Year 1 Monitoring Report

FINAL

MOCKINGBIRD SITE

NCDMS Project # 100021 (Contract # 7185)
USACE Action ID: SAW-2017-01505
DWR Project #20171040

Davie County, North Carolina
Yadkin River Basin
HUC 03040101

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RE: Mockingbird Site: Year 1 Monitoring Report (NCDMS ID 100021)

Listed below are comments provided by DMS on November 15, 2021 regarding the Mockingbird Site: Year 1 Report and RES' responses.

DMS has reviewed the draft MY1 (2021) Monitoring Report for the Mockingbird Site. This deliverable documents stream restoration and enhancement activities totaling 6,427.8 SMUs (warm thermal regime). A few comments follow:

Monitoring Report/General Comments:

Please map the location of the minor hand grading / repair on HC1
Now included on the MY1 CCPV Figure

During the DMS visit in October 2021, major scalloping / mowing was observed within the easement boundary of TP-3 (possibly elsewhere).In the annual reports please discuss all potential easement violations including boundary conditions. This should be brought to thelandowner's attention and rectified as soon as possible, and additional posting/signage installed if necessary. Photos available if needed.
The easement encroachment has been noted and the extents will be investigated. Repair options will be considered based on the damage along with additional boundary markers. The landowner will be contacted to ensure further encroachment does not occur in the future.

If possible, please indicate the consecutive days of flow on the flow gage graph, and show the corresponding period on the graph.
Done. These are now included on the flow graphs.

Digital Support File Comments:

- Please submit the random veg plots as polygons rather than points.
Done. These are located in support files>visual assessment data>CCPV

- Please submit photos as individual JPEGS.
Done. These are included in support files>visual assessment data

- Please submit the features used to display the existing wetlands in the CCPV.

Done. These are located in support files>visual assessment data>CCPV

- If available, please submit features that characterize the mitigation plan footage.

Done. These are located in support files>visual assessment data>CCPV

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1.0 Project Summary

1.1 Project Location and Description

The Mockingbird Site (the "Project") is located in Davie County, North Carolina, approximately eight miles west of Clemmons and five miles northwest of Bermuda Run. Water quality stressors affecting the Project included livestock production, agricultural production, and lack of riparian buffer. The Project presents 8,998 linear feet of stream restoration, enhancement, and preservation generating 6,427.833 Warm Stream Mitigation Units (SMU) along Hauser Creek and eight unnamed tributaries.

The Project's total easement area is 27.46 acres within the overall drainage area of 1,540 acres. The Project has two separate portions along Hauser Creek and in between those portions is the Scout Mitigation Bank. While each site could be developed independently of the other, the combined easements result in greater continuity of protected corridors along the main stem of Hauser Creek. The downstream end of the Project connects to the DMS Hauser Creek Mitigation Site, which closed out in 2017 and is now in NCDEQ stewardship. All easements combined total approximately 49.33 acres and 14,605 linear feet of stream that are protected in perpetuity. Approximately 10,400 LF of Hauser Creek is protected by these three projects and this is 60% of Hauser Creek's total length (Figure 1).

The stream design approach for the Project was to combine the analog method of natural channel design with analytical methods to evaluate stream flows and hydraulic performance of the channel and floodplain. The analog method involved the use of a reference reach, or "template" stream, adjacent to, nearby, or previously in the same location as the design reach. The template parameters of the analog reach were replicated to create the features of the design reach. The analog approach is useful when watershed and boundary conditions are similar between the design and analog reaches (Skidmore et al., 2001). Hydraulic geometry was developed using analytical methods to identify the design discharge.

The Project has been constructed and planted and 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. Funding will be supplied by the responsible party on a yearly basis until such time an endowment is established.

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 goals are:

- 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;
- Improve instream habitat;
- Restore and enhance native floodplain vegetation;
- Indirectly support the goals of the 2009 Upper Yadkin Pee-Dee RBRP to improve water quality and to reduce sediment and nutrient loads; and
- Protect Water Supply Watersheds (WSW).

The Project objectives to address the goals are:

- Designed and reconstructed stream channels sized to convey bankfull flows that maintain a stable dimension, profile, and planform based on modeling watershed conditions, and reference reach conditions;
- 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;
- Increased forested riparian buffers to at least 50 feet on both sides of the channel along the Project reaches with a hardwood riparian plant community;
- Implemented two sediment traps in order to limit inputs of sediment, nutrients, and fecal coliform to streams from surrounding farming operations;
- Treated exotic invasive species; and
- Established a permanent conservation easement on the Project.

Functional uplift, benefits, and improvements within the Project area, as based on the Function Based Framework, are outlined in the Mitigation Plan**.**

1.3 Project Success Criteria

The success criteria for the Project follows the 2016 USACE Wilmington District Stream and Wetland Compensatory Mitigation Update, the Mockingbird Site Final Mitigation Plan (November 2018), and subsequent agency guidance. Cross section and vegetation plot monitoring takes place in Years 0, 1, 2, 3, 5, and 7. Hydrology and visual monitoring takes place annually. Specific success criteria components are presented below.

Stream Restoration Success Criteria

Four bankfull flow events must be documented within the seven-year monitoring period. The bankfull events must occur in separate years. Otherwise, the stream monitoring will continue until four bankfull events have been documented in separate years. *Stage recorders were installed on the bottom of Reach HC1 and Reach NM2 to document bankfull events.*

There should be little change in as-built cross sections. If changes do take place, they should be evaluated to determine if they represent a movement toward a less stable condition (for example down-cutting or erosion), or are minor changes that represent an increase in stability (for example settling, vegetative changes, deposition along the banks, or decrease in width/depth ratio). Cross sections shall be classified using the Rosgen stream classification method, and all monitored cross sections should fall within the quantitative parameters defined for channels of the design stream type. For C/E channels, bank height ratio shall not exceed 1.2, and the entrenchment ratio shall be no less than 2.2 within restored reaches. For B channels, bank height ratio shall not exceed 1.2, and the entrenchment ratio shall be no less than 1.4 within restored reaches. Channel stability should be demonstrated through a minimum of four bankfull events documented in the seven-year monitoring period.

Digital images are used to subjectively evaluate channel aggradation or degradation, bank erosion, success of riparian vegetation, and effectiveness of erosion control measures. Longitudinal images should not indicate the absence of developing bars within the channel or an excessive increase in channel depth. Lateral

images should not indicate excessive erosion or continuing degradation of the banks over time. A series of images over time should indicate successional maturation of riparian vegetation.

Stream restoration reaches will be monitored to document intermittent or seasonal surface flow. This will be accomplished through direct observation and the use of hydraulic pressure transducers with data loggers. Intermittent reaches must demonstrate a minimum of 30 consecutive days of flow. Flow gauges were installed on Reaches NM1, NM4, TP2 and TP3.

Vegetation Success Criteria

Specific and measurable success criteria for plant density within the riparian buffers on the Project follow IRT Guidance. The interim measures of vegetative success for the Project is the survival of at least 320 planted three-year old trees per acre at the end of Year 3, 260 trees per acre with an average of seven feet in height at the end of Year 5, and the final vegetative success criteria is 210 trees per acre with an average height of ten feet at the end of Year 7 (USACE, 2016). Volunteer trees are counted, identified to species, and included in the yearly monitoring reports, but are not counted towards the success criteria of total planted stems. Moreover, any single species can only account for up to 50 percent of the required number of stems within any vegetation plot. Any stems in excess of 50 percent will be shown in the monitoring table but will not be used to demonstrate success.

Level	Goal	Treatment	Outcome	Monitoring Metric	Performance Standard
1 ***Hydrology***	To transport water from the watershed to the channel in a non-erosive manner	Convert land-use of Project reaches from pasture to riparian forest Install two sediment traps to regulate floodplain runoff coming into the reach (TP2 & TP3)	Improve the transport of water from the watershed to the Project reaches in a non-erosive way	NA	NA
				Visually monitor integrity of runoff attenuation structure: Performed semiannually (*indirect measurement*)	Identify and document instability and/or flaws to the structure
2 ***Hydraulic***	To transport water in a stable non-erosive manner	Reduce bank height ratios and increase entrenchment ratios by reconstructing channels to mimic reference reach conditions	Improve flood bank connectivity by reducing bank height ratios and increase entrenchment ratios	Crest gauges and/or pressure transducers: Inspected semiannually	Four bankfull events occurring in separate years
					At least 30 days of continuous flow each year
				Cross sections: Surveyed in Years 1, 2, 3, 5 and 7	Entrenchment ratio shall be no less than 2.2 within restored reaches
					Bank height ratio shall not exceed 1.2
3 ***Geomorphology***	To create a diverse bedform To achieve dynamic equilibrium	Establish a riparian buffer to reduce erosion and sediment transport into project streams. Establish stable banks with livestakes, erosion control matting, and other in stream structures	Reduce erosion rates and channel stability to reference reach conditions Improve bedform diversity (pool spacing, percent riffles, etc. Increase buffer width to 50 feet	As-built stream profile	NA
				Cross sections: Surveyed in Years 1, 2, 3, 5 and 7	Entrenchment ratio shall be no less than 1.4 for B channels and no less than 2.2 for C/E channels (restored reaches)
				Visual monitoring	Bank height ratio shall not exceed 1.2
				Visual monitoring: Performed at least semiannually	Identify and document significant stream problem areas; i.e. erosion, degradation, aggradation, etc.
				Vegetation plots: Surveyed in Years 1, 2, 3, 5 and 7	MY 1-3: 320 trees/acre MY 5: 260 trees/acre (7 ft. tall) MY 7: 210 trees/acre (10 ft. tall)
4 ***Physiochemical °***	To achieve appropriate levels for water temperature, dissolved oxygen concentration, and other important nutrients including but not limited to Nitrogen and Phosphorus	Exclude livestock from riparian areas with exclusion fence or conservation easement, and plant a riparian buffer	Improve stream temperature regulation through introduction of canopy Decrease nutrient loading through filtration of planted riparian buffer, and removing livestock from the riparian areas	Vegetation plots: Surveyed in Years 1, 2, 3, 5 and 7 (*indirect measurement*)	MY 1-3: 320 trees/acre MY 5: 260 trees/acre (7 ft. tall) MY 7: 210 trees/acre (10 ft. tall)
				Visual assessment of established fencing and conservation signage: Performed at least semiannually (*indirect measurement*)	Inspect fencing and signage. Identify and document any damaged or missing fencing and/or signs
5 ***Biology ****	To achieve functionality in levels 1-4 to support the life histories of aquatic and riparian plants and animals	Plant a riparian buffer, install habitat features, and construct pools of varying depths	Improve aquatic habitat through the installation of habitat features, construction of pools at varying depths, and planting the riparian buffer	Visual monitoring of in-stream habitat features: Performed at least semiannually (*indirect measurement*)	Identify and document significant stream problem areas; i.e. degradation, aggradation, stressed or failed structures, etc.

*° These categories are measured indirectly; *These categories are not quantifiably measured*

1.4 Project Components

The restoration reaches 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 8,998 LF of stream, generating 6,427.833 Warm Stream Mitigation Units (SMU) (**Table 1**) as established in the Approved Mitigation Plan. Changes made between mitigation plan approval and construction are detailed in **Section 1.6**.

Mitigation Approach	Linear Feet	Ratio	Warm SMU
Restoration	4,849	1.00000	4,849.000
Enhancement I	155	1.50000	103.333
Enhancement II	3,587	2.50000	1,434.800
Preservation	407	10.00000	40.700
Total	8,998		6,427.833

1.5 Stream Design/Approach

The Project includes Priority I Restoration, Priority II Restoration, Enhancement Levels I and II, and Preservation. 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 were also a crucial element of the project and were used to determine the design discharge and to verify the design as a whole.

The Project is broken into the following reaches:

Reach HC1 – Reach HC1 begins at the upstream end of the northern portion of the project and at the downstream limits of the Scout Mitigation Bank Project. There is a 40-foot easement break between the two projects that coincides with a culvert crossing and includes 24 LF of 48-inch double barrel RCP. The reach totals 2,083 LF of Priority I Restoration to address historic channelization and livestock impacts. Priority I Restoration provided higher functional uplift and less risk of failure when connected to the restoration on upstream Reach HC3. The left bank was crop land while the right bank was active pasture, which contributed to significant disturbance on both banks. Restoration activities included constructing a new channel within the natural valley with appropriate dimensions and pattern, adding channel plugs where necessary and backfilling the abandoned channel. Backfilling the abandoned stream channel created wetlands in the ephemeral pool areas. In-stream structures such as log sills, brush toes, rock cross vanes, and rock/wood constructed riffles were installed for channel stability and to improve habitat. A minimum 50-foot buffer was implemented along each side of the channel. Buffer activities will improve riparian areas that will filter runoff from adjacent pastures, thereby reducing nutrient and sediment loads to the channel.

Reach NM1 – Historically channelized reach NM1 begins at the ephemeral/intermittent break on the right bank near the top of HC1 and flows west to a confluence with HC1. Active pasture previously surrounded this reach. The reach totals 229 LF of Enhancement II, and enhancement activities includes buffer plantings and the treatment of invasive species. This reach treatment ends at the farm path.

Reach NM2 – Reach NM2 begins on the west side of Reach HC1 and flows east to the confluence with HC1 near it's midpoint. The reach totals 637 LF of Priority I Restoration and 731 LF of Priority II Restoration. Due to elevation and slope constraints, Priority II Restoration was utilized at the top of the reach, blending into Priority I as it nears the HC1 floodplain. Active crop land previously surrounded this reach as well as limited cattle exposure. There is a 40-foot easement break for a culvert crossing where an existing 72-inch CMP was removed and replaced with 24 LF of a double barrel 48-inch RCP. Restoration activities included constructing a new channel within the natural valley with appropriate dimensions and pattern, adding channel plugs where necessary and backfilling the abandoned channel. In-stream structures such as log sills, brush toes, log cross vanes, and rock/wood constructed riffles were installed for channel stability and to improve habitat. A minimum 50-foot buffer was maintained along on each side of the channel. Buffer activities improve riparian areas that filter runoff from adjacent fields, thereby reducing nutrient and sediment loads to the channel.

Reach NM3 – Reach NM3 begins at a culvert on the west side of Reach HC1, near the downstream end of the Project, and flows east to a confluence with HC1. The reach totals 280 LF of Priority I Restoration to address historic channelization and excess deposition due to agricultural practices. The incised reach was surrounded by fields of row crops and lacked a protective buffer. Restoration activities included constructing a new channel with appropriate dimensions and pattern, adding channel plugs where necessary and backfilling the abandoned channel. In-stream structures such as log sills, brush toes, rock cross vanes, and constructed riffles were installed for channel stability and to improve habitat. A minimum of 50 feet of buffer on each side of the channel was implemented. Buffer activities will improve riparian areas that will filter runoff from adjacent fields, reducing nutrient and sediment loads to the channel.

Reach NM4 – NM4 is a headwater reach that forms from the hills on the east side of HC1 near the downstream portion of the Project. Active pasture previously surrounded this reach. This reach totals 253 LF of Enhancement II. Treatment included removing an existing crossing at a 15-inch RCP, establishing a minimum 50-foot riparian buffer, and instream structures such as rock cross vanes and log sills to provide channel stability.

Reach NM5 – NM5 is a headwater reach that forms within the eastern floodplain of Reach HC1, just upstream of Reach NM4, and flows west to a confluence with HC1. Realignment of Reach HC1 will displace the majority of NM5 due to plugging this channel at its confluence with the existing HC1 and filling in that abandoned channel. A small portion of intermittent channel is protected within the easement but does not receive credit. Active pasture previously surrounded this reach.

Reach JS1 – Reach JS1 begins in a previously active pasture, north of Spillman Road, and flows east into the existing DMS Hauser Creek Mitigation Site that exists downstream from the Project. This reach totals 523 LF of Priority I Restoration to address historic channelization, livestock impacts and erosion. Restoration activities included removing an existing ford, constructing a new channel within the natural valley, backfilling the abandoned channel, and reconnecting to the floodplain for frequent inundation. In-stream structures such as log sills, brush toes, log cross vanes, rock cross vanes, and constructed riffles were installed for channel stability and to improve habitat. A minimum of 50 feet of buffer on each side of the channel was implemented. Buffer activities improve riparian areas that filter runoff from adjacent pastures, thereby reducing nutrient and sediment loads to the channel. The channel ties back into the existing location in order to connect to the 72-inch CMP under the landowner's gravel driveway.

Reach HC2-A – Reach HC2-A begins at the upstream end of the Project (the southern portion of the project), and flows north to Reach HC2-B. The reach totals 2,018 LF of Enhancement II. Agricultural fields and bottomland hardwood forests are located adjacent to the reach. Enhancement activities included the re-establishment of a riparian buffer along the channel (buffers extended a minimum of 50 feet from the top of each bank) and invasive species treatment as needed. Buffer improvements filter runoff from adjacent

pastures, thereby reducing nutrient and sediment loads to the channel. Additional habitat improvements were gained through livestock exclusion. There is a 31-foot easement break to maintain an existing ford crossing within the bottom third of this reach.

Reach HC2-B – Reach HC2-B begins immediately downstream of Reach HC2-A and flows north to Reach HC2-C. The reach totals 595 LF of Priority I Restoration to address historic channelization and cattle exposure. The reach was surrounded by active pasture and the downstream portion is surrounded by disturbed bottomland hardwood forests and riparian wetlands. Restoration activities included constructing a new channel within the natural valley with appropriate dimensions and pattern, adding channel plugs where necessary and backfilling the abandoned channel. In-stream structures such as log sills, brush toes, cross vanes, rock A-vanes, and constructed riffles were installed for channel stability and to improve habitat. A minimum of 50 feet of buffer on each side of the channel was implemented. Buffer activities improve riparian areas that will filter runoff from adjacent pastures, thereby reducing nutrient and sediment loads to the channel. Reach TP3 ties into HC2-B prior to a proposed 35-foot easement break and ford crossing, before transitioning into Reach HC2-C. Also, the reach was built through part of a jurisdictional wetland that is on the right bank floodplain and was degraded from cattle access and pasture-use. While this project is not claiming any wetland credit, the raised channel bed enhanced the wetlands' hydrology by reconnecting the floodplain wetlands to the stream. Also, backfilling the abandoned stream channel created additional wetlands in the ephemeral pool areas. A gauge was installed on the right floodplain to monitor the wetland hydrology and will be reported annually.

Reach HC2-C – This reach begins at the downstream end of HC2-B and flows north from a ford crossing to the upstream end of HC2-D. Although cattle have been historically excluded from this reach, upstream pasture activity and travel across the existing ford previously resulted in bed and bank erosion and sedimentation. The reach totals 155 LF of Enhancement I, and enhancement activities included laying back and/or benching the left bank and installing coir matting and live stakes to provide channel stabilization. Bottomland hardwoods are located adjacent to the reach.

Reach HC2-D – Reach begins immediately downstream of Reach HC2-C and flows north to the downstream boundary of the southern portion of the easement. The reach totals 407 LF of preservation with minimum 50-foot buffers. Bottomland hardwoods surround this reach.

Reach TP1 – Reach TP1 begins on the east side of Reach HC2-A in headwater Piedmont forest and flows west to a confluence with Reach HC1-A. Lightly disturbed forest surrounds this reach. The reach totals 146 LF of Enhancement II, where cattle exclusion and supplemental planting of the riparian buffer occured. This reach treatment ends at the fence line.

Reach TP2 - This reach begins on the east side of Reach HC2-A, just downstream of the confluence of TP1 with HC2-A and flows southwest to a confluence with Hauser Creek. The reach totals 471 LF of Enhancement II. The reach was surrounded by active pasture and a small wetland occurs near the stream origin. Enhancement activities included reestablishing the riparian buffer with native vegetation and cattle exclusion. A sediment trap was installed upstream of ephemeral/intermittent stream break to provide sediment and nutrient control from upland agricultural practices.

Reach TP3 – This reach begins to the east of Reach HC2-B and flows southwest to a confluence with HC2-B upstream of an easement break. The reach totals 470 LF of Enhancement II. The reach was surrounded by active pasture and forms out of a headwater wetland. A sediment trap (made from woody debris and livestakes) was installed at the upper end of the reach to provide sediment and nutrient control from upland agricultural practices.

1.6 Construction and As-Built Conditions

Stream construction and planting was completed in June 2020. Overall, the Site was built to design plans and guidelines. However, there were two changes that were made between the time of Final Mitigation Plan approval and site construction that reduced the project linear footage by 88 feet. The first was an error on the stationing for TP2. The crediting was mistakenly shown starting above the ESP structure, where the channel was non-jurisdictional. The crediting should begin below the ESP, shortening the reach from 471 to 441. The second was a design change on NM1 that reduced the linear footage from 229 to 171. Both changes are shown on the redline survey and on **Table 1,** however the project credits remain as established in the Final Mitigation Plan. The as-built survey (including a redlined version) is included in the As-Built Baseline Report.

Planting plan changes are outlined on Table 7, **Appendix C**. Planting plan changes were based on bare root availability. Monitoring devices had minor shifts in locations, however the quantities of devices remained the same as proposed for vegetation plots (15), flow gauges (4), stage recorders (2), and wetland gauges (1). Cross sections were installed in all the proposed locations where stream work was completed and removed from reaches (preservation and EII) where stream work was not completed. The total number of cross sections was reduced from 26 to 21.

1.7 Year 1 Monitoring Performance (MY1)

The Mockingbird MY1 activities were performed in July and October 2021. All Year 1 Monitoring data is present below and in the appendices. The Site is on track to meeting vegetation and stream interim success criteria.

Vegetation

Monitoring of the 10 fixed vegetation plots and five random vegetation plots was completed in October 2021. MY1 monitoring data indicates that all plots are exceeding the interim success criteria of 320 planted stems per acre. Planted stem densities ranged from 364 to 1,012 planted stems per acre with a mean of 656 planted stems per acre across all the plots. Volunteer species were noted in five of the plots. The average stem height in the plots was 2.5 feet. A total of 16 species were documented within the plots. Vegetation data are in **Appendix C**, associated photos are in **Appendix B,** and plot locations are in **Appendix B**.

Visual assessment of vegetation outside of the monitoring plots indicates that the herbaceous vegetation is becoming well established throughout the project. A small amount of Chinese privet was observed in the wooded areas around HC2-B and TP2. Invasive species treatments will be administered as necessary throughout the monitoring period. In January 2021, about 500 bareroot trees were supplemental planted around VP 6 and 7.

Stream Geomorphology

Cross section and geomorphology data collection for MY1 was collected on July 13 and 14, 2021. Summary tables and cross section plots are in **Appendix D**. Overall the MY1 cross sections relatively match the baseline cross sections. The as-built conditions show that shear stress and velocities have been reduced for all restoration/enhancement reaches. All reaches were designed as gravel bed channels and remain classified as gravel bed channels post-construction.

Visual assessment of the stream channel was performed to document signs of instability, such as eroding banks, structural instability, or excessive sedimentation. The channel is transporting sediment as designed

and will continue to be monitored for aggradation and degradation. One minor area of bank erosion was hand repaired on the right bank of HC1in January 2021. This repair included grading the bank back and installing coir logs and livestakes.

Stream Hydrology

Two stage recorders and four flow gauges were installed in June 2020: one stage recorder on HC1, one stage recorder on NM2 and flow gauges on NM1, NM4, TP2, and TP3. The stage recorders are in place to document bankfull events and the flow gauge to document at least intermittent flow. The stage recorder on HC1 recorded fourteen bankfull events in MY0 and MY1 with the highest reading being 3.45 feet above top of bank. The stage recorder on NM2 recorded five bankfull events with the highest reading being 1.04 feet above top of bank. The flow gauges on NM1, NM4, TP2, and TP3 recorded between one and five flow events lasting between 51 and 279 consecutive days. All recorded streams are on track to pass hydrology metrics. Stream hydrology data is included in the **Appendix E**. Gauge locations can be found on **Figure 2** and photos are in **Appendix B**.

Wetland Hydrology

One groundwater well (GW1) was installed in April 2020. The goal of the groundwater well is to track the hydrology in the jurisdictional wetlands on site post-construction. There is no hydroperiod success criteria for these groundwater wells. In MY1, GW1 recorded a consecutive hydroperiod of eight percent of the growing season. Wetland hydrology data is included in **Appendix E**. Groundwater well locations can be found on **Figure 2**.

2.0 Methods

Stream 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 21 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 gauge was also installed in a pool and records flow conditions at an hourly interval. Water level data from the flow gauge is corrected using the height of the downstream riffle to detect stream flow events.

Vegetation success is being monitored at ten permanent monitoring plots and five random monitoring plots. Vegetation plot monitoring follows the CVS-EEP Level 2 Protocol for Recording Vegetation, version 4.2 (Lee et al. 2008) and includes analysis of species composition and density of planted species. Data are processed using the CVS data entry tool. In the field, the four corners of each plot were permanently marked with PVC at the origin and metal conduit at the other corners. Photos of each plot are taken from the origin each monitoring year. The random plots are 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 were 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 document maintenance of jurisdictional groundwater levels in the stream restoration area (as requested by NCIRT). This is accomplished with an automatic pressure transducer gauge (located in a groundwater well) that records the daily groundwater level. One automatic pressure transducer is installed above ground for use as a barometric reference. Gauges are downloaded quarterly and wetland hydroperiods are calculated during the growing season. Gauge installation followed

current regulatory guidance. Visual observations of primary and secondary wetland hydrology indicators are also recorded during quarterly site visits.

3.0 References

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Appendix A

Background Tables

The Mockingbird Site - Mitigation Components											
Reach	**Exisiting Footage**	**Mitigation Plan Footage**	**Mitigation Category**	**Restoration Level**	**Prioirty Level**	**Mitigation Ratio (X:1)**	**Mitigation Plan Credit**	**As-Built Footage**			**Notes**
HC2-A	1,345	1345	Warm	EII	N/A	2.50000	538.000	1345			Riparian and supplemental planting, livestock exclusion, invasives treatment
HC2-A	673	673	Warm	EII	N/A	2.50000	269.200	673			Riparian and supplemental planting, livestock exclusion, invasives treatment
HC2-B	568	595	Warm	R	1	1.00000	595.000	595			Channel restoration, riparian planting, livestock exclusion
HC2-C	155	155	Warm	EI	3	1.50000	103.333	155			Bank grading and stabilzation, supplemental planting, conservation easement
HC2-D	408	407	Warm	P	N/A	10.00000	40.700	407			Conservation Easement
HC1	2,135	2083	Warm	R	1	1.00000	2083.000	2,083			Channel restoration, riparian planting, livestock exclusion
TP1	157	146	Warm	EII	N/A	2.50000	58.400	146			Riparian planting, livestock exclusion
TP2*	450	471	Warm	EII	N/A	2.50000	188.400	441			Riparian planting, livestock exclusion
TP3	525	470	Warm	EII	N/A	2.50000	188.000	470			Riparian planting, livestock exclusion
NM1*	229	229	Warm	EII	N/A	2.50000	91.600	171			Riparian planting, livestock exclusion
NM2	889	997	Warm	R	1 & 2	1.00000	997.000	997			Channel restoration, riparian planting, livestock exclusion
NM2	330	371	Warm	R	1	1.00000	371.000	371			Channel restoration, riparian planting, livestock exclusion
NM3	197	280	Warm	R	1	1.00000	280.000	280			Channel restoration, riparian planting
NM4	286	253	Warm	EII	N/A	2.50000	101.200	253			Riparian planting, livestock exclusion
JS1	465	523	Warm	R	1	1.00000	523.000	523			Channel restoration, riparian planting, livestock exclusion

*Stream length changed at as-built

Project Credits

Restoration Level	Stream	Riparian Wetland		Non-riparian Wetland
		Riverine	Non-Riverine	
Restoration	4,849.000			
Enhancement				
Enhancement I	103.333			
Enhancement II	1,434.800			
Creation				
Preservation	40.700			
High Quality Pres				
Total	6,427.833			

Table 2. Project Activity and Reporting History
Mockingbird Mitigation Site

Elapsed Time Since grading complete: 1 year 4 months
Elapsed Time Since planting complete: 1 year 4 months
Number of reporting Years[1]: 1

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Restoration Plan	NA	Nov-19
Final Design – Construction Plans	NA	Sep-19
Stream Construction	NA	Jun-20
Site Planting	NA	Jun-20
As-built (Year 0 Monitoring – baseline)	Jun-20	Oct-20
HC1 Hand Repair	NA	Jan-21
Supplemental Planting (VP 6 and 7)	NA	Jan-21
Year 1 Monitoring	XS: Jul-21 VP: Oct-21	Jan-22
Year 2 Monitoring		
Year 3 Monitoring		
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 Mockingbird Mitigation Site	
Designer Primary project design POC	RES / 3600 Glenwood Ave., Suite 100, Raleigh, NC 27612 Frasier Mullen
Construction Contractor Construction contractor POC	KBS Earthwork Inc. / 5616 Coble Church Rd., Julian, NC 27283 Kory Strader
Survey Contractor Survey contractor POC	Matrix East, PLLC / 906 N. Queen St., Suite A, Kinston, NC 28501 Chris Paderick, PLS
Planting Contractor Planting contractor POC	H&J Forestry Matt Hitch
Monitoring Performers	RES / 3600 Glenwood Ave, Suite 100, Raleigh, NC 27612
Stream Monitoring POC	Ryan Medric (919) 741-6268
Vegetation Monitoring POC	Ryan Medric (919) 741-6268

Table 4. Project Background Information				
Project Name		Mockingbird		
County		Davie		
Project Area (acres)		27.46		
Project Coordinates (latitude and longitude)		Northern portion: Latitude: 36.038433 Longitude: -80.516410 Southern Portion: Latitude: 36.028029 Longitude: -80.502333		
Planted Acreage (Acres of Woody Stems Planted)		23.2		
Project Watershed Summary Information				
Physiographic Province		Southern Outer Piedmont		
River Basin		Yadkin Pee-Dee		
USGS Hydrologic Unit 8-digit	03040101	USGS Hydrologic Unit 14-digit	3040101160010	
DWR Sub-basin		3/7/2002		
Project Drainage Area (Acres and Square Miles)		1,540 ac (2.406 sqmi)		
Project Drainage Area Percentage of Impervious Area		2%		
CGIA Land Use Classification		Managed Herbaceous Cover and Mixed Upland Hardwoods		
Regulatory Considerations				
Parameters		**Applicable?**	**Resolved?**	**Supporting**
Water of the United States - Section 404		Yes	Yes	Mit Plan
Water of the United States - Section 401		Yes	Yes	Mit Plan
Endangered Species Act		Yes	Yes	Mit Plan
Historic Preservation Act		Yes	Yes	Mit Plan
Coastal Zone Management Act (CZMA or CAMA)		No	N/A	N/A
FEMA Floodplain Compliance		Yes	No	Mit Plan
Essential Fisheries Habitat		No	N/A	N/A

Reach Summary Information														
Parameters	**HC1**	**HC2-A**	**HC2-B**	**HC2-C**	**HC2-D**	**JS1**	**NM1**	**NM2**	**NM3**	**NM4**	**NM5**	**TP1**	**TP2**	**TP3**
Length of reach (linear feet)	2,135	2018	568	563	563	465	229	1219	197	286	101	157	450	525
Valley confinement (Confined, moderately confined, unconfined)														
Drainage area (Acres and Square Miles)	1,319 ac	55 ac	151 ac	194 ac	207 ac	221 ac	20 ac	330 ac	74 ac	27 ac	24 ac	45 ac	20 ac	20 ac
Perennial, Intermittent, Ephemeral	P	P	P	P	P	P	I	P	P	I	I	P	I	I
NCDWR Water Quality Classification														
Stream Classification (existing)	E5	B3c	F3/C3	C3	C3	E5	E4	E4	E6b	E6b	E6b	B3c	C6b	B6
Stream Classification (proposed)	E3/E4		E3/E4			E4/E5		E4/E5	E3/E4					

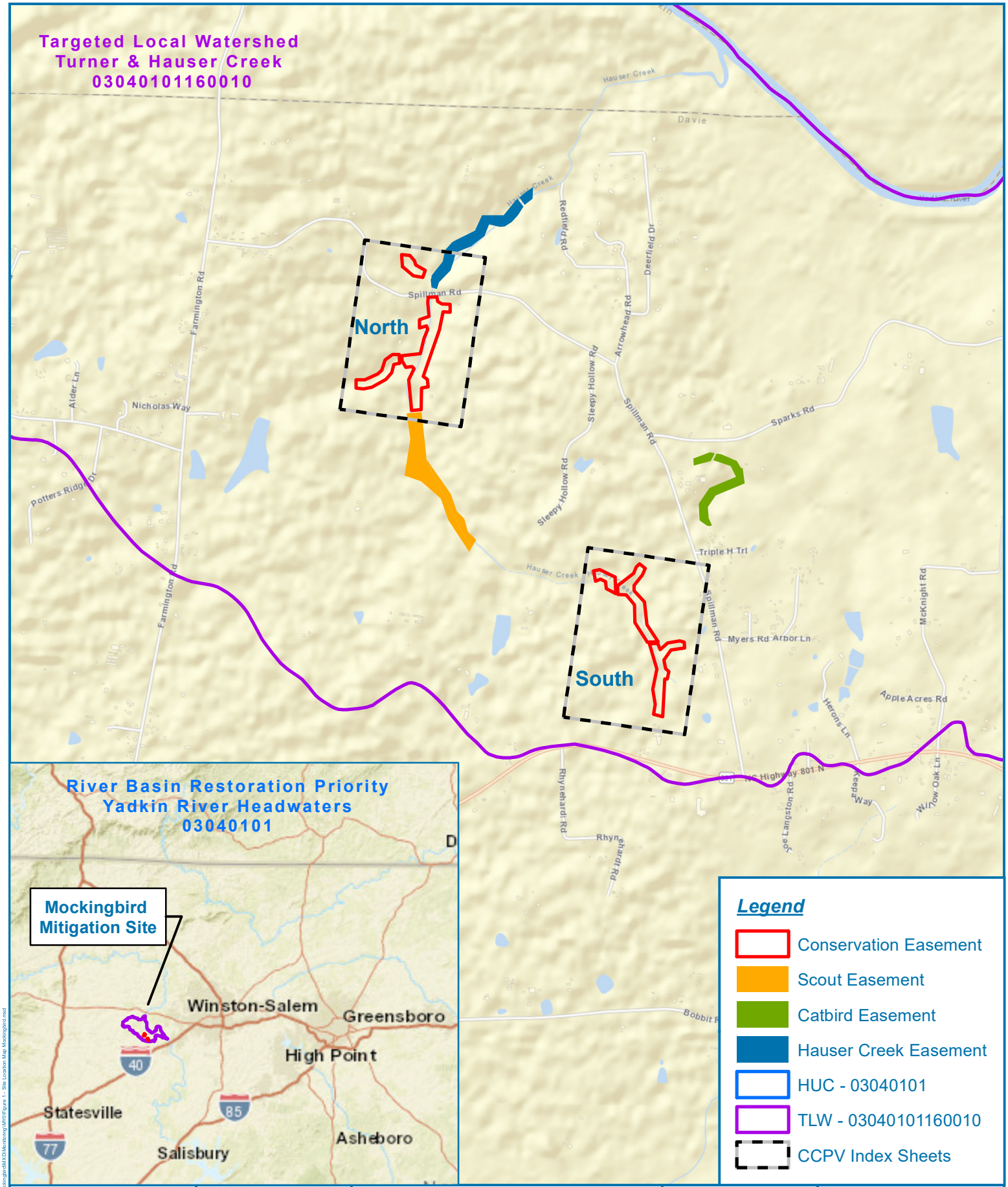


Figure 1 - Site Location Map

Mockingbird Mitigation Site

Davie County, North Carolina

Date: 6/22/2020

Drawn by: HKH

Checked By: RTM

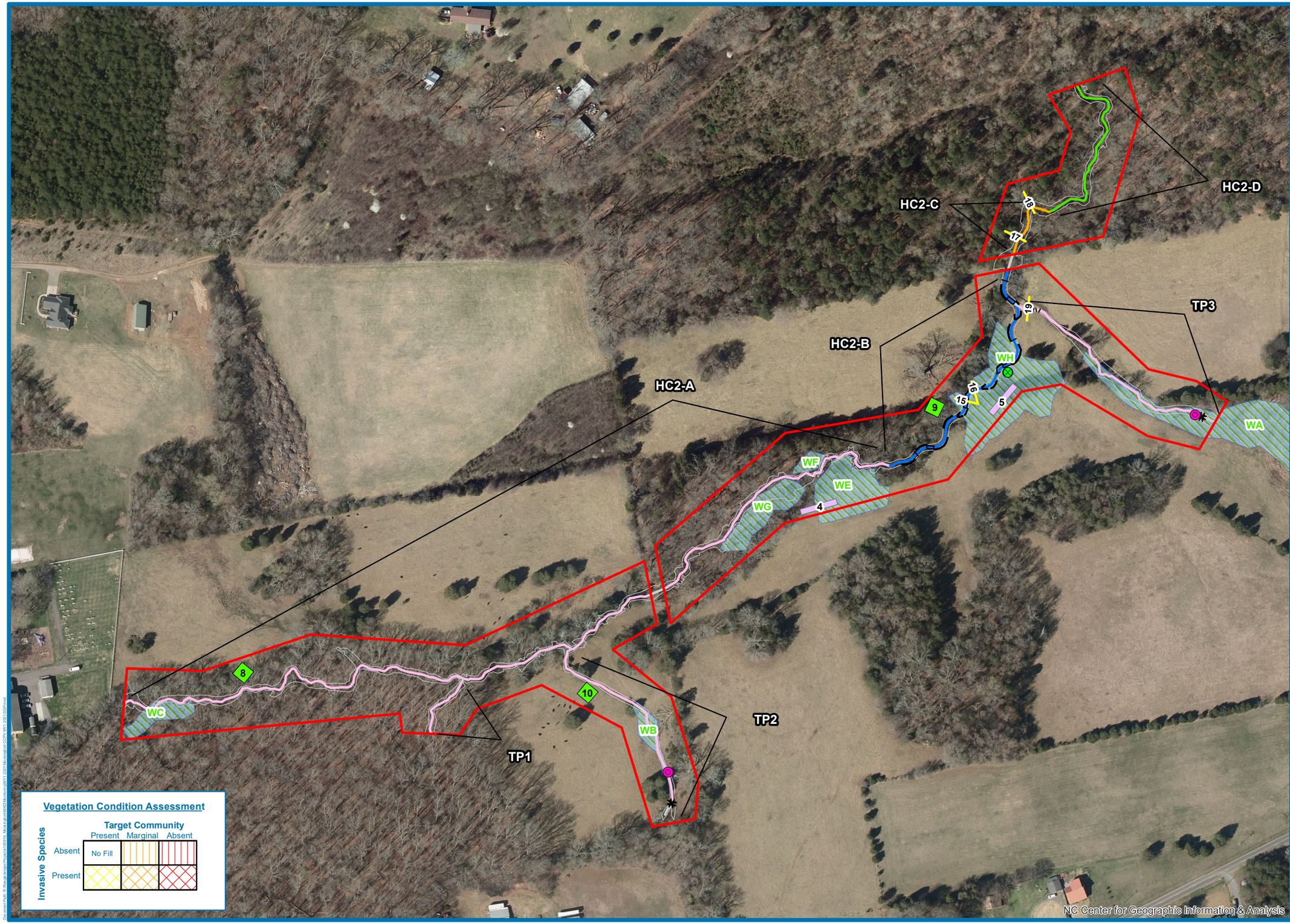
1 inch = 2,000 feet

res

Document Path: R:\resgis\drotos\gis\projects\NC\Mockingbird\MXD\Monitoring\MW\Figure 1 - Site Location Map Mockingbird.mxd

Appendix B

Visual Assessment Data



res

N
S
E
W

0 100 200
Feet

Figure 2

Current Conditions
Plan View

Mockingbird
Mitigation Site
South
MY1 2021

Davie County, NC

Date: 1/17/2022	Drawn by: RTM
Lat: 35.671107	Long: -82.669235

LEGEND

- Conservation Easement
- Fixed VP >320 stems/acre
- Random VP >320 stems/acre
- Top of Bank
- Existing Wetland
- Flow Gauge
- Stage Recorder
- Wetland Gauge/Amb
- Stream Repair 2021
- Structure
- Cross Section

Mitigation Approach

- Restoration
- Enhancement I
- Enhancement II
- Preservation
- No Credit

Vegetation Condition Assessment

Invasive Species	Target Community: Present	Target Community: Marginal	Target Community: Absent
Absent	No Fill		
Present			

res

N
S
E
W

0 100 200
Feet

Figure 2

Current Conditions
Plan View

Mockingbird
Mitigation Site
North
MY1 2021

Davie County, NC

Date: 1/17/2022	Drawn by: RTM
Lat: 35.671107	Long: -82.669235

LEGEND

- Conservation Easement
- Fixed VP >320 stems/acre
- Random VP >320 stems/acre
- Top of Bank
- Existing Wetland
- Flow Gauge
- Stage Recorder
- Wetland Gauge/Amb
- Stream Repair 2021
- Structure
- Cross Section

Mitigation Approach

- Restoration
- Enhancement I
- Enhancement II
- Preservation
- No Credit

Table 5. Visual Stream Morphology Stability Assessment
Mockingbird Site - NM2
Assessed Length 1,368 feet

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	**1. Vertical Stability** (Riffle and Run Units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars).			0	0	100%			
		2. Degradation - Evidence of downcutting.			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate.	22	22			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6).	20	20			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle).	20	20			100%			
2. Bank	**1. Scoured / Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	34	34			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	34	34			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	34	34			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does NOT exceed 15%.	34	34			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	34	34			100%			

Date of last site inspection - 10/06/2021

Table 5 Cont'd. Visual Stream Morphology Stability Assessment
Mockingbird Site - NM3
Assessed Length 280 feet

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	**1. Vertical Stability** (Riffle and Run Units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars).			0	0	100%			
		2. Degradation - Evidence of downcutting.			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate.	10	10			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6).	11	11			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle).	11	11			100%			
2. Bank	**1. Scoured / Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	13	13			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	13	13			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	13	13			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does NOT exceed 15%.	13	13			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	13	13			100%			

Date of last site inspection - 10/06/2021

Table 5 Cont'd. Visual Stream Morphology Stability Assessment
Mockingbird Site - HC1
Assessed Length 2,083 feet

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	**1. Vertical Stability** (Riffle and Run Units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars).			0	0	100%			
		2. Degradation - Evidence of downcutting.			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate.	30	30			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6).	28	28			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle).	28	28			100%			
2. Bank	**1. Scoured / Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	47	47			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	47	47			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	47	47			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does NOT exceed 15%.	47	47			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	47	47			100%			

Date of last site inspection - 10/06/2021

Table 5 Cont'd. Visual Stream Morphology Stability Assessment
Mockingbird Site - HC2-B
Assessed Length 595 feet

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	**1. Vertical Stability** (Riffle and Run Units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars).			0	0	100%			
		2. Degradation - Evidence of downcutting.			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate.	14	14			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6).	13	13			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle).	13	13			100%			
2. Bank	**1. Scoured / Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	19	19			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	19	19			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	19	19			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does NOT exceed 15%.	19	19			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	19	19			100%			

Date of last site inspection - 10/06/2021

Table 5 Cont'd. Visual Stream Morphology Stability Assessment
Mockingbird Site - JS1
Assessed Length 523 feet

Major Channel Category	Channel Sub-Category	Metric	Number Stable, Performing as Intended	Total Number in As-built	Number of Unstable Segments	Amount of Unstable Footage	% Stable, Performing as Intended	Number with Stabilizing Woody Vegetation	Footage with Stabilizing Woody Vegetation	Adjusted % for Stabilizing Woody Vegetation
1. Bed	**1. Vertical Stability** (Riffle and Run Units)	1. Aggradation - Bar formation/growth sufficient to significantly deflect flow laterally (not to include point bars).			0	0	100%			
		2. Degradation - Evidence of downcutting.			0	0	100%			
	2. Riffle Condition	1. Texture/Substrate - Riffle maintains coarser substrate.	7	7			100%			
	3. Meander Pool Condition	1. Depth Sufficient (Max Pool Depth : Mean Bankfull Depth ≥ 1.6).	7	7			100%			
		2. Length appropriate (>30% of centerline distance between tail of upstream riffle and head of downstream riffle).	7	7			100%			
2. Bank	**1. Scoured / Eroding**	Bank lacking vegetative cover resulting simply from poor growth and/or scour and erosion.			0	0	100%	0	0	100%
	2. Undercut	Banks undercut/overhanging to the extent that mass wasting appears likely. Does NOT include undercuts that are modest, appear sustainable and are providing habitat.			0	0	100%	0	0	100%
	3. Mass Wasting	Bank slumping, calving, or collapse.			0	0	100%	0	0	100%
				Totals	0	0	100%	0	0	100%
3. Engineered Structures	**1. Overall Integrity**	Structures physically intact with no dislodged boulders or logs.	13	13			100%			
	2. Grade Control	Grade control structures exhibiting maintenance of grade across the sill.	13	13			100%			
	2a. Piping	Structures lacking any substantial flow underneath sills or arms.	13	13			100%			
	3. Bank Protection	Bank erosion within the structures extent of influence does NOT exceed 15%.	13	13			100%			
	4. Habitat	Pool forming structures maintaining ~ Max Pool Depth : Mean Bankfull Depth Ratio ≥ 1.6. Rootwads/logs providing some cover at base-flow.	13	13			100%			

Date of last site inspection - 10/06/2021

Table 6 Vegetation Condition Assessment

Planted Acreage[1] **18.6**

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

Easement Acreage[2] **27.46**

Vegetation Category	Definitions	Mapping Threshold	CCPV Depiction	Number of Polygons	Combined Acreage	% of Easement Acreage
4. Invasive Areas of Concern[4]	Areas or points (if too small to render as polygons at map scale).	1000 SF	Yellow Crosshatch	0	0.00	0.0%
5. Easement Encroachment Areas[3]	Areas or points (if too small to render as polygons at map scale).	none	Red Simple Hatch	0	0.00	0.0%

Date of last site inspection - 10/06/2021

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.

Mockingbird MY1 Vegetation Monitoring Plot Photos

Vegetation Plot 1 (10/6/2021)

Vegetation Plot 2 (10/6/2021)

Vegetation Plot 3 (10/6/2021)

Vegetation Plot 4 (10/6/2021)

Mockingbird MY0 Vegetation Monitoring Plot Photos

Vegetation Plot 5 (10/6/2021)

Vegetation Plot 6 (10/7/2021)

Vegetation Plot 7 (10/7/2021)

Vegetation Plot 8 (10/6/2021)

Mockingbird MY0 Vegetation Monitoring Plot Photos

Vegetation Plot 9 (10/6/2021)

Vegetation Plot 10 (10/6/2021)

Mockingbird MY1 Random Vegetation Monitoring Plot Photos

Random Plot 1 (10/6/2021)

Random Plot 2 (10/6/2021)

Random Plot 3 (10/6/2021)

Random Plot 4 (10/6/2021)

Mockingbird Monitoring Device Photos

Stage Recorder HC1 (10/6/2021)

Stage Recorder NM2 (10/6/2021)

Flow Gauge NM1 (10/6/2021)

Flow Gauge NM4 (10/6/2021)

Mockingbird Monitoring Device Photos

Flow Gauge TP2 (10/6/2021)

Flow Gauge TP3 (10/6/2021)

Groundwater Well 1 (10/6/2021)

Mockingbird MY1 Random Vegetation Monitoring Plot Photos

Random Plot 5 (10/6/2021)

Appendix C

Vegetation Plot Data

Table 7. Planted Species Summary

Common Name	Scientific Name	Mitigation Plan %	As-Built %	Total Stems Planted
Water Oak	*Quercus nigra*	15	14	4,000
Willow Oak	*Quercus phellos*	15	12	3,500
River Birch	*Betula nigra*	15	12	3,500
Sycamore	*Platanus occidnetalis*	15	12	3,400
Northern Red Oak	*Quercus rubra*	10	11	3,300
Persimmon	*Diospyros virginiana*	5	11	3,200
Yellow Poplar	*Liriodendron tulipifera*	10	11	3,200
Green Ash	*Fraxinus pennsylvanica*	10	5	1,500
Crab Apple	*Malus angustifolia*	0	3	900
Eastern Redbud	*Cercis canadensis*	0	3	800
Black Walnut	*Juglans nigra*	0	2	700
Elderberry	*Sambucus candadensis*	0	1	500
Silky Dogwood	*Cornus amomum*	0	1	400
Sugarberry	*Celtis laevigata*	0	1	350
American Plum	*Prunus americana*	0	1	300
Blackgum	*Nyssa sylvatica*	5	0	0
			Total	29,550
			Planted Area	18.6
			As-built Planted Stems/Acre	1,589

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 Stem Height (ft)**
1	486	0	486	Yes	1.8
2	688	0	688	Yes	1.3
3	688	0	688	Yes	1.3
4	607	0	607	Yes	2.6
5	850	81	931	Yes	2.8
6	486	0	486	Yes	1.7
7	364	81	445	Yes	2.3
8	728	2630	3359	Yes	3.9
9	769	40	809	Yes	2.5
10	769	2873	3642	Yes	2.9
R1	567	0	567	Yes	3.4
R2	607	0	607	Yes	2.4
R3	850	0	850	Yes	3.1
R4	364	0	364	Yes	1.4
R5	1012	0	1012	Yes	2.5
Project Avg	**656**	**380**	**1049**	**Yes**	**2.5**

Table 9. Stem Count Total and Planted by Plot Species

EEP Project Code 100021. Project Name: Mockingbird

			Current Plot Data (MY1 2021)																												
			100021-01-0001			100021-01-0002			100021-01-0003			100021-01-0004			100021-01-0005			100021-01-0006			100021-01-0007			100021-01-0008			100021-01-0009			100021-01-0010		
Scientific Name	Common Name	Species Type	Pno LS	P-all	T	Pno LS	P-all	T	Pno LS	P-all	T	Pno LS	P-all	T	Pno LS	P-all	T	Pno LS	P-all	T	Pno LS	P-all	T	Pno LS	P-all	T	Pno LS	P-all	T	Pno LS	P-all	T
Betula nigra	river birch	Tree	1	1	1							10	10	10	3	3	3				2	2	2	17	17	17	7	7	7	11	11	11
Celtis laevigata	sugarberry	Tree																													
Celtis occidentalis	common hackberry	Tree													1	1	1														
Cephalanthus occidentalis	common buttonbush	Shrub													6	6	6														
Cercis canadensis	eastern redbud	Tree																													
Diospyros virginiana	common persimmon	Tree				1	1	1	7	7	7				3	3	3	2	2	2	3	3	5						1			1
Fraxinus pennsylvanica	green ash	Tree																								65	5	5	5			50
Juglans nigra	black walnut	Tree																													
Liriodendron tulipifera	tuliptree	Tree				1	1	1	2	2	2													1	1	1					
Morus rubra	red mulberry	Tree																													
Platanus occidentalis	American sycamore	Tree	1	1	1							3	3	3	5	5	6	5	5	5											
Prunus americana	American plum	Tree																													
Quercus alba	white oak	Tree				6	6	6																							
Quercus nigra	water oak	Tree													1	1	1	1	1	1	1	1	1								
Quercus phellos	willow oak	Tree				5	5	5	5	5	5	2	2	2				3	3	3	3	3	3				2	2	2	6	6	6
Quercus rubra	northern red oak	Tree	10	10	10	4	4	4	3	3	3				2	2	2	1	1	1							5	5	5	2	2	2
Ulmus alata	winged elm	Tree																														20
Ulmus americana	American elm	Tree															1															
Stem count			12	12	12	17	17	17	17	17	17	15	15	15	21	21	23	12	12	12	9	9	11	18	18	83	19	19	20	19	19	90
size (ares)			1			1			1			1			1			1			1			1			1			1		
size (ACRES)			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02			0.02		
Species count			3	3	3	5	5	5	4	4	4	3	3	3	7	7	8	5	5	5	4	4	4	2	2	3	4	4	5	3	3	6
Stems per ACRE			486	486	486	688	688	688	688	688	688	607	607	607	850	850	931	486	486	486	364	364	445	728	728	3359	769	769	809	769	769	3642

EEP Project Code 100021. Project Name: Mockingbird			Current Plot Data (MY1 2021)														Annual Means					
			100021-01-R1			100021-01-R2			100021-01-R3			100021-01-R4			100021-01-R5			MY1 (2021)			MY0 (2020)		
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
Acer negundo	Boxelder maple	Tree				1	1	1										1	1	1			
Betula nigra	river birch	Tree				2	2	2	11	11	11				10	10	10	74	74	74	54	54	54
Celtis laevigata	sugarberry	Tree																			2	2	2
Celtis occidentalis	common hackberry	Tree																1	1	1			
Cephalanthus occidentalis	common buttonbush	Shrub																6	6	6	7	7	7
Cercis canadensis	eastern redbud	Tree																			5	5	5
Diospyros virginiana	common persimmon	Tree	3	3	3	6	6	6				1	1	1	3	3	3	29	29	33	15	15	15
Fraxinus pennsylvanica	green ash	Tree	1	1	1	2	2	2	1	1	1							9	9	129	5	5	5
Juglans nigra	black walnut	Tree																			10	10	10
Liriodendron tulipifera	tuliptree	Tree				2	2	2	2	2	2							8	8	8	13	13	13
Morus rubra	red mulberry	Tree							3	3	3							3	3	3	2	2	2
Platanus occidentalis	American sycamore	Tree	10	10	10										8	8	8	32	32	33	16	16	16
Prunus americana	American plum	Tree																			3	3	3
Quercus alba	white oak	Tree										1	1	1				7	7	7			
Quercus nigra	water oak	Tree																3	3	3	8	8	8
Quercus phellos	willow oak	Tree				2	2	2				1	1	1				29	29	29	67	67	67
Quercus rubra	northern red oak	Tree							3	3	3	6	6	6	4	4	4	40	40	40	90	90	90
Salix nigra	Black willow	Tree							1	1	1							1	1	1			
Ulmus alata	winged elm	Tree																		20			
Ulmus americana	American elm	Tree																		1			
		Stem count	14	14	14	15	15	15	21	21	21	9	9	9	25	25	25	243	243	389	297	297	297
		size (ares)	1			1			1			1			1			15			10		
		size (ACRES)	0.02			0.02			0.02			0.02			0.02			0.37			0.25		
		Species count	3	3	3	6	6	6	6	6	6	4	4	4	4	4	4	14	14	16	14	14	14
		Stems per ACRE	567	567	567	607	607	607	850	850	850	364	364	364	1012	1012	1012	656	656	1049	1202	1202	1202

Appendix D

Stream Measurement and

Geomorphology Data

Table 10. Baseline Stream Data Summary
Mockingbird Mitigation Site - Reach NM2

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)		---	---	---	9.3	---	---	10.0	---	2	13.7	---	---	15.0	---	2	---	16.0	---	15.4	15.9	15.9	16.3	0.6	2
Floodprone Width (ft)					20.7	---	---	>30	---	2	>30	---	---	>50	---	2	---	>50	---	65.0	65.0	65.0	65.0	0.0	2
Bankfull Mean Depth (ft)		---	---	---	1.8	---	---	2.5	---	2	0.6	---	---	1.4	---	2	---	1.6	---	---	---	---	---	---	---
[1]Bankfull Max Depth (ft)					2.6	---	---	4.0	---	2	0.8	---	---	1.7	---	2	---	2.2	---	1.9	2.0	2.0	2.0	0.1	2
Bankfull Cross Sectional Area (ft^2)		---	---	---	17.8	---	---	23.0	---	2	3.0	---	---	18.1	---	2	---	25.3	---	20.7	22.0	22.0	23.2	1.8	2
Width/Depth Ratio					3.8	---	---	5.6	---	2	8.9	---	---	9.8	---	2	---	10.1	---	---	---	---	---	---	---
Entrenchment Ratio					2.1	---	---	>2.2	---	2	>2.2	---	---	>4	---	2	---	3.1	---	4.0	4.1	4.1	4.2	0.1	2
[1]Bank Height Ratio					1.1	---	---	2.4	---	2	1.0	---	---	1.2	---	2	---	1.0	---	1.0	1.0	1.0	1.0	0.0	2
Profile																									
Riffle Length (ft)					---	---	---	---	---	---	4	---	---	18	---	---	7	---	21	12.7	24.6	21.0	60.3	12.1	22
Riffle Slope (ft/ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	0.04	0.8	0.8	2.5	0.6	22
Pool Length (ft)					---	---	---	---	---	---	3	---	---	42	---	---	6	---	49	18	40	39	67	12	20
Pool Max depth (ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pool Spacing (ft)					---	---	---	---	---	---	12	---	---	64	---	---	21	---	75	41	63	59	120	19	19
Pattern																									
Channel Beltwidth (ft)					---	---	---	---	---	---	15	---	---	55.5	---	---	33	---	60	33	---	---	60	---	---
Radius of Curvature (ft)					---	---	---	---	---	---	6	---	---	103.3	---	---	28	---	75	28	---	---	75	---	---
Rc:Bankfull width (ft/ft)					---	---	---	---	---	---	1	---	---	6.9	---	---	1.8	---	4.4	1.8	---	---	4.4	---	---
Meander Wavelength (ft)					---	---	---	---	---	---	23	---	---	66	---	---	69	---	91	69	---	---	91	---	---
Meander Width Ratio					---	---	---	---	---	---	4.4	---	---	7.7	---	---	2.1	---	3.5	2.1	---	---	3.5	---	---
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					E4						E4						E4/E5			E4/E5					
Bankfull Velocity (fps)		---	---	---	---						---						---			---					
Bankfull Discharge (cfs)		---	---	---	---						---						---			---					
Valley length (ft)					1089						---						1348			---					
Channel Thalweg length (ft)					1219						---						1366			---					
Sinuosity (ft)					1.12						---						1.01			---					
Water Surface Slope (Channel) (ft/ft)					0.0042						---						0.0026			---					
Channel slope (ft/ft)					0.0076						---						0.0026			---					
[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 (continued)
Mockingbird Mitigation Site - Reach NM3

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)		---	---	---	---	---	6.7	---	---	1	5.2	---	---	13.7	---	2	---	6.4	---	---	---	6.2	---	---	---
Floodprone Width (ft)					---	---	21.9	---	---	1	>30	---	---	>50	---	2	---	30.0	---	---	---	>65	---	---	---
Bankfull Mean Depth (ft)		---	---	---	---	---	0.6	---	---	1	0.6	---	---	1.4	---	2	---	0.7	---	---	---	---	---	---	---
[1]Bankfull Max Depth (ft)					---	---	1.4	---	---	1	0.8	---	---	1.7	---	2	---	1.0	---	---	---	1.2	---	---	---
Bankfull Cross Sectional Area (ft^2)		---	---	---	---	---	3.9	---	---	1	3.0	---	---	18.1	---	2	---	4.7	---	---	---	4.3	---	---	---
Width/Depth Ratio					---	---	11.4	---	---	1	8.9	---	---	9.8	---	2	---	8.7	---	---	---	---	---	---	---
Entrenchment Ratio					---	---	3.3	---	---	1	>2.2	---	---	>4	---	2	---	4.7	---	---	---	>10.6	---	---	---
[1]Bank Height Ratio					---	---	0.8	---	---	1	1.0	---	---	1.2	---	2	---	1.0	---	---	---	1.0	---	---	---
Profile																									
Riffle Length (ft)					---	---	---	---	---	---	4	---	---	18	---	---	4	---	22	4.4	10.2	8.7	20.3	5.5	10
Riffle Slope (ft/ft)					---	---	---	---	---	---	---	---	---	---	---	---		---		0.5	2.6	2.3	6.6	2.1	10
Pool Length (ft)					---	---	---	---	---	---	3	---	---	42	---	---	4	---	12	6	15	13	24	7	11
Pool Max depth (ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pool Spacing (ft)					---	---	---	---	---	---	12	---	---	64	---	---	15	---	43	16	25	25	42	8	10
Pattern																									
Channel Beltwidth (ft)					---	---	---	---	---	---	15	---	---	55.5	---	---	18	---	43	18	---	43	---	---	---
Radius of Curvature (ft)					---	---	---	---	---	---	6	---	---	103.3	---	---	7	---	21	7	---	21	---	---	---
Rc:Bankfull width (ft/ft)					---	---	---	---	---	---	1	---	---	6.9	---	---	1.1	---	3	1.1	---	3	---	---	---
Meander Wavelength (ft)					---	---	---	---	---	---	23	---	---	66	---	---	28	---	53	28	---	53	---	---	---
Meander Width Ratio					---	---	---	---	---	---	3.6	---	---	7.7	---	---	4	---	6.2	4	---	6.2	---	---	---
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					E6b						E4						E3/E4			E3/E4					
Bankfull Velocity (fps)		---	---	---	---						---						---			---					
Bankfull Discharge (cfs)		---	---	---	---						---						---			---					
Valley length (ft)					190						---						240			---					
Channel Thalweg length (ft)					198						---						280			---					
Sinuosity (ft)					1.04						---						1.17			---					
Water Surface Slope (Channel) (ft/ft)					---						---						0.013			---					
Channel slope (ft/ft)					0.0289						---						0.013			---					
[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 (continued)
Mockingbird Mitigation Site - Reach HC1

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)		---	---	---	11.9	---	15.4	20.0	---	3	5.2	---	---	13.7	---	2	---	21.8	---	19.6	20.6	20.0	22.2	1.4	3
Floodprone Width (ft)					27.4	---	30.0	50.0	---	3	>30	---	---	>50	---	2	---	50.0	---	65.0	65.0	65.0	65.0	0.0	3
Bankfull Mean Depth (ft)		---	---	---	1.9	---	2.0	2.5	---	3	0.6	---	---	1.4	---	2	---	2.2	---	---	---	---	---	---	---
[1]Bankfull Max Depth (ft)					3.2	---	3.7	3.8	---	3	0.8	---	---	1.7	---	2	---	2.9	---	2.3	2.5	2.4	2.8	0.3	3
Bankfull Cross Sectional Area (ft^2)		---	---	---	23.0	---	38.0	40.0	---	3	3.0	---	---	18.1	---	2	---	47.0	---	33.3	37.4	33.4	45.6	7.1	3
Width/Depth Ratio					6.1	---	6.2	10.1	---	3	8.9	---	---	9.8	---	2	---	10.1	---	---	---	---	---	---	---
Entrenchment Ratio					1.4	---	2.5	3.2	---	3	>2.2	---	---	>4	---	2	---	2.3	---	2.9	3.2	3.3	3.3	0.2	3
[1]Bank Height Ratio					1.8	---	1.8	1.8	---	3	1.0	---	---	1.2	---	2	---	1.0	---	1.0	1.0	1.0	1.0	0.0	3
Profile																									
Riffle Length (ft)					---	---	---	---	---	---	4	---	---	18	---	---	10	---	29	8	24	22	93	15	30
Riffle Slope (ft/ft)					---	---	---	---	---	---	---	---	---	---	---	---		---		0.01	1.0	0.8	2.4	0.7	30
Pool Length (ft)					---	---	---	---	---	---	3	---	---	42	---	---	8	---	67	17	47	50	65	12	28
Pool Max depth (ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pool Spacing (ft)					---	---	---	---	---	---	12	---	---	64	---	---	29	---	103	46	73	70	163	22	27
Pattern																									
Channel Beltwidth (ft)					---	---	---	---	---	---	15	---	---	55.5	---	---	45	---	82	45	---	82	---	---	---
Radius of Curvature (ft)					---	---	---	---	---	---	6	---	---	103.3	---	---	38	---	103	38	---	103	---	---	---
Rc:Bankfull width (ft/ft)					---	---	---	---	---	---	1	---	---	6.9	---	---	1.7	---	4.4	1.7	---	4.4	---	---	---
Meander Wavelength (ft)					---	---	---	---	---	---	23	---	---	66	---	---	95	---	123	95	---	123	---	---	---
Meander Width Ratio					---	---	---	---	---	---	3.6	---	---	7.7	---	---	2.1	---	3.5	2.1	---	3.5	---	---	---
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					E5						E4						E3/E4			E3/E4					
Bankfull Velocity (fps)		---	---	---	---						---						---			---					
Bankfull Discharge (cfs)		---	---	---	---												---								
Valley length (ft)					1925						---						1925			---					
Channel Thalweg length (ft)					2135						---						2083			---					
Sinuosity (ft)					1.11						---						1.08			---					
Water Surface Slope (Channel) (ft/ft)					0.0051						---						0.003			---					
Channel slope (ft/ft)					0.0028						---						0.003			---					
[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 (continued)
Mockingbird Mitigation Site - Reach HC2-B

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)		---	---	---	---	---	11.7	---	---	1	5.2	---	---	13.7	---	2	---	12.6	---	---	---	12.0	---	---	---
Floodprone Width (ft)					---	---	15.0	---	---	1	>30	---	---	>50	---	2	---	50.0	---	---	---	>50	---	---	---
Bankfull Mean Depth (ft)		---	---	---	---	---	1.0	---	---	1	0.6	---	---	1.4	---	2	---	1.3	---	---	---	---	---	---	---
[1]Bankfull Max Depth (ft)					---	---	1.2	---	---	1	0.8	---	---	1.7	---	2	---	1.8	---	---	---	1.6	---	---	---
Bankfull Cross Sectional Area (ft^2)		---	---	---	---	---	11.9	---	---	1	3.0	---	---	18.1	---	2	---	16.4	---	---	---	14.0	---	---	---
Width/Depth Ratio					---	---	11.6	---	---	1	8.9	---	---	9.8	---	2	---	9.7	---	---	---	---	---	---	---
Entrenchment Ratio					---	---	1.3	---	---	1	>2.2	---	---	>4	---	2	---	4.0	---	---	---	>4.2	---	---	---
[1]Bank Height Ratio					---	---	2.0	---	---	1	1.0	---	---	1.2	---	2	---	1.0	---	---	---	1.0	---	---	---
Profile																									
Riffle Length (ft)					---	---	---	---	---	---	4	---	---	18	---	---	6	---	17	7	15	12	54	12	14
Riffle Slope (ft/ft)					---	---	---	---	---	---	---	---	---	---	---	---		---		0.1	1.6	1.4	4.4	1.2	14
Pool Length (ft)					---	---	---	---	---	---	3	---	---	42	---	---	5	---	39	2	32	33	43	10	13
Pool Max depth (ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pool Spacing (ft)					---	---	---	---	---	---	12	---	---	64	---	---	17	---	59	10	43	45	55	12	12
Pattern																									
Channel Beltwidth (ft)					---	---	---	---	---	---	15	---	---	55.5	---	---	26	---	47	26	---	47	---	---	---
Radius of Curvature (ft)					---	---	---	---	---	---	6	---	---	103.3	---	---	22	---	59	22	---	59	---	---	---
Rc:Bankfull width (ft/ft)					---	---	---	---	---	---	1	---	---	6.9	---	---	1.7	---	4.4	1.7	---	4.4	---	---	---
Meander Wavelength (ft)					---	---	---	---	---	---	23	---	---	66	---	---	55	---	71	55	---	71	---	---	---
Meander Width Ratio					---	---	---	---	---	---	3.6	---	---	7.7	---	---	3.5	---	4	3.5	---	4	---	---	---
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					F3						E4						E3/E4			E3/E4					
Bankfull Velocity (fps)		---	---	---	---						---						---			---					
Bankfull Discharge (cfs)		---	---	---	---												---								
Valley length (ft)					586						---						487			---					
Channel Thalweg length (ft)					673						---						595			---					
Sinuosity (ft)					1.15						---						1.22			---					
Water Surface Slope (Channel) (ft/ft)					0.011						---						0.005			---					
Channel slope (ft/ft)					0.0092						---						0.005			---					
[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 (continued)
Mockingbird Mitigation Site - Reach JS1

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)		---	---	---	---	---	8.8	---	---	1	5.2	---	---	13.7	---	2	---	13.5	---	---	---	13.3	---	---	---
Floodprone Width (ft)					---	---	10.7	---	---	1	>30	---	---	>50	---	2	---	50.0	---	---	---	>60.8	---	---	---
Bankfull Mean Depth (ft)		---	---	---	---	---	1.6	---	---	1	0.6	---	---	1.4	---	2	---	1.4	---	---	---	---	---	---	---
[1]Bankfull Max Depth (ft)					---	---	3.0	---	---	1	0.8	---	---	1.7	---	2	---	1.9	---	---	---	1.8	---	---	---
Bankfull Cross Sectional Area (ft^2)		---	---	---	---	---	14.4	---	---	1	3.0	---	---	18.1	---	2	---	19.4	---	---	---	17.0	---	---	---
Width/Depth Ratio					---	---	5.4	---	---	1	8.9	---	---	9.8	---	2	---	9.4	---	---	---	---	---	---	---
Entrenchment Ratio					---	---	1.2	---	---	1	>2.2	---	---	>4	---	2	---	3.7	---	---	---	>4.6	---	---	---
[1]Bank Height Ratio					---	---	1.1	---	---	1	1.0	---	---	1.2	---	2	---	1.0	---	---	---	1.0	---	---	---
Profile																									
Riffle Length (ft)					---	---	---	---	---	---	4	---	---	18	---	---	6	---	18	6.1	27.5	16.4	102.4	33.6	7
Riffle Slope (ft/ft)					---	---	---	---	---	---	---	---	---	---	---	---		---		0.3	1.3	1.2	3.0	1.0	7
Pool Length (ft)					---	---	---	---	---	---	3	---	---	42	---	---	5	---	42	23	39	36	54	12	7
Pool Max depth (ft)					---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
Pool Spacing (ft)					---	---	---	---	---	---	12	---	---	64	---	---	18	---	64	39	68	58	139	37	6
Pattern																									
Channel Beltwidth (ft)					---	---	---	---	---	---	15	---	---	55.5	---	---	28	---	51	28	---	51	---	---	---
Radius of Curvature (ft)					---	---	---	---	---	---	6	---	---	103.3	---	---	24	---	64	24	---	64	---	---	---
Rc:Bankfull width (ft/ft)					---	---	---	---	---	---	1	---	---	6.9	---	---	1.8	---	4.4	1.8	---	4.4	---	---	---
Meander Wavelength (ft)					---	---	---	---	---	---	23	---	---	66	---	---	59	---	76	59	---	76	---	---	---
Meander Width Ratio					---	---	---	---	---	---	3.6	---	---	7.7	---	---	2.1	---	5	2.1	---	5	---	---	---
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					E5						E4						E4/E5			E4/E5					
Bankfull Velocity (fps)		---	---	---	---						---						---			---					
Bankfull Discharge (cfs)		---	---	---	---												---								
Valley length (ft)					470						---						470			---					
Channel Thalweg length (ft)					465						---						500			---					
Sinuosity (ft)					0.99						---						1.06			---					
Water Surface Slope (Channel) (ft/ft)					0.0095						---						0.0036			---					
Channel slope (ft/ft)					0.0095						---						0.0036			---					
[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: Mockingbird #100021

	Cross Section 1 (Pool)							Cross Section 2 (Riffle)							Cross Section 3 (Pool)							Cross Section 4 (Riffle)							Cross Section 5 (Pool)						
	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]	709.5	709.6						709.5	709.7						711.2	711.5						711.1	711.3						717.9	718.3					
Bankfull Width (ft)[1]	-	-	-	-	-	-	-	13.3	13.4						-	-	-	-	-	-	-	6.2	8.6						-	-	-	-	-	-	-
Floodprone Width (ft)[1]	-	-	-	-	-	-	-	>60.8	>64.1						-	-	-	-	-	-	-	>65	>65.5						-	-	-	-	-	-	-
Bankfull Max Depth (ft)[2]	1.6	2.1						1.8	2.0						1.3	1.2						1.2	1.0						3.1	2.0					
Low Bank Elevation (ft)	-	709.7						709.5	709.7						-	711.3						711.1	711.2						-	718.0					
Bankfull Cross Sectional Area (ft^2)[2]	15.1	15.5						17.0	16.4						4.5	3.3						4.3	3.6						25.8	19.3					
Bankfull Entrenchment Ratio[1]	-	-	-	-	-	-	-	>4.6	>4.8						-	-	-	-	-	-	-	>10.6	>7.7						-	-	-	-	-	-	-
Bankfull Bank Height Ratio[1]	-	-	-	-	-	-	-	1.0	1.0						-	-	-	-	-	-	-	1.0	0.9						-	-	-	-	-	-	-

	Cross Section 6 (Riffle)							Cross Section 7 (Pool)							Cross Section 8 (Riffle)							Cross Section 9 (Riffle)							Cross Section 10 (Pool)						
	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]	718.0	718.1						713.9	713.9						713.5	713.6						710.6	710.7						710.5	710.5					
Bankfull Width (ft)[1]	16.3	21.3						-	-	-	-	-	-	-	15.4	17.5						22.2	24.4						-	-	-	-	-	-	-
Floodprone Width (ft)[1]	>65	>65.2						-	-	-	-	-	-	-	>65	>65.1						>65	>65.4						-	-	-	-	-	-	-
Bankfull Max Depth (ft)[2]	2.0	1.6						3.0	3.1						1.9	2.1						2.8	2.9						3.9	4.0					
Low Bank Elevation (ft)	718.0	717.7						-	714.0						713.5	713.5						710.6	710.6						-	710.7					
Bankfull Cross Sectional Area (ft^2)[2]	23.2	14.7						27.6	29.0						20.7	19.9						45.6	43.6						50.7	58.5					
Bankfull Entrenchment Ratio[1]	>4	>3.1						-	-	-	-	-	-	-	>4.2	>3.7						>2.9	>2.7						-	-	-	-	-	-	-
Bankfull Bank Height Ratio[1]	1.0	0.8						-	-	-	-	-	-	-	1.0	1.0						1.0	1.0						-	-	-	-	-	-	-

	Cross Section 11 (Pool)							Cross Section 12 (Riffle)							Cross Section 13 (Riffle)							Cross Section 14 (Pool)							Cross Section 15 (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]	713.2	713.3						713.6	713.5						714.9	714.9						715.1	715.1						758.0	758.0					
Bankfull Width (ft)[1]	-	-	-	-	-	-	-	19.6	25.0						20.0	19.2						-	-	-	-	-	-	-	12.0	13.5					
Floodprone Width (ft)[1]	-	-	-	-	-	-	-	>65	>64.5						>65	>64.8						-	-	-	-	-	-	-	>50	>50.4					
Bankfull Max Depth (ft)[2]	4.3	4.0						2.4	2.3						2.3	2.5						4.0	4.3						1.6	1.7					
Low Bank Elevation (ft)	-	713.1						713.6	713.3						714.94	715.0						-	715.1						757.99	757.9					
Bankfull Cross Sectional Area (ft^2)[2]	46.3	40.9						33.3	29.3						33.4	34.4						47.7	47.8						14.0	12.7					
Bankfull Entrenchment Ratio[1]	-	-	-	-	-	-	-	>3.3	>2.6						>3.3	>3.4						-	-	-	-	-	-	-	>4.2	>3.7					
Bankfull Bank Height Ratio[1]	-	-	-	-	-	-	-	1.0	0.9						1.0	1.0						-	-	-	-	-	-	-	1.0	0.9					

	Cross Section 16 (Pool)							Cross Section 17 (Riffle) EI							Cross Section 18 (Pool) EI							Cross Section 19 (Riffle) EII							Cross Section 20 (Riffle) EII						
	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]	757.9	757.9						751.9	751.5						751.8	751.9						754.9	754.9						715.0	714.9					
Bankfull Width (ft)[1]	-	-	-	-	-	-	-	10.3	9.1						-	-	-	-	-	-	-	7.1	9.7						12.4	16.9					
Floodprone Width (ft)[1]	-	-	-	-	-	-	-	17.1	16.3						-	-	-	-	-	-	-	>50.5	>50.5						>49.9	>49.7					
Bankfull Max Depth (ft)[2]	2.9	2.9						1.3	1.8						2.7	2.8						1.2	1.1						1.2	1.0					
Low Bank Elevation (ft)	-	757.9						751.86	751.9						751.8	752.0						754.87	754.8						715.0	714.8					
Bankfull Cross Sectional Area (ft^2)[2]	23.2	23.5						8.9	12.8						26.8	28.3						5.8	4.8						7.5	5.1					
Bankfull Entrenchment Ratio[1]	-	-	-	-	-	-	-	1.7	1.8						-	-	-	-	-	-	-	>7.1	>5.2						>4.0	>2.9					
Bankfull Bank Height Ratio[1]	-	-	-	-	-	-	-	1.0	1.3						-	-	-	-	-	-	-	1.0	0.9						1.0	0.9					

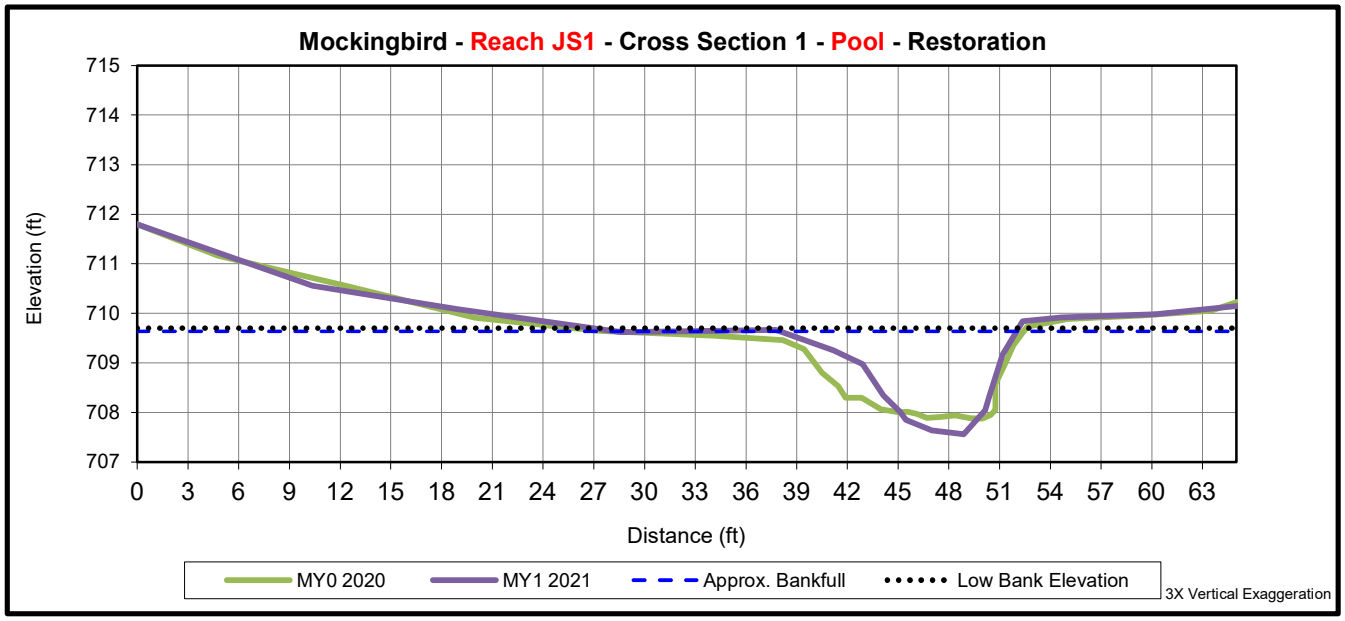
	Cross Section 21 (Riffle) EII						
	Base	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	712.4	712.4					
Bankfull Width (ft)[1]	5.5	6.1					
Floodprone Width (ft)[1]	24.7	6.1					
Bankfull Max Depth (ft)[2]	0.7	1.1					
Low Bank Elevation (ft)	712.40	712.6					
Bankfull Cross Sectional Area (ft^2)[2]	2.6	4.2					
Bankfull Entrenchment Ratio[1]	4.5	4.5					
Bankfull Bank Height Ratio[1]	1.0	1.3					

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

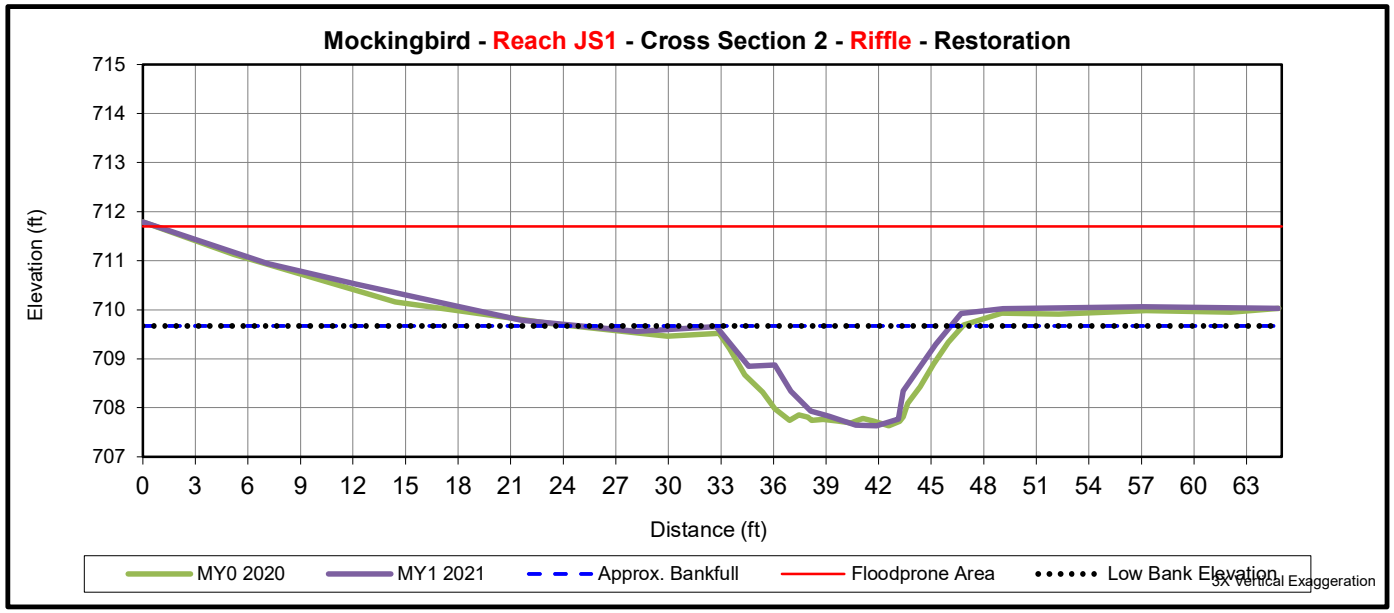


	Cross Section 1 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA	709.45	709.6					
Bankfull Width (ft)[1]	-	-					
Floodprone Width (ft)[1]	-	-					
Bankfull Max Depth (ft)[2]	1.6	2.1					
Low Bank Elevation (ft)	-	709.7					
Bankfull Cross Sectional Area (ft^2)[2]	15.1	15.5					
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

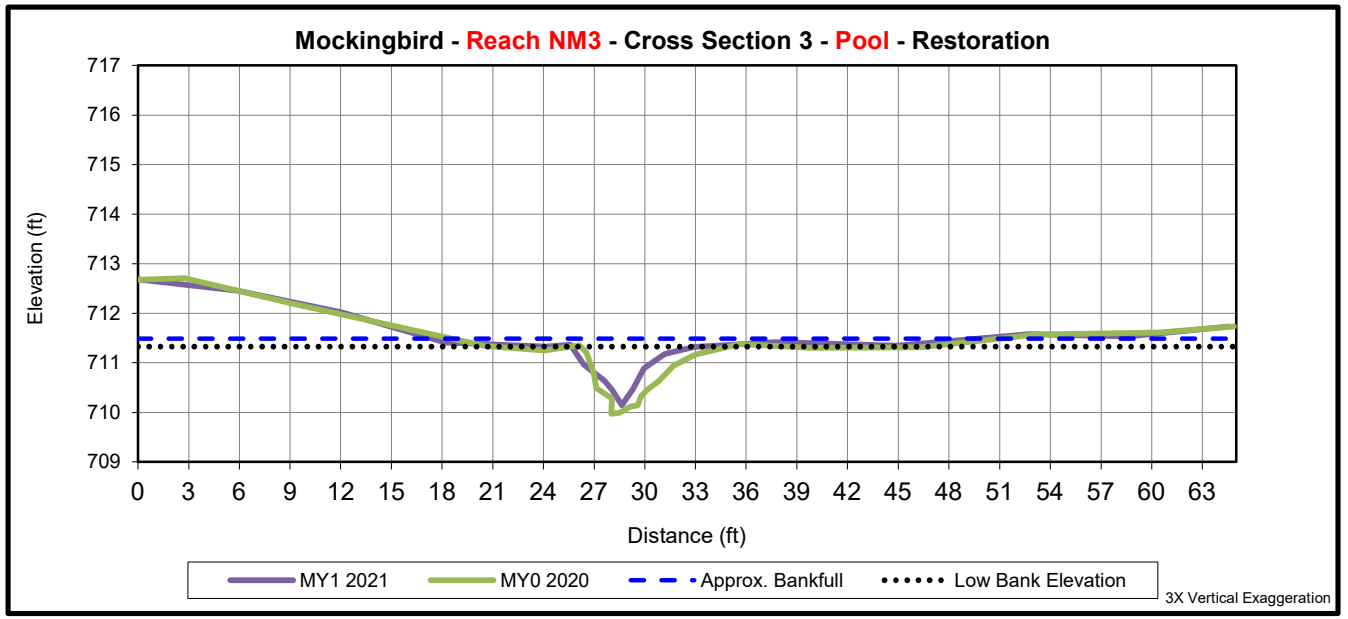


	Cross Section 2 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	709.46	709.7					
Bankfull Width (ft)[1]	13.3	13.4					
Floodprone Width (ft)[1]	>60.8	>64.1					
Bankfull Max Depth (ft)[2]	1.8	2.0					
Low Bank Elevation (ft)	709.46	709.7					
Bankfull Cross Sectional Area (ft^2)[2]	17.0	16.4					
Bankfull Entrenchment Ratio[1]	>4.6	>4.8					
Bankfull Bank Height Ratio[1]	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

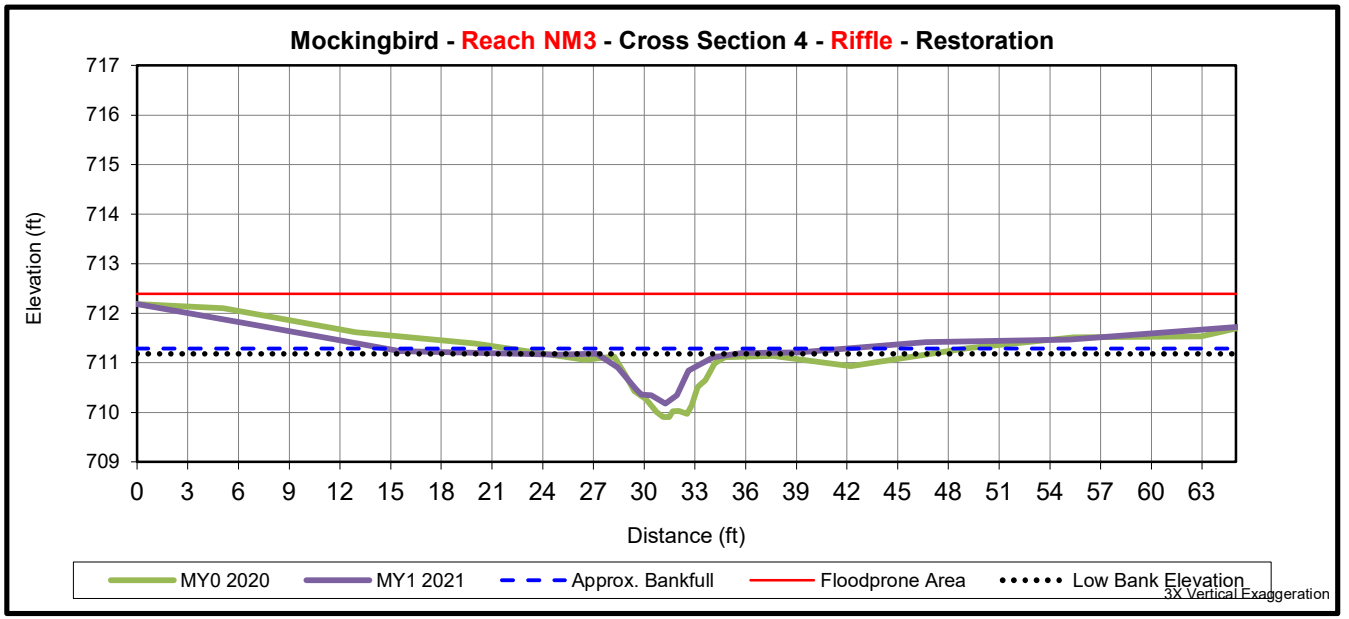


	Cross Section 3 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	711.25	711.5					
Bankfull Width (ft)[1]	-	-					
Floodprone Width (ft)[1]	-	-					
Bankfull Max Depth (ft)[2]	1.3	1.2					
Low Bank Elevation (ft)	-	711.3					
Bankfull Cross Sectional Area (ft^2)[2]	4.5	3.3					
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

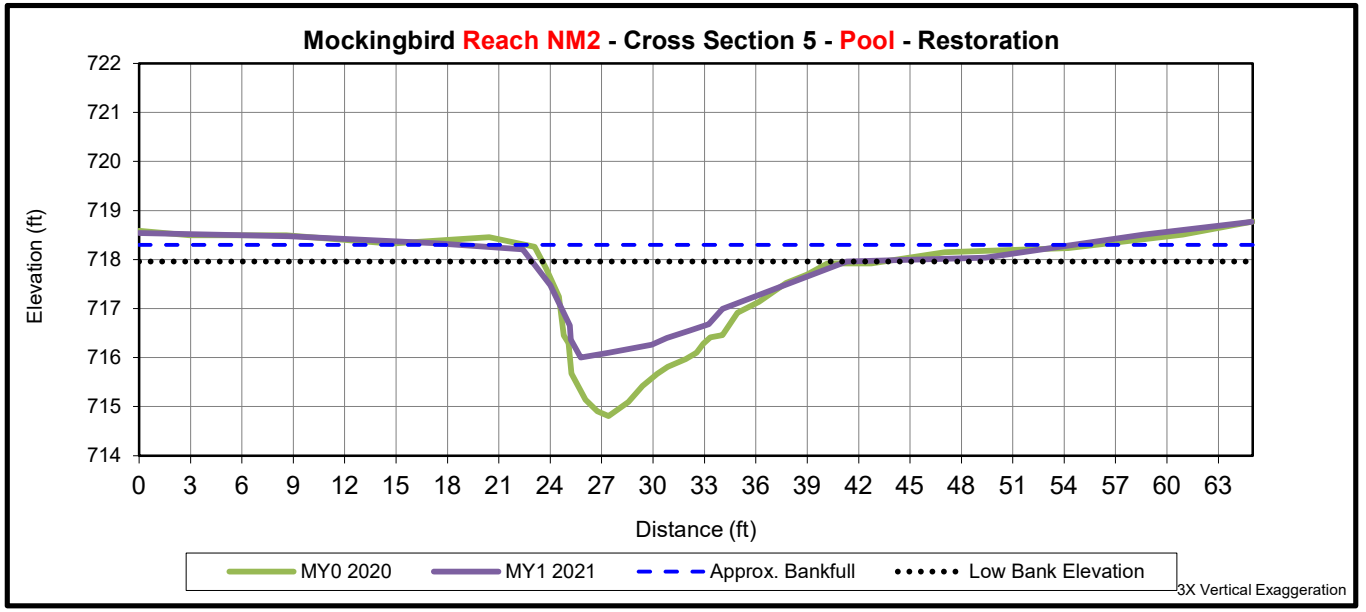


	Cross Section 4 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	711.07	711.3					
Bankfull Width (ft)[1]	6.2	8.6					
Floodprone Width (ft)[1]	>65	>65.5					
Bankfull Max Depth (ft)[2]	1.2	1.0					
Low Bank Elevation (ft)	711.07	711.2					
Bankfull Cross Sectional Area (ft^2)[2]	4.3	3.6					
Bankfull Entrenchment Ratio[1]	>10.6	>7.7					
Bankfull Bank Height Ratio[1]	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

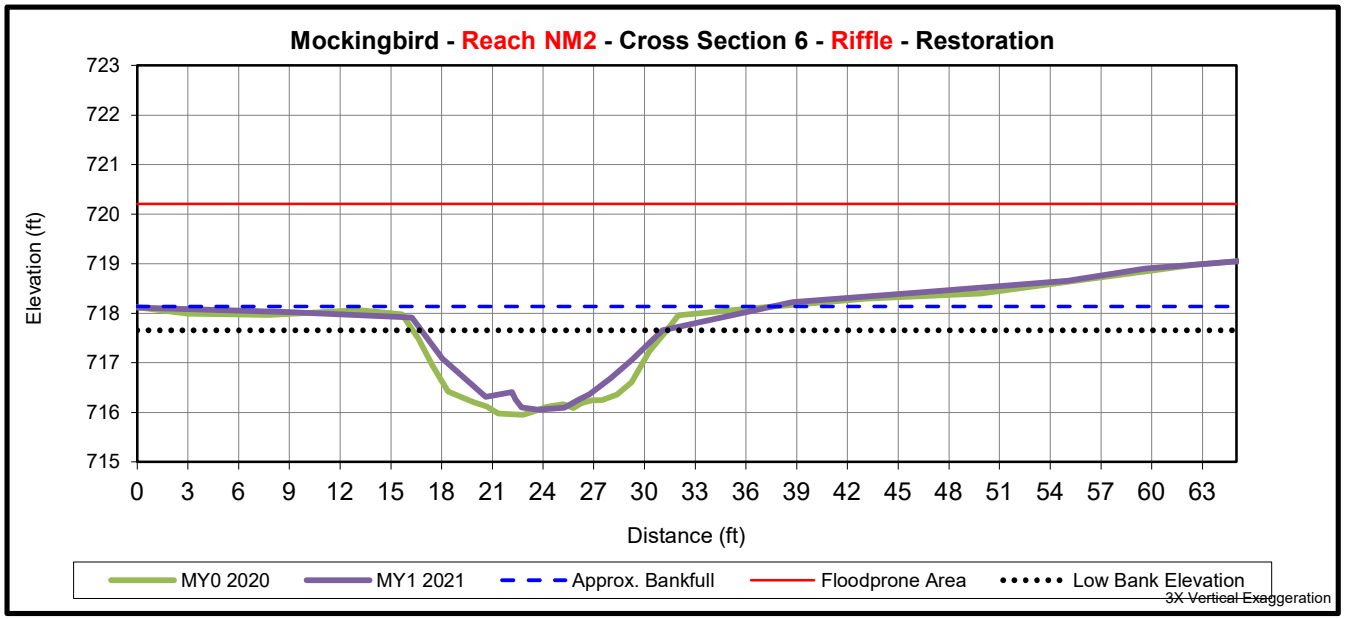


	Cross Section 5 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	717.92	718.3					
Bankfull Width (ft)[1]	-	-					
Floodprone Width (ft)[1]	-	-					
Bankfull Max Depth (ft)[2]	3.1	2.0					
Low Bank Elevation (ft)	-	718.0					
Bankfull Cross Sectional Area (ft^2)[2]	25.8	19.3					
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

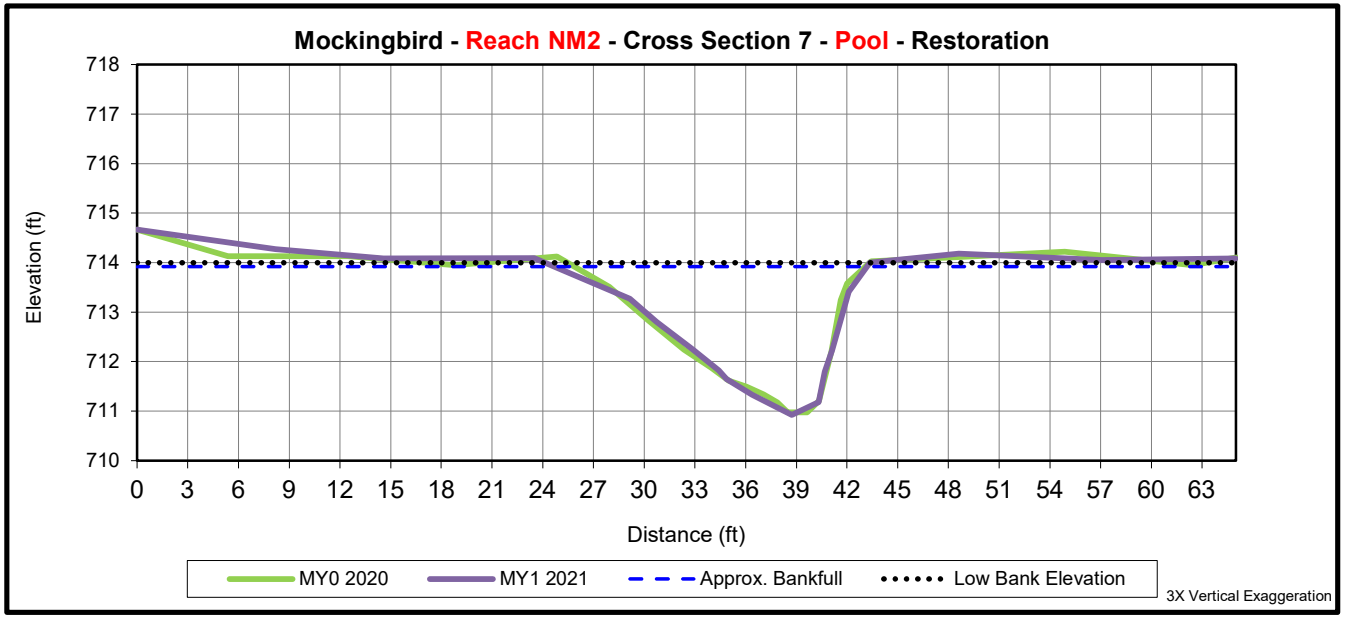


	Cross Section 6 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	717.96	718.1					
Bankfull Width (ft)[1]	16.3	21.3					
Floodprone Width (ft)[1]	>65	>65.2					
Bankfull Max Depth (ft)[2]	2.0	1.6					
Low Bank Elevation (ft)	717.96	717.7					
Bankfull Cross Sectional Area (ft^2)[2]	23.2	14.7					
Bankfull Entrenchment Ratio[1]	>4	>3.1					
Bankfull Bank Height Ratio[1]	1.0	0.8					

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

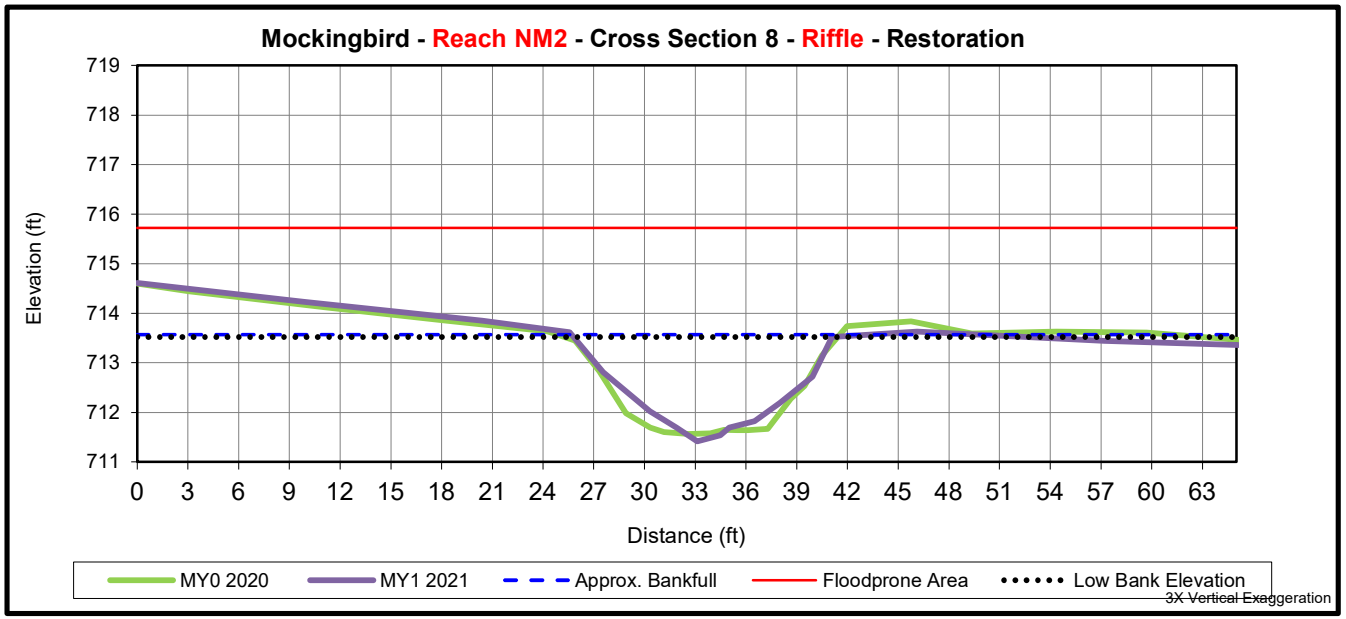


	Cross Section 7 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	713.94	713.9					
Bankfull Width (ft)[1]	-	-					
Floodprone Width (ft)[1]	-	-					
Bankfull Max Depth (ft)[2]	3.0	3.1					
Low Bank Elevation (ft)	-	714.0					
Bankfull Cross Sectional Area (ft^2)[2]	27.6	29.0					
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

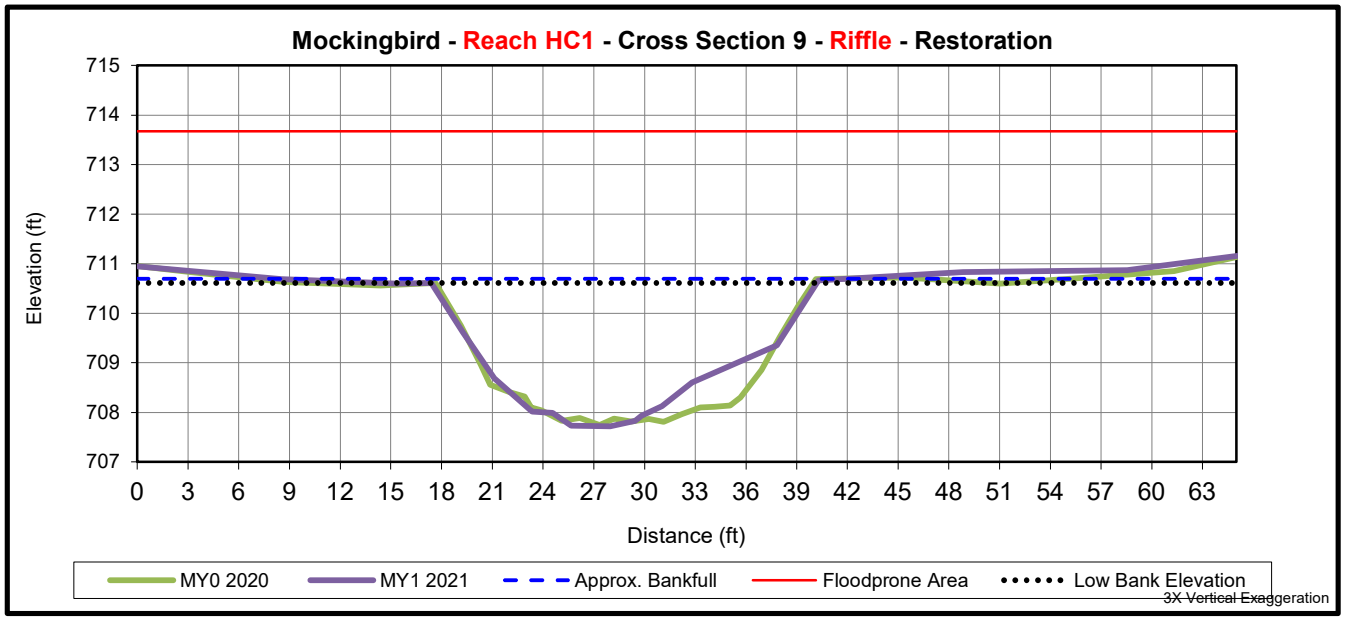


	Cross Section 8 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	713.45	713.6					
Bankfull Width (ft)[1]	15.4	17.5					
Floodprone Width (ft)[1]	>65	>65.1					
Bankfull Max Depth (ft)[2]	1.9	2.1					
Low Bank Elevation (ft)	713.45	713.5					
Bankfull Cross Sectional Area (ft^2)[2,2]	20.7	19.9					
Bankfull Entrenchment Ratio[1]	>4.2	>3.7					
Bankfull Bank Height Ratio[1]	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

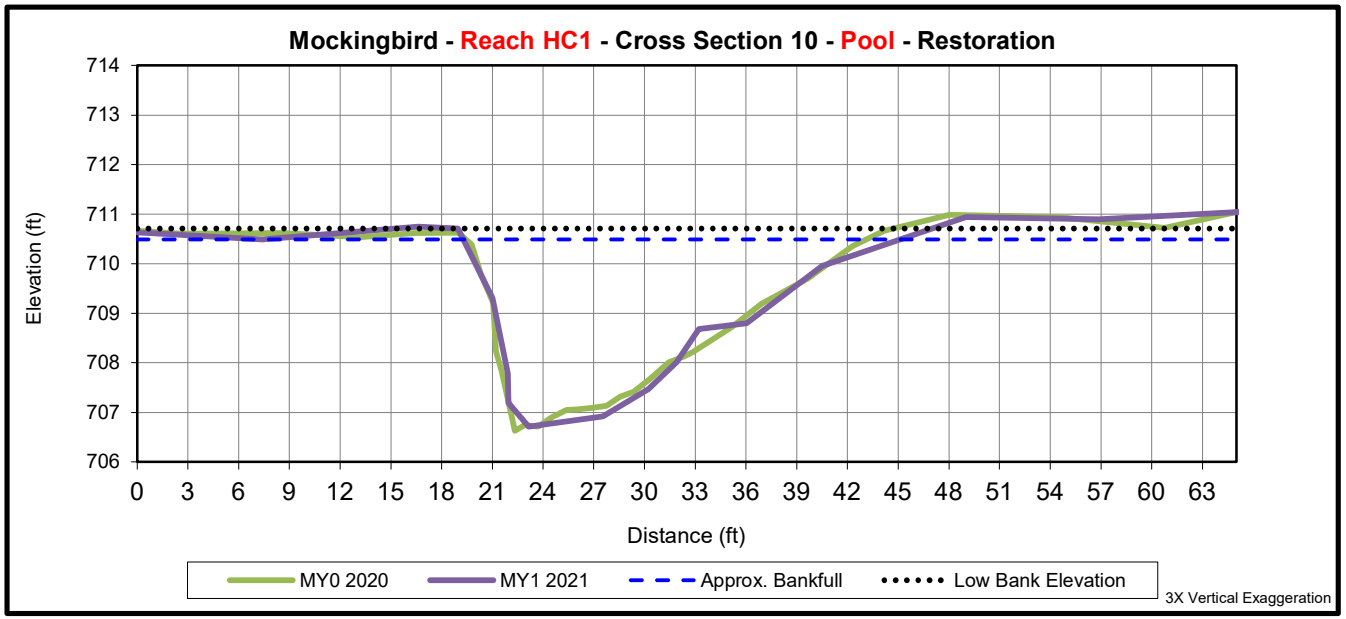


	Cross Section 9 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	710.56	710.7					
Bankfull Width (ft)[1]	22.2	24.4					
Floodprone Width (ft)[1]	>65	>65.4					
Bankfull Max Depth (ft)[2]	2.8	2.9					
Low Bank Elevation (ft)	710.56	710.6					
Bankfull Cross Sectional Area (ft^2)[2]	45.6	43.6					
Bankfull Entrenchment Ratio[1]	>2.9	>2.7					
Bankfull Bank Height Ratio[1]	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

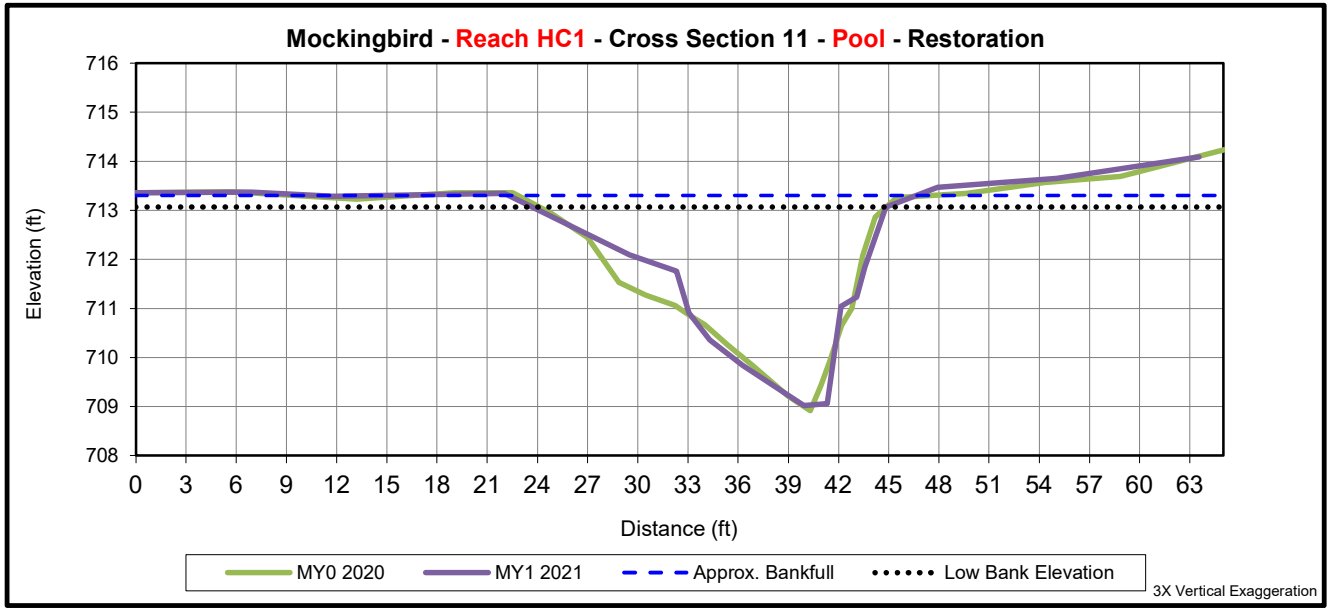


	Cross Section 10 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	710.53	710.5					
Bankfull Width (ft)[1]	-	-					
Floodprone Width (ft)[1]	-	-					
Bankfull Max Depth (ft)[2]	3.9	4.0					
Low Bank Elevation (ft)	-	710.7					
Bankfull Cross Sectional Area (ft^2)[2]	50.7	58.5					
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

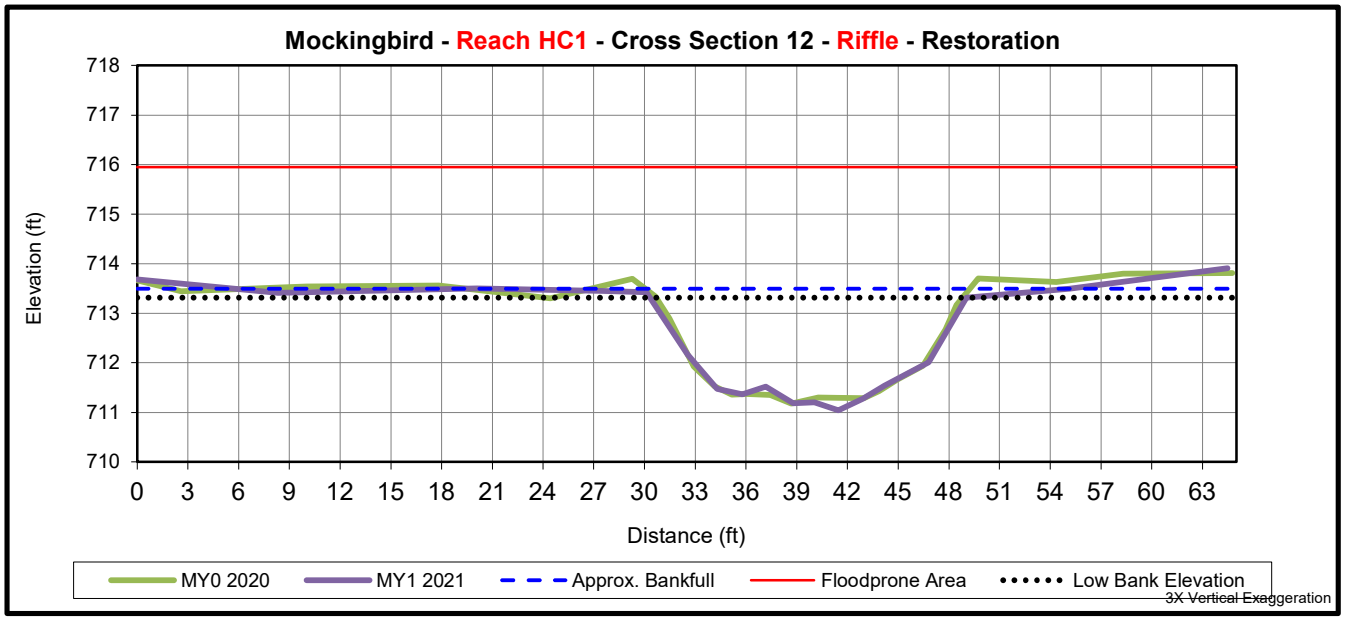


	Cross Section 11 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	713.23	713.3					
Bankfull Width (ft)[1]	-	-					
Floodprone Width (ft)[1]	-	-					
Bankfull Max Depth (ft)[2]	4.3	4.0					
Low Bank Elevation (ft)	-	713.1					
Bankfull Cross Sectional Area (ft^2)[2]	46.3	40.9					
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

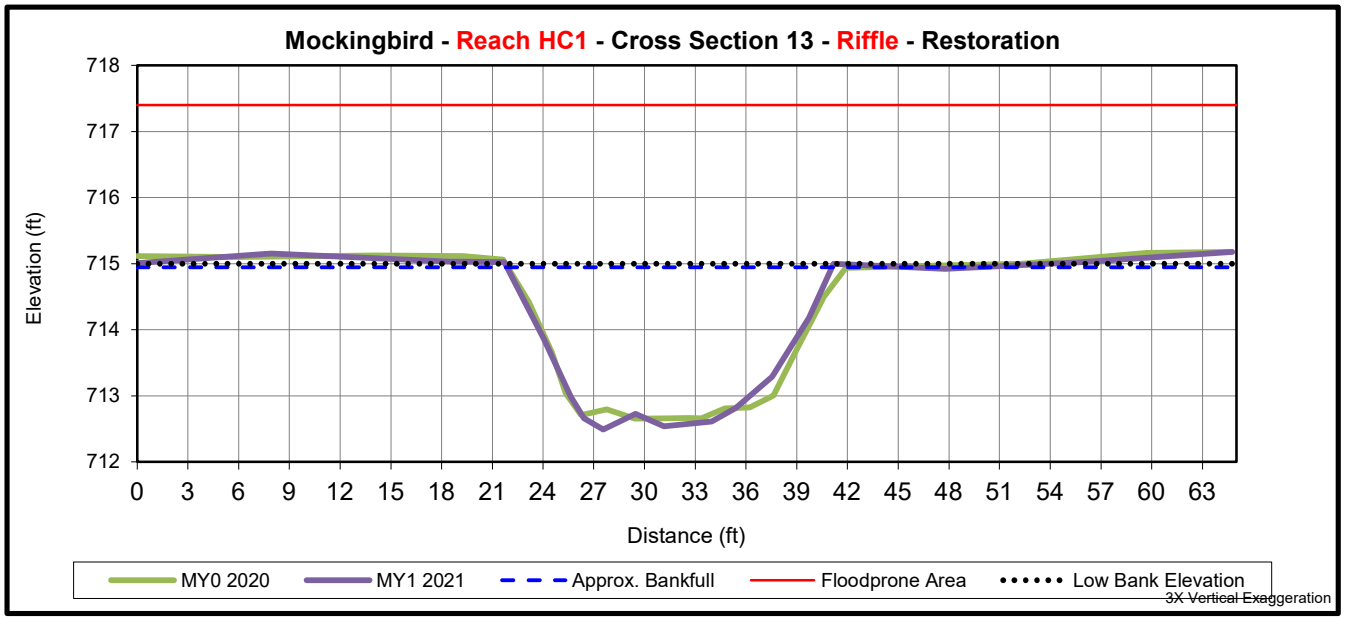


	Cross Section 12 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	713.56	713.5					
Bankfull Width (ft)[1]	19.6	25.0					
Floodprone Width (ft)[1]	>65	>64.5					
Bankfull Max Depth (ft)[2]	2.4	2.3					
Low Bank Elevation (ft)	713.56	713.3					
Bankfull Cross Sectional Area (ft^2)[2]	33.3	29.3					
Bankfull Entrenchment Ratio[1]	>3.3	>2.6					
Bankfull Bank Height Ratio[1]	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

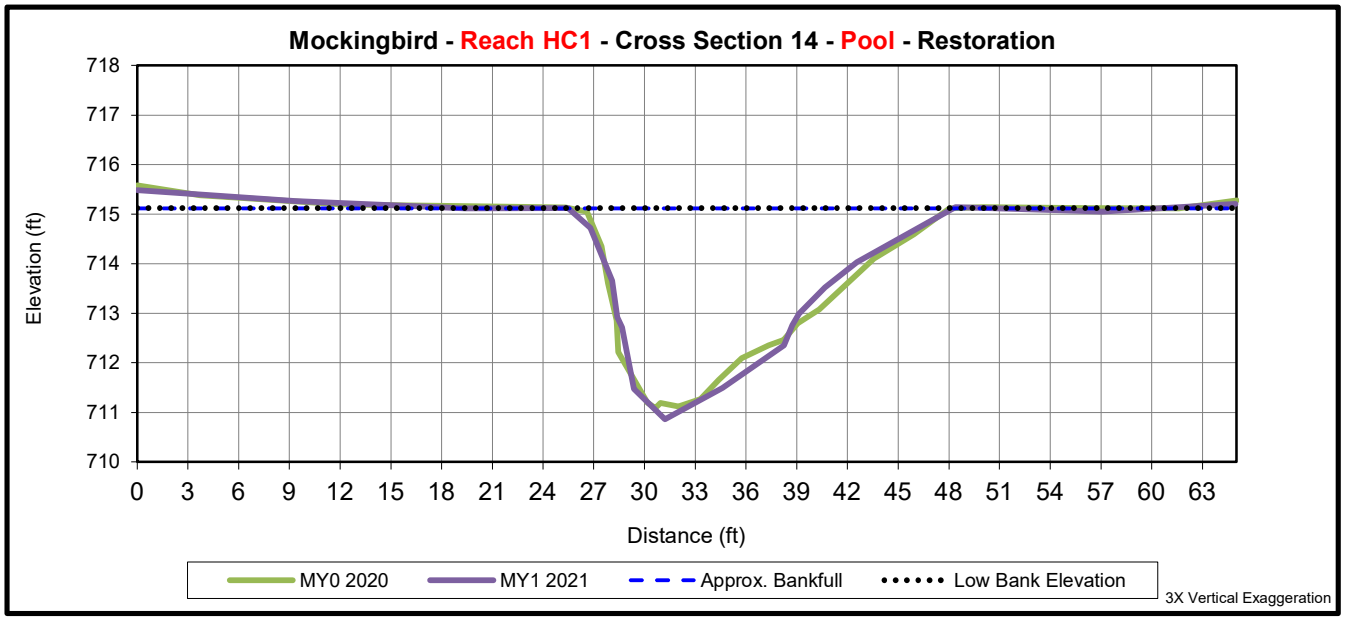


	Cross Section 13 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	714.94	714.9					
Bankfull Width (ft)[1]	20.0	19.2					
Floodprone Width (ft)[1]	>65	>64.8					
Bankfull Max Depth (ft)[2]	2.3	2.5					
Low Bank Elevation (ft)	714.94	715.0					
Bankfull Cross Sectional Area (ft^2)[2]	33.4	34.4					
Bankfull Entrenchment Ratio[1]	>3.3	>3.4					
Bankfull Bank Height Ratio[1]	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

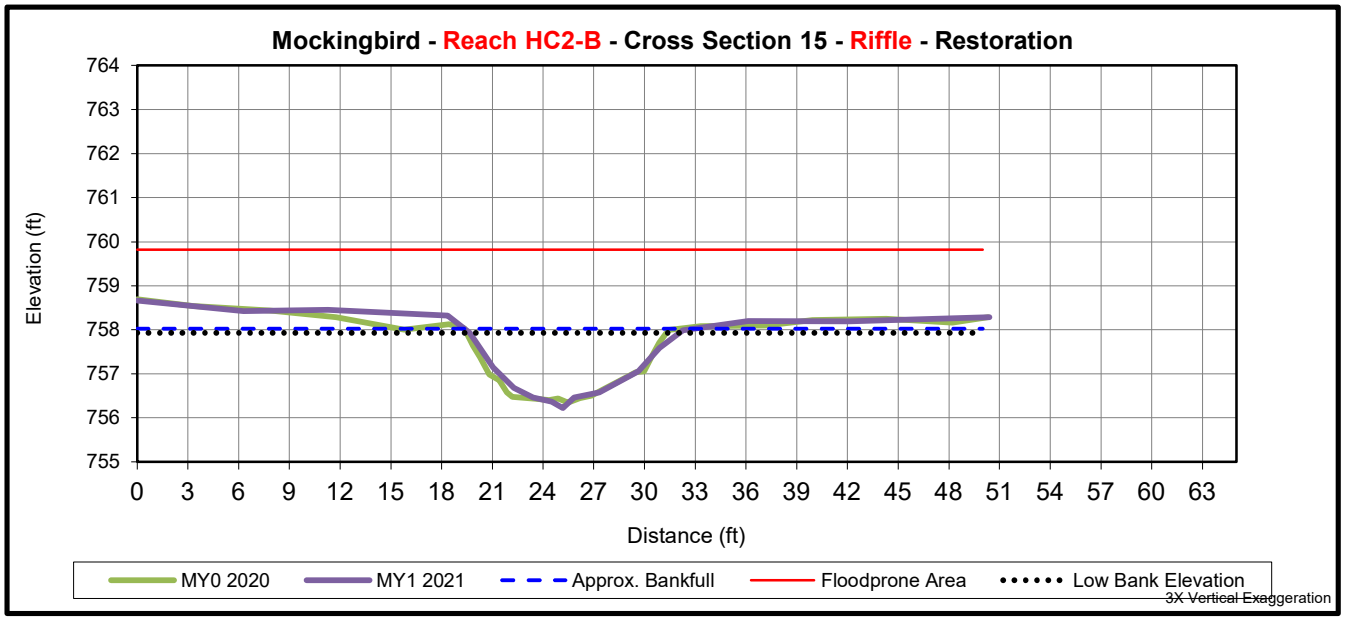


	Cross Section 14 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	715.11	715.1					
Bankfull Width (ft)[1]	-	-					
Floodprone Width (ft)[1]	-	-					
Bankfull Max Depth (ft)[2]	4.0	4.3					
Low Bank Elevation (ft)	-	715.1					
Bankfull Cross Sectional Area (ft^2)[2]	47.7	47.8					
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

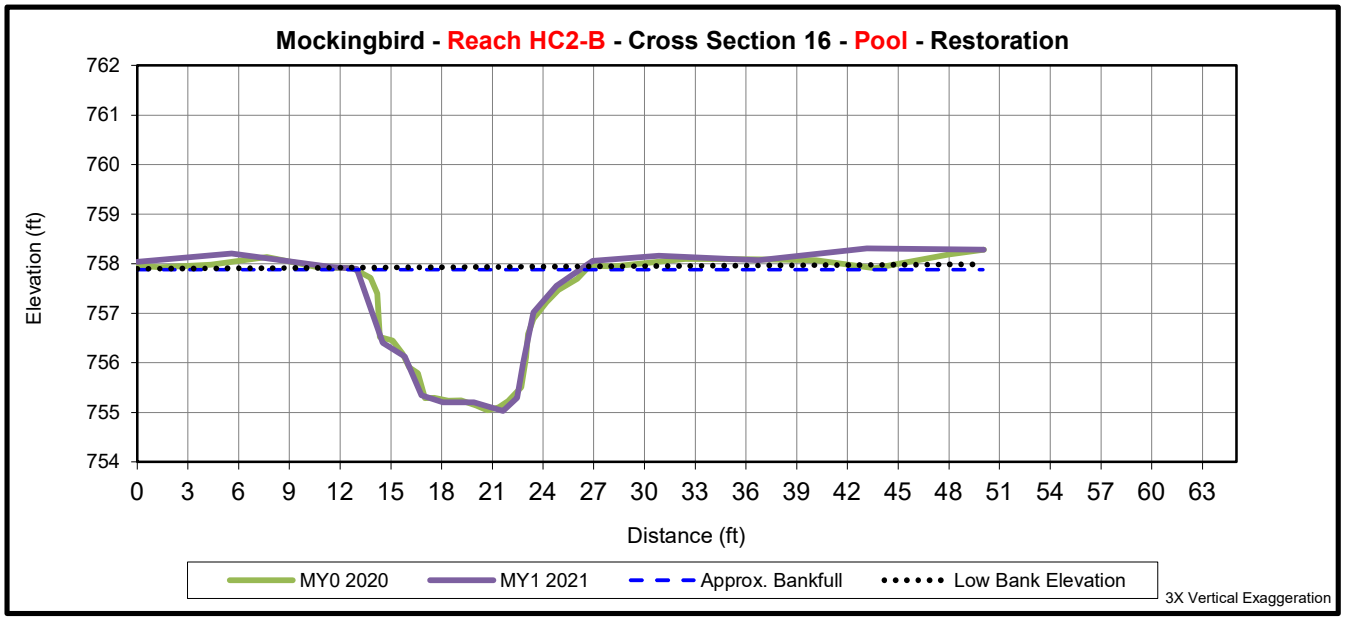


	Cross Section 15 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	757.99	758.0					
Bankfull Width (ft)[1]	12.0	13.5					
Floodprone Width (ft)[1]	>50	>50.4					
Bankfull Max Depth (ft)[2]	1.6	1.7					
Low Bank Elevation (ft)	757.99	757.9					
Bankfull Cross Sectional Area (ft^2)[2]	14.0	12.7					
Bankfull Entrenchment Ratio[1]	>4.2	>3.7					
Bankfull Bank Height Ratio[1]	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

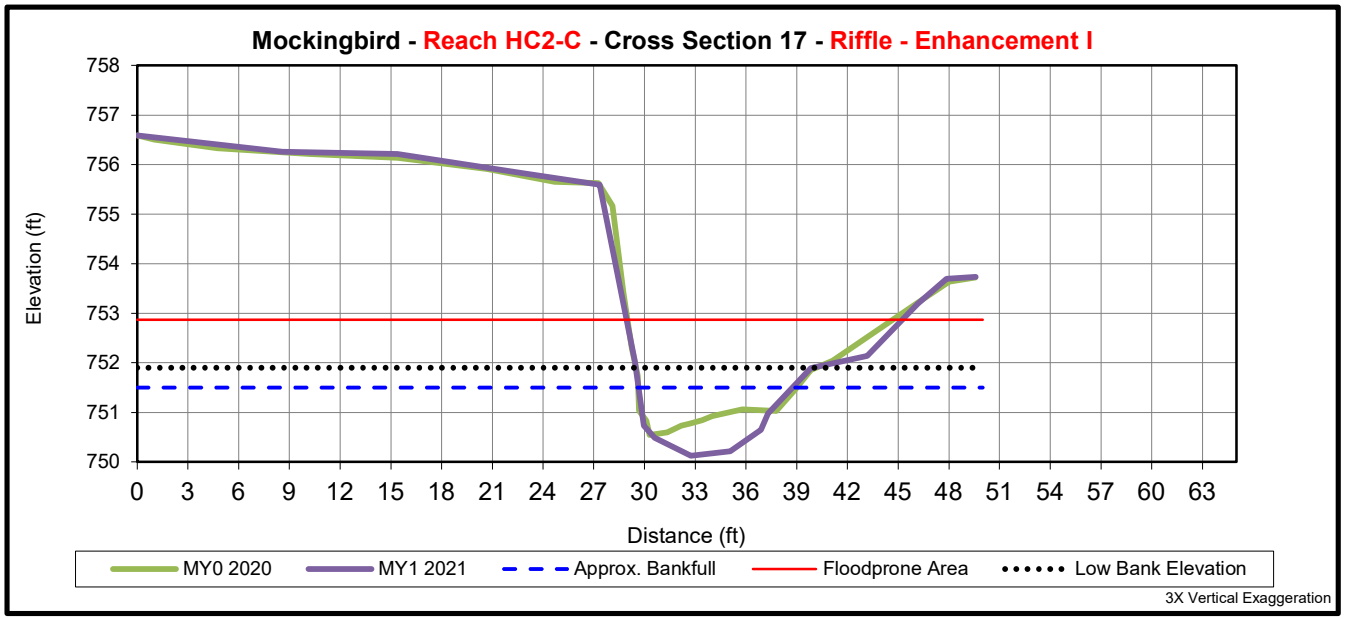


	Cross Section 16 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	757.91	757.9					
Bankfull Width (ft)[1]	-	-					
Floodprone Width (ft)[1]	-	-					
Bankfull Max Depth (ft)[2]	2.9	2.9					
Low Bank Elevation (ft)	-	757.9					
Bankfull Cross Sectional Area (ft^2)[2]	23.2	23.5					
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

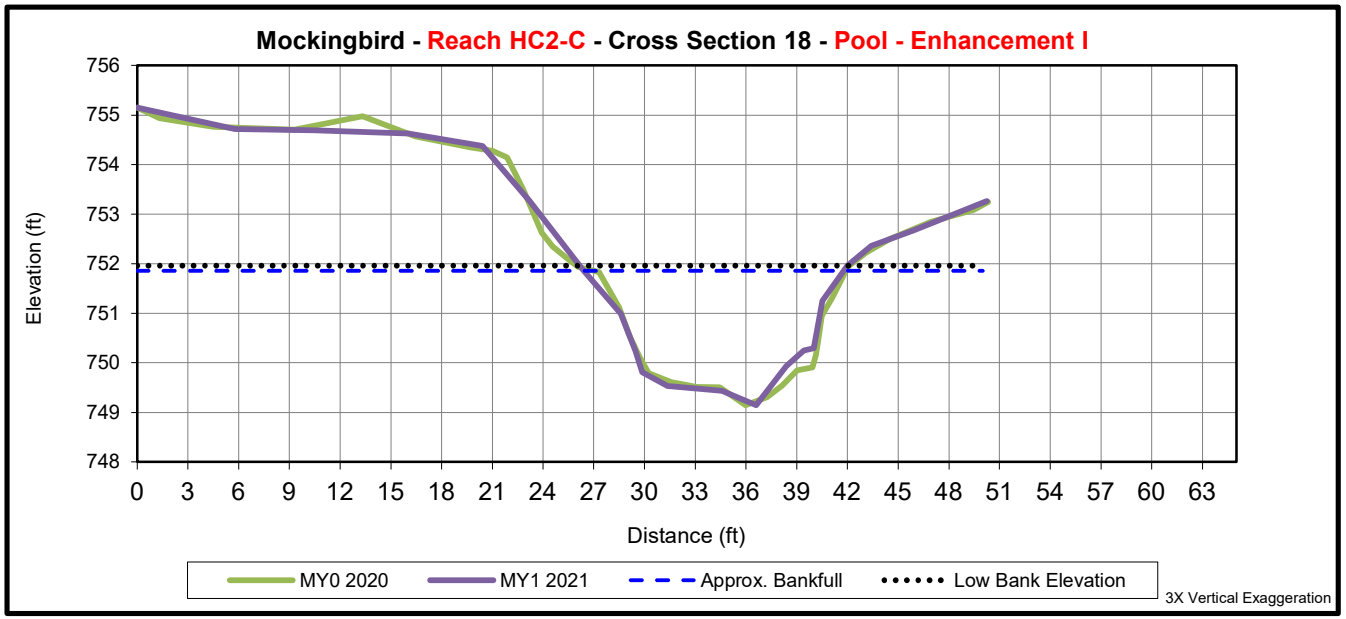


	Cross Section 17 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	751.86	751.5					
Bankfull Width (ft)[1]	10.3	9.1					
Floodprone Width (ft)[1]	17.1	16.3					
Bankfull Max Depth (ft)[2]	1.3	1.8					
Low Bank Elevation (ft)	751.86	751.9					
Bankfull Cross Sectional Area (ft^2)[2]	8.9	12.8					
Bankfull Entrenchment Ratio[1]	1.7	1.8					
Bankfull Bank Height Ratio[1]	1.0	1.3					

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

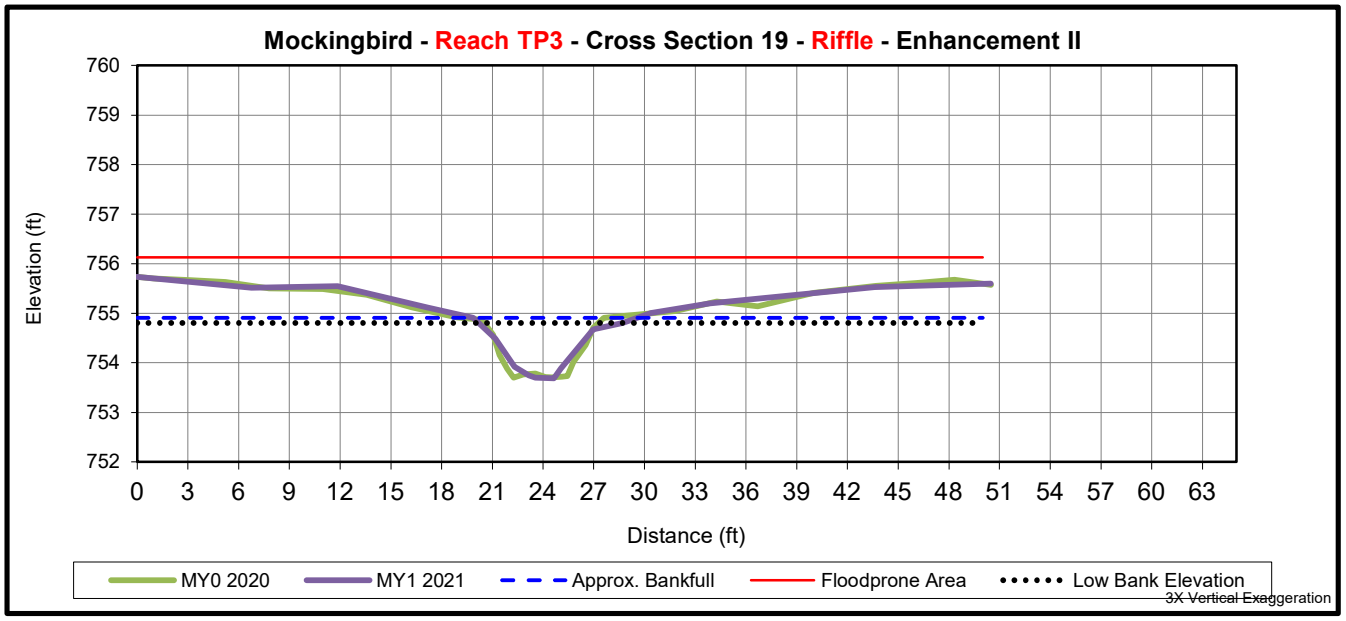


	Cross Section 18 (Pool)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	751.83	751.9					
Bankfull Width (ft)[1]	-	-					
Floodprone Width (ft)[1]	-	-					
Bankfull Max Depth (ft)[2]	2.7	2.8					
Low Bank Elevation (ft)	751.83	752.0					
Bankfull Cross Sectional Area (ft^2)[2]	26.8	28.3					
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

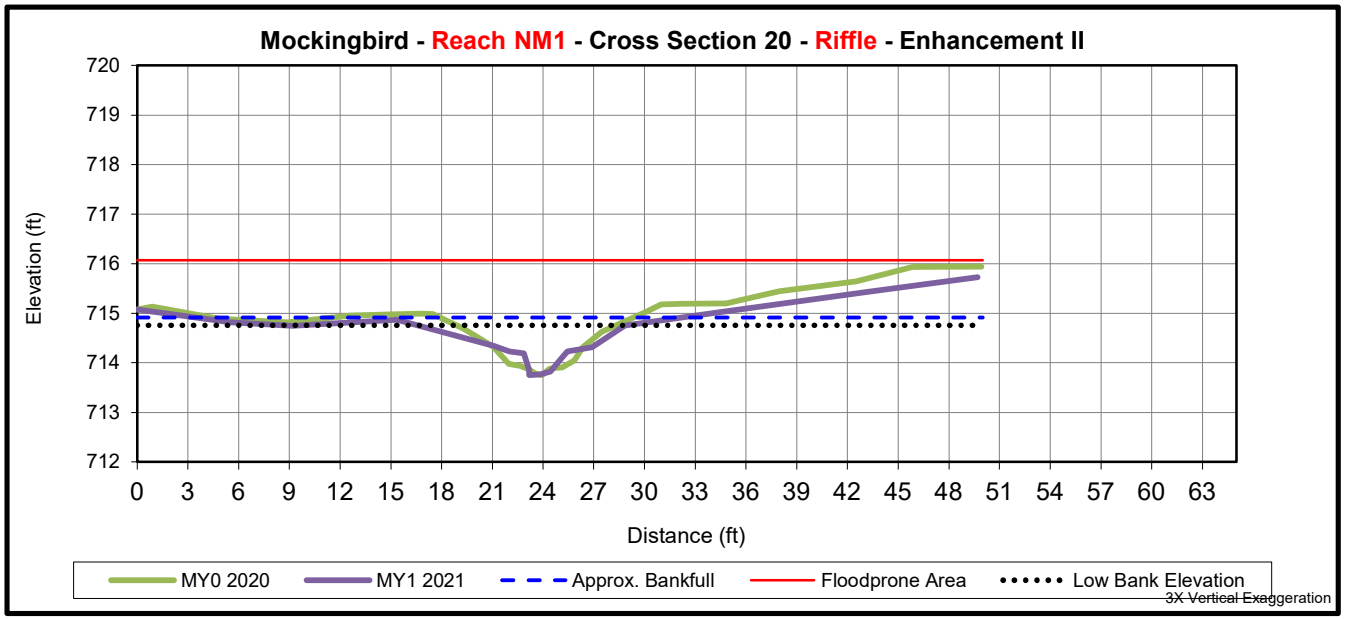


	Cross Section 19 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	754.87	754.9					
Bankfull Width (ft)[1]	7.1	9.7					
Floodprone Width (ft)[1]	>50.5	>50.5					
Bankfull Max Depth (ft)[2]	1.2	1.1					
Low Bank Elevation (ft)	754.87	754.8					
Bankfull Cross Sectional Area (ft^2)[2]	5.8	4.8					
Bankfull Entrenchment Ratio[1]	>7.1	>5.2					
Bankfull Bank Height Ratio[1]	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

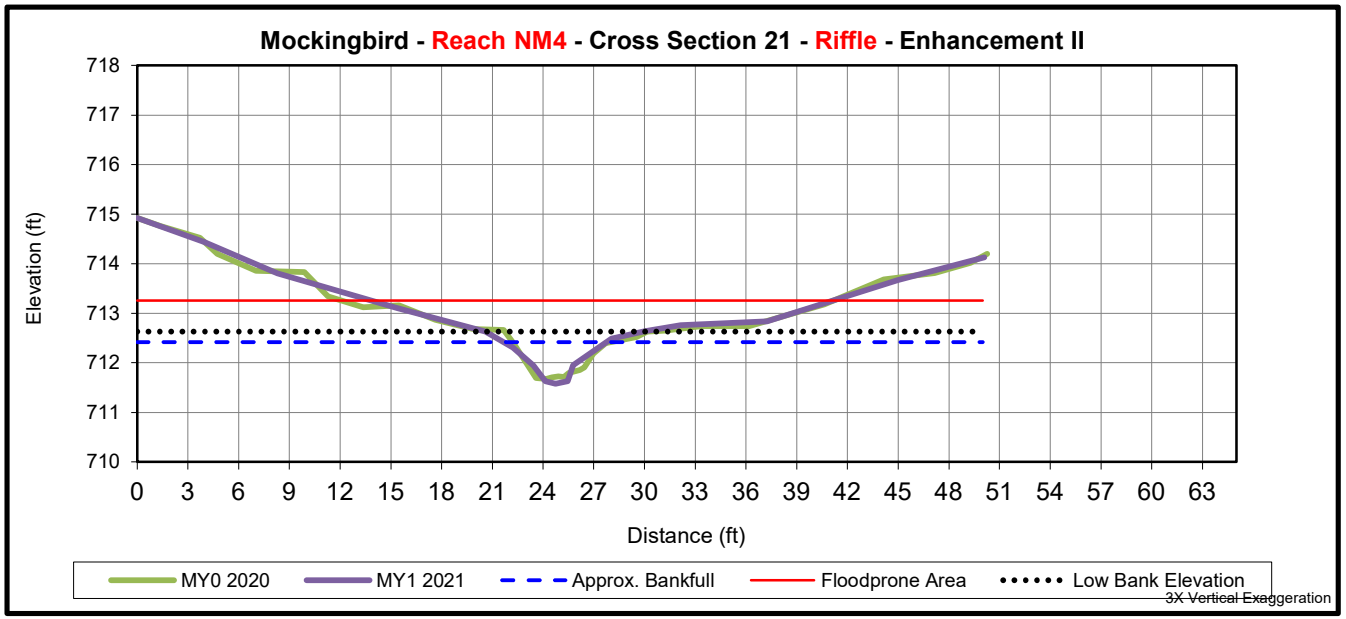


	Cross Section 20 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	714.99	714.9					
Bankfull Width (ft)[1]	12.4	16.9					
Floodprone Width (ft)[1]	>49.9	>49.7					
Bankfull Max Depth (ft)[2]	1.2	1.0					
Low Bank Elevation (ft)	714.99	714.8					
Bankfull Cross Sectional Area (ft^2)[2]	7.5	5.1					
Bankfull Entrenchment Ratio[1]	>4.0	>2.9					
Bankfull Bank Height Ratio[1]	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 21 (Riffle)						
	MY0	MY1	MY2	MY3	MY5	MY7	MY+
Bankfull Elevation (ft) - Based on AB-XSA[1]	712.40	712.4					
Bankfull Width (ft)[1]	5.5	6.1					
Floodprone Width (ft)[1]	24.7	6.1					
Bankfull Max Depth (ft)[2]	0.7	1.1					
Low Bank Elevation (ft)	712.40	712.6					
Bankfull Cross Sectional Area (ft^2)[2]	2.6	4.2					
Bankfull Entrenchment Ratio[1]	4.5	4.5					
Bankfull Bank Height Ratio[1]	1.0	1.3					

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

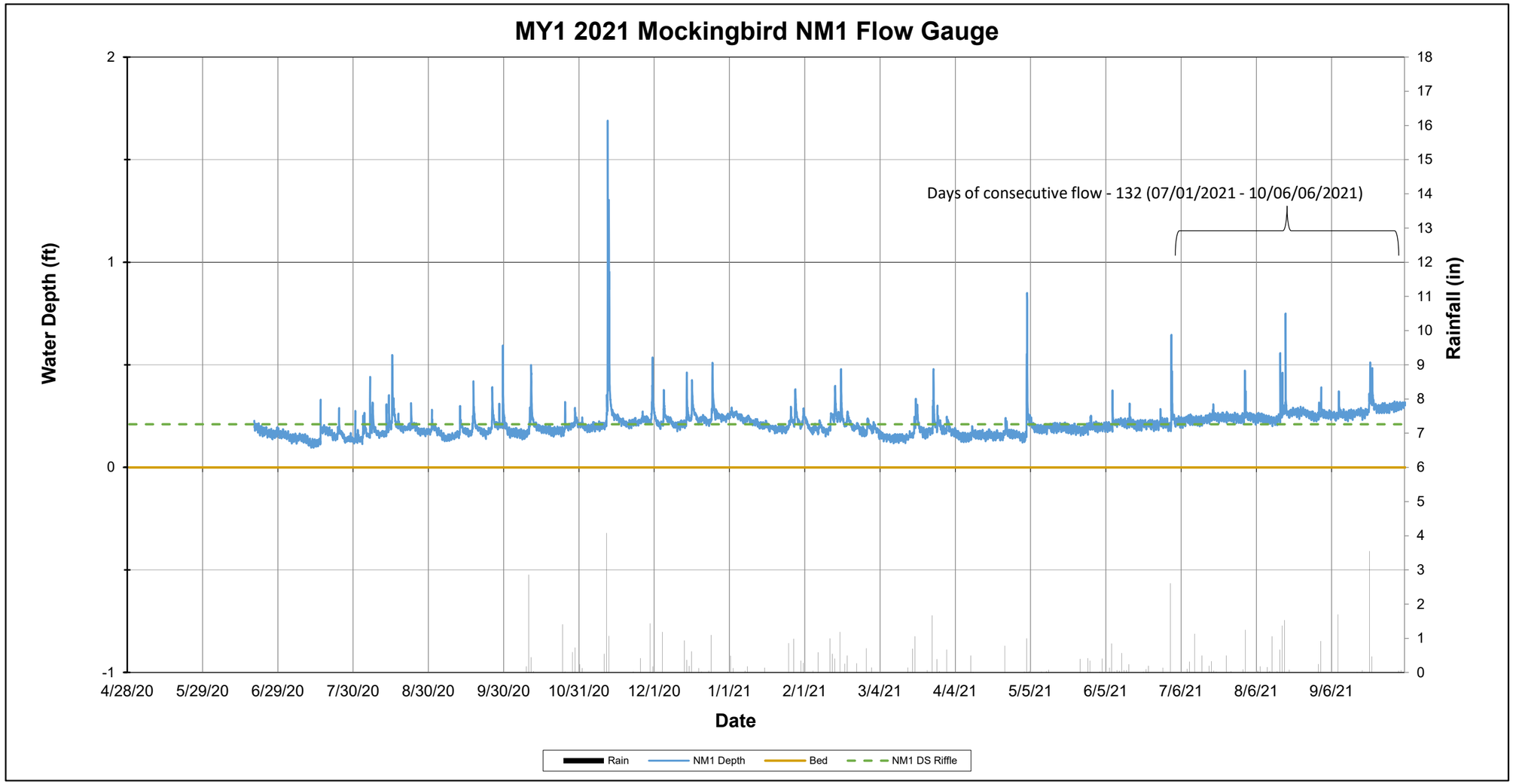
Hydrology Data

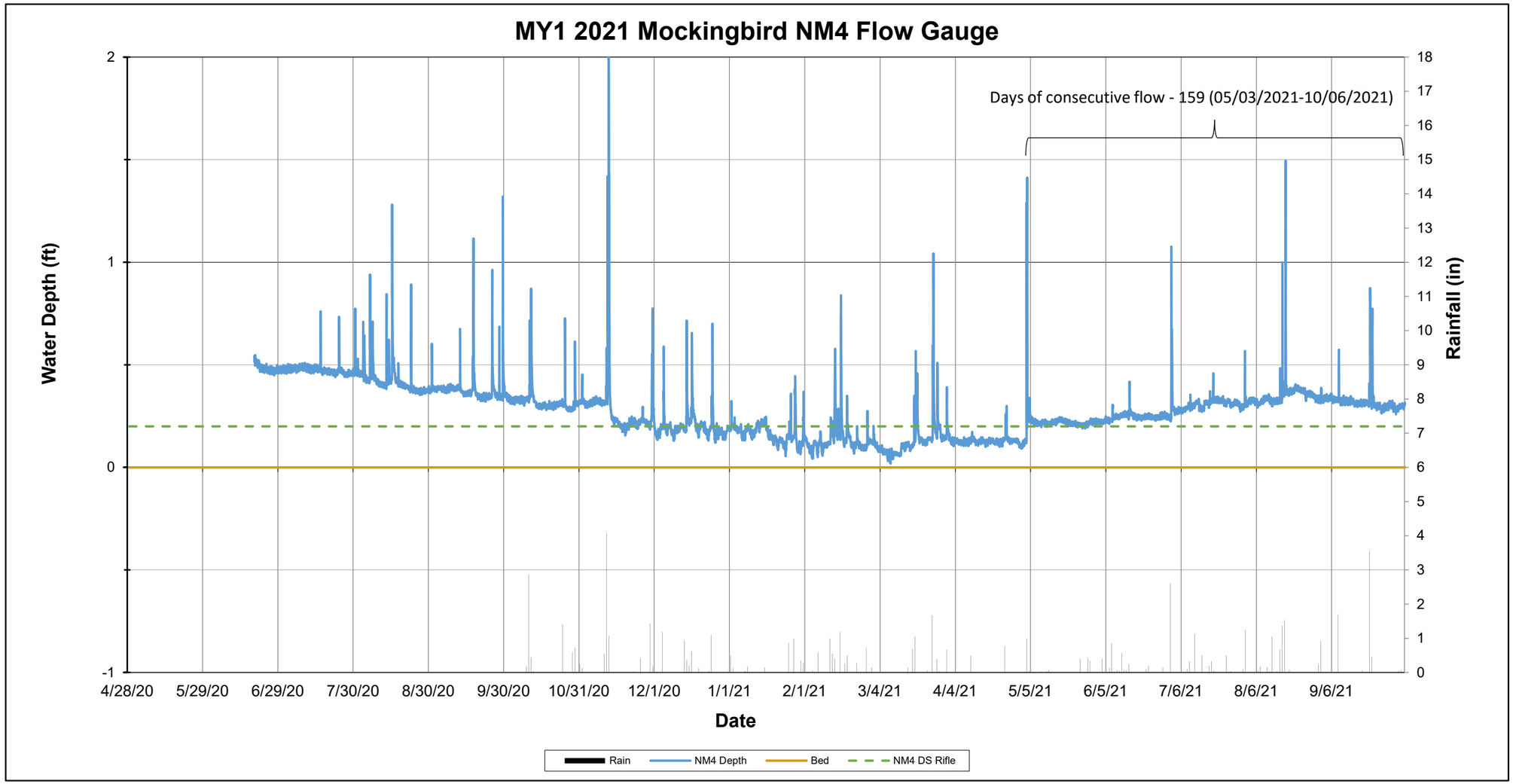
Table 12. Rainfall Summary MY1 2021

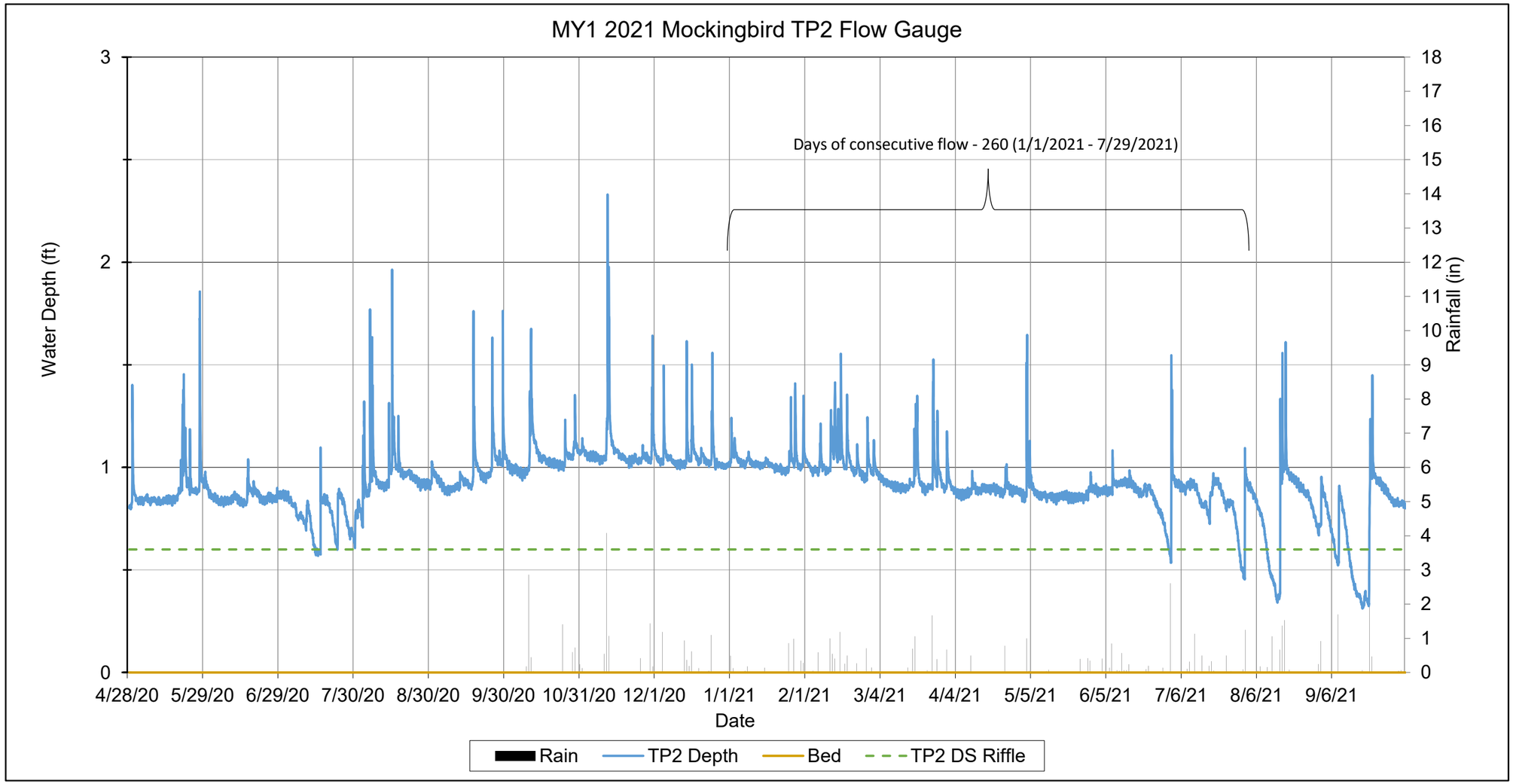
Month	Average	Normal Limits		Yadkinville Station Precipitation
		30 Percent	70 Percent	
January	3.89	2.80	4.59	3.22
February	3.49	2.41	4.16	5.82
March	4.66	3.21	5.55	4.25
April	3.56	2.22	4.31	1.97
May	4.31	2.90	5.16	2.40
June	3.93	2.26	4.78	3.00
July	4.10	2.93	4.85	5.83
August	3.33	2.36	3.95	6.56
September	4.00	2.33	4.86	7.00
October	3.69	2.11	4.45	0.21
November	3.13	2.35	3.65	---
December	3.54	2.29	4.26	---
Total	45.63	30.17	54.57	40.26
Above Normal Limits	Below Normal Limits			

Table 13. Documentation of Geomorphically Significant Flow Events

Year	Number of Bankfull Events	Maximum Bankfull Height (ft)	Date of Maximum Bankfull Event	
Stage Recorder HC1				
MY0/1 2020	10	3.447	11/11/2020	
MY1 2021	4	1.257	5/3/2021	
Stage Recorder NM2				
MY0/1 2020	4	1.04	11/11/2020	
MY1 2021	1	0.13	8/18/2021	
Year	**Number of Flow Events**	**Maximum Consecutive Flow Days**	**Maximum Cummlative Flow Days**	**Maximum Consecutive Flow Date Range**
Flow Gauge NM1				
MY0/1 2020	2	51	54	11/11/2020 - 12/31/2021
MY1 2021	5	97	132	7/1/2021 - 10/6/2021
Flow Gauge NM4				
MY0/1 2020	2	165	169	6/19/2020 - 12/1/2020
MY1 2021	2	156	159	5/3/2021 - 10/6/2021
Flow Gauge TP2				
MY0/1 2020	2	168	246	7/16/2020 - 12/31/2020
MY1 2021	5	210	260	1/1/2021 - 7/29/2021
Flow Gauge TP3				
MY0/1 2020	1	247	247	4/28/2020 - 12/31/2020
MY1 2021	1	279	279	1/1/2021 - 10/6/2021


MY1 2021 Mockingbird NM1 Flow Gauge
Water Depth (ft)
Rainfall (in)
Days of consecutive flow - 132 (07/01/2021 - 10/06/06/2021)
2
1
0
-1
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
4/28/20
5/29/20
6/29/20
7/30/20
8/30/20
9/30/20
10/31/20
12/1/20
1/1/21
2/1/21
3/4/21
4/4/21
5/5/21
6/5/21
7/6/21
8/6/21
9/6/21
Date
Rain
NM1 Depth
Bed
NM1 DS Riffle


MY1 2021 Mockingbird NM4 Flow Gauge
Days of consecutive flow - 159 (05/03/2021-10/06/2021)
Water Depth (ft)
Rainfall (in)
2
1
0
-1
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
4/28/20
5/29/20
6/29/20
7/30/20
8/30/20
9/30/20
10/31/20
12/1/20
1/1/21
2/1/21
3/4/21
4/4/21
5/5/21
6/5/21
7/6/21
8/6/21
9/6/21
Date
Rain
NM4 Depth
Bed
NM4 DS Rifle


MY1 2021 Mockingbird TP2 Flow Gauge
Days of consecutive flow - 260 (1/1/2021 - 7/29/2021)
Water Depth (ft)
Rainfall (in)
3
2
1
0
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
4/28/20
5/29/20
6/29/20
7/30/20
8/30/20
9/30/20
10/31/20
12/1/20
1/1/21
2/1/21
3/4/21
4/4/21
5/5/21
6/5/21
7/6/21
8/6/21
9/6/21
Date
Rain
TP2 Depth
Bed
TP2 DS Riffle

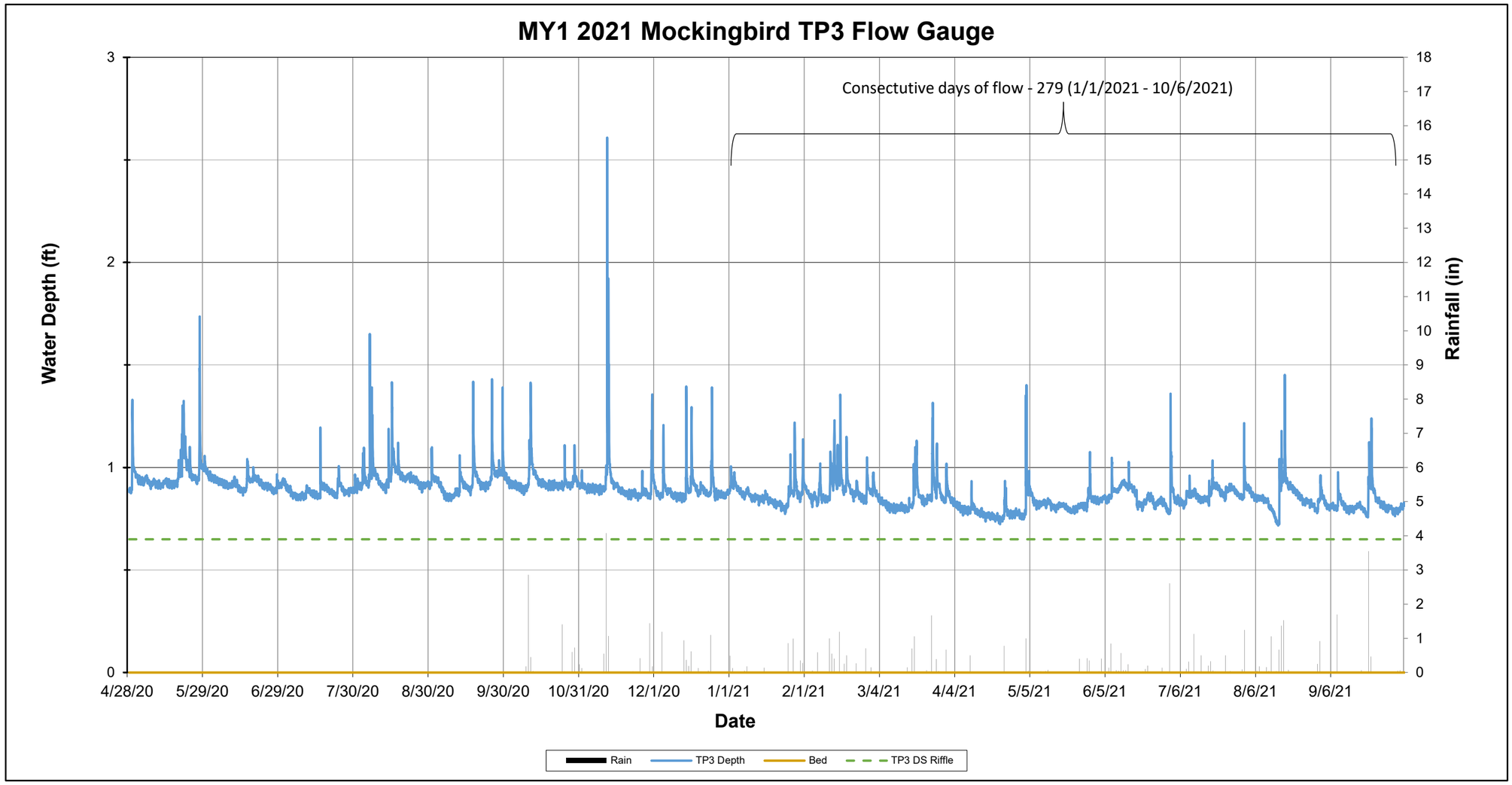
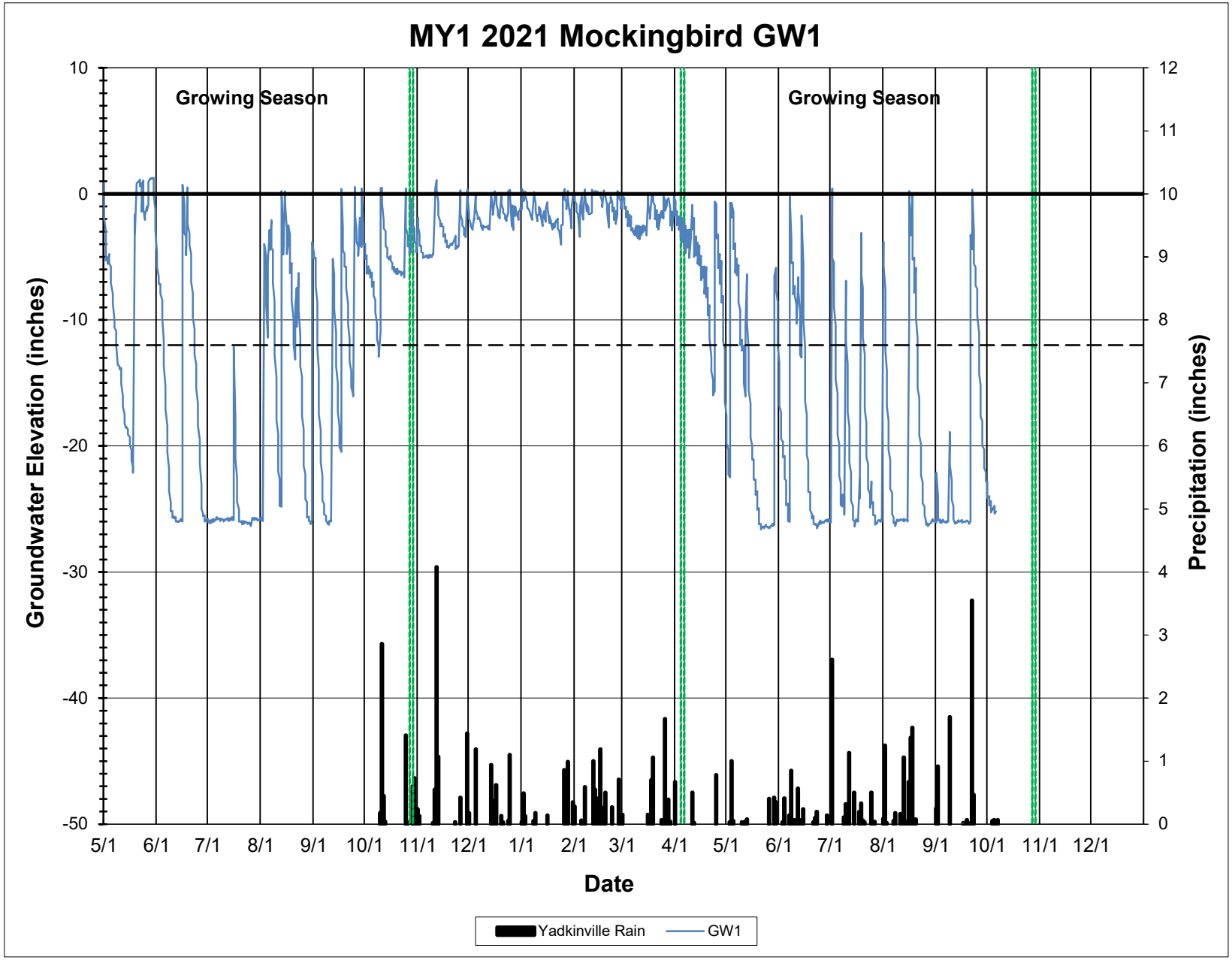

MY1 2021 Mockingbird TP3 Flow Gauge
Consectutive days of flow - 279 (1/1/2021 - 10/6/2021)
Water Depth (ft)
Rainfall (in)
3
2
1
0
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
4/28/20
5/29/20
6/29/20
7/30/20
8/30/20
9/30/20
10/31/20
12/1/20
1/1/21
2/1/21
3/4/21
4/4/21
5/5/21
6/5/21
7/6/21
8/6/21
9/6/21
Date
Rain
TP3 Depth
Bed
TP3 DS Riffle

Table 14.

2021 Max Hydroperiod (Growing Season 5-Apr through 28-Oct, 206 days)					
Well ID	**Consecutive**		**Cumulative**		**Occurrences**
	Days	**Hydroperiod (%)**	**Days**	**Hydroperiod (%)**	
GW1	17	8	58	28	13

Table 15.

Summary of Groundwater Monitoring Results Mockingbird								
Well ID	**Hydroperiod (%)**							
	Year 0/1 (2020)	**Year 1 (2021)**	**Year 2 (2022)**	**Year 3 (2023)**	**Year 4 (2024)**	**Year 5 (2025)**	**Year 6 (2026)**	**Year 7 (2027)**
GW1	9	8						


MY1 2021 Mockingbird GW1
Growing Season
Growing Season
Groundwater Elevation (inches)
Precipitation (inches)
Date
10
0
-10
-20
-30
-40
-50
12
11
10
9
8
7
6
5
4
3
2
1
0
5/1
6/1
7/1
8/1
9/1
10/1
11/1
12/1
1/1
2/1
3/1
4/1
5/1
6/1
7/1
8/1
9/1
10/1
11/1
12/1
Yadkinville Rain
GW1