafter) or affect the community structure for existing, more established tree/shrub stands over timeframes that are slightly longer (e.g. 1-2 decades). The low/moderate concern group are those species that generally do not have this capacity over the timeframes discussed and therefore are not expected to be mapped with regularity, but can be mapped, if in the judgement of the observer their coverage, density or distribution is suppressing the viability, density, or growth of planted woody stems. Decisions as to whether remediation will be needed are based on the integration of risk factors by EEP such as species present, their coverage, distribution relative to native biomass, and the practicality of treatment. For example, even modest amounts of Kudzu or Japanese Knotweed early in the projects history will warrant control, but potentially large coverages of Microstegium in the herb layer will not likley trigger control because of the limited capacities to impact tree/shrub layers within the timeframes discussed and the potential impacts of treating extensive amounts of ground cover. Those species with the "watch list" designator in gray shade are of interest as well, but have yet to be observed across the state with any frequency. Those in *red italics* are of particular interest given their extreme risk/threat level for mapping as points where isolated specimens are found, particularly ealry in a projects monitoring history. However, areas of discreet, dense patches will of course be mapped as polygons. The symbology scheme below was one that was found to be helpful for symbolzing invasives polygons, particulalry for situations where the conditon for an area is somewhere between isolated specimens and dense, discreet patches. In any case, the point or polygon/area feature can be symbolized to describe things like high or low concern and species can be listed as a map inset, in legend items if the number of species are limited or in the narrative section of the executive summary.

Little Sebastian MY3 Vegetation Monitoring Plot Photos

Vegetation Plot 1 (10/31/2023)

Vegetation Plot 2 (10/31/2023)

Vegetation Plot 3 (10/31/2023)

Vegetation Plot 4 (10/31/2023)

Vegetation Plot 5 (10/31/2023)

Vegetation Plot 6 (10/31/2023)

Random Vegetation Plot 1 (10/31/2023)

Random Vegetation Plot 2 (10/31/2023)

Random Vegetation Plot 3 (10/31/2023)

Little Sebastian Monitoring Device Photos - October 31, 2023

Flow Gauge JN2-B

Flow Gauge JN7

Flow Gauge BS1-A

Stage Recorder BS1-E

Stage Recorder JN3-B

Groundwater Well 1

Groundwater Well 2

Flow Camera

Little Sebastian Crossing Photos - June 27, 2023 & October 31, 2023

JN2-C (upstream)

JN2-C (downstream)

JN2-D (upstream)

JN2-D (downstream)

JN3-B (upstream)

JN3-B (downstream)

MC1-C (downstream)

MC3-B/C

BS1-E (upstream)

BS1-E (downstream)

Little Sebastian General Photos

Reach JN2-A (June 27, 2023)

Reach MC3-B (October 31, 2023)

Easement Markers (June 27, 2023)

Easement Markers (October 31, 2023)

Supplemental Planting (March 28, 2023)

Supplemental Planting (March 28, 2023)

Bankfull Event MC1-C (June 20, 2023)

Right Bank Erosion & Brush Toe Failure
on MC1-C / Stream Problem Area #1 (10/31/2023)

Right Bank Erosion BS1-C / Stream Problem
Area #2 (11/7/2023)

Failing Log Sill BS1-C / Stream Problem
Area #3 (10/31/2023)

Appendix C

Vegetation Plot

Data

Table 7. Planted Species Summary

Common Name	Scientific Name	Mit Plan %	As-Built %	Total Stems Planted
Willow Oak	*Quercus phellos*	15	15	1,600
River Birch	*Betula nigra*	15	15	1,600
Sycamore	*Platanus occidentalis*	10	15	1,600
Water Oak	*Quercus nigra*	15	14	1,600
Northern Red Oak	*Quercus rubra*	10	11	1,200
Yellow Poplar	*Liriodendron tulipifera*	10	10	1,100
Green Ash	*Fraxinus pennsylvanica*	10	5	600
Persimmon	*Diospyros virginiana*	5	5	600
Buttonbush	*Cephalanthus occidentalis*	0	5	600
Sugarberry	*Celtis laevigata*	0	5	600
Elderberry	*Sambucus canadensis*	5	0	0
Nyssa sylvatica	*Blackgum*	5	0	0
			Total	11,100
			Planted Area	10.7
			As-built Planted Stems/Acre	1,037

Table 8. Vegetation Plot Mitigation Success Summary

Wetland/Stream Vegetation Totals (per acre)					
Plot #	Planted Stems/Acre	Volunteer Stems/Acre	Total Stems/Acre	Success Criteria Met?	Average Planted Stem Height (ft)
1	769	162	931	Yes	3.7
2	971	121	1093	Yes	4.5
3	1093	121	1214	Yes	5.2
4	1133	202	1335	Yes	2.1
5	769	121	890	Yes	4.9
6	607	81	688	Yes	3.1
R1	607	0	607	Yes	4.9
R2	688	0	688	Yes	5.3
R3	526	0	526	Yes	4.2
Project Avg	**796**	**135**	**886**	Yes	**4.2**

Table 9. Stem Count Total and Planted by Plot Species

Little Sebastian			Current Plot Data (MY3 2023)																										
			100027-01-0001			100027-01-0002			100027-01-0003			100027-01-0004			100027-01-0005			100027-01-0006			R1			R2			R3		
Scientific Name	Common Name	Species Type	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			2			2			1															
Betula nigra	river birch	Tree	6	6	7				4	4	4				5	5	5				1	1	1	6	6	6			
Celtis laevigata	sugarberry	Tree																1	1	1									
Cephalanthus occidentali	common buttonbush	Shrub	5	5	5	4	4	5				1	1	1				1	1	1	1	1	1						
Diospyros virginiana	common persimmon	Tree				1	1	1						1				4	4	4	1	1	1						
Fraxinus pennsylvanica	green ash	Tree													2	2	2	1	1	1				2	2	2			
Hamamelis virginiana	American witchhazel	Tree									1																		
Liriodendron tulipifera	tuliptree	Tree	2	2	3				1	1	1	1	1	1						2							3	3	3
Nyssa sylvatica	black tupelo	Tree																									2	2	2
Pinus	pine	Tree												2															
Platanus occidentalis	American sycamore	Tree	3	3	3	6	6	6	15	15	15	8	8	9	5	5	5	2	2	2	7	7	7	6	6	6			
Quercus alba	white oak	Tree																									1	1	1
Quercus nigra	water oak	Tree	1	1	1	2	2	2	2	2	2	3	3	3	3	3	3	2	2	2	2	2	2						
Quercus phellos	willow oak	Tree				5	5	5	4	4	4	14	14	14	1	1	3	3	3	3	1	1	1	2	2	2	4	4	4
Quercus rubra	northern red oak	Tree	2	2	2	6	6	6	1	1	1	1	1	1	3	3	4	1	1	1	2	2	2	1	1	1	2	2	2
Salix caroliniana	black willow	Tree																									1	1	1
		Stem count	19	19	23	24	24	27	27	27	30	28	28	33	19	19	22	15	15	17	15	15	15	17	17	17	13	13	13
		size (ares)	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		
		Species count	6	6	7	6	6	7	6	6	8	6	6	9	6	6	6	8	8	9	7	7	7	5	5	5	6	6	6
		Stems per ACRE	769	769	931	971	971	1093	1093	1093	1214	1133	1133	1335	769	769	890	607	607	688	607	607	607	688	688	688	526	526	526

Little Sebastian			Annual Means											
			MY3 (2023)			MY2 (2022)			MY1 (2021)			MY0 (2021)		
Scientific Name	Common Name	Species Type	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T	PnoLS	P-all	T
Acer rubrum	red maple	Tree			7									
Betula nigra	river birch	Tree	22	22	23	22	22	22	22	22	22	18	18	18
Celtis laevigata	sugarberry	Tree	1	1	1	1	1	1	3	3	3	4	4	4
Cephalanthus occidentali	common buttonbush	Shrub	12	12	13	13	13	13	12	12	12	26	26	26
Diospyros virginiana	common persimmon	Tree	6	6	7	4	4	4	3	3	3	7	7	7
Fraxinus pennsylvanica	green ash	Tree	5	5	5	3	3	3	4	4	4	9	9	9
Hamamelis virginiana	American witchhazel	Tree			1									
Liriodendron tulipifera	tuliptree	Tree	7	7	10	10	10	10	8	8	8	11	11	11
Nyssa sylvatica	black tupelo	Tree	2	2	2									
Pinus	pine	Tree			2									
Platanus occidentalis	American sycamore	Tree	52	52	53	57	57	57	53	53	53	53	53	53
Quercus alba	white oak	Tree	1	1	1									
Quercus nigra	water oak	Tree	15	15	15	15	15	15	13	13	13	29	29	29
Quercus phellos	willow oak	Tree	34	34	36	38	38	38	48	48	48	53	53	53
Quercus rubra	northern red oak	Tree	19	19	20	20	20	20	20	20	20	37	37	37
Salix caroliniana	black willow	Tree	1	1	1									
		Stem count	177	177	197	183	183	183	186	186	186	247	247	247
		size (ares)	9			9			9			9		
		size (ACRES)	0.22			0.22			0.22			0.22		
		Species count	13	13	16	10	10	10	10	10	10	10	10	10
		Stems per ACRE	796	796	886	832	832	832	845	845	845	1123	1123	1123

Appendix D

Stream Measurement and Geomorphology Data

Table 10. Baseline Stream Data Summary
Little Sebastian Mitigation Site - Reach JN-3

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)		---	---	---	14.9	16.4	--	17.9	---	2	7.1	12.3	--	17.5	---	2	---	16.0	---	---	---	15.0	---	---	1
Floodprone Width (ft)					37.0	48.5	--	60.0	---	2	>30	51.3	--	72.5	---	2	---	>50	---	---	---	>64.4	---	---	1
Bankfull Mean Depth (ft)		---	---	---	1.6	1.7	--	1.6	---	2	1.0	1.3	--	1.6	---	2	---	2.2	---	---	---	---	---	---	---
[1]Bankfull Max Depth (ft)					2.1	3.0	--	3.9	---	2	1.2	1.9	--	2.6	---	2	---	2.9	---	---	---	2.2	---	---	1
Bankfull Cross Sectional Area (ft^2)		---	---	---	26.1	27.3	--	28.5	---	2	6.7	17.2	--	27.7	---	2	---	26.9	---	---	---	22.8	---	---	1
Width/Depth Ratio					8.5	9.9	--	11.2	---	2	7.4	9.3	--	11.1	---	2	---	9.5	---	---	---	---	---	---	---
Entrenchment Ratio					2.5	3.0	--	3.4	---	2	>4	4.2	--	4.3	---	2	---	>2.2	---	---	---	>4.3	---	---	1
[1]Bank Height Ratio					1.0	1.2	--	1.3	---	2	1.0	1.2	--	1.3	---	2	---	1.0	---	---	---	1.0	---	---	1
Profile																									
Riffle Length (ft)					---	---	---	---	---	---	5.6	---	---	17	---	---	7	---	29	14	25	22	48	10	18
Riffle Slope (ft/ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.43	2.605	2.735	5.1	1.23176	18
Pool Length (ft)					---	---	---	---	---	---	4	---	---	16	---	---	4	---	18	19	35	34	55	10	17
Pool Max depth (ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pool Spacing (ft)					---	---	---	---	---	---	26	---	---	68	---	---	29	---	75	38	59	59	78	11	15
Pattern																									
Channel Beltwidth (ft)					---	---	---	---	---	---	20	---	---	85	---	---	39	---	94	39	---	---	94	---	---
Radius of Curvature (ft)					---	---	---	---	---	---	7	---	---	54	---	---	14	---	60	14	---	---	60	---	---
Rc:Bankfull width (ft/ft)					---	---	---	---	---	---	0.9	---	---	3.7	---	---	0.9	---	3.7	0.9	---	---	3.7	---	---
Meander Wavelength (ft)					---	---	---	---	---	---	33	---	---	105	---	---	74	---	116	74	---	---	116	---	---
Meander Width Ratio					---	---	---	---	---	---	2.4	---	---	5.9	---	---	2.4	---	5.9	2.4	---	---	5.9	---	---
Transport parameters																									
Reach Shear Stress (competency) lb/f^2					---												---			---					
Max part size (mm) mobilized at bankfull					---												---			---					
Stream Power (transport capacity) W/m^2					---												---			---					
Additional Reach Parameters																									
Rosgen Classification					E3						E3/E4b						E3			E3					
Bankfull Velocity (fps)		---	---	---	---						---						---			---					
Bankfull Discharge (cfs)		---	---	---	---												---			---					
Valley length (ft)					602						160						945			945					
Channel Thalweg length (ft)					772						189						1088			1088					
Sinuosity (ft)					1.225						1.195						1.15			1.15					
Water Surface Slope (Channel) (ft/ft)					---						---						---			---					
Channel slope (ft/ft)					0.0125						1.85						0.0085			0.0085					
[3]Bankfull Floodplain Area (acres)					---						---						---			---					
[4]% of Reach with Eroding Banks					---						---														
Channel Stability or Habitat Metric					---						---														
Biological or Other					---						---														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10. Baseline Stream Data Summary
Little Sebastian Mitigation Site - Reach MC1-C

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Dimension and Substrate - Riffle Only																									
Bankfull Width (ft)		---	---	---	---	---	17.4	---	---	1	7.1	12.3	--	17.5	---	2	---	23.0	---	---	---	21.3	---	---	1
Floodprone Width (ft)					---	---	50.0	---	---	1	>30	51.3	--	72.5	---	2	---	>50	---	---	---	>64.9	---	---	1
Bankfull Mean Depth (ft)		---	---	---	---	---	1.8	---	---	1	1.0	1.3	--	1.6	---	2	---	2.4	---	---	---	---	---	---	---
[1]Bankfull Max Depth (ft)					---	---	2.9	---	---	1	1.2	1.9	--	2.6	---	2	---	3.2	---	---	---	3.2	---	---	1
Bankfull Cross Sectional Area (ft^2)		---	---	---	---	---	30.6	---	---	1	6.7	17.2	--	27.7	---	2	---	54.4	---	---	---	49.8	---	---	1
Width/Depth Ratio					---	---	10.0	---	---	1	7.4	9.3	--	11.1	---	2	---	9.7	---	---	---	---	---	---	---
Entrenchment Ratio					---	---	2.9	---	---	1	>4	4.2	--	4.3	---	2	---	>2.2	---	---	---	>3	---	---	1
[1]Bank Height Ratio					---	---	1.0	---	---	1	1.0	1.2	--	1.3	---	2	---	1.0	---	---	---	1.0	---	---	1
Profile																									
Riffle Length (ft)					---	---	---	---	---	---	5.6	---	---	17	---	---	10	---	41	14	25	18	61	17	7
Riffle Slope (ft/ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.19	2.32	1.35	4.8	1.89753	7
Pool Length (ft)					---	---	---	---	---	---	4	---	---	16	---	---	6	---	25	36	51	48	73	12	6
Pool Max depth (ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pool Spacing (ft)					---	---	---	---	---	---	26	---	---	68	---	---	41	---	108	65	81	73	109	19	5
Pattern																									
Channel Beltwidth (ft)					---	---	---	---	---	---	20	---	---	85	---	---	56	---	135	56	---	---	135	---	---
Radius of Curvature (ft)					---	---	---	---	---	---	7	---	---	54	---	---	21	---	86	21	---	---	86	---	---
Rc:Bankfull width (ft/ft)					---	---	---	---	---	---	0.9	---	---	3.7	---	---	1	---	4	1	---	---	4	---	---
Meander Wavelength (ft)					---	---	---	---	---	---	33	---	---	105	---	---	106	---	167	106	---	---	167	---	---
Meander Width Ratio					---	---	---	---	---	---	2.4	---	---	5.9	---	---	2	---	6	2	---	---	6	---	---
Transport parameters																									
Reach Shear Stress (competency) lb/f^2					---												---			---					
Max part size (mm) mobilized at bankfull					---												---			---					
Stream Power (transport capacity) W/m^2					---												---			---					
Additional Reach Parameters																									
Rosgen Classification					E3						E3/E4b						E3			E3					
Bankfull Velocity (fps)		---	---	---	---						---						---			---					
Bankfull Discharge (cfs)		---	---	---	---												---			---					
Valley length (ft)					1109						160						478			478					
Channel Thalweg length (ft)					1288						189						542			542					
Sinuosity (ft)					1.16						1.195						1.13			1.13					
Water Surface Slope (Channel) (ft/ft)					---						---						---			---					
Channel slope (ft/ft)					0.008						1.85						0.0085			0.0085					
[3]Bankfull Floodplain Area (acres)					---						---						---			---					
[4]% of Reach with Eroding Banks					---						---														
Channel Stability or Habitat Metric					---						---														
Biological or Other					---						---														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Table 10. Baseline Stream Data Summary
Little Sebastian Mitigation Site - Reach BS-1

Parameter	Gauge[2]	Regional Curve			Pre-Existing Condition						Reference Reach(es) Data						Design			Monitoring Baseline					
Dimension and Substrate - Riffle Only		LL	UL	Eq.	Min	Mean	Med	Max	SD[5]	n	Min	Mean	Med	Max	SD[5]	n	Min	Med	Max	Min	Mean	Med	Max	SD[5]	n
Bankfull Width (ft)		---	---	---	---	---	3.2	---	---	1	7.1	12.3	--	17.5	---	2	---	4.5	---	5.7	6.0	---	6.3	---	2
Floodprone Width (ft)					---	---	60.0	---	---	1	>30	51.3	--	72.5	---	2	---	---	---	11.3	17.6	---	23.8	---	2
Bankfull Mean Depth (ft)		---	---	---	---	---	1.6	---	---	1	1.0	1.3	--	1.6	---	2	---	0.6	---	---	---	---	---	---	---
[1]Bankfull Max Depth (ft)					---	---	3.9	---	---	1	1.2	1.9	--	2.6	---	2	---	0.7	---	0.7	0.9	---	1.1	---	2
Bankfull Cross Sectional Area (ft^2)		---	---	---	---	---	2.4	---	---	1	6.7	17.2	--	27.7	---	2	---	2.7	---	2.6	3.3	---	4.0	---	2
Width/Depth Ratio					---	---	4.2	---	---	1	7.4	9.3	--	11.1	---	2	---	7.4	---	---	---	---	---	---	---
Entrenchment Ratio					---	---	3.4	---	---	1	>4	4.2	--	4.3	---	2	---	>1.4	---	2.0	2.9	---	3.8	---	2
[1]Bank Height Ratio					---	---	1.0	---	---	1	1.0	1.2	--	1.3	---	2	---	1.0	---	1.0	1.0	---	1.0	---	2
Profile																									
Riffle Length (ft)					---	---	---	---	---	---	5.6	---	---	17	---	---	4.0	---	11	4	16	16	32	8	19
Riffle Slope (ft/ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.1	5.9	5.0	14.5	3.7	19
Pool Length (ft)					---	---	---	---	---	---	4	---	---	16	---	---	2.0	---	7	11	18	15	43	8	17
Pool Max depth (ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pool Spacing (ft)					---	---	---	---	---	---	26	---	---	68	---	---	5.0	---	20	21	34	33	63	10	17
Pattern																									
Channel Beltwidth (ft)					---	---	---	---	---	---	20	---	---	85	---	---	13.0	---	19.0	13.0	---	---	19.0	---	---
Radius of Curvature (ft)					---	---	---	---	---	---	7	---	---	54	---	---	4.0	---	10.0	4.0	---	---	10.0	---	---
Rc:Bankfull width (ft/ft)					---	---	---	---	---	---	0.9	---	---	3.7	---	---	1.0	---	2.0	1.0	---	---	2.0	---	---
Meander Wavelength (ft)					---	---	---	---	---	---	33	---	---	105	---	---	21.0	---	32.0	21.0	---	---	32.0	---	---
Meander Width Ratio					---	---	---	---	---	---	2.4	---	---	5.9	---	---	3.0	---	4.0	3.0	---	---	4.0	---	---
Transport parameters																									
Reach Shear Stress (competency) lb/f^2					---												---			---					
Max part size (mm) mobilized at bankfull					---												---			---					
Stream Power (transport capacity) W/m^2					---												---			---					
Additional Reach Parameters																									
Rosgen Classification					B4a						E3/E4b						B4/E4			B4/E4					
Bankfull Velocity (fps)		---	---	---	---						---						---			---					
Bankfull Discharge (cfs)		---	---	---	---												---			---					
Valley length (ft)					1508						160						1017			1017					
Channel Thalweg length (ft)					1703						189						1028			1028					
Sinuosity (ft)					1.13						1.195						1.01			1.01					
Water Surface Slope (Channel) (ft/ft)					---						---						---			---					
Channel slope (ft/ft)					0.049						1.85						0.025-0.035			0.025-0.035					
[3]Bankfull Floodplain Area (acres)					---						---						---			---					
[4]% of Reach with Eroding Banks					---						---														
Channel Stability or Habitat Metric					---						---														
Biological or Other					---						---														

Shaded cells indicate that these will typically not be filled in.

1 = The distributions for these parameters can include information from both the cross-section measurements and the longitudinal profile. 2 = For projects with a proximal USGS gauge in-line with the project reach (added bankfull verification - rare).

3. Utilizing XS measurement data produce an estimate of the bankfull floodplain area in acres, which should be the area from the top of bank to the toe of the terrace riser/slope.

4 = Proportion of reach exhibiting banks that are eroding based on the visual survey for comparison to monitoring data; 5. Of value/needed only if the n exceeds 3

Appendix D. Table 11 - Monitoring Data - Dimensional Morphology Summary (Dimensional Parameters – Cross Sections)

Project Name/Number: Little Sebastian #100027

	Cross Section 1 (Riffle)							Cross Section 2 (Riffle)							Cross Section 3 (Riffle)							Cross Section 4 (Riffle)							Cross Section 5 (Riffle)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1214.7	1214.8	1214.8	1214.7				1211.2	1211.3	1211.4	1211.3				1170.7	1170.7	1170.7	1170.4				1165.0	1164.9	1165.0	1164.9				1150.6	1150.7	1150.8	1150.8			
Bankfull Width (ft)[1]	5.4	5.1	5.5	5.2				5.4	5.6	5.7	5.9				5.3	5.8	5.6	4.8				9.0	8.8	8.5	4.7				21.3	21.0	21.3	21.1			
Floodprone Width (ft)[1]	13.1	11.2	11.5	12.6				8.7	8.8	9.4	9.4				>34.8	>34.1	>33.5	34.3				>43.9	>43.2	>43.9	>49				>64.9	>65.1	>65	>65			
Bankfull Max Depth (ft)[2]	0.7	1.0	1.2	0.9				0.5	0.8	0.9	1.0				1.0	1.1	1.0	1.5				0.9	0.8	0.8	1.3				3.2	3.1	3.0	3.1			
Low Bank Elevation (ft)	1214.74	1215.0	1215.2	1214.8				1211.2	1211.6	1211.7	1211.8				1170.7	1170.8	1170.7	1170.7				1165.0	1164.8	1164.9	1164.7				1150.6	1150.6	1150.7	1150.7			
Bankfull Cross Sectional Area (ft^2)[2]	2.4	4.1	4.9	2.9				2.3	4.1	4.3	5.7				3.5	4.3	3.8	4.9				3.5	2.6	2.4	2.9				49.8	48.2	47.2	46.3			
Bankfull Entrenchment Ratio[1]	2.4	2.2	2.1	2.4				1.6	1.6	1.7	1.6				>6.6	>5.9	>5.9	7.2				>4.9	>4.9	>5.2	>10.5				>3.0	>3.1	>3.1	>3.1			
Bankfull Bank Height Ratio[1]	1.0	1.4	1.5	1.1				1.0	1.5	1.6	1.8				1.0	1.1	1.1	1.2				1.0	0.9	0.9	0.9				1.0	1.0	1.0	0.9			

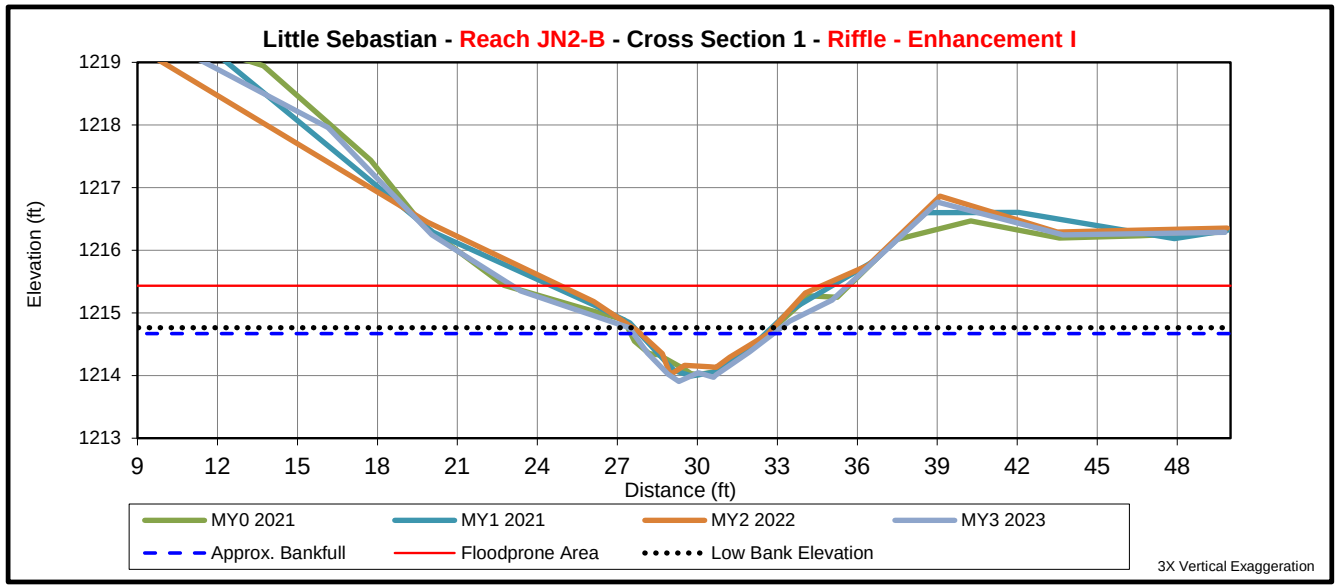
	Cross Section 6 (Pool)							Cross Section 7 (Riffle)							Cross Section 8 (Pool)							Cross Section 9 (Pool)							Cross Section 10 (Riffle)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1150.5	1150.6	1150.7	1150.7				1157.4	1157.3	1157.4	1157.4				1157.2	1157.2	1157.3	1157.6				1188.3	1188.4	1188.4	1188.4				1187.6	1187.6	1187.6	1187.6			
Bankfull Width (ft)[1]	-	-	-	-				15.0	15.0	14.9	15.1				-	-	-	-				-	-	-	-				6.3	7.1	7.7	7.1			
Floodprone Width (ft)[1]	-	-	-	-				>64.4	>64.7	>64.3	>64.4				-	-	-	-				-	-	-	-				23.8	23.5	23.3	21.8			
Bankfull Max Depth (ft)[2]	4.1	4.1	4.0	4.1				2.2	2.4	2.5	2.6				3.6	4.2	4.3	4.2				1.0	0.9	1.1	1.0				1.1	1.0	1.1	1.0			
Low Bank Elevation (ft)	-	-	-	-				1157.4	1157.4	1157.4	1157.6				-	-	-	-				-	-	-	-				1187.6	1187.5	1187.6	1187.6			
Bankfull Cross Sectional Area (ft^2)[2]	56.7	56.4	54.2	53.3				22.8	24.4	23.5	26.5				34.8	34.0	32.5	30.9				3.6	3.0	3.7	3.5				4.0	3.4	4.2	4.3			
Bankfull Entrenchment Ratio[1]	-	-	-	-				>4.3	>4.3	>4.3	>4.3				-	-	-	-				-	-	-	-				3.8	3.3	3.0	3.1			
Bankfull Bank Height Ratio[1]	-	-	-	-				1.0	1.0	1.0	1.1				-	-	-	-				-	-	-	-				1.0	0.9	1.0	1.0			

	Cross Section 11 (Riffle)							Cross Section 12 (Pool)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1136.4	1136.4	1136.5	1136.5				1136.1	1136.2	1136.3	1136.4			
Bankfull Width (ft)[1]	5.7	6.5	6.5	6.0				-	-	-	-			
Floodprone Width (ft)[1]	11.3	11.3	11.9	12.1				-	-	-	-			
Bankfull Max Depth (ft)[2]	0.7	0.7	0.7	0.8				1.2	0.9	1.0	0.8			
Low Bank Elevation (ft)	1136.4	1136.5	1136.4	1136.5				-	-	-	-			
Bankfull Cross Sectional Area (ft^2)[2]	2.6	3.0	2.3	2.5				4.6	4.1	3.5	2.5			
Bankfull Entrenchment Ratio[1]	2.0	1.7	1.8	2.0				-	-	-	-			
Bankfull Bank Height Ratio[1]	1.0	1.1	0.9	1.0				-	-	-	-			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

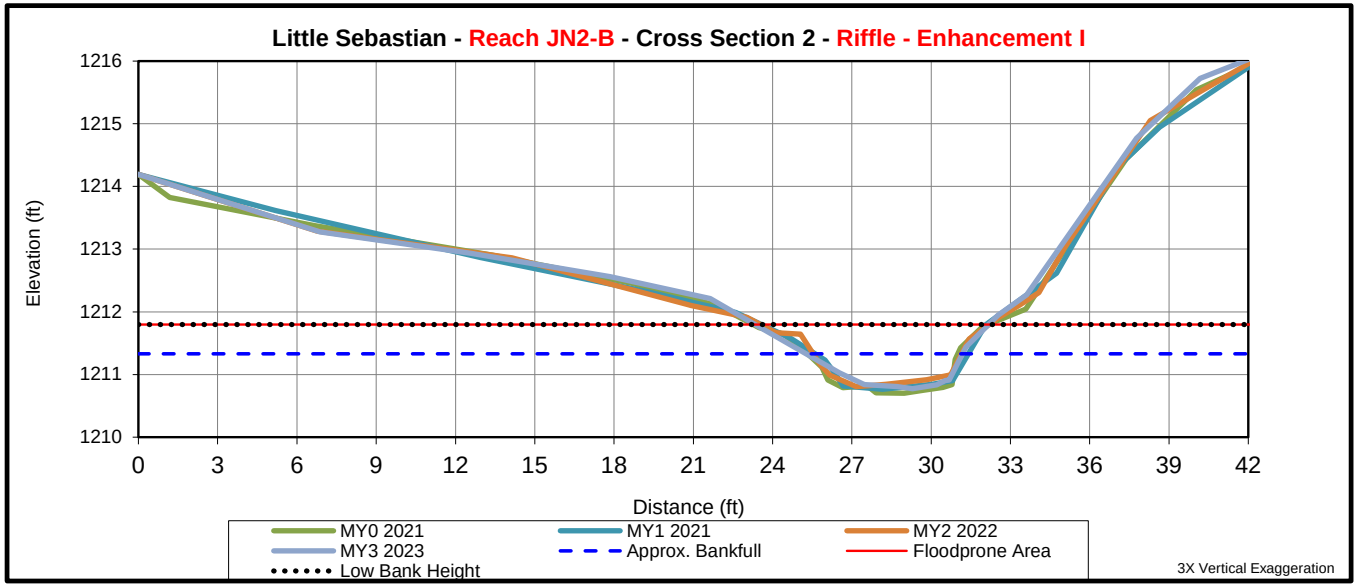


	Cross Section 1 (Riffle)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1214.7	1214.8	1214.8	1214.7			
Bankfull Width (ft)[1]	5.4	5.1	5.5	5.2			
Floodprone Width (ft)[1]	13.1	11.2	11.5	12.6			
Bankfull Max Depth (ft)[2]	0.7	1.0	1.2	0.9			
Low Bank Elevation (ft)	1214.74	1215.0	1215.2	1214.8			
Bankfull Cross Sectional Area (ft^2)[2]	2.4	4.1	4.9	2.9			
Bankfull Entrenchment Ratio[1]	2.4	2.2	2.1	2.4			
Bankfull Bank Height Ratio[1]	1.0	1.4	1.5	1.1			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

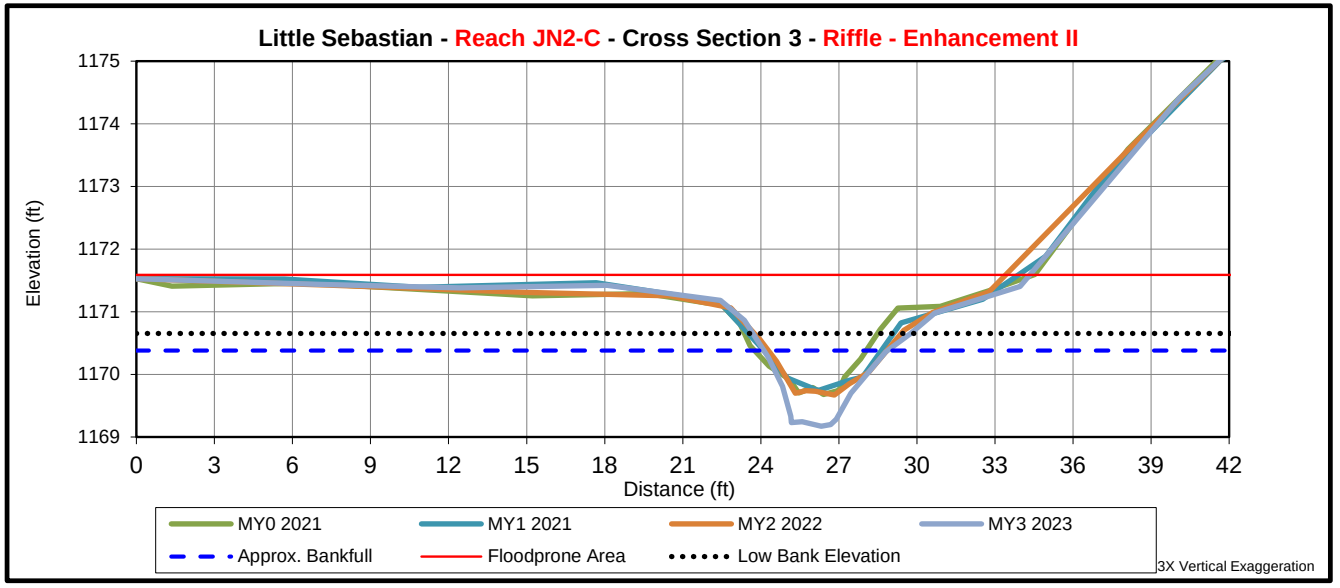


	Cross Section 2 (Riffle)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1211.2	1211.3	1211.4	1211.3			
Bankfull Width (ft)[1]	5.4	5.6	5.7	5.9			
Floodprone Width (ft)[1]	8.7	8.8	9.4	9.4			
Bankfull Max Depth (ft)[2]	0.5	0.8	0.9	1.0			
Low Bank Elevation (ft)	1211.2	1211.6	1211.7	1211.8			
Bankfull Cross Sectional Area (ft^2)[2]	2.3	4.1	4.3	5.7			
Bankfull Entrenchment Ratio[1]	1.6	1.6	1.7	1.6			
Bankfull Bank Height Ratio[1]	1.0	1.5	1.6	1.8			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

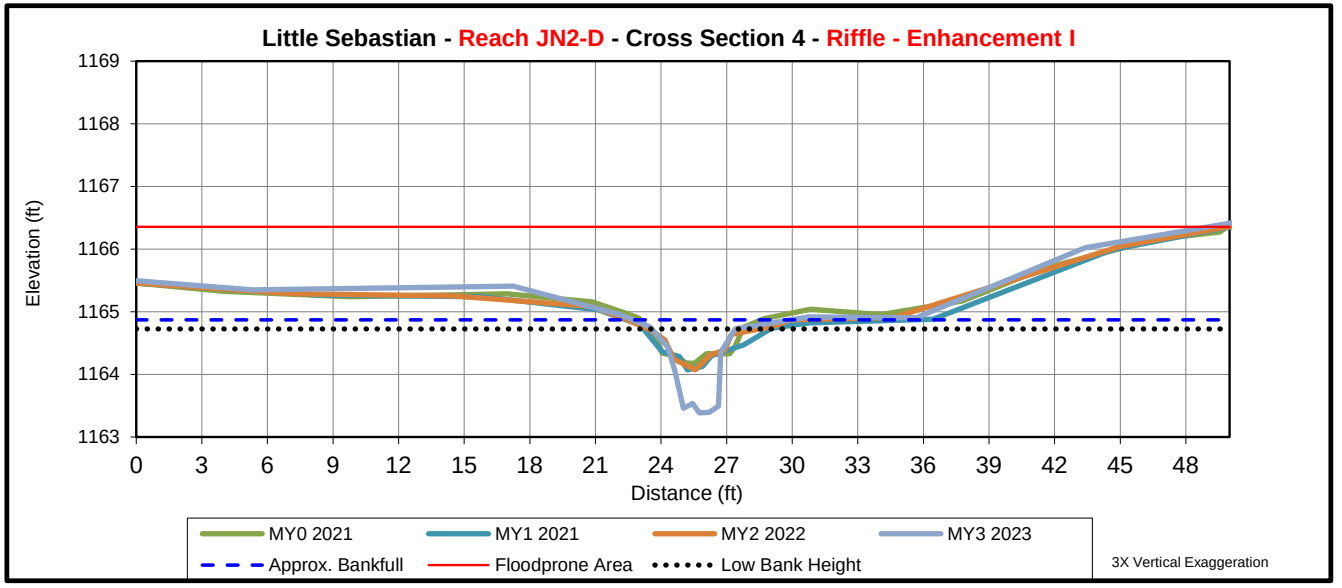


	Cross Section 3 (Riffle)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1170.7	1170.7	1170.7	1170.4			
Bankfull Width (ft)[1]	5.3	5.8	5.6	4.8			
Floodprone Width (ft)[1]	>34.8	>34.1	>33.5	34.3			
Bankfull Max Depth (ft)[2]	1.0	1.1	1.0	1.5			
Low Bank Elevation (ft)	1170.7	1170.8	1170.7	1170.7			
Bankfull Cross Sectional Area (ft^2)[2]	3.5	4.3	3.8	4.9			
Bankfull Entrenchment Ratio[1]	>6.6	>5.9	>5.9	7.2			
Bankfull Bank Height Ratio[1]	1.0	1.1	1.1	1.2			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

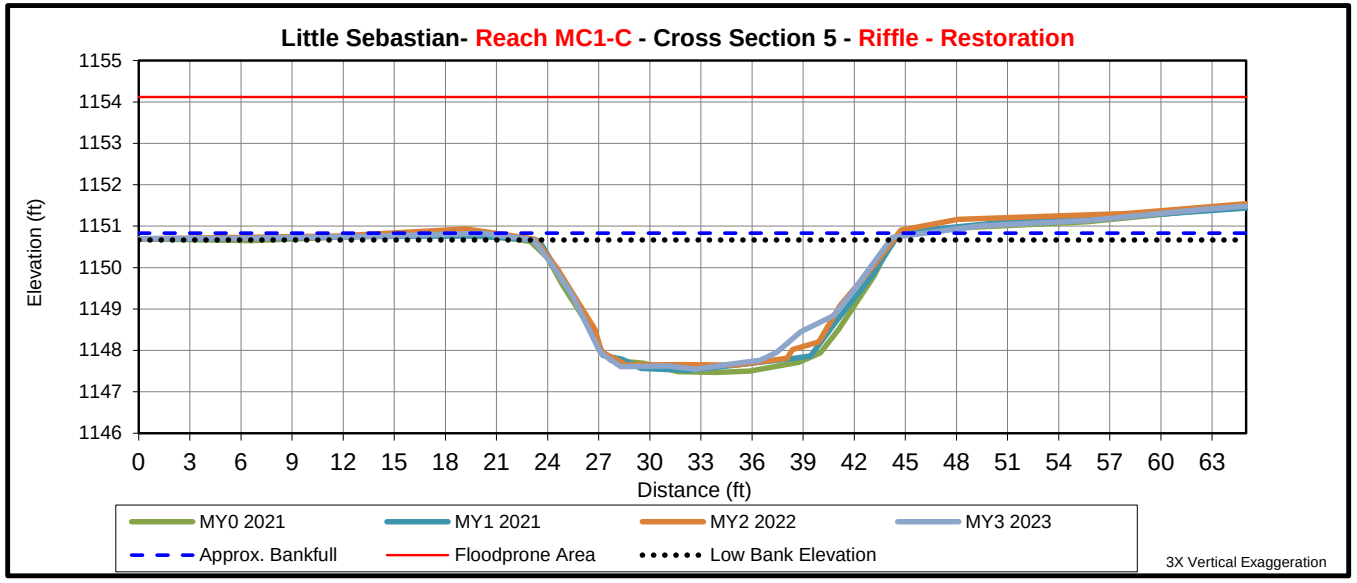


	Cross Section 4 (Riffle)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1165.0	1164.9	1165.0	1164.9			
Bankfull Width (ft)[1]	9.0	8.8	8.5	4.7			
Floodprone Width (ft)[1]	>43.9	>43.2	>43.9	>49			
Bankfull Max Depth (ft)[2]	0.9	0.8	0.8	1.3			
Low Bank Elevation (ft)	1165.0	1164.8	1164.9	1164.7			
Bankfull Cross Sectional Area (ft^2)[2]	3.5	2.6	2.4	2.9			
Bankfull Entrenchment Ratio[1]	>4.9	>4.9	>5.2	>10.5			
Bankfull Bank Height Ratio[1]	1.0	0.9	0.9	0.9			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

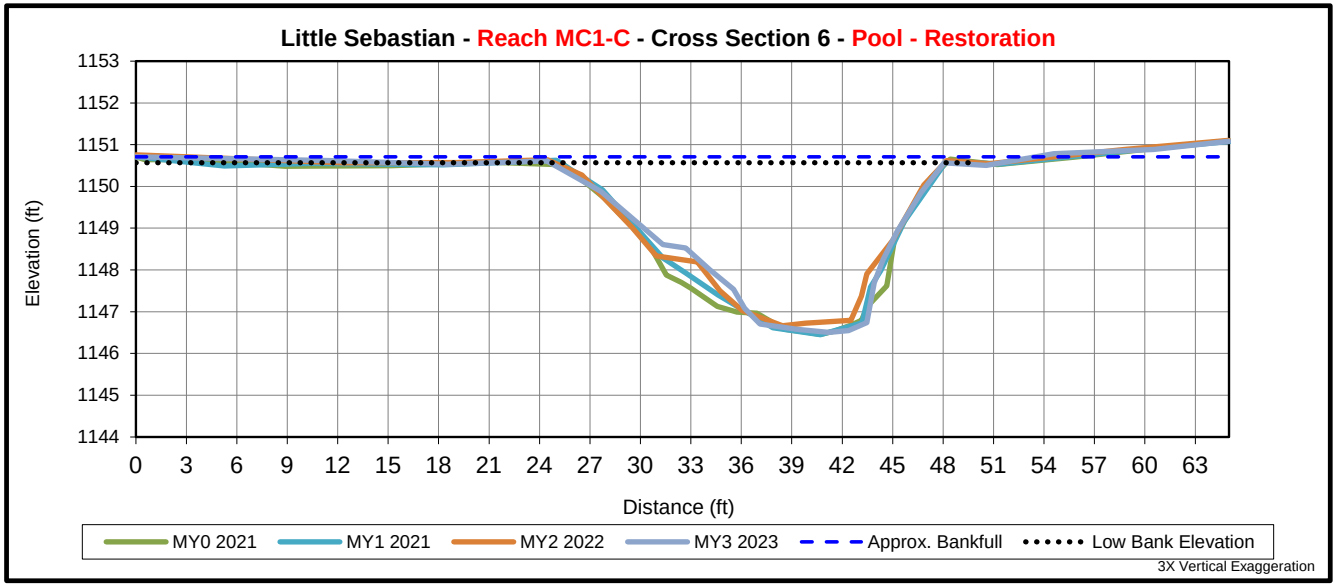


	Cross Section 5 (Riffle)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1150.6	1150.7	1150.8	1150.8			
Bankfull Width (ft)[1]	21.3	21.0	21.3	21.1			
Floodprone Width (ft)[1]	>64.9	>65.1	>65	>65			
Bankfull Max Depth (ft)[2]	3.2	3.1	3.0	3.1			
Low Bank Elevation (ft)	1150.6	1150.6	1150.7	1150.7			
Bankfull Cross Sectional Area (ft^2)[2]	49.8	48.2	47.2	46.3			
Bankfull Entrenchment Ratio[1]	>3.0	>3.1	>3.1	>3.1			
Bankfull Bank Height Ratio[1]	1.0	1.0	1.0	0.9			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

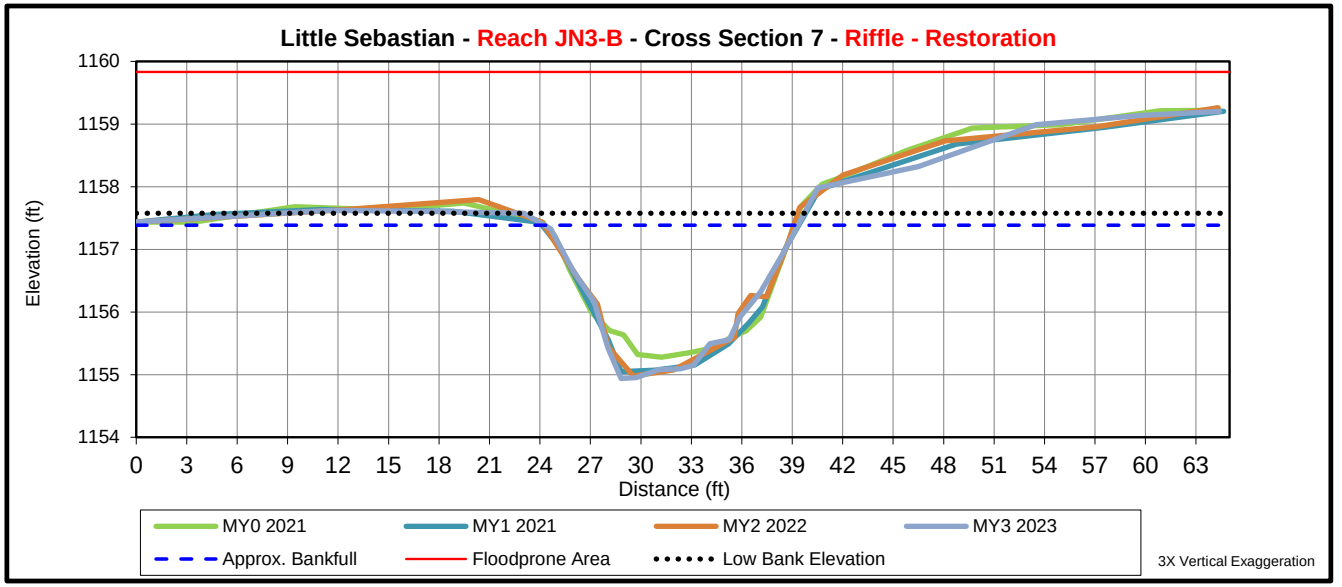


	Cross Section 6 (Pool)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1150.5	1150.6	1150.7	1150.7			
Bankfull Width (ft)[1]	-	-	-	-			
Floodprone Width (ft)[1]	-	-	-	-			
Bankfull Max Depth (ft)[2]	4.1	4.1	4.0	4.1			
Low Bank Elevation (ft)	-	-	-	-			
Bankfull Cross Sectional Area (ft^2)[2]	56.7	56.4	54.2	53.3			
Bankfull Entrenchment Ratio[1]	-	-	-	-			
Bankfull Bank Height Ratio[1]	-	-	-	-			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

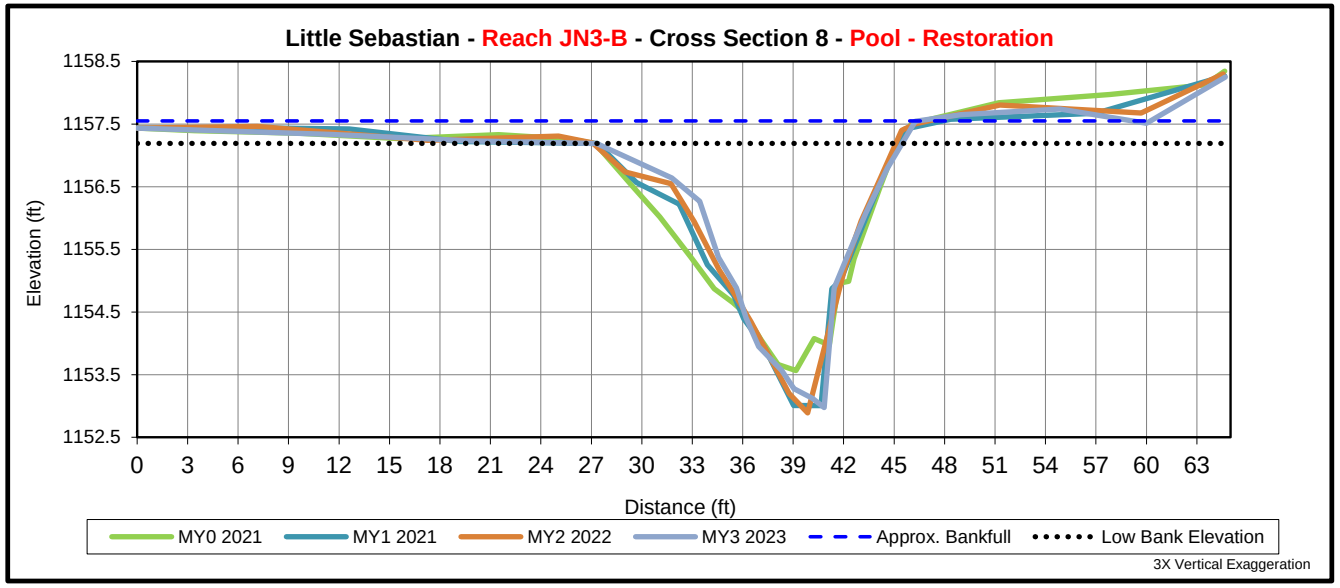


	Cross Section 7 (Riffle)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1157.4	1157.3	1157.4	1157.4			
Bankfull Width (ft)[1]	15.0	15.0	14.9	15.1			
Floodprone Width (ft)[1]	>64.4	>64.7	>64.3	>64.4			
Bankfull Max Depth (ft)[2]	2.2	2.4	2.5	2.6			
Low Bank Elevation (ft)	1157.4	1157.4	1157.4	1157.6			
Bankfull Cross Sectional Area (ft^2)[2]	22.8	24.4	23.5	26.5			
Bankfull Entrenchment Ratio[1]	>4.3	>4.3	>4.3	>4.3			
Bankfull Bank Height Ratio[1]	1.0	1.0	1.0	1.1			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

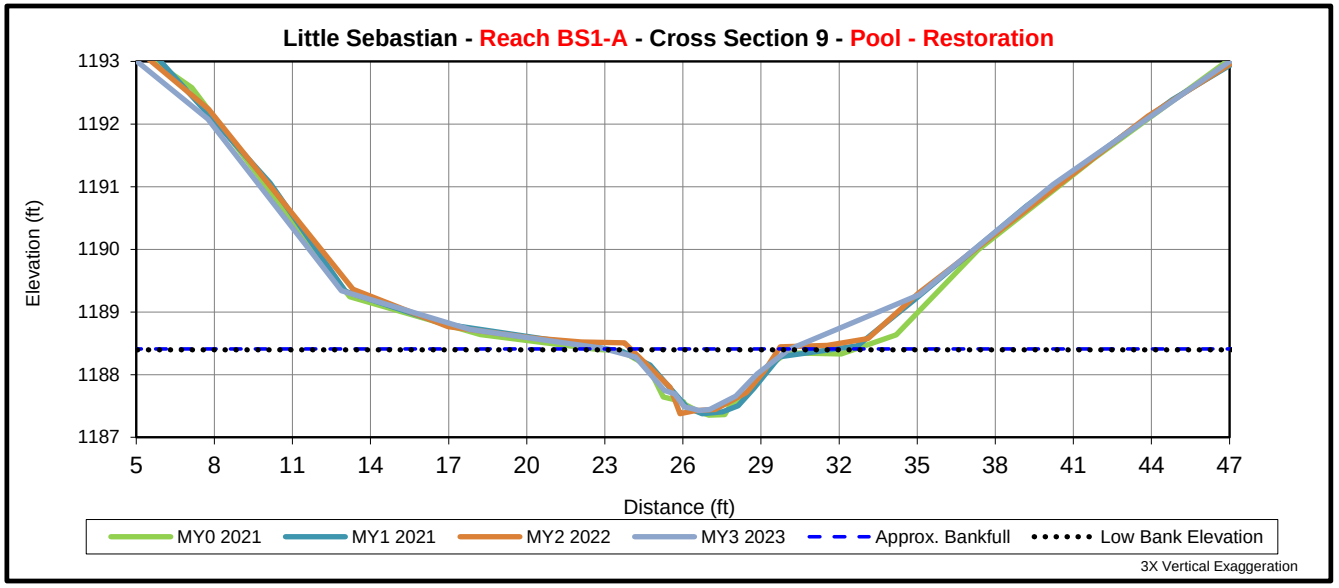


	Cross Section 8 (Pool)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1157.2	1157.2	1157.3	1157.6			
Bankfull Width (ft)[1]	-	-	-	-			
Floodprone Width (ft)[1]	-	-	-	-			
Bankfull Max Depth (ft)[2]	3.6	4.2	4.3	4.2			
Low Bank Elevation (ft)	-	-	-	-			
Bankfull Cross Sectional Area (ft^2)[2]	34.8	34.0	32.5	30.9			
Bankfull Entrenchment Ratio[1]	-	-	-	-			
Bankfull Bank Height Ratio[1]	-	-	-	-			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

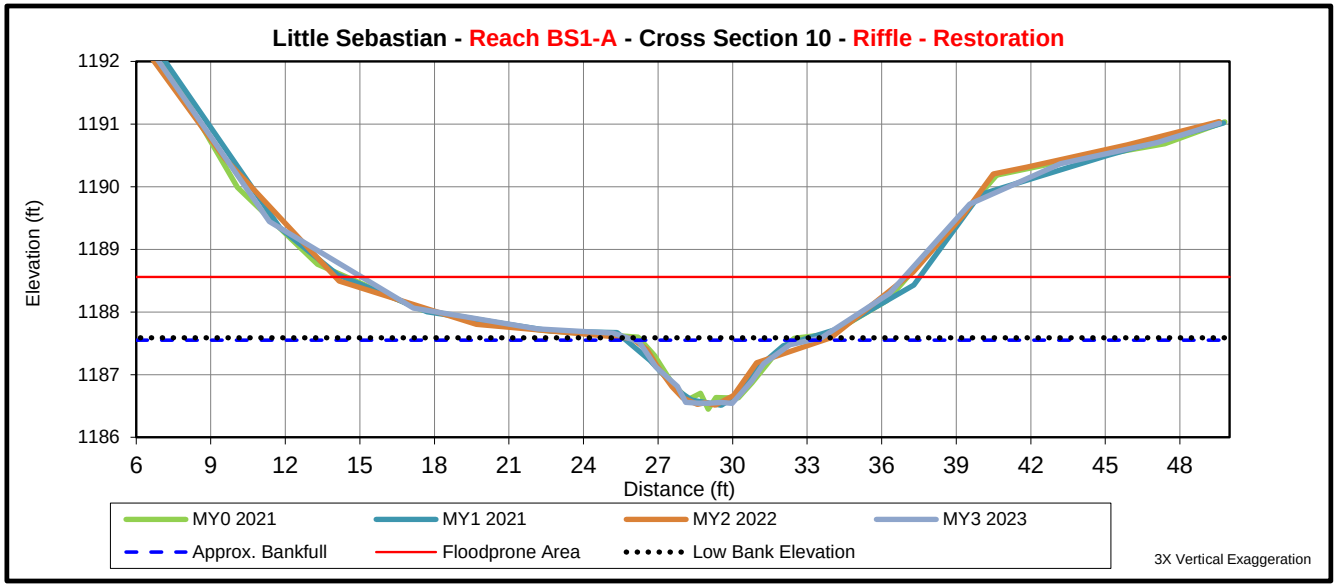


	Cross Section 9 (Pool)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1188.3	1188.4	1188.4	1188.4			
Bankfull Width (ft)[1]	-	-	-	-			
Floodprone Width (ft)[1]	-	-	-	-			
Bankfull Max Depth (ft)[2]	1.0	0.9	1.1	1.0			
Low Bank Elevation (ft)	-	-	-	-			
Bankfull Cross Sectional Area (ft^2)[2]	3.6	3.0	3.7	3.5			
Bankfull Entrenchment Ratio[1]	-	-	-	-			
Bankfull Bank Height Ratio[1]	-	-	-	-			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

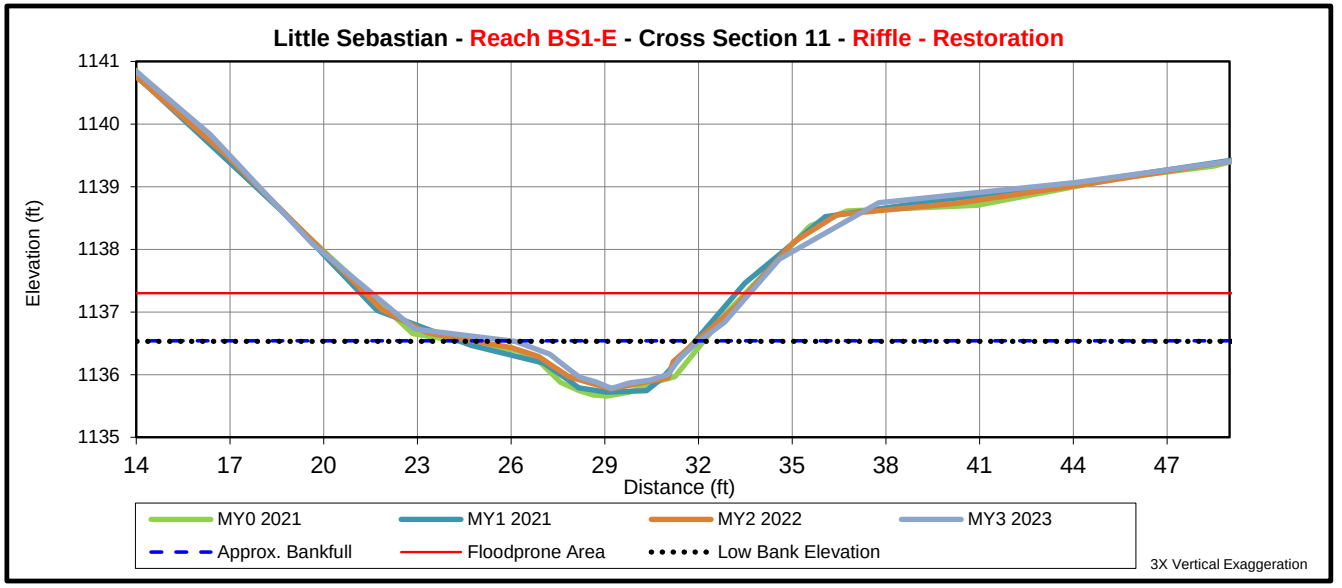


	Cross Section 10 (Riffle)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1187.6	1187.6	1187.6	1187.6			
Bankfull Width (ft)[1]	6.3	7.1	7.7	7.1			
Floodprone Width (ft)[1]	23.8	23.5	23.3	21.8			
Bankfull Max Depth (ft)[2]	1.1	1.0	1.1	1.0			
Low Bank Elevation (ft)	1187.6	1187.5	1187.6	1187.6			
Bankfull Cross Sectional Area (ft^2)[2]	4.0	3.4	4.2	4.3			
Bankfull Entrenchment Ratio[1]	3.8	3.3	3.0	3.1			
Bankfull Bank Height Ratio[1]	1.0	0.9	1.0	1.0			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream

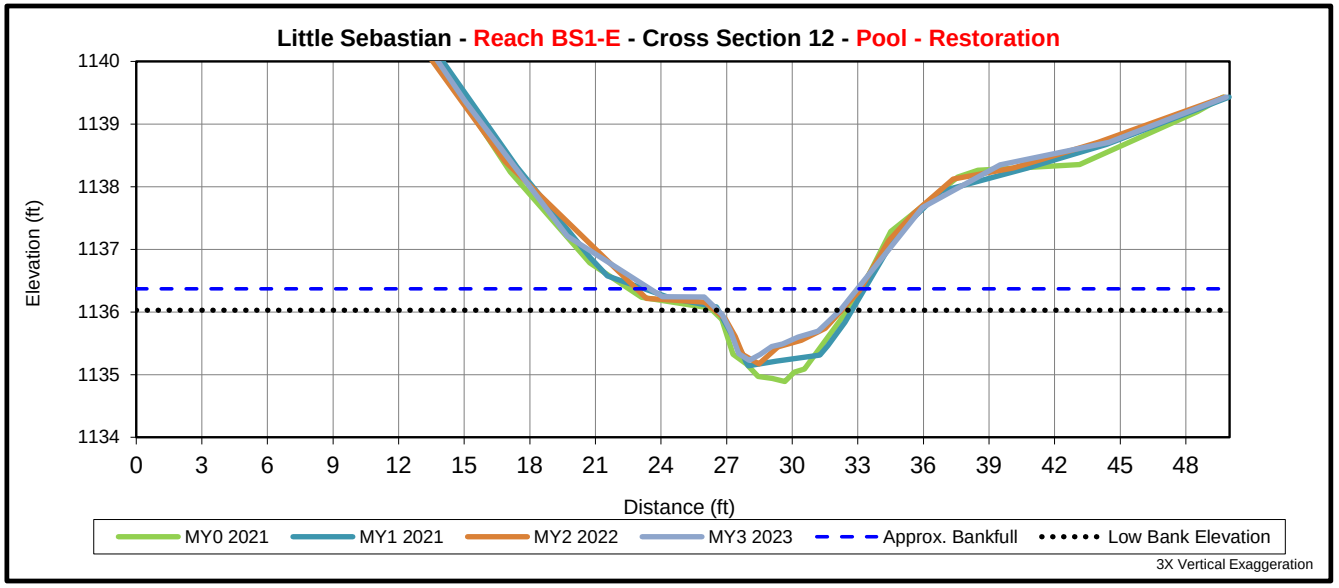


	Cross Section 11 (Riffle)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1136.4	1136.4	1136.5	1136.5			
Bankfull Width (ft)[1]	5.7	6.5	6.5	5.9			
Floodprone Width (ft)[1]	11.3	11.3	11.9	12.1			
Bankfull Max Depth (ft)[2]	0.7	0.7	0.7	0.8			
Low Bank Elevation (ft)	1136.4	1136.5	1136.4	1136.5			
Bankfull Cross Sectional Area (ft^2)[2]	2.6	3.0	2.3	2.5			
Bankfull Entrenchment Ratio[1]	2.0	1.7	1.8	2.1			
Bankfull Bank Height Ratio[1]	1.0	1.1	0.9	1.0			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Upstream

Downstream



	Cross Section 12 (Pool)						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	1136.1	1136.2	1136.3	1136.4			
Bankfull Width (ft)[1]	-	-	-	-			
Floodprone Width (ft)[1]	-	-	-	-			
Bankfull Max Depth (ft)[2]	1.2	0.9	1.0	0.8			
Low Bank Elevation (ft)	-	-	-	-			
Bankfull Cross Sectional Area (ft^2)[2]	4.6	4.1	3.5	2.5			
Bankfull Entrenchment Ratio[1]	-	-	-	-			
Bankfull Bank Height Ratio[1]	-	-	-	-			

1 - Uses the as-built cross sectional area as the basis for adjusting each subsequent years bankfull elevation
2 - Uses the current years low top of bank as the basis for adjusting each subsequent years bankfull elevation

Appendix E

Hydrology

Data

Table 12. Rainfall Summary MY3 2023

Month	Average	Normal Limits		Project Location Precipitation*
		30 Percent	70 Percent	
2022				
November	3.36	1.99	4.08	4.94
December	4.03	2.8	4.79	3.34
2023				
January	3.87	2.59	4.63	4.52
February	3.18	2.18	3.79	3.40
March	3.85	2.66	4.58	2.75
April	4.22	2.67	5.10	7.88
May	4.60	2.93	5.55	4.36
June	4.55	3.17	5.41	7.32
July	5.27	3.86	6.19	5.22
August	4.69	2.58	5.73	4.80
September	4.36	2.50	5.31	7.81
October	3.62	2.41	4.34	0.98
November	3.14	1.65	3.84	1.75
December	3.82	2.63	4.55	0.45
Total Annual **	49.18	43.01	53.24	51.23
Above Normal Limits	Below Normal Limits			

WETS Station: Elkin CRONOS Station is approximately 13 miles south of the site

*Project Location Precipitation is a location-weighted average of surrounding gauged data retrieved by the USACE Antecedent Precipitation Tool. Gauges used include Dobson 2.3 SE, Elkin, Hamptonvile 1.4 NNW, Yadkinville 0.2 E, and Yadkinville 6 E

**Total Annual represents the average total precipitation, annually, as calculated by the 30-year period.

Table 13. Documentation of Geomorphically Significant Flow Events

Year	Bankfull Events	Maximum Bankfull Height (ft)	Estimated Date of Highest Event	
Stage Recorder JN3-B				
MY1 2021	0	N/A	N/A	
MY2 2022	1	0.02	7/9/2022	
MY3 2023	6	0.46	6/20/2023	
Stage Recorder BS1-E				
MY1 2021	0	N/A	N/A	
MY2 2022	0	N/A	N/A	
MY3 2023	1	0.02	6/20/2023	
Year	**Flow Events**	**Maximum Consecutive Flow Days**	**Cummlative Flow Days**	**Consecutive Flow Days**
Flow Gauge BS1-A				
MY1 2021	1	243	243	3/19/2021 - 11/17/2021
MY2 2022	5	119	153	7/6/2022 - 11/2/2022
MY3 2023	1	303	303	1/1/2023 - 10/31/2023
Flow Gauge JN2-B				
MY1 2021	1	243	243	3/19/2021 - 11/17/2021
MY2 2022	1	305	305	1/1/2022 - 11/2/2022
MY3 2023	4	113	294	7/10/2023 - 10/31/2023
Flow Gauge JN7*				
MY2 2022	1	273	273	2/1/2022 - 11/2/2022
MY3 2023	3	186	292	1/1/2023 - 7/6/2023

*Flow Gauge on JN7 was installed on February 1, 2022

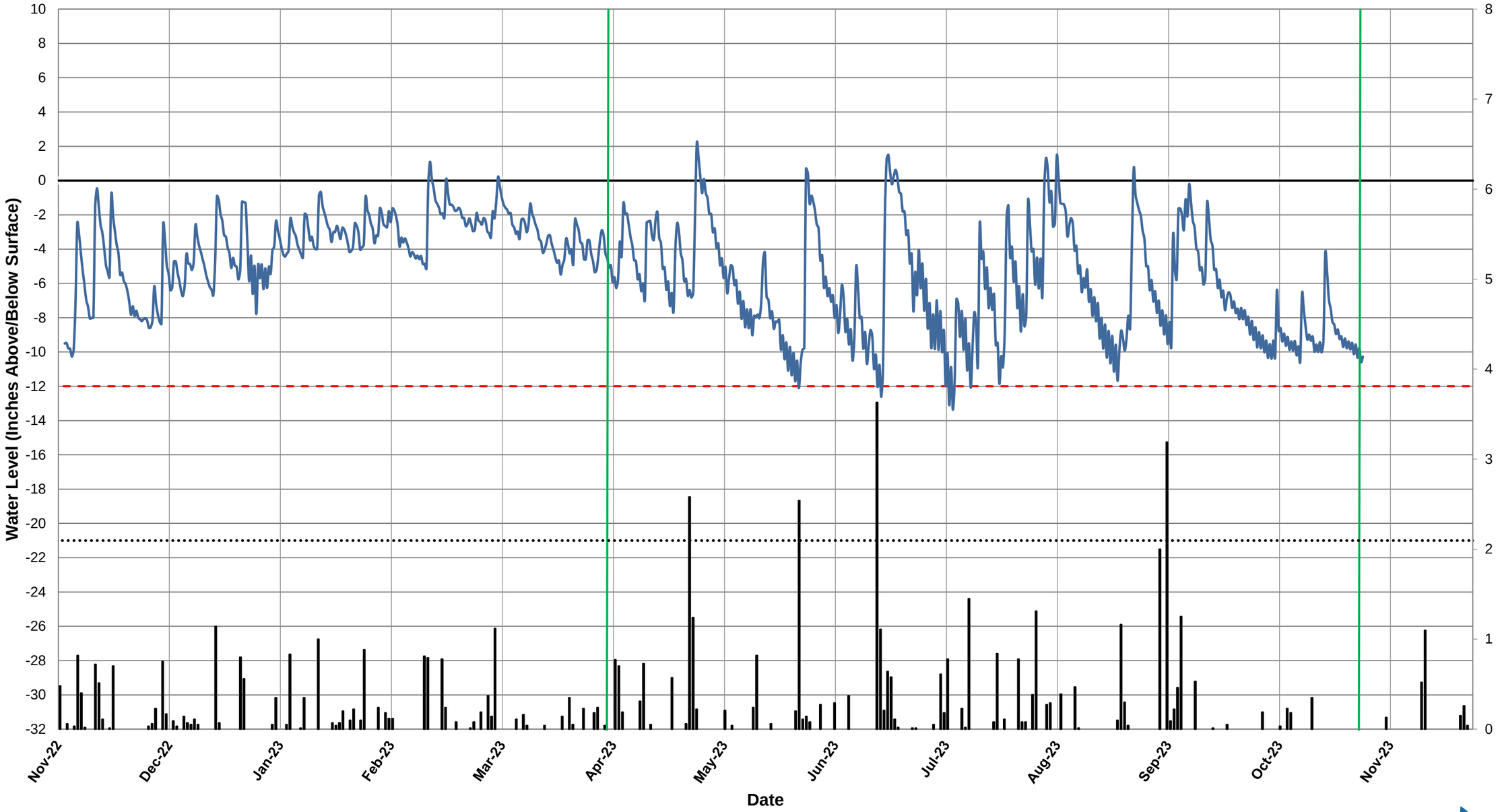
Table 14. 2023 Max Hydroperiod

2023 Max Hydroperiod (Growing Season 3-Apr through 30-Oct, 210 days)					
Well ID	**Consecutive**		**Cumulative**		**Occurrences**
	Days	**Hydroperiod (%)**	**Days**	**Hydroperiod (%)**	
GW1	210	100	210	100	1
GW2	210	100	210	100	1

Table 15. Summary of Groundwater Monitoring Results

Summary of Groundwater Monitoring Results							
Little Sebastian							
Well ID	Hydroperiod (%)						
	Year 1 (2021)	**Year 2 (2022)**	**Year 3 (2023)**	**Year 4 (2024)**	**Year 5 (2025)**	**Year 6 (2026)**	**Year 7 (2027)**
GW1	41	15	100				
GW2	100	100	100				

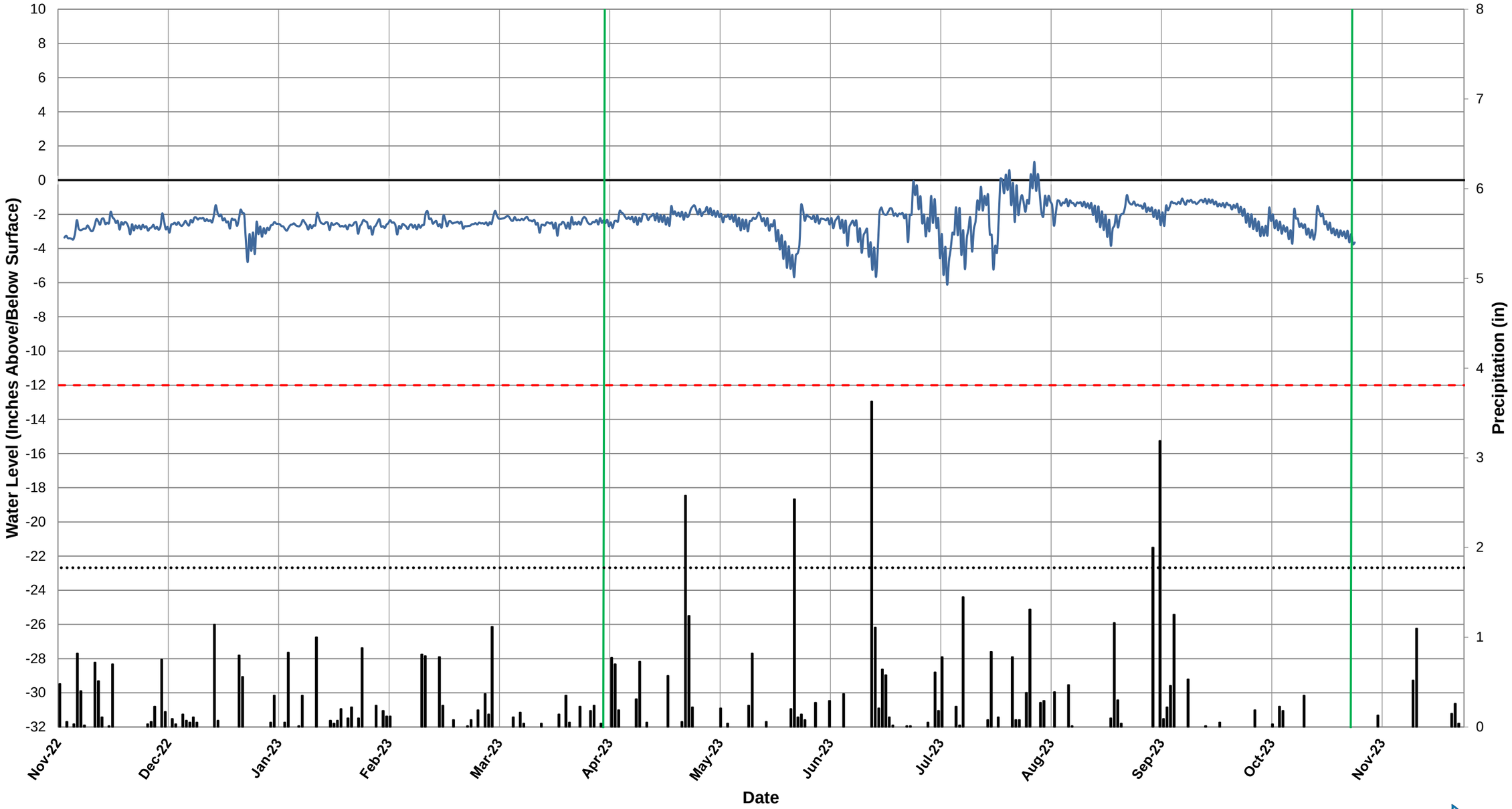
MY3 Little Sebastian GW1



210 Consecutive Days of Hydrology
04/03/2023 - 10/30/2023

Daily Precip (in) | GW1 | Growing Season Start | Growing Season End | Logger Depth

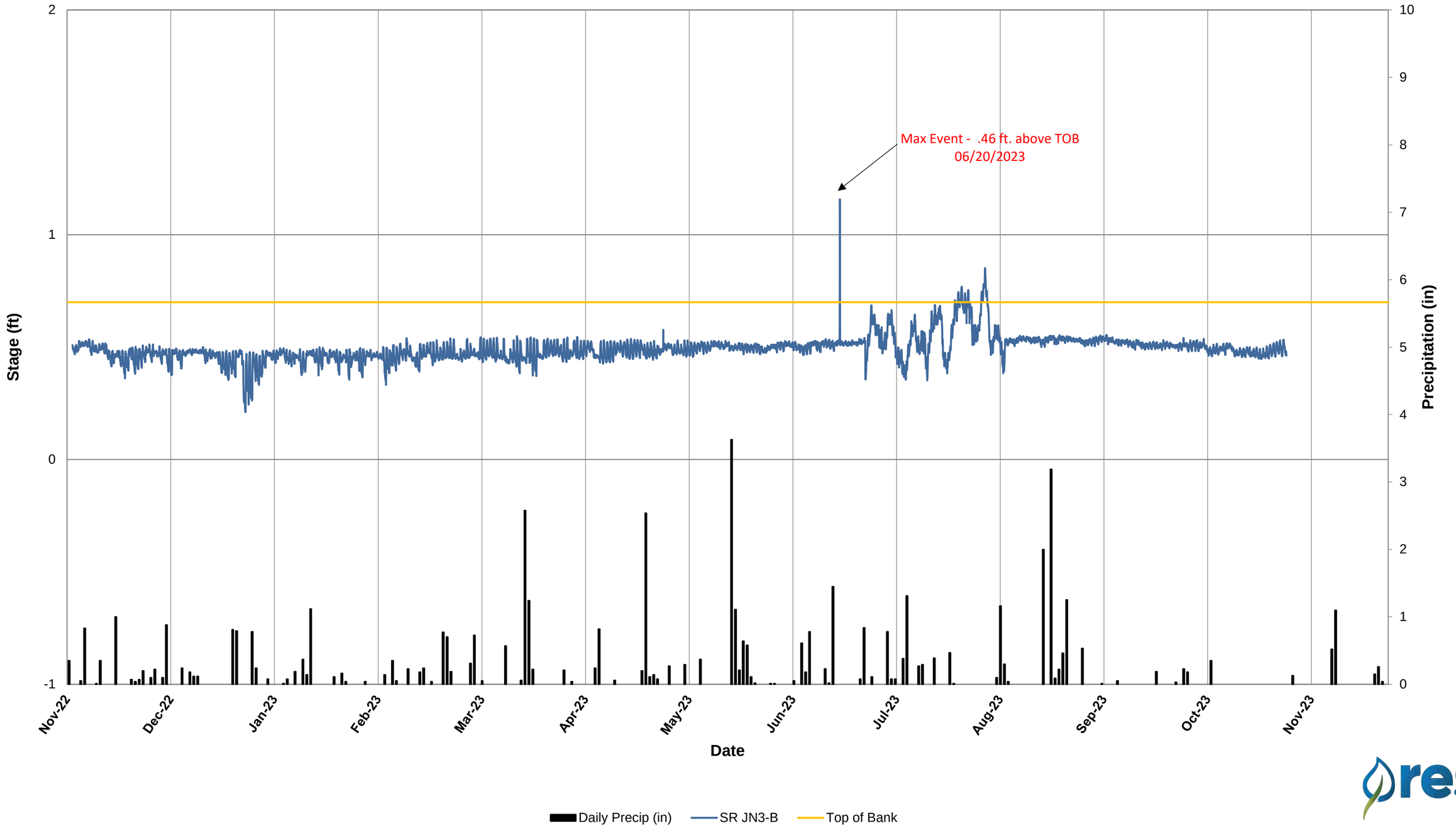
MY3 Little Sebastian GW2



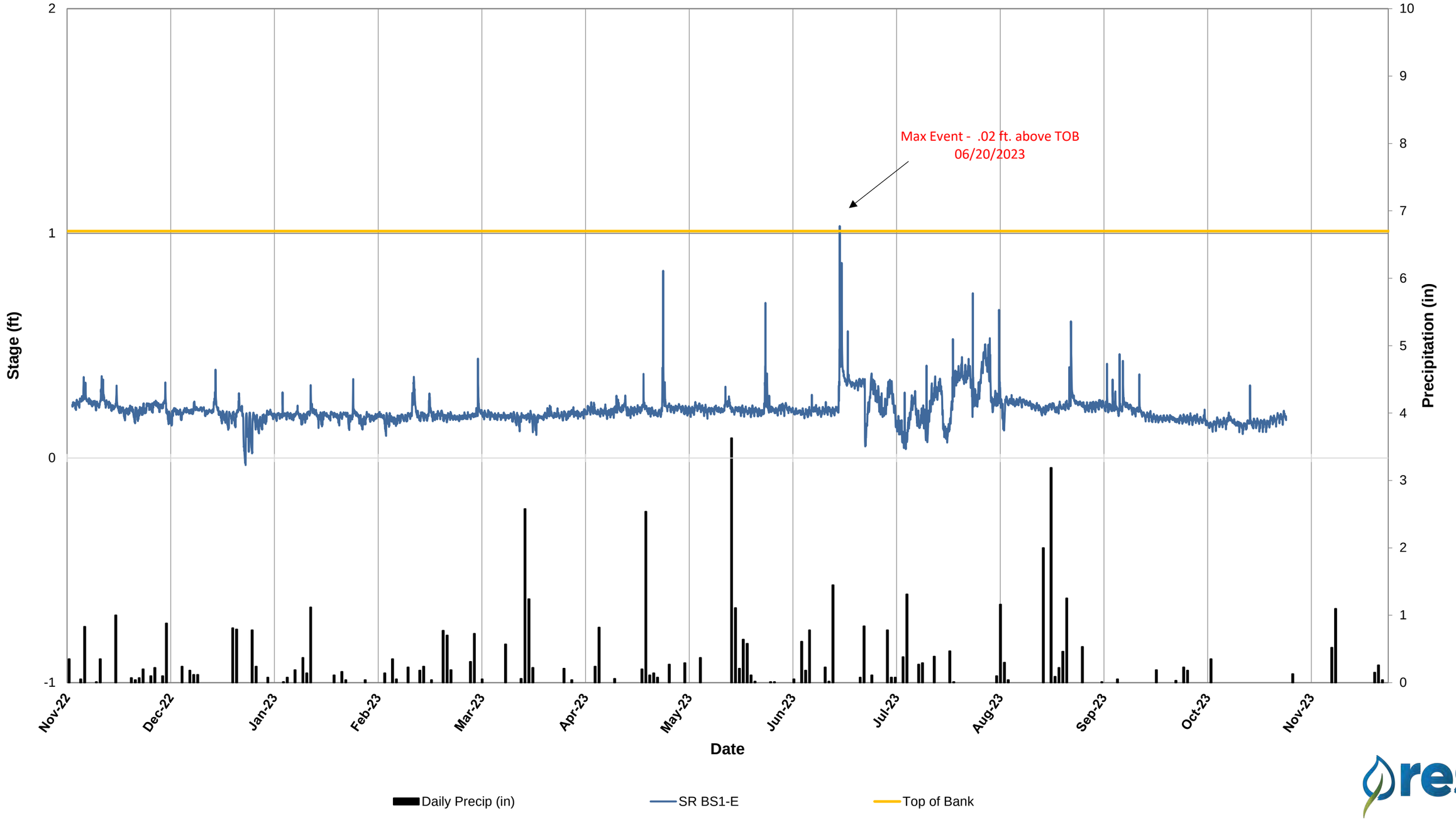
210 Consecutive Days of Hydrology
04/03/2023 - 10/30/2023

Daily Precip (in) | GW2 | Growing Season Start | Growing Season End | Logger Depth

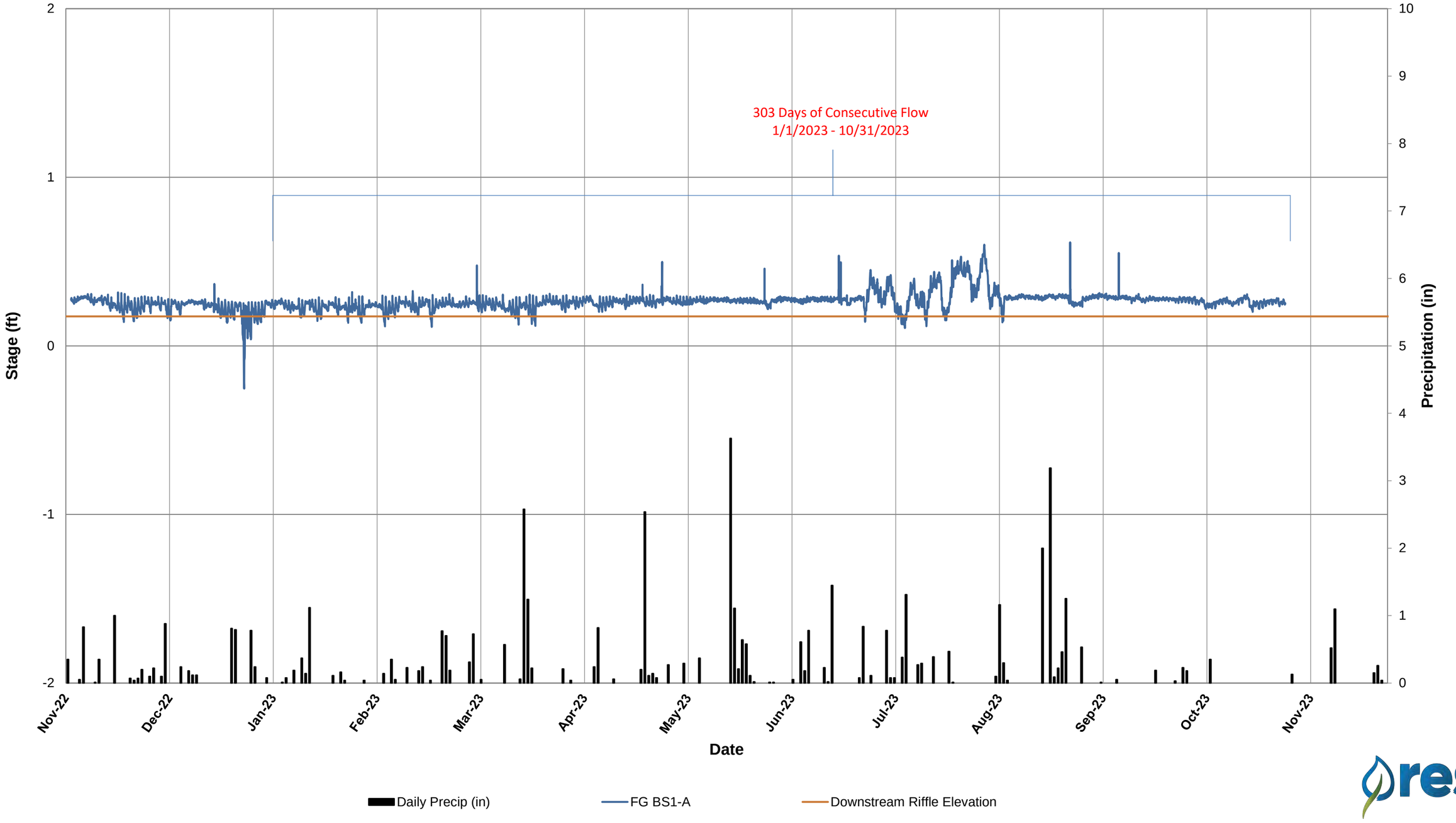
MY3 Little Sebastian JN3-B Stage Recorder Graph



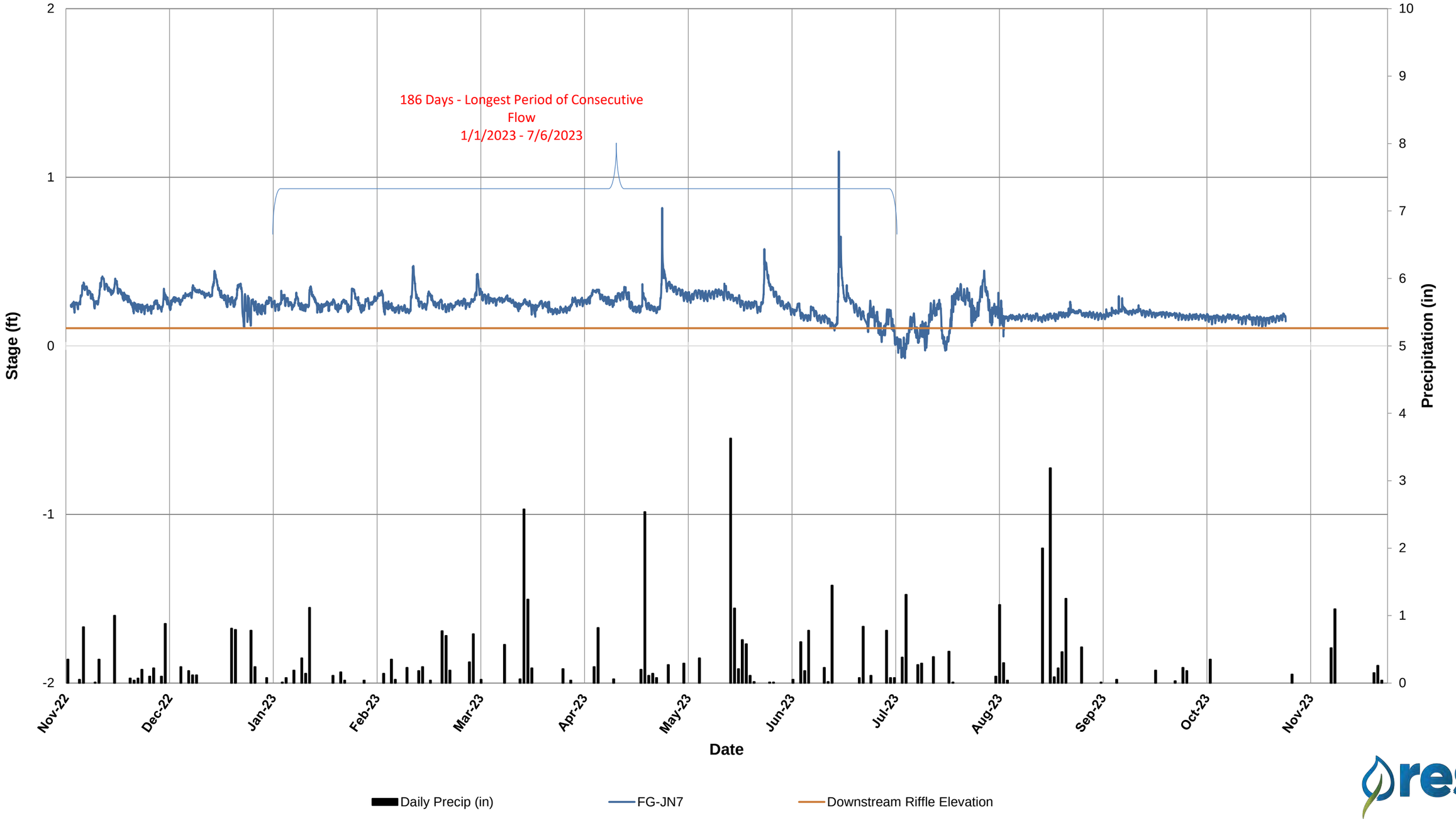
MY3 Little Sebastian BS1-E Stage Recorder Graph



MY3 Little Sebastian BS1-A Flow Gauge Graph



MY3 Little Sebastian JN7 Flow Gauge Graph



MY3 Little Sebastian JN2-B Flow Gauge Graph