HE-0001 Year 2 Stream Monitoring Report

January, 2026

Buncombe County, NC

Prepared for:
North Carolina Department of Transportation

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1.0 SUMMARY

Ecosystem Planning and Restoration, LLC (EPR) was contracted by the North Carolina Department of Transportation (NCDOT; Client) to evaluate the impact of road construction on an unnamed tributary (Latitude: 35.508309 N, Longitude: -82.575510 W) to the French Broad River (UTFBR) in Buncombe County, NC. The proposed HE-0001 roadway project will cross UTFBR using a proposed culvert crossing. As of December 2025, the proposed road path has been logged and prepared for construction, but active road construction has not begun. EPR's scope of work includes providing stream monitoring services prior to the roadway construction and for one year during construction to assess potential changes in stream stability and overall ecological health. Baseline monitoring occurred in late 2023 and Year 1 monitoring took place in December 2024. No construction activities occurred during Year 1 (2024). During 2025 (Year 2), the HE-0001 road corridor was cleared and preparations for construction were made. Approximately 200 linear feet of the main tributary, UTFBR, were impacted by the tree clearing as well as the upstream sections of UT1 and UT2. There were no direct impacts on the monitoring reaches on UTFBR, but cross sections on both UT1 and UT2 were impacted. No construction activities had occurred as of Year 2 field data collection. This report summarizes the Year 2 monitoring data collection effort and results from 2025.

2.0 MONITORING FEATURE INSTALLATION AND DATA COLLECTION

EPR conducted the initial monitoring feature setup and baseline data collection on November 1st and 2nd, 2023. Four separate assessment reaches were established on UTFBR. The length of the assessment reaches was approximately 20 times the measured bankfull width at each reach. Two cross-sections and several photo points were also located on two smaller unnamed tributaries (UT1 and UT2), but no other data was collected on these streams. The most upstream reach, Reach 1, was located upstream of the proposed culvert crossing and will serve as a control for data comparison between the Baseline and active construction monitoring. It is anticipated that the road construction will have limited to no significant impact on the stability and overall ecological health of this upstream reach. The other three reaches were spaced out between the site of the proposed culvert construction and the existing culvert under I-26.

The downstream end of UTFBR has a drainage area of 0.17 square miles. The watershed was primarily forested (89.4%) prior to the recent tree clearing, and was likely completely forested until the last few years. Several unpaved forest roads run throughout the watershed. The riparian area is characterized by a mature hardwood overstory and rhododendron-dominated shrub stratum. The majority of UTFBR is a second-order stream, and the two tributaries are first-order streams.

Year 2 field data collection included cross-sections, longitudinal profiles, photo points, Bank Erosion Hazard Index/Near Bank Stress (BEHI/NBS), reach-wide riffle pebble counts, macroinvertebrate sampling, and water quality sampling at each reach.

The location of each monitoring feature and assessment reach is shown in Figure 1.

In late September 2024 the monitored reaches were impacted by the remnants of Hurricane Helene. Several trees were blown down across the access road as well as the stream itself. Most of the trees completely spanned the stream and did not significantly impact stream stability or function. A few trees fell directly next to the stream and significantly changed the stream bank shape in these areas but only

had localized impacts. Some of the monitoring survey control point pins were covered by storm debris but all of them were recovered in Year 1. Reach 4 appeared to have been the most directly impacted by the storm, and the longitudinal profile exhibited minor downcutting in some areas and aggradation in others. These impacts are discussed in greater detail in the following sections.

2.1 Cross-Sections

Two riffle cross-sections were installed in each of the four assessment reaches along with one riffle cross-section on each of the two tributaries that flow into UTFBR from the east. The cross-sections were installed by driving a 2-foot length of rebar perpendicular to, and on each side of the stream far enough from the channel to capture the entire flood prone width. Each cross-section pin was marked with a steel T-post. The actual elevations of the cross-section pins are unknown, so an assumed elevation was used in Baseline monitoring and will be used throughout subsequent monitoring years. The cross-sections were surveyed from left to right looking downstream using a Topcon RL-H5A laser level and grade rod, and the location of each pin was located using GPS.

The cross-section measurements that are reported in Table 1 and the attached cross-section plots are: bankfull area, bankfull width, bankfull max depth, bankfull mean depth, entrenchment ratio, width to depth ratio, and the bank height ratio. The Rosgen stream type at each cross-section is also included, as well as photos of each cross-section. The assumed bankfull elevation that was established in Baseline monitoring is held constant each year to make bankfull measurements. Cross-section measurements and plots were made using an open-source spreadsheet tool developed by the Ohio Department of Natural Resources (Mecklenburg, 2006).

Most of the cross-sections surveyed on UTFBR did not indicate any significant aggradation or degradation but minor shifts in the bankfull dimensions were apparent on some of the monitoring cross-sections. The monitored streams seem to still be adjusting to changes in the watershed from Hurricane Helene in 2024, but most of this adjustment was minor from Year 1 to Year 2.

XS9 and XS10 on UT1 and UT2, respectively, were the most impacted by the tree clearing that occurred in 2025. The stream channels themselves do not appear to have been affected by the clearing, although the amount of herbaceous vegetation in the channels increased since 2024, likely due to the reduced tree canopy. The steep valley walls and riparian area seem to be the most impacted by the clearing. The cross-section pins on XS10 were damaged during the clearing so the cross section had to be manually adjusted so that it would line up with the previous years' plots. EPR will closely monitor UT1 & UT2 to see how clearing and future construction efforts affect the streams. The section of UTFBR that was cleared does not contain any monitoring cross-sections, but visual assessments indicate that some downcutting has occurred in this area. Like UT1 and UT2, herbaceous vegetation now dominates the channel and riparian area. This area will be visually assessed again in Year 3 to determine if it has continued to adjust.

The Rosgen stream types at each cross-section are still appropriate for the landscape setting and valley type at each location. The valley type for UTFBR Reach 1 is a confined colluvial valley type, with narrower floodplains on both sides of the stream. In this upstream section, the stream is a B4a stream type. Downstream, the valley transitions into a confined alluvial valley type with some sections being unconfined. The stream types for Reaches 2, 3, and 4 transition between E4b, C4, and C4b respectively. The entire length of the assessed stream is bounded on the right by an unpaved forest road that runs

along the toe of the valley wall. In the more confined areas this road embankment makes up the right valley wall. In Reach 4, the road embankment artificially confines the stream on the right side of the valley, reducing the available floodplain and potentially leading to increased erosion and some of the incision that was previously mentioned.

The location of each monitoring cross-section is shown in Figure 1. Cross-section data is summarized in Table 1 and the plots are attached.

2.2 Longitudinal Profiles

The upstream end of each longitudinal profile was monumented using a 2-foot length of rebar and is marked with a steel T-post, either on the streambank or in the channel itself. The actual elevation of the rebar pins was unknown, so the top of each section of rebar was assigned an assumed elevation of 100.0 feet. This same assumed elevation was used during baseline monitoring and will be used in future surveys to ensure the profile data can be overlaid and effectively compared. The profiles began and ended at a head of riffle feature, and the location of the top and bottom ends of the profiles were located using GPS. Stream features that were surveyed included the stream thalweg, water surface, bankfull, and low top of bank (if applicable).

Several measurements were made using the profile survey data. Measurements and plots were made using the Mecklenburg Tool. Riffle slope was calculated by measuring the water surface slope of every riffle in the assessment reach. The riffle slope ratio was calculated by dividing the slope of each riffle by the overall reach water surface slope. Pool to pool spacing was measured longitudinally between the maximum depth point of each successive pool in the profile. The pool to pool spacing ratio is the distance between each pool divided by the bankfull width from the surveyed riffle cross-section within that reach. The pool depth was measured from bankfull to the pool maximum depth elevation at every pool in the assessment reach. The pool depth ratio is that depth divided by the mean depth from the surveyed riffle cross-section within that reach. The most representative riffle cross-section from each assessment reach was selected to calculate the ratios. The cross-section that was used to calculate the ratios for each reach is indicated on the attached Profile Calculations forms and will be held constant throughout monitoring.

In general, the longitudinal profile survey data for all four reaches indicate that UTFBR has not incised or aggraded significantly and has retained appropriate bedform diversity compared to the Year 1 survey. Some of the bedform features (head of riffles and pools) have migrated slightly on a few of of the reaches and the profiles on Reaches 2, 3 and 4 no longer begin at the head of riffle. The surveyed channel slopes ranged from 0.049 ft/ft (Reach 1) to 0.019 ft/ft (Reach 3), and the ratios for each parameter are close to what would be expected under reference conditions, although there were some outliers in each reach. Reach 4, which was slightly incised in the Baseline survey, has stayed mostly consistent though Years 1 and 2 although some riffles have adjusted. Reach 3 appears to have stabilized since its shift from Baseline to Year 1. Some minor pool and riffle adjustment occurred after Hurricane Helene, but the Year 2 profile indicates that the stream has adjusted to near the baseline conditions.

The longitudinal profile for Reach 4 was shortened to station 220.0 because of active construction from the ongoing I-26 widening project. A retaining wall is being added to the roadway causing the downstream culvert to extend approximately 40 feet upstream. A pump around system was installed on

the day of the field survey, so this downstream section of the assessment reach was not available and will not be moving forward.

The location of each assessment reach is shown in Figure 1. Longitudinal profile data are summarized in Table 2 and the plots and calculations are attached.

2.3 Pebble Counts

One representative pebble count was conducted within each assessment reach, for a total of four samples. A minimum of one hundred randomly selected riffle surface particles were measured and recorded throughout the riffle sections of each assessment reach. The intermediate axis of each particle was measured with a metric ruler and recorded. Particle size distributions were developed using the Mecklenburg Tool.

The pebble count data indicates that the sediment type in UTFBR is predominantly gravel (61%-78%) with some intermixed cobble (22%-36%). Reach 4 has some exposed bedrock. This substrate size distribution is characteristic of a high gradient, headwater stream in the Southern Appalachians. Compared to Year 1 monitoring pebble count data, the D50 decreased back to near baseline conditions on Reach 1 and Reach 2. Sampled sediment in Reach 3 has remained consistent throughout monitoring. Sediment in Reach 4 has consistently coarsened since Baseline, from a D50 of 23 to 37 and then to 49 mm.

The location of each assessment reach is shown in Figure 1. A summary of the pebble data is provided in Table 3, and the pebble count data and plots are attached.

2.4 Bank Erosion Hazard Index/Near Bank Stress (BEHI/NBS)

A BEHI and NBS assessment was conducted for the entire length of both stream banks within each reach of UTFBR. The BEHI/NBS method was developed to predict the risk of erosion for a given stream bank. It involves measurements and visual estimates of bankfull height in relation to bank height, root density, root depth, bank angle, surface protection, and bank materials.

Each assessment reach was broken into bank segments of similar condition. All segments of stream bank with the same BEHI/NBS rating were combined to determine the dominant BEHI/NBS condition score for the reach. The dominant scores for the Year 2 Monitoring assessment were all either LOW/LOW or MODERATE/LOW, indicating a relatively low risk of bank erosion based on the geomorphic and vegetative characteristics of the stream. The few stream banks that were affected by hurricane Helene have mostly stabilized. The treefalls that affected localized sections of stream banks have not worsened. These treefall areas may not be represented in the BEHI/NBS data if the trees were not located within the assessment reaches or were not significant enough to change the dominant score.

The location of each assessment reach is shown in Figure 1. A BEHI/NBS data summary is provided in Table 4.

2.5 Photo Points

Representative photographs were taken along UTFBR, UT1 and UT2. A total of 36 photograph locations were recorded using GPS so that the subsequent monitoring photographs can be taken from the same locations throughout the next monitoring year. Year 2 monitoring photographs were also taken at any erosional areas or other areas of interest. Outside of the assessment reaches, there were a few sections

of the stream that appeared to have higher levels of erosion and instability, but these were typically isolated and not indicative of a larger stability issue. The stream also goes subsurface occasionally, mostly in the upstream reaches, but not for more than approximately one hundred feet.

The photo log is attached to this report, and the locations of the representative photographs are shown in Figure 1.

2.6 Benthic Macroinvertebrate Sampling

One benthic macroinvertebrate sample was collected within each assessment reach for a total of four samples. All sampling and analysis followed the Qual 4 sampling procedures in the NC DEQ Standard Operating Procedures for the Collection and Analysis of Benthic Macroinvertebrates (Version 5.0). EPR staff collected each sample using the kick net sampling method, a sieve bucket, forceps, a picking tray and a plastic container filled with ethyl alcohol to preserve the samples. The samples were transferred to a certified laboratory for analysis.

The NC Biotic Index (NCBI) is a weighted average of the tolerance values for the organisms identified in the sample in relation to their abundance. The NCBI is scaled from 0.0 to 10.0, with lower values representing more pristine conditions and higher values representing more degraded conditions. Year 2 NCBI scores for the four sample sites were 2.84, 2.72, 2.68, and 2.32 for Reaches 1, 2, 3, and 4 respectively. These all represent high quality conditions, and the bioclassification for every sample site was Excellent. The biotic index scores for all sites improved since Year 1 except Reach 1, which had similar scores between the two years. The *ephemeroptera*, *plecoptera*, *trichoptera* (EPT) taxa richness scores ranged from 13-20, and the % of organisms with tolerance values less than 3 (% INTOL) ranged from 55.09 to 77.42. These values all indicate that the assessed streams were supporting functioning macrobenthic populations during the Year 2 survey. Most of the macroinvertebrate indices for the project reaches showed minor improvement since Year 1, but Reach 4 showed the most significant improvement. In Year 1, most indices for Reach 4 showed significant decline including in NC biotic index, taxa richness, EPT taxa richness, % intolerant species, and bioclassification. This is the most downstream reach at the site and this could have been due to impacts from Hurricane Helene. EPR noted in Year 1 that there was shifted streambed sediment and a reduction in leaf pack in Reach 4. In Year 2, all of these same macroinvertebrate indices showed significant improvement from Year 1, indicating that the reach may have rebounded from any potential impacts from the storm.

An extremely rare genus of stonefly, *Ostrocerca*, was found in the sample from Reach 1. Presence of this genus is an indicator of good water quality.

The location of each monitoring assessment reach is shown in Figure 1. The benthic macroinvertebrate data is summarized in Table 4 and the report is attached.

2.7 Stream Flow

One stream flow gauge was installed in a large pool in UTFBR between Reaches 2 and 3. The logger used in the gauge is an ONSET HOBO U20-001-04 stainless steel water level gauge. A second logger was installed nearby on the streambank to serve as an atmospheric barometric pressure gauge. The relative elevation of the logger was surveyed, in addition to the relative elevation of the downstream riffle grade control point and the bankfull benches on both sides of the stream. This data provides a detailed record of the flow regime for UTFBR, including the stream stage and bankfull events. The flow regime has not

changed compared to Year 1 Monitoring. The gauge collected 336 days of consecutive flow, indicating UTFBR is a perennial stream at the location of the gauge. Note that the gauge was last downloaded on 12/3/2025 so no data was available for the remainder of December. These data will be presented in the Year 3 report. No bankfull events were recorded during Year 2 monitoring.

The location of the stream gauge is shown in Figure 1. The Year 1 flow gauge plot is attached. Flow data will continue to be taken throughout the coming year (2026).

2.8 Water Quality Sampling

One in-situ water quality sample was collected within each assessment reach on UTFBR during Year 2 monitoring. Water quality was not collected during baseline monitoring in 2023. The samples were collected using a Horiba U-50 Series Multiparameter Water Quality Meter, which collects temperature (F°), dissolved oxygen (mg/L), pH, turbidity (NTU), and conductivity (mS/cm).

Water temperature increased as the samples were taken throughout the day, ranging from 42° F (UTFBR Reach 2) to 50.5° F (UTFBR Reach 1). Dissolved oxygen had a larger range in values, from 7.71 mg/L on Reach 3 to 20.78 mg/L on Reach 4. The measured pH ranged from 6.30 on Reach 4 to 8.7 on Reach 1. Turbidity ranged from 2.8 NTU on Reach 3 to 13.2 on Reach 1. Lastly, conductivity increased as samples were collected downstream. Reach 1 had the lowest level of conductivity at 0.016 (mS/cm) and Reach 4 had the highest level at 0.042 (mS/cm). The data that was collected throughout UTFBR generally showed readings representative of a minimally disturbed watershed. Water quality sampling throughout road construction can be used to track any potential changes to water quality.

3.0 CONCLUSIONS

Year 2 stream monitoring for the HE-0001 road project indicates that UTFBR has remained stable in 2025 and has only been minimally impacted by tree clearing activities in the watershed so far. Thick herbaceous vegetation has covered the tributaries likely due to more exposure to sunlight. Geomorphically, the tributaries have not suffered any changes except the lack of riparian buffer. The last approximately 40 feet of UTFBR has been impacted by a pump around station. A retaining wall from the ongoing I-26 widening project is being constructed and the existing culvert will be extended upstream. During Year 3 monitoring, EPR will inspect the area to see if the construction has had any lasting impact on the stream. The lower reach of this project has large bedrock knickpoints that will not allow further downcutting.

UTFBR has remained stable from Baseline monitoring and is functioning overall with only minor shifts in bankfull dimensions and bed features. As was the case in previous monitoring years, none of the streams of interest are in a reference or pristine condition but none appeared particularly degraded or unstable either. UTFBR and its tributaries are effectively functioning as headwater streams for the French Broad River, and only minor signs of instability and erosion have been noted over the last three monitoring years. The most prominent signs of disturbance and instability were associated with the forest road crossings, fallen trees from Hurricane Helene, and the downstream culvert under I-26. Some of the assessment reaches were moderately incised, while other areas had adequate floodplain access. Overall, the assessed reaches still had channel dimension, pattern, and profile that is appropriate for the landscape and valley type.

The data that was collected during Year 2 monitoring, along with data collected in previous monitoring years, will serve as a comprehensive summary of the existing conditions prior to the HE-0001 road development. If any changes in flow regime, sediment transport, and channel stability occur, they will likely be detected in the future monitoring as the watershed adjusts from Hurricane Helene and any potential impacts from the proposed road construction.

4.0 REFERENCES

Bunte, Kristin and Abt, Steven R. 2001. Sampling Surface and Subsurface Particle-Size Distributions in Wadable Gravel- and Cobble-Bed Streams for Analyses in Sediment Transport, Hydraulics, and Streambed Monitoring. USDA Forest Service, Rocky Mountain Research Station, Fort Collins, CO. RMRS-GTR-74.

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Rosgen, Dave. 2008. River Stability Field Guide, Second Edition.

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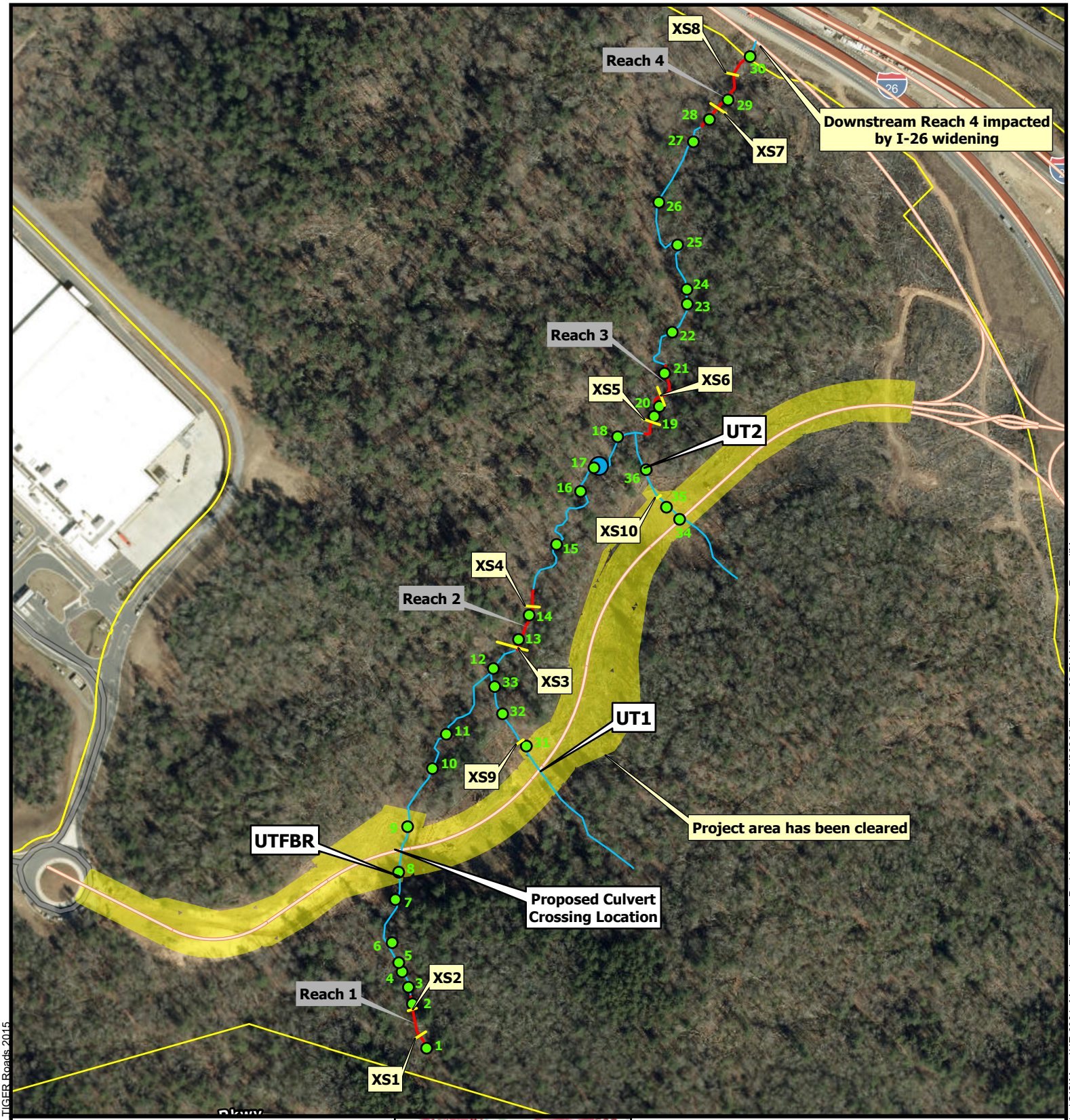
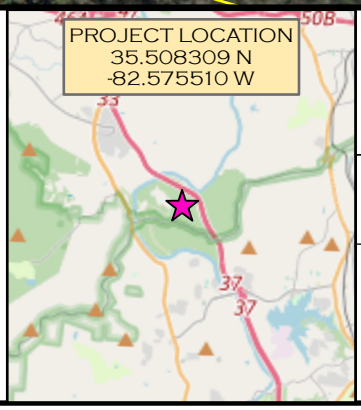
NC Department of Environmental Quality. 2016. Standard Operating Procedures for the Collection and Analysis of Benthic Macroinvertebrates. Division of Water Resources. Raleigh, North Carolina. February 2016.

FIGURE



- Project Streams
- Assessment Reach
- Stream Gauge
- Cross Section
- Parcel Boundaries
- Proposed Road ROW
- Proposed Road Alignment
- Photo Points



HE-0001 Monitoring

Buncombe County, NC

Figure 1
Year 2
Monitoring Map

Date:
January 2026

Prepared By:

Ecosystem Planning & Restoration

0 175 350 ft

1 inch = 350 feet

N

Sources: ESRI Aerial Imagery 2017, Open Street Map, TIGER Roads 2015

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TABLES

Table 1. Cross Section Data Summary
HE-0001 Stream Monitoring

	UTFBR - Reach 1						UTFBR - Reach 2					
	XS1			XS2			XS3			XS4		
	Baseline (2023)	Year 1 (2024)	Year 2 (2025)	Baseline (2023)	Year 1 (2024)	Year 2 (2025)	Baseline (2023)	Year 1 (2024)	Year 2 (2025)	Baseline (2023)	Year 1 (2024)	Year 2 (2025)
Bankfull Elevation (ft.) - Assumed Elevation	89.76	89.76	89.76	90.60	90.60	90.60	90.16	90.16	90.16	92.53	92.53	92.53
Bankfull Area (ft.)	1.20	1.91	1.77	2.28	1.96	2.59	4.45	4.11	4.07	4.11	4.65	3.98
Bankfull Width (ft.)	4.22	4.44	4.74	5.73	5.99	5.96	5.31	5.15	5.13	6.72	7.23	6.74
Bankfull Max Depth (ft.)	0.41	0.70	0.66	0.49	0.51	0.60	1.07	1.11	1.08	0.82	0.97	0.83
Bankfull Mean Depth (ft.)	0.29	0.43	0.37	0.40	0.33	0.44	0.84	0.80	0.79	0.61	0.64	0.59
Entrenchment Ratio	3.58	4.20	3.94	1.34	1.32	1.46	12.00	12.54	12.65	2.38	3.00	2.34
Width to Depth Ratio	14.77	10.30	12.74	14.41	18.34	13.67	6.35	6.45	6.46	11.00	11.26	11.44
Bank Height Ratio (Based on Baseline Assumed Bankfull Elevation)	1.00	0.99	1.00	1.00	1.00	1.00	1.24	1.25	1.26	1.22	1.28	1.31
Rosgen Stream Type	C4b	E4b	C4b	B4a	B4a	B4a	E4b	E4b	E4b	E4b	E4b	E4b
	UTFBR - Reach 3						UTFBR - Reach 4					
	XS5			XS6			XS7			XS8		
	Baseline (2023)	Year 1 (2024)	Year 2 (2025)	Baseline (2023)	Year 1 (2024)	Year 2 (2025)	Baseline (2023)	Year 1 (2024)	Year 2 (2025)	Baseline (2023)	Year 1 (2024)	Year 2 (2025)
Bankfull Elevation (ft.) - Assumed Elevation	93.16	93.16	93.16	93.43	93.43	93.41	90.66	90.66	90.66	92.26	92.26	92.26
Bankfull Area (ft.)	4.54	4.77	4.76	4.76	4.17	3.85	6.88	6.35	7.05	6.70	4.70	4.93
Bankfull Width (ft.)	10.05	10.12	10.67	9.18	8.93	10.41	9.28	8.87	10.15	10.10	8.90	8.97
Bankfull Max Depth (ft.)	0.72	0.83	0.83	0.86	0.84	0.84	0.89	0.86	0.85	1.00	0.80	0.90
Bankfull Mean Depth (ft.)	0.45	0.47	0.45	0.52	0.47	0.37	0.74	0.72	0.69	0.70	0.50	0.55
Entrenchment Ratio	1.69	1.79	3.01	4.68	4.78	4.10	1.27	1.92	1.83	3.00	3.00	3.19
Width to Depth Ratio	22.26	21.45	23.95	17.72	19.15	28.20	12.51	12.38	14.62	15.20	16.80	16.33
Bank Height Ratio (Based on Baseline Assumed Bankfull Elevation)	2.03	1.89	1.71	1.57	1.51	1.54	2.31	2.33	2.05	1.00	0.99	1.00
Rosgen Stream Type	B4	B4	C4	C4	C4	C4	B4	B4	B4	C4b	C4b	C4b
	UT1			UT2		
	XS9			XS10		
	Baseline (2023)	Year 1 (2024)	Year 2 (2025)	Baseline (2023)	Year 1 (2024)	Year 2 (2025)
Bankfull Elevation (ft.) - Assumed Elevation	94.60	94.60	94.60	91.22	91.22	91.22
Bankfull Area (ft.)	0.74	0.95	0.76	1.82	1.47	1.21
Bankfull Width (ft.)	3.63	4.37	3.48	2.50	3.43	3.10
Bankfull Max Depth (ft.)	0.38	0.45	0.32	0.86	0.67	0.54
Bankfull Mean Depth (ft.)	0.20	0.22	0.22	0.73	0.43	0.39
Entrenchment Ratio	4.96	4.25	4.99	3.16	2.10	2.19
Width to Depth Ratio	17.84	20.12	15.97	3.44	8.02	7.92
Bank Height Ratio (Based on Baseline Assumed Bankfull Elevation)	1.00	0.82	0.97	1.00	1.01	1.02
Rosgen Stream Type	C4b	C4b	C4b	E4b	B4	B4

Table 2. Longitudintal Profile Data Summary
HE-0001 Stream Monitoring

	UTFBR - Reach 1								
	Baseline (2023)			Year 1 (2024)			Year 2 (2025)		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Channel Slope (ft/ft)		0.049			0.049			0.047	
Riffle Slope (ft/ft)	0.040	0.054	0.068	0.048	0.058	0.074	0.059	0.065	0.073
Riffle Slope Ratio	0.81	1.09	1.37	0.98	1.19	1.52	1.21	1.34	1.50
Pool to Pool Spacing	17.00	27.17	38.70	21.90	24.57	27.70	14.30	27.50	39.10
Pool to Pool Spacing Ratio	2.97	4.74	6.75	3.66	4.10	4.62	2.40	4.61	6.56
Pool Depth	0.73	0.89	1.07	0.63	0.84	1.22	0.37	0.75	1.21
Pool Depth Ratio	1.83	2.22	2.68	1.90	2.56	3.69	0.84	1.70	2.75
	UTFBR - Reach 2								
	Baseline (2023)			Year 1 (2024)			Year 2 (2025)		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Channel Slope (ft/ft)		0.034			0.033			0.034	
Riffle Slope (ft/ft)	0.036	0.050	0.058	0.012	0.048	0.108	0.028	0.059	0.136
Riffle Slope Ratio	1.05	1.47	1.70	0.36	1.45	3.28	0.83	1.76	4.03
Pool to Pool Spacing	16.10	24.31	34.30	12.60	20.33	34.40	13.50	23.05	39.50
Pool to Pool Spacing Ratio	2.40	3.62	5.10	1.74	2.81	4.76	2.00	3.42	5.86
Pool Depth	0.74	0.84	1.09	0.74	1.30	1.68	0.73	1.30	1.63
Pool Depth Ratio	1.22	1.38	1.78	1.16	2.04	2.62	1.24	2.20	2.77
	UTFBR - Reach 3								
	Baseline (2023)			Year 1 (2024)			Year 2 (2025)		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Channel Slope (ft/ft)		0.020			0.019			0.019	
Riffle Slope (ft/ft)	0.019	0.039	0.064	0.018	0.056	0.109	0.019	0.046	0.080
Riffle Slope Ratio	0.95	1.97	3.19	0.95	2.91	5.68	0.94	2.34	4.01
Pool to Pool Spacing	31.90	45.53	53.10	8.20	28.37	45.20	22.10	39.46	50.90
Pool to Pool Spacing Ratio	3.47	4.96	5.78	0.92	3.18	5.06	2.12	3.79	4.89
Pool Depth	0.90	1.37	1.98	0.68	1.53	2.07	1.02	1.57	1.82
Pool Depth Ratio	1.72	2.63	3.81	1.44	3.26	4.40	2.75	4.24	4.93
	UTFBR - Reach 4								
	Baseline (2023)			Year 1 (2024)			Year 2 (2025)		
	Min	Mean	Max	Min	Mean	Max	Min	Mean	Max
Channel Slope (ft/ft)		0.030			0.027			0.030	
Riffle Slope (ft/ft)	0.020	0.045	0.080	0.023	0.067	0.114	0.022	0.062	0.093
Riffle Slope Ratio	0.65	1.48	2.63	0.87	2.50	4.22	0.74	2.10	3.14
Pool to Pool Spacing	20.20	32.03	48.10	20.00	35.15	65.00	19.00	36.50	69.40
Pool to Pool Spacing Ratio	2.00	3.17	4.76	2.25	3.95	7.30	2.12	4.07	7.74
Pool Depth	0.68	1.30	1.85	0.75	1.18	1.46	1.06	1.66	2.12
Pool Depth Ratio	0.97	1.86	2.65	1.41	2.22	2.76	1.93	3.02	3.86

Table 3. Sediment Data Summary
HE-0001 Stream Monitoring

	UTFBR - Reach 1			UTFBR - Reach 2			UTFBR - Reach 3			UTFBR - Reach 4		
	Baseline (2023)	Year 1 (2024)	Year 2 (2025)	Baseline (2023)	Year 1 (2024)	Year 2 (2025)	Baseline (2023)	Year 1 (2024)	Year 2 (2025)	Baseline (2023)	Year 1 (2024)	Year 2 (2025)
D16	8	11	11	11	18	11	11	15	17	5	14	23
D35	13	18	17	22	29	20	22	25	27	11	26	35
D50	18	24	22	36	42	34	35	36	39	23	37	49
D65	33	31	42	53	62	45	49	46	52	46	57	67
D84	75	49	78	91	97	77	76	64	80	94	110	110
D95	110	80	130	130	120	140	110	100	120	150	160	170
silt/clay	1%	0%	0%	2%	0%	0%	3%	0%	0%	0%	0%	0%
sand	3%	1%	1%	2%	0%	0%	1%	1%	0%	9%	7%	0%
gravel	73%	90%	77%	71%	66%	78%	73%	83%	77%	65%	62%	61%
cobble	24%	9%	22%	25%	34%	22%	23%	15%	23%	25%	31%	36%
boulder	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%
Bedrock	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	3%

Table 4. BEHI/NBS Data Summary
HE-0001 Stream Monitoring

	UTFBR - Reach 1			UTFBR - Reach 2			UTFBR - Reach 3			UTFBR - Reach 4		
	Baseline (2023)	Year 1 (2024)	Year 2 (2025)	Baseline (2023)	Year 1 (2024)	Year 2 (2025)	Baseline (2023)	Year 1 (2024)	Year 2 (2025)	Baseline (2023)	Year 1 (2024)	Year 2 (2025)
Dominant BEHI/NBS	LOW/LOW (58%)	LOW/LOW (62%)	LOW/LOW (65%)	MOD/LOW (45%)	LOW/LOW (42%)	LOW/LOW (44%)	MOD/LOW (44%)	MOD/LOW (26%)	LOW/LOW (47%)	MOD/LOW (56%)	MOD/LOW (43%)	MOD/LOW (24%)

Table 5. Benthic Macroinvertebrate Report
HE-0001 Stream Monitoring

SITE	D50-MM[1]			TOTAL #[2]			NCBI[3]			TAXA RICHNESS[4]			EPT TAXA RICHNESS[5]			% INTOL (TV <3)[6]			BIOCLASSIFICATION[7]		
	Baseline (2023)	Year 1 (2024)	Year 2 (2025)	Baseline (2023)	Year 1 (2024)	Year 2 (2025)	Baseline (2023)	Year 1 (2024)	Year 2 (2025)	Baseline (2023)	Year 1 (2024)	Year 2 (2025)	Baseline (2023)	Year 1 (2024)	Year 2 (2025)	Baseline (2023)	Year 1 (2024)	Year 2 (2025)	Baseline (2023)	Year 1 (2024)	Year 2 (2025)
R1	18	24	22	96	149	96	2.21	2.67	2.84	22	20	23	12	13	13	80.90	58.39	73.96	EXCELLENT	EXCELLENT	EXCELLENT
R2	36	42	34	164	133	171	3.05	3.17	2.72	28	27	30	12	15	17	61.39	64.66	73.10	EXCELLENT	EXCELLENT	EXCELLENT
R3	35	36	39	102	222	265	3.05	3.09	2.68	23	28	29	9	17	19	62.24	53.15	55.09	EXCELLENT	EXCELLENT	EXCELLENT
R4	23	37	49	140	200	217	2.78	4.30	2.32	26	19	35	13	10	20	68.35	10.00	77.42	EXCELLENT	GOOD	EXCELLENT

[1] The median substrate size measured in millimeters.

[2] Total number of individuals collected in each sample.

[3] A weighted average of the tolerance values for the organisms on a scale ranging from 0.0 to 10.0 with lower values representing more pristine conditions.

[4] The total number of different taxonmic groups found in a given sample.

[5] The number of different species belonging to the insect orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies) found in a given sample.

[6] Provides a measure of the sensitivity of aquatic organisms to degraded water quality.

[7] A categorization of the overall health of a water body based on the macroinvertebrate species collected.

Table 6. Water Quality Sampling Report
HE-0001 Stream Monitoring

Parameter	UTFBR - Reach 1		UTFBR - Reach 2		UTFBR - Reach 3		UTFBR - Reach 4	
Monitoring Year	Year 1 (2024)	Year 2 (2025)	Year 1 (2024)	Year 2 (2025)	Year 1 (2024)	Year 2 (2025)	Year 1 (2024)	Year 2 (2025)
Temp. (F)	49.9	50.5	49.0	42.0	46.0	44.3	45.2	45.6
DO (mg/L)	4.25	8.13	2.77	7.87	8.16	7.71	4.77	20.78
pH	7.48	8.66	7.36	7.87	7.85	7.87	8.41	6.30
Turbidity (NTU)	21.0	13.2	2.2	6.3	8.0	2.8	12.4	3.3
Conductivity (mS/cm)	0.019	0.016	0.022	0.025	0.023	0.025	0.042	0.042
Notes	Sample taken at 9:00 A.M.		Sample taken at 11:00 A.M.		Sample taken at 2:30 P.M.		Sample taken at 4:00 P.M.	

General Notes/Observations:
-Clear condtions, sunny with a high of 45°F. In-situ water quality samples were collected in the same locations as the macroinvertebrate samples.

-Water quality measurements were not taken during Baseline (2023) monitoring.

PHOTO LOG

HE-0001 Stream Monitoring Project
Representative Site Photographs (taken 12/3/2025)

Photo Point 1 (UTFBR Reach 1 facing upstream)

Photo Point 2 (UTFBR Reach 1 facing upstream)

Photo Point 3 (UTFBR facing upstream)

Photo Point 4 (UTFBR facing upstream)

Photo Point 5 (UTFBR facing downstream at road crossing)

Photo Point 6 (UTFBR culvert facing upstream)

HE-0001 Stream Monitoring Project
Representative Site Photographs (taken 12/3/2025)

Photo Point 7 (UTFBR facing downstream)

Photo Point 8 (UTFBR facing downstream)

Photo Point 9 (UTFBR facing downstream)

Photo Point 10 (UTFBR facing downstream)

Photo Point 11 (UTFBR facing downstream)

Photo Point 12 (UTFBR facing downstream)

HE-0001 Stream Monitoring Project
Representative Site Photographs (taken 12/3/2025)

Photo Point 13 (UTFBR Reach 2 facing upstream)

Photo Point 14 (UTFBR Reach 2 facing upstream)

Photo Point 15 (UTFBR Reach 2 facing downstream)

Photo Point 16 (UTFBR facing downstream)

Photo Point 17 (UTFBR facing downstream, stream gauge)

Photo Point 18 (UTFBR facing downstream)

HE-0001 Stream Monitoring Project
Representative Site Photographs (taken 12/3/2025)

Photo Point 19 (UTFBR Reach 3 facing downstream)

Photo Point 20 (UTFBR Reach 3 facing downstream)

Photo Point 21 (UTFBR Reach 3 facing upstream)

Photo Point 22 (UTFBR culvert, facing downstream)

Photo Point 23 (UTFBR culvert, facing upstream)

Photo Point 24 (UTFBR facing downstream)

HE-0001 Stream Monitoring Project
Representative Site Photographs (taken 12/3/2025)

Photo Point 25 (UTFBR facing downstream)

Photo Point 26 (UTFBR Reach 4, facing downstream)

Photo Point 27 (UTFBR Reach 4, facing downstream)

Photo Point 28 (UTFBR Reach 4, facing downstream)

Photo Point 29 (UTFBR Reach 4, facing downstream)

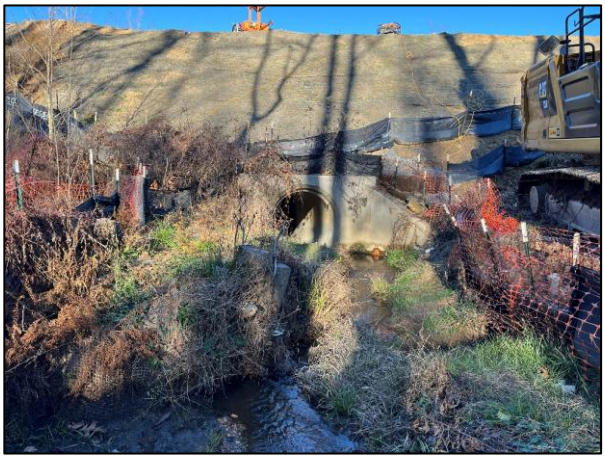


Photo Point 30 (UTFBR Reach 4, facing downstream, I-26 culvert)

HE-0001 Stream Monitoring Project
Representative Site Photographs (taken 12/3/2025)

Photo Point 31 (UT1 facing upstream)

Photo Point 32 (UT1 facing upstream)

Photo Point 33 (UT1 facing downstream)

Photo Point 34 (UT2 facing upstream)

Photo Point 35 (UT2 facing upstream at head cut)

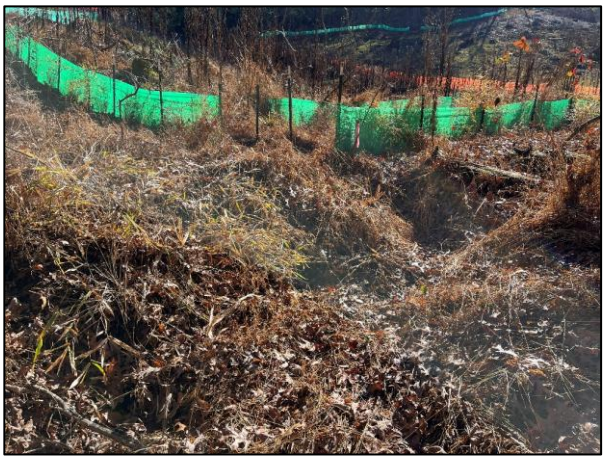


Photo Point 36 (UT2 facing upstream)

HE-0001 Stream Monitoring Project
Representative Site Photographs (taken 12/3/2025)

Supplemental stream photo (Reach 4)

Construction stream diversion (lower Reach 4)

UT2 overview

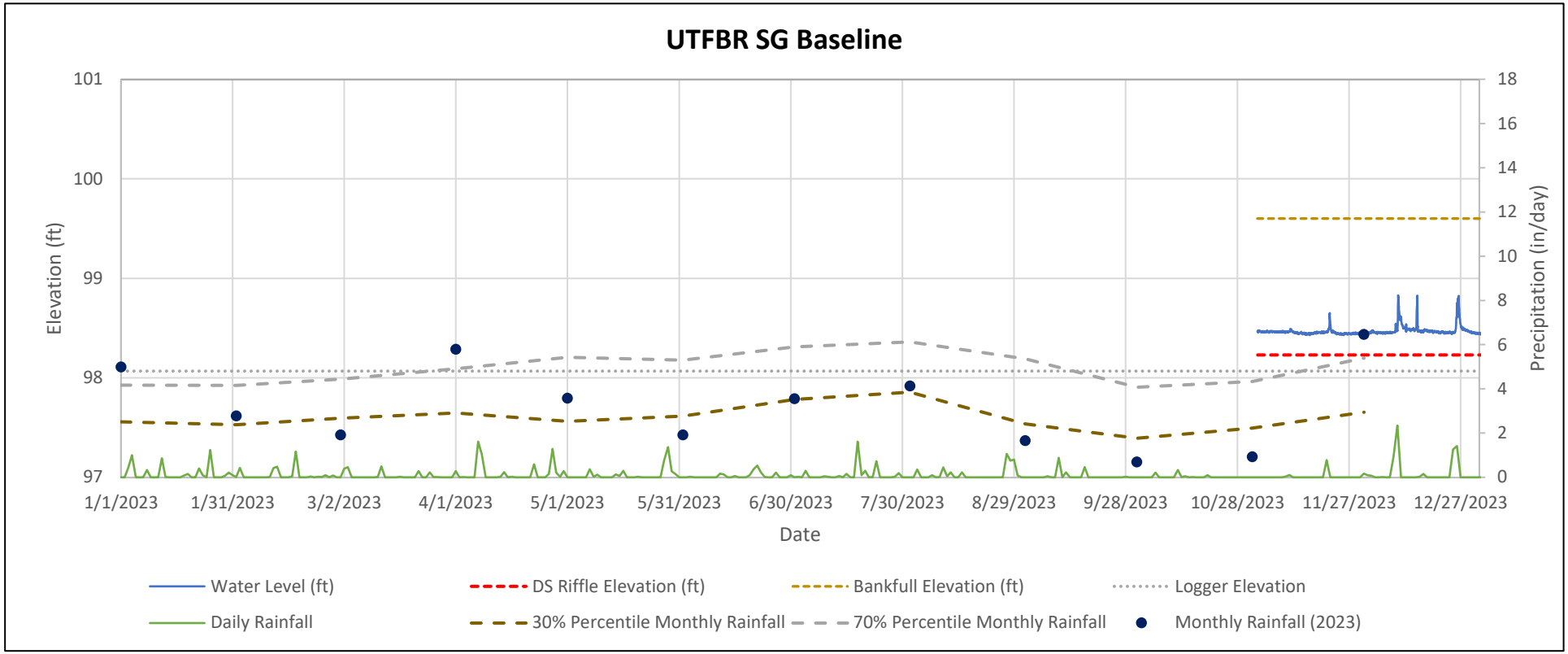
UT1 overview

Proposed culvert crossing (facing north)

Proposed culvert crossing (facing west)

STREAM GAUGE DATA AND PLOT

HE0001 Monitoring
Existing Conditions Streamflow Data (2023)

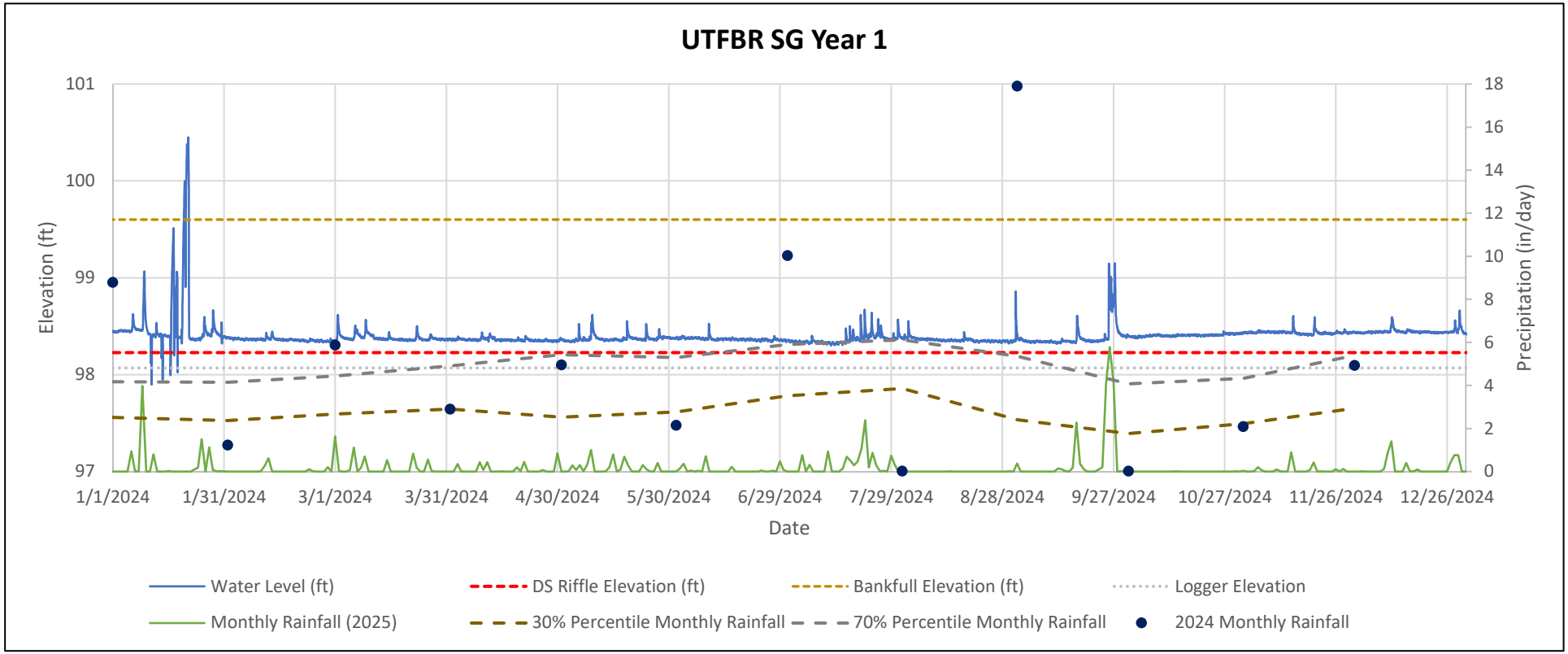


Site Info	
Stream	HE0001 Monitoring
Reach	UT French Broad River
Date Installed	11/3/2023
Serial Number	21826375

Note: All elevations are relative to surveyed iron which was assigned an assumed elevation of 100.00 ft
*Rainfall data from Gauging Station ASH Regional Airport 5 miles SE https://agacis.rcc-acis.org/?fips=37021

2023 Existing Conditions Streamflow Data	
Gauge ID	UTFBR SG Baseline
Start Date	11/3/2023
End Date	12/31/2023
Recordings Per Day	24
Logger Elevation (ft)	98.07
Controlling Grade Elevation (ft)	98.23
Bankfull Elevation (ft)	99.60
Most Consecutive Days of Flow	60
Total Days of Flow	59
Max High Water Elevation	0.60
Bankfull Events	0

HE0001 Monitoring
Existing Conditions Streamflow Data (2024)

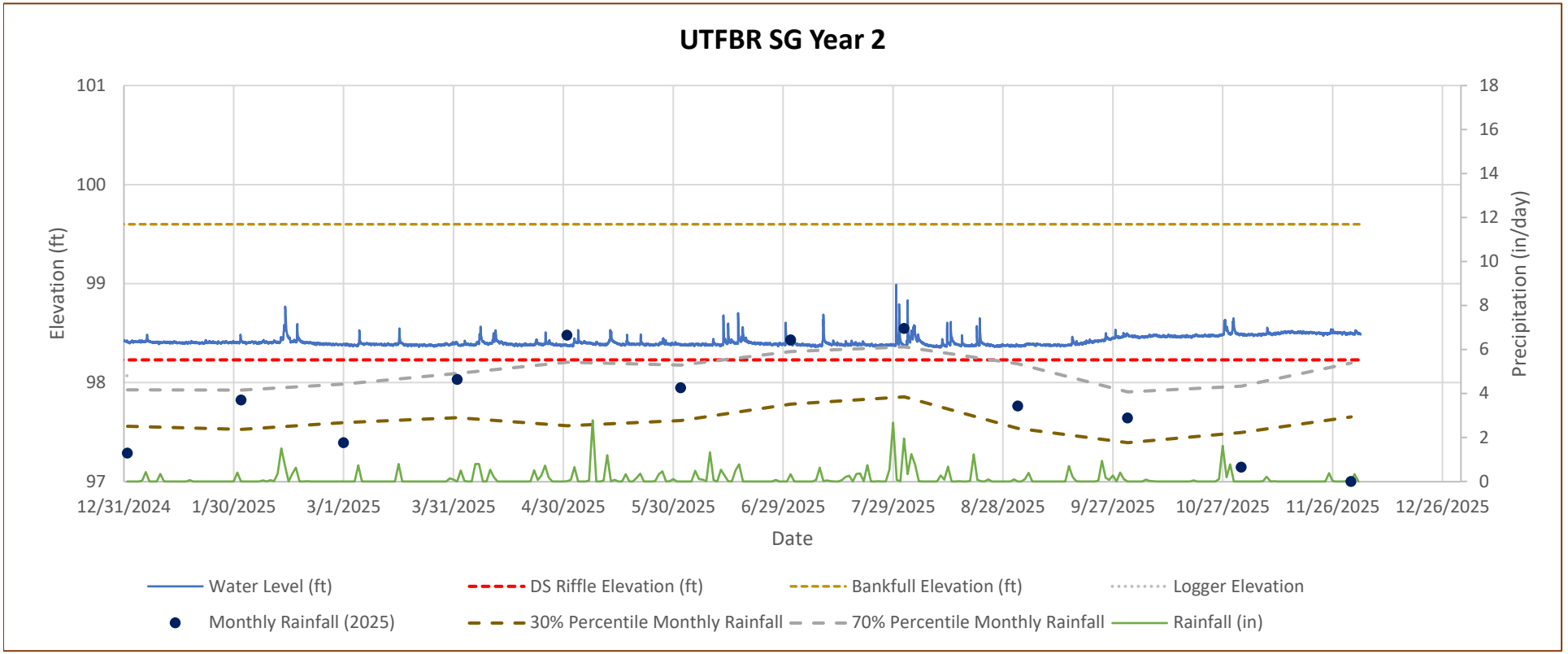


Site Info	
Stream	HE0001 Monitoring
Reach	UT French Broad River
Date Installed	11/3/2023
Serial Number	21826375

Note: All elevations are relative to surveyed iron which was assigned an assumed elevation of 100.00 ft
*Rainfall data from Gauging Station ASH Regional Airport 5 miles SE https://agacis.rcc-acis.org/?fips=37021
*Data was corrupted from 1/11-1/21 from freezing temperatures

2024 Existing Conditions Streamflow Data	
Gauge ID	UTFBR SG Year 1
Start Date	1/1/2024
End Date	12/31/2024
Recordings Per Day	24
Logger Elevation (ft)	98.07
Controlling Grade Elevation (ft)	98.23
Bankfull Elevation (ft)	99.60
Most Consecutive Days of Flow	365
Total Days of Flow	365
Max High Water Elevation	0.92
Bankfull Events	0

HE0001 Monitoring
Existing Conditions Streamflow Data (2025)



Site Info	
Stream	HE0001 Monitoring
Reach	UT French Broad River
Date Installed	11/3/2023
Serial Number	21826375

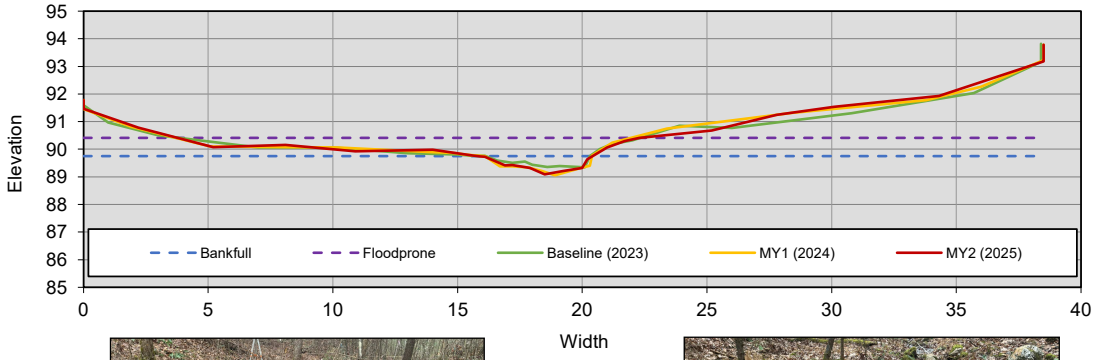
Note: All elevations are relative to surveyed iron which was assigned an assumed elevation of 100.00 ft
*Rainfall data from Gauging Station ASH Regional Airport 5 miles SE https://agacis.rcc-acis.org/?fips=37021

2025 Existing Conditions Streamflow Data	
Gauge ID	UTFBR SG Year 2
Start Date	1/1/2025
End Date	12/3/2025
Recordings Per Day	24
Logger Elevation (ft)	98.07
Controlling Grade Elevation (ft)	98.23
Bankfull Elevation (ft)	99.60
Most Consecutive Days of Flow	336
Total Days of Flow	336
Max High Water Elevation	0.76
Bankfull Events	0

CROSS-SECTION PLOTS

Cross Section 1 - XS1

Sta. 0 + 39.8 UTFBR - Reach 1 - MY2 (Dec. 2025). Riffle



XS1 Facing Downstream

XS1 Facing Upstream

Bankfull Dimensions

1.77	x-section area (ft.sq.)
4.74	width (ft)
0.37	mean depth (ft)
0.66	max depth (ft)
5.07	wetted perimeter (ft)
0.35	hyd radi (ft)
12.74	width-depth ratio
18.69	W flood prone area (ft)
3.94	entrenchment ratio
0.66	low bank height (ft)
1.00	low bank height ratio
C4b	Stream Type (Rosgen, 1996)

Materials

18.0	D50 Riffle (mm)
75.0	D84 Riffle (mm)
52.3	threshold grain size (mm):

Bankfull Flow

3.2	velocity (ft/s)
5.6	discharge rate (cfs)

Forces & Power

4.9	channel slope (%)
1.06	shear stress (lb/sq.ft.)
0.74	shear velocity (ft/s)
3.6	unit strm power (lb/ft/s)

Flow Resistance

0.052	Manning's roughness
0.44	D'Arcy-Weisbach fric.
4.3	resistance factor u/u*
1.5	relative roughness

Cross Section

reference ID	XS1	
instrument height	94.46	109.46
longitudinal station	39	39.0

Bankfull Stage

FS		---
elevation	89.76	97.10

Low Bank Height

FS		---
elevation	89.76	

Flood Prone Area

width fpa		18.7

Channel Slope

percent slope		4.9

Flow Resistance

Manning's "n"		0.052
D'Arcy - Weisbach "f"		0.44

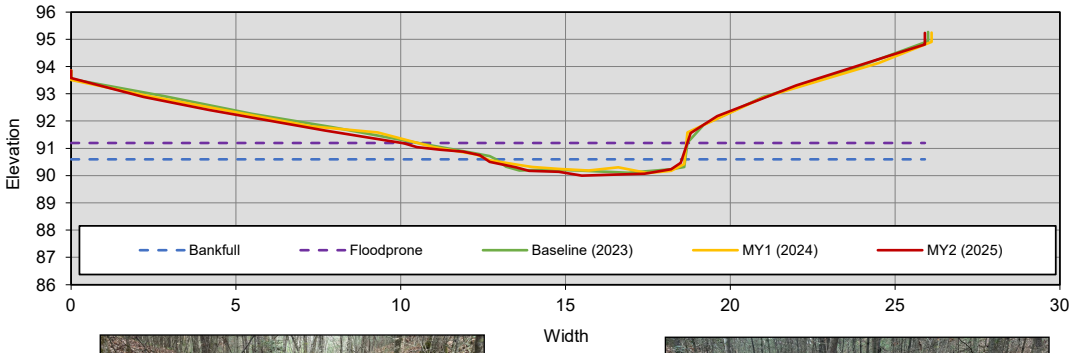
Note:

Assumed instrument height, not tied to grid.

Distance (ft)	BS (ft)	HI (ft)	FS (ft)	Elevation (ft)	Omit Bkf	Notes
0		94.46	2.68	91.78		lpin
0		94.46	2.99	91.47		lpin
2.2		94.46	3.68	90.78		
5.2		94.46	4.39	90.07		
8.1		94.46	4.3	90.16		
10.9		94.46	4.54	89.92		
14		94.46	4.48	89.98		
15.6		94.46	4.69	89.77		
15.9		94.46	4.72	89.74		OB
16.1		94.46	4.73	89.73		
16.9		94.46	5.05	89.41		EC
17.2		94.46	5.04	89.42		
17.9		94.46	5.14	89.32		
18.5		94.46	5.36	89.1		
19.2		94.46	5.26	89.2		
20		94.46	5.14	89.32		
20.2		94.46	4.83	89.63		
21		94.46	4.4	90.06		
21.7		94.46	4.16	90.3		
22.3		94.46	4.05	90.41		
		94.46				
25.2		94.46	3.78	90.68		
27.8		94.46	3.22	91.24		
30.1		94.46	2.93	91.53		
34.3		94.46	2.53	91.93		
38.5		94.46	1.28	93.18		rpin
38.5		94.46	0.67	93.79		Lpin

Cross Section 2 -XS2

Sta. 1 + 17.8 UTFBR - Reach 1 - MY2 (Dec. 2025), Riffle



XS2 Facing Downstream

XS2 Facing Upstream

Bankfull Dimensions

2.59	x-section area (ft.sq.)
5.96	width (ft)
0.44	mean depth (ft)
0.60	max depth (ft)
6.25	wetted perimeter (ft)
0.41	hyd radi (ft)
13.67	width-depth ratio
8.70	W flood prone area (ft)
1.46	entrenchment ratio
0.60	low bank height (ft)
1.00	low bank height ratio
B4a	Stream Type (Rosgen, 1996)

Materials

18.0	D50 Riffle (mm)
75.0	D84 Riffle (mm)
62.4	threshold grain size (mm):

Bankfull Flow

3.6	velocity (ft/s)
9.4	discharge rate (cfs)

Forces & Power

4.9	channel slope (%)
1.27	shear stress (lb/sq.ft.)
0.81	shear velocity (ft/s)
4.8	unit strm power (lb/ft/s)

Flow Resistance

0.051	Manning's roughness
0.40	D'Arcy-Weisbach fric.
4.5	resistance factor u/u*
1.8	relative roughness

Cross Section

reference ID	XS2	
instrument height	97.57	108.26
longitudinal station	119.5	119.5

Bankfull Stage

FS		---
elevation	90.6	93.78

Low Bank Height

FS		---
elevation	90.6	

Flood Prone Area

width fpa		8.7

Channel Slope

percent slope		4.9

Flow Resistance

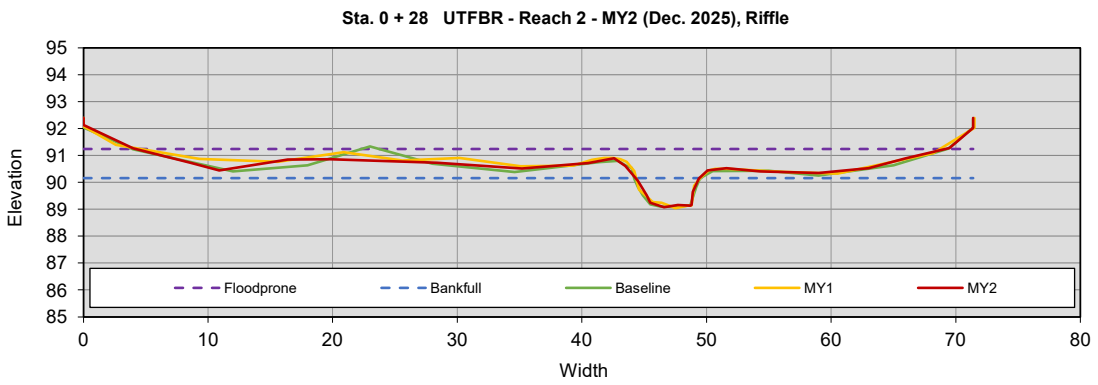
Manning's "n"		0.051
D'Arcy - Weisbach "f"		0.40

Note:

Assumed instrument height, not tied to grid.

Distance (ft)	BS (ft)	HI (ft)	FS (ft)	Elevation (ft)	Omit Bkf	Notes
0		97.57	3.71	93.86		LP
0		97.57	3.99	93.58		LP
2.2		97.57	4.69	92.88		
4.2		97.57	5.17	92.4		
7.7		97.57	5.92	91.65		
10.1		97.57	6.39	91.18		
10.5		97.57	6.53	91.04		
11.2		97.57	6.62	90.95		
11.9		97.57	6.69	90.88		
12.4		97.57	6.82	90.75		TOB
12.7		97.57	7.07	90.5		
13.5		97.57	7.27	90.3		
13.9		97.57	7.4	90.17		TEC
14.8		97.57	7.43	90.14		
15.5		97.57	7.57	90		
17.4		97.57	7.5	90.07		
18.2		97.57	7.34	90.23		TEC
18.5		97.57	7.1	90.47		
18.8		97.57	6.01	91.56		
19.6		97.57	5.39	92.18		
22		97.57	4.26	93.31		
25.9		97.57	2.76	94.81		TRP
25.9		97.57	2.33	95.24		TRP

Cross Section 3 - XS3



XS3 Facing Downstream

XS3 Facing Upstream

Bankfull Dimensions

4.07	x-section area (ft.sq.)
5.13	width (ft)
0.79	mean depth (ft)
1.08	max depth (ft)
6.07	wetted perimeter (ft)
0.67	hyd radi (ft)
6.46	width-depth ratio
64.88	W flood prone area (ft)
12.65	entrenchment ratio
1.36	low bank height (ft)
1.26	low bank height ratio
E4b	Stream Type (Rosgen, 1996)

Materials

34.0	D50 Riffle (mm)
77.0	D84 Riffle (mm)
70.8	threshold grain size (mm):

Bankfull Flow

4.4	velocity (ft/s)
18.0	discharge rate (cfs)

Forces & Power

3.44	channel slope (%)
1.44	shear stress (lb/sq.ft.)
0.86	shear velocity (ft/s)
7.5	unit strm power (lb/ft/s)

Flow Resistance

0.048	Manning's roughness
0.31	D'Arcy-Weisbach fric.
5.7	resistance factor u/u*
3.1	relative roughness

Cross Section

reference ID	XS3	
instrument height	95.69	108.06
longitudinal station	27.4	27.4

Bankfull Stage

FS		---
elevation	90.16	97.90

Low Bank Height

FS	5.25	= 90.44 elev
elevation		

Flood Prone Area

width fpa		64.9

Channel Slope

percent slope	3.4	3.4

Flow Resistance

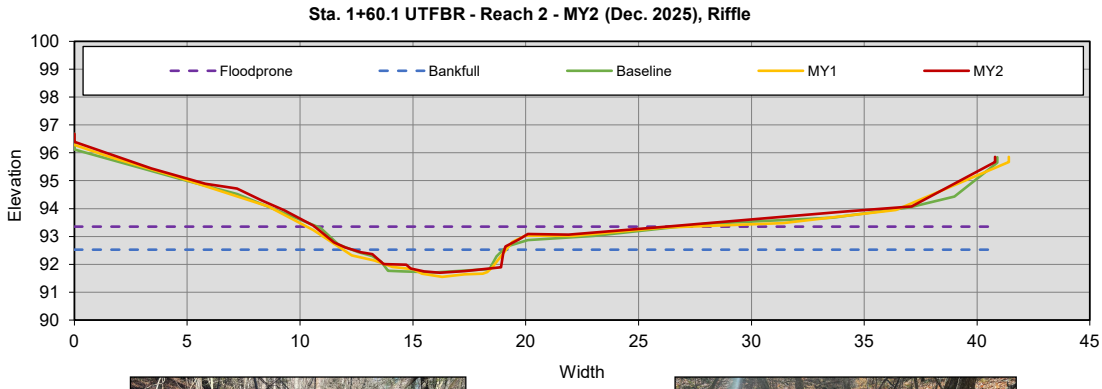
Manning's "n"	0.048	0.043
D'Arcy - Weisbach "f"		0.25

Note:

Assumed instrument height, not tied to grid.

Distance (ft)	BS (ft)	HI (ft)	FS (ft)	Elevation (ft)	Omit Bkf	Notes
0		95.69	3.29	92.4	☐	TRP
0		95.69	3.56	92.13	☐	BRP
4		95.69	4.42	91.27	☐	
8.6		95.69	4.96	90.73	☐	
10.9		95.69	5.25	90.44	☐	
16.4		95.69	4.84	90.85	☐	
19.8		95.69	4.83	90.86	☐	
28.4		95.69	4.96	90.73	☐	
35.2		95.69	5.17	90.52	☐	
40.5		95.69	4.97	90.72	☐	
42.6		95.69	4.8	90.89	☐	
43.5		95.69	5.08	90.61	☐	TOB
44.5		95.69	5.63	90.06	☐	
45.2		95.69	6.18	89.51	☐	
45.5		95.69	6.45	89.24	☐	LEC
46.6		95.69	6.61	89.08	☐	
47.7		95.69	6.53	89.16	☐	
48.7		95.69	6.55	89.14	☐	
48.8		95.69	6.53	89.16	☐	REC
48.9		95.69	6.04	89.65	☐	
49.4		95.69	5.55	90.14	☐	BKF
50.1		95.69	5.25	90.44	☐	TOB
51.6		95.69	5.16	90.53	☐	
54.3		95.69	5.28	90.41	☐	
59		95.69	5.34	90.35	☐	
63		95.69	5.16	90.53	☐	
66		95.69	4.79	90.9	☐	
69.5		95.69	4.41	91.28	☐	
71.4		95.69	3.67	92.02	☐	BRP
71.4		95.69	3.29	92.4	☐	TRP

Cross Section 4 -XS4



XS4 Facing Downstream

XS4 Facing Upstream

Bankfull Dimensions

3.98	x-section area (ft.sq.)
6.74	width (ft)
0.59	mean depth (ft)
0.83	max depth (ft)
7.43	wetted perimeter (ft)
0.53	hyd radi (ft)
11.44	width-depth ratio
15.76	W flood prone area (ft)
2.34	entrenchment ratio
1.09	low bank height (ft)
1.31	low bank height ratio
E4b	Stream Type (Rosgen, 1996)

Materials

34.0	D50 Riffle (mm)
77.0	D84 Riffle (mm)
56.4	threshold grain size (mm):

Bankfull Flow

3.6	velocity (ft/s)
14.5	discharge rate (cfs)

Forces & Power

3.44	channel slope (%)
1.15	shear stress (lb/sq.ft.)
0.77	shear velocity (ft/s)
4.6	unit strm power (lb/ft/s)

Flow Resistance

0.050	Manning's roughness
0.36	D'Arcy-Weisbach fric.
5.1	resistance factor u/u*
2.3	relative roughness

Cross Section

reference ID	XS4	
instrument height	100.58	101.19
longitudinal station	160.1	162.5

Bankfull Stage

FS		---
elevation	92.53	93.44

Low Bank Height

FS	7.79	= 92.79 elev
elevation		

Flood Prone Area

width fpa		15.8

Channel Slope

percent slope	3.44	3.4

Flow Resistance

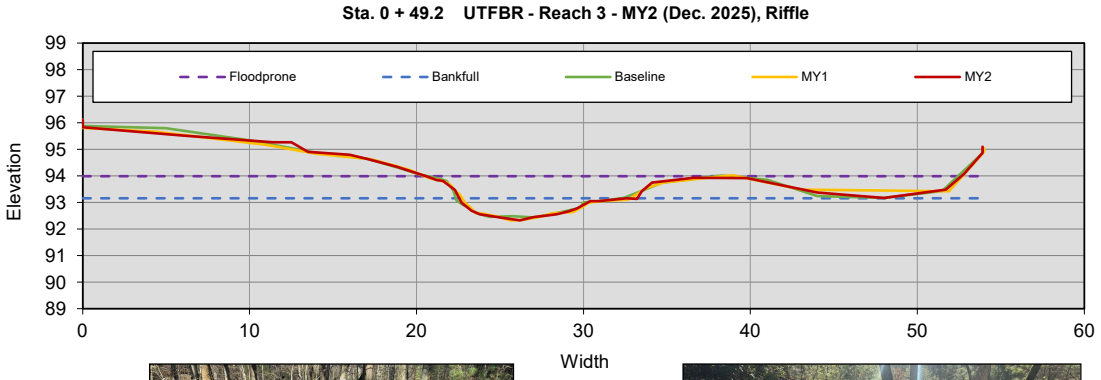
Manning's "n"	0.05	0.046
D'Arcy - Weisbach "f"		0.31

Note:

Assumed instrument height, not tied to grid.

Distance (ft)	BS (ft)	HI (ft)	FS (ft)	Elevation (ft)	Omit Bkf	Notes
0		100.58	3.9	96.68		TLP
0		100.58	4.19	96.39		BLP
3.4		100.58	5.14	95.44		
5.8		100.58	5.69	94.89		
7.2		100.58	5.86	94.72		
8.3		100.58	6.29	94.29		
9.3		100.58	6.64	93.94		
10.6		100.58	7.19	93.39		
11.5		100.58	7.79	92.79		
12		100.58	7.97	92.61		
12.7		100.58	8.15	92.43		BKF
13.2		100.58	8.22	92.36		
13.7		100.58	8.57	92.01		
14.7		100.58	8.6	91.98		
14.9		100.58	8.73	91.85		LEC
15.5		100.58	8.84	91.74		
16.2		100.58	8.88	91.7		
17.3		100.58	8.82	91.76		
18.9		100.58	8.69	91.89		REC
19		100.58	8.18	92.4		
19.1		100.58	7.94	92.64		
19.7		100.58	7.69	92.89		
20.1		100.58	7.49	93.09		TOB
21.9		100.58	7.52	93.06		
26.4		100.58	7.22	93.36		
34.1		100.58	6.69	93.89		
37.1		100.58	6.51	94.07		
40.8		100.58	4.91	95.67		BRP
40.8		100.58	4.73	95.85		TRP

Cross Section 5 - XS5



XS5 Facing Downstream

XS5 Facing Upstream

Bankfull Dimensions

4.76	x-section area (ft.sq.)
10.67	width (ft)
0.45	mean depth (ft)
0.83	max depth (ft)
10.95	wetted perimeter (ft)
0.43	hyd radi (ft)
23.95	width-depth ratio
32.10	W flood prone area (ft)
3.01	entrenchment ratio
1.42	low bank height (ft)
1.71	low bank height ratio
C4	Stream Type (Rosgen, 1996)

Materials

39.0	D50 Riffle (mm)
80.0	D84 Riffle (mm)
25.0	threshold grain size (mm):

Bankfull Flow

2.4	velocity (ft/s)
11.3	discharge rate (cfs)

Forces & Power

1.88	channel slope (%)
0.51	shear stress (lb/sq.ft.)
0.51	shear velocity (ft/s)
1.25	unit strm power (lb/ft/s)

Flow Resistance

0.049	Manning's roughness
0.37	D'Arcy-Weisbach fric.
4.6	resistance factor u/u*
1.7	relative roughness

Cross Section

reference ID	XS5	
instrument height	100.97	104.79
longitudinal station	50.4	50.4

Bankfull Stage

FS		---
elevation	93.16	97.42

Low Bank Height

FS		---
elevation	93.75	

Flood Prone Area

width fpa	32.1	32.1

Channel Slope

percent slope	1.88	2

Flow Resistance

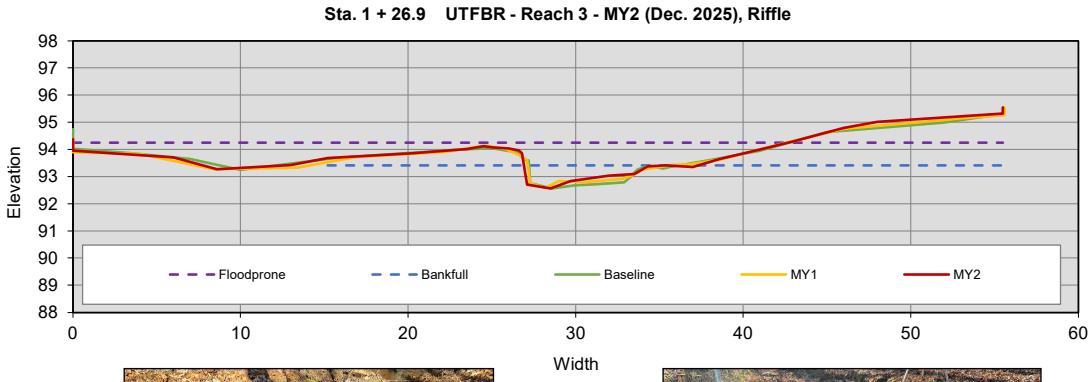
Manning's "n"		0.049
D'Arcy - Weisbach "f"		0.37

Note:

Assumed instrument height, not tied to grid.

Distance (ft)	BS (ft)	HI (ft)	FS (ft)	Elevation (ft)	Omit Bkf	Notes
0		100.97	4.86	96.11		TLP
0		100.97	5.14	95.83		TLP
6		100.97	5.46	95.51		
11.4		100.97	5.71	95.26		
12.5		100.97	5.71	95.26		
13.5		100.97	6.07	94.9		
16		100.97	6.18	94.79		
17.2		100.97	6.36	94.61		
18.8		100.97	6.62	94.35		
20.7		100.97	7.01	93.96		
21.2		100.97	7.13	93.84		
21.6		100.97	7.16	93.81		
22.3		100.97	7.5	93.47		
22.7		100.97	7.98	92.99		
23.3		100.97	8.28	92.69		EC
23.8		100.97	8.42	92.55		
25		100.97	8.54	92.43		
26.2		100.97	8.64	92.33		
27		100.97	8.53	92.44		
28.4		100.97	8.42	92.55		
29.1		100.97	8.31	92.66		EC
29.6		100.97	8.2	92.77		
30.4		100.97	7.92	93.05		
30.9		100.97	7.93	93.04		
32.6		100.97	7.82	93.15		TOF
33.2		100.97	7.84	93.13		
33.5		100.97	7.55	93.42		
34.1		100.97	7.22	93.75		TOB
36.6		100.97	7.04	93.93		
39.8		100.97	7.06	93.91		

Cross Section 6 -XS6



XS6 Facing Downstream

XS6 Facing Upstream

Bankfull Dimensions

3.85	x-section area (ft.sq.)
10.41	width (ft)
0.37	mean depth (ft)
0.84	max depth (ft)
11.07	wetted perimeter (ft)
0.35	hyd radi (ft)
28.20	width-depth ratio
42.70	W flood prone area (ft)
4.10	entrenchment ratio
1.29	low bank height (ft)
1.54	low bank height ratio
C4	Stream Type (Rosgen, 1996)

Materials

39.0	D50 Riffle (mm)
80.0	D84 Riffle (mm)
20.0	threshold grain size (mm):

Bankfull Flow

2.0	velocity (ft/s)
7.5	discharge rate (cfs)

Forces & Power

1.88	channel slope (%)
0.41	shear stress (lb/sq.ft.)
0.46	shear velocity (ft/s)
0.85	unit strm power (lb/ft/s)

Flow Resistance

0.051	Manning's roughness
0.44	D'Arcy-Weisbach fric.
4.28	resistance factor u/u*
1.41	relative roughness

Cross Section

reference ID	XS6	
instrument height	99.9	104.79
longitudinal station	129.6	129.6

Bankfull Stage

FS		---
elevation	93.41	95.88

Low Bank Height

FS		---
elevation	93.86	

Flood Prone Area

width fpa	42.7	42.7

Channel Slope

percent slope	1.88	2

Flow Resistance

Manning's "n"		0.051
D'Arcy - Weisbach "f"		0.44

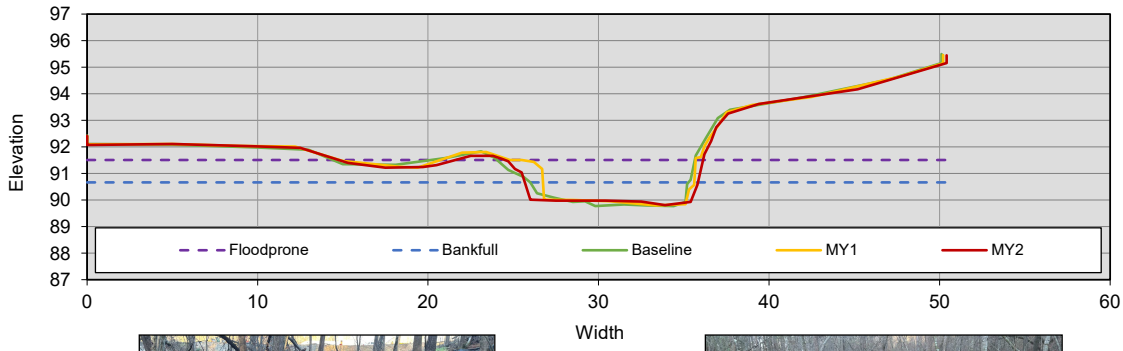
Note:

Assumed instrument height, not tied to grid.

Distance (ft)	BS (ft)	HI (ft)	FS (ft)	Elevation (ft)	Omit Bkf	Notes
0		99.9	5.52	94.38		LP
0		99.9	5.95	93.95	☑	LP
6		99.9	6.19	93.71	☑	
8.6		99.9	6.63	93.27	☑	
13		99.9	6.48	93.42	☑	
15.2		99.9	6.22	93.68		
20.3		99.9	6.04	93.86		
23.5		99.9	5.89	94.01		
24.5		99.9	5.78	94.12		
25.1		99.9	5.83	94.07		
26		99.9	5.87	94.03		
26.6		99.9	5.94	93.96		
26.8		99.9	6.04	93.86		TOB
27.1		99.9	7.2	92.7		TOC
28.5		99.9	7.33	92.57		TOG
29.7		99.9	7.07	92.83		
32		99.9	6.87	93.03		
33.5		99.9	6.81	93.09		
34.3		99.9	6.52	93.38		
35.4		99.9	6.49	93.41		
37		99.9	6.55	93.35		
38.6		99.9	6.26	93.64		
40.8		99.9	5.94	93.96		
43		99.9	5.61	94.29		
46		99.9	5.11	94.79		
48		99.9	4.89	95.01		
55.5		99.9	4.58	95.32		LP
55.5		99.9	4.35	95.55		LP

Cross Section 7 - XS7

Sta. 0 + 77.5 UTFBR - Reach 4 - MY2 (Dec. 2025), Riffle



XS7 Facing Downstream

XS7 Facing Upstream

Bankfull Dimensions

7.05	x-section area (ft.sq.)
10.15	width (ft)
0.69	mean depth (ft)
0.85	max depth (ft)
11.00	wetted perimeter (ft)
0.64	hyd radi (ft)
14.62	width-depth ratio
18.60	W flood prone area (ft)
1.83	entrenchment ratio
1.74	low bank height (ft)
2.05	low bank height ratio
B4	Stream Type (Rosgen, 1996)

Materials

49.0	D50 Riffle (mm)
110.0	D84 Riffle (mm)
61.8	threshold grain size (mm):

Bankfull Flow

3.7	velocity (ft/s)
25.8	discharge rate (cfs)

Forces & Power

3.14	channel slope (%)
1.26	shear stress (lb/sq.ft.)
0.81	shear velocity (ft/s)
5	unit strm power (lb/ft/s)

Flow Resistance

0.054	Manning's roughness
0.39	D'Arcy-Weisbach fric.
4.5	resistance factor u/u*
1.9	relative roughness

Cross Section

reference ID	XS7	
instrument height	100.77	103.54
longitudinal station	77.6	77.6

Bankfull Stage

FS		---
elevation	90.66	94.29

Low Bank Height

FS	9.22	= 91.55 elev
elevation		

Flood Prone Area

width fpa		18.6

Channel Slope

percent slope	3.14	3

Flow Resistance

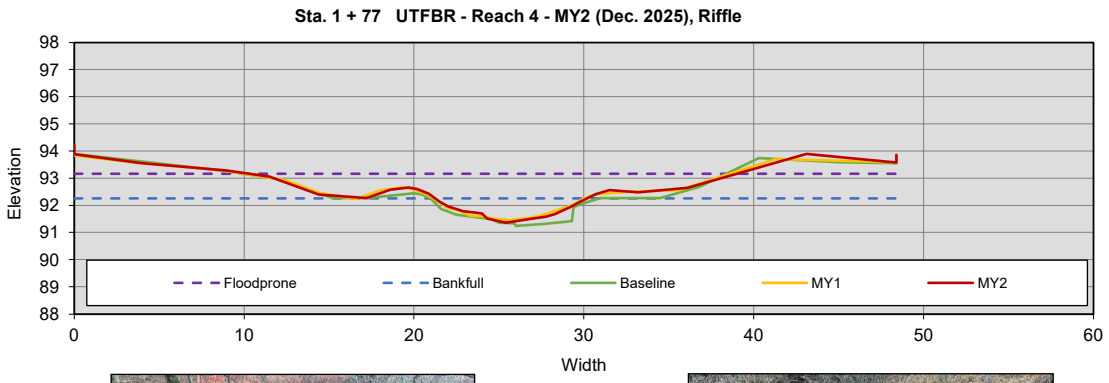
Manning's "n"		0.054
D'Arcy - Weisbach "f"		0.39

Note:

Assumed instrument height, not tied to grid. Tree fell on left bank, altering the dimensions of the cross section.

Distance (ft)	BS (ft)	HI (ft)	FS (ft)	Elevation (ft)	Omit Bkf	Notes
0		100.77	8.36	92.41		TLP
0		100.77	8.7	92.07		TLP
5		100.77	8.67	92.1		
9.7		100.77	8.75	92.02		
12.5		100.77	8.81	91.96		
15.3		100.77	9.38	91.39		
17.5		100.77	9.55	91.22		
19.7		100.77	9.53	91.24		
20.5		100.77	9.46	91.31		
22.5		100.77	9.11	91.66		
23.8		100.77	9.11	91.66		
24.3		100.77	9.22	91.55		TUB
24.7		100.77	9.32	91.45		
25.1		100.77	9.61	91.16		
25.5		100.77	9.74	91.03		TUF
26		100.77	10.76	90.01		TLC
27.5		100.77	10.8	89.97		
30.4		100.77	10.8	89.97		
32.5		100.77	10.83	89.94		
33.9		100.77	10.96	89.81		TWG
35.4		100.77	10.85	89.92		TLC
35.8		100.77	10.21	90.56		
36.2		100.77	9.05	91.72		
36.6		100.77	8.56	92.21		
36.9		100.77	8.04	92.73		
37.6		100.77	7.52	93.25		TUB
39.4		100.77	7.16	93.61		
45.2		100.77	6.6	94.17		
50.4		100.77	5.62	95.15		TRP
50.4		100.77	5.32	95.45		TLP

Cross Section 8 -XS8



XS8 Facing Downstream

XS8 Facing Upstream

Bankfull Dimensions

4.93	x-section area (ft.sq.)
8.97	width (ft)
0.55	mean depth (ft)
0.90	max depth (ft)
9.22	wetted perimeter (ft)
0.53	hyd radi (ft)
16.33	width-depth ratio
28.65	W flood prone area (ft)
3.19	entrenchment ratio
0.90	low bank height (ft)
1.00	low bank height ratio
C4b	Stream Type (Rosgen, 1996)

Materials

49.0	D50 Riffle (mm)
110.0	D84 Riffle (mm)
51.5	threshold grain size (mm):

Bankfull Flow

3.1	velocity (ft/s)
15.5	discharge rate (cfs)

Forces & Power

3.14	channel slope (%)
1.05	shear stress (lb/sq.ft.)
0.74	shear velocity (ft/s)
3.4	unit strm power (lb/ft/s)

Flow Resistance

0.055	Manning's roughness
0.44	D'Arcy-Weisbach fric.
4.3	resistance factor u/u*
1.5	relative roughness

Cross Section

reference ID	XS8	
instrument height	100.45	99.18
longitudinal station	172.7	172.7

Bankfull Stage

FS		---
elevation	92.26	91.44

Low Bank Height

FS	8.19	= 92.26 elev
elevation		

Flood Prone Area

width fpa		28.6

Channel Slope

percent slope	3.14	3

Flow Resistance

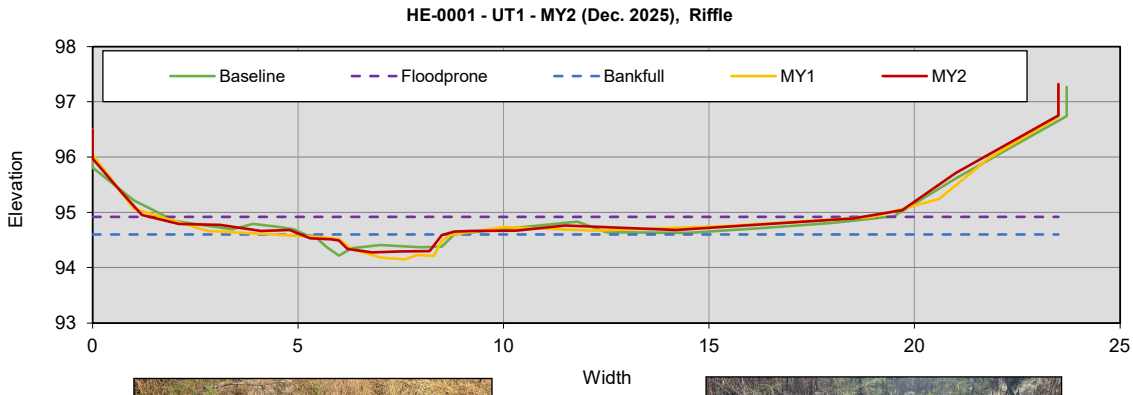
Manning's "n"		0.055
D'Arcy - Weisbach "f"		0.44

Note:

Assumed instrument height, not tied to grid.

Distance (ft)	BS (ft)	HI (ft)	FS (ft)	Elevation (ft)	Omit Bkf	Notes
0		100.45	6.24	94.21		Thalweg
0		100.45	6.57	93.88		Thalweg
4		100.45	6.9	93.55		
9		100.45	7.17	93.28		
11.5		100.45	7.39	93.06		
14.4		100.45	8.06	92.39		
17.2		100.45	8.19	92.26		
18.6		100.45	7.88	92.57		
19.7		100.45	7.8	92.65		
20.2		100.45	7.85	92.6		TOB
20.9		100.45	8.03	92.42		
21.5		100.45	8.32	92.13		
22		100.45	8.49	91.96		
22.9		100.45	8.67	91.78		
24		100.45	8.75	91.7		
24.3		100.45	8.94	91.51		TOC
25.4		100.45	9.09	91.36		BWG
27		100.45	8.94	91.51		
27.8		100.45	8.87	91.58		TOC
28.3		100.45	8.77	91.68		
29.2		100.45	8.52	91.93		
29.8		100.45	8.31	92.14		
30.7		100.45	8.04	92.41		TOB
31.5		100.45	7.89	92.56		
33.2		100.45	7.97	92.48		
36.1		100.45	7.81	92.64		
43.1		100.45	6.56	93.89		
48.4		100.45	6.88	93.57		Thalweg
48.4		100.45	6.6	93.85		Thalweg

Cross Section - XS9



XS9 Facing Downstream

XS9 Facing Upstream

Bankfull Dimensions

0.76	x-section area (ft.sq.)
3.48	width (ft)
0.22	mean depth (ft)
0.32	max depth (ft)
3.67	wetted perimeter (ft)
0.21	hyd radi (ft)
15.97	width-depth ratio
17.37	W flood prone area (ft)
4.99	entrenchment ratio
0.37	low bank height (ft)
1.16	low bank height ratio
C4b	Stream Type (Rosgen, 1996)

Materials

---	D50 (mm)
---	D84 (mm)
---	threshold grain size (mm):

Bankfull Flow

---	velocity (ft/s)
---	discharge rate (cfs)

Forces & Power

---	channel slope (%)
---	shear stress (lb/sq.ft.)
---	shear velocity (ft/s)
---	unit strm power (lb/ft/s)

Flow Resistance

---	Manning's roughness
---	D'Arcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Cross Section

reference ID	XS9	
instrument height	102.72	---
longitudinal station		---

Bankfull Stage

FS		---
elevation	94.6	---

Low Bank Height

FS	8.07	= 94.65 elev
elevation		

Flood Prone Area

width fpa		17.4

Channel Slope

percent slope	-	---

Flow Resistance

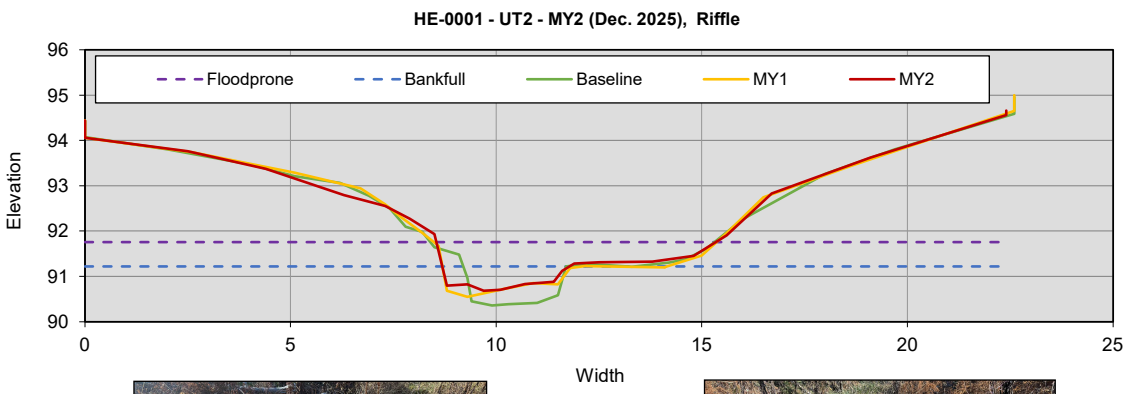
Manning's "n"		---
D'Arcy - Weisbach "f"		---

Note:

Assumed instrument height, not tied to grid.

Distance (ft)	BS (ft)	HI (ft)	FS (ft)	Elevation (ft)	Omit Bkf	Notes
0		102.72	6.22	96.5		LP
0		102.72	6.75	95.97		LP
0.7		102.72	7.36	95.36		
1.2		102.72	7.77	94.95		
2.1		102.72	7.93	94.79		
3.1		102.72	7.95	94.77		
4.1		102.72	8.06	94.66		
4.8		102.72	8.04	94.68		OB
5.3		102.72	8.19	94.53		
5.8		102.72	8.21	94.51		
6		102.72	8.23	94.49		
6.2		102.72	8.38	94.34		EC
6.8		102.72	8.44	94.28		
7.5		102.72	8.43	94.29		
8.2		102.72	8.42	94.3		EC
8.5		102.72	8.13	94.59		
8.8		102.72	8.07	94.65		OB
9.2		102.72	8.06	94.66		
10.3		102.72	8.05	94.67		
11.5		102.72	7.96	94.76		
14.2		102.72	8.04	94.68		
18.5		102.72	7.83	94.89		
19.7		102.72	7.68	95.04		
21		102.72	7.01	95.71		
23.5		102.72	5.97	96.75		RP
23.5		102.72	5.4	97.32		RP

Cross Section - XS10



XS10 Facing Downstream

XS10 Facing Upstream

Bankfull Dimensions

1.21	x-section area (ft.sq.)
3.10	width (ft)
0.39	mean depth (ft)
0.54	max depth (ft)
3.61	wetted perimeter (ft)
0.34	hyd radi (ft)
7.92	width-depth ratio
6.80	W flood prone area (ft)
2.19	entrenchment ratio
0.55	low bank height (ft)
1.02	low bank height ratio
B4	Stream Type (Rosgen, 1996)

Materials

---	D50 (mm)
---	D84 (mm)
---	threshold grain size (mm):

Bankfull Flow

---	velocity (ft/s)
---	discharge rate (cfs)

Forces & Power

---	channel slope (%)
---	shear stress (lb/sq.ft.)
---	shear velocity (ft/s)
---	unit strm power (lb/ft/s)

Flow Resistance

---	Manning's roughness
---	D'Arcy-Weisbach fric.
---	resistance factor u/u*
---	relative roughness

Cross Section

reference ID: XS10
instrument height: 100.55 ---
longitudinal station: --- ---

Bankfull Stage

FS: --- ---
elevation: 91.22 ---

Low Bank Height

FS: --- ---
elevation: 91.23

Flood Prone Area

width fpa: 6.8 6.8

Channel Slope

percent slope: - ---

Flow Resistance

Manning's "n": --- ---
D'Arcy - Weisbach "f": --- ---

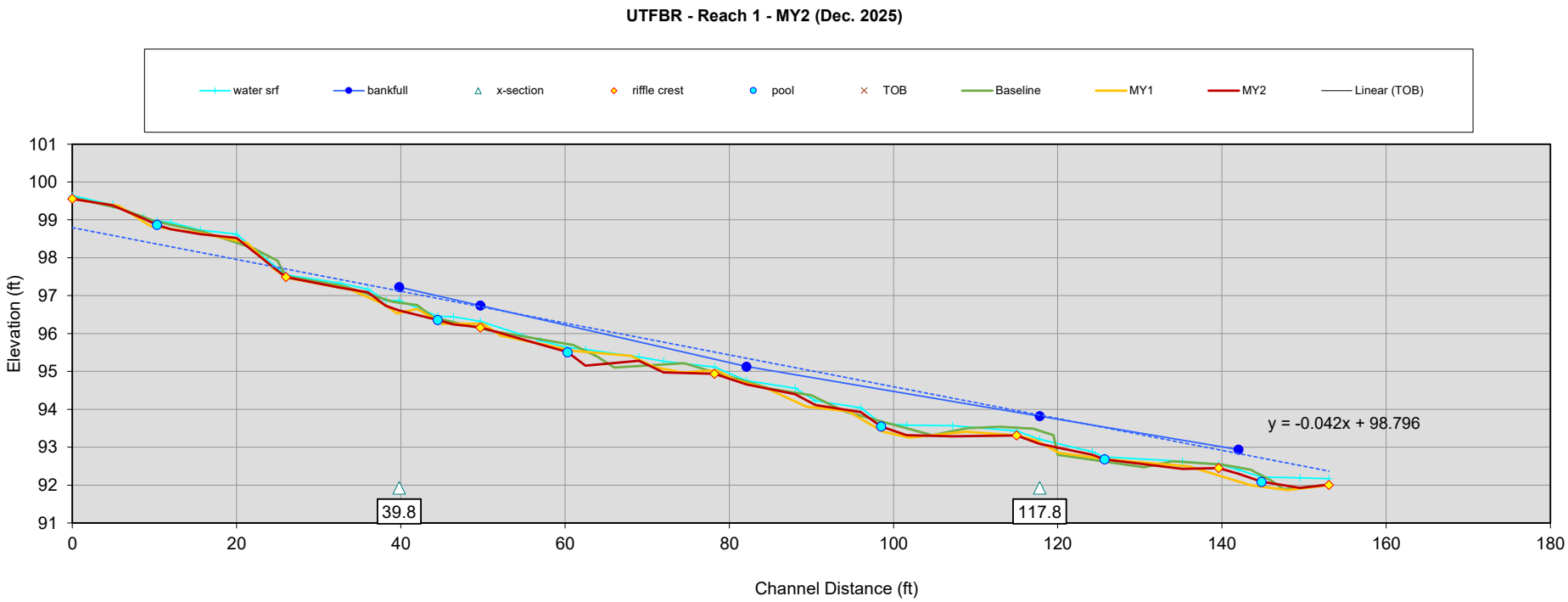
Note:

Assumed instrument height, not tied to grid. Manually adjusted stationing to account for damage to XS from clearing

Distance (ft)	BS (ft)	HI (ft)	FS (ft)	Elevation (ft)	Omit Bkf	Notes
0		100.55	6.11	94.44		TLP
0		100.55	6.49	94.06		BLP
2.5		100.55	6.79	93.76		
4.4		100.55	7.18	93.37		
6.3		100.55	7.76	92.79		
7.3		100.55	8	92.55		
7.9		100.55	8.28	92.27		
8.5		100.55	8.62	91.93		
8.8		100.55	9.76	90.79		
9.3		100.55	9.73	90.82		
9.7		100.55	9.87	90.68		
10.1		100.55	9.85	90.7		
10.7		100.55	9.72	90.83		
11.4		100.55	9.67	90.88		
11.6		100.55	9.43	91.12		TOB
11.9		100.55	9.27	91.28		
12.5		100.55	9.24	91.31		
13.8		100.55	9.23	91.32		
14.8		100.55	9.1	91.45		
15.6		100.55	8.65	91.9		
16.7		100.55	7.72	92.83		
19.1		100.55	6.93	93.62		
22.4		100.55	5.99	94.56		BRP
22.4		100.55	5.89	94.66		TRP

LONGITUDINAL PROFILE PLOTS AND CALCULATIONS

Longitudinal Profile



*Elevation is assumed, not tied to grid.

Function-Based Parameter Calculations from Field Survey

Project	HE-0001 Monitoring
Reach ID	UTFBR - Reach 1
Date	12/3/2025
Year	MY2

Green cells contain calculations, do not edit

Reach Data*

Stream Slope (%)	4.88%
Bankfull Width (ft)	5.96
Mean Depth (ft)	0.44
Reach Length (ft)	153

*Data from Reach 1 XS2

Bankfull and Top of Bank Regression Equations

Feature	Slope (ft/ft)	Y-intercept
Bankfull	-0.042	98.796

Stream Type Classification

Entrenchment Ratio	1.46
Width/Depth Ratio	13.67
Channel Material Estimate (D50)	Gravel
Stream Type (Rosgen, 1996)	**B4a**

*Data from Reach 1 XS2

Riffle Data

Riffle Slopes

Head of Riffle (Sta.)	Head of Riffle (WS El.)	End of Riffle (Sta.)	End of Riffle (WS El.)	Riffle Slope (ft/ft)	Riffle Slope Ratio
0.00	99.64	10.30	98.97	0.065	1.33
26.00	97.55	44.50	96.46	0.059	1.21
49.70	96.32	60.30	95.63	0.065	1.33
78.20	95.12	98.50	93.63	0.073	1.50
115.00	93.43	125.70	92.74	0.064	1.32
139.60	92.55	144.80	92.21	0.065	1.34
		Min		0.059	1.21
		Mean		0.065	1.34
		Max		0.073	1.50

Pool Data

Pool Spacing

Station 1	Station 2	Length	Ratio
12.00	46.40	34.40	5.77
46.40	62.50	16.10	2.70
62.50	101.60	39.10	6.56
101.60	135.20	33.60	5.64
135.20	149.50	14.30	2.40
Min		14.30	2.40
Mean		27.50	4.61
Max		39.10	6.56

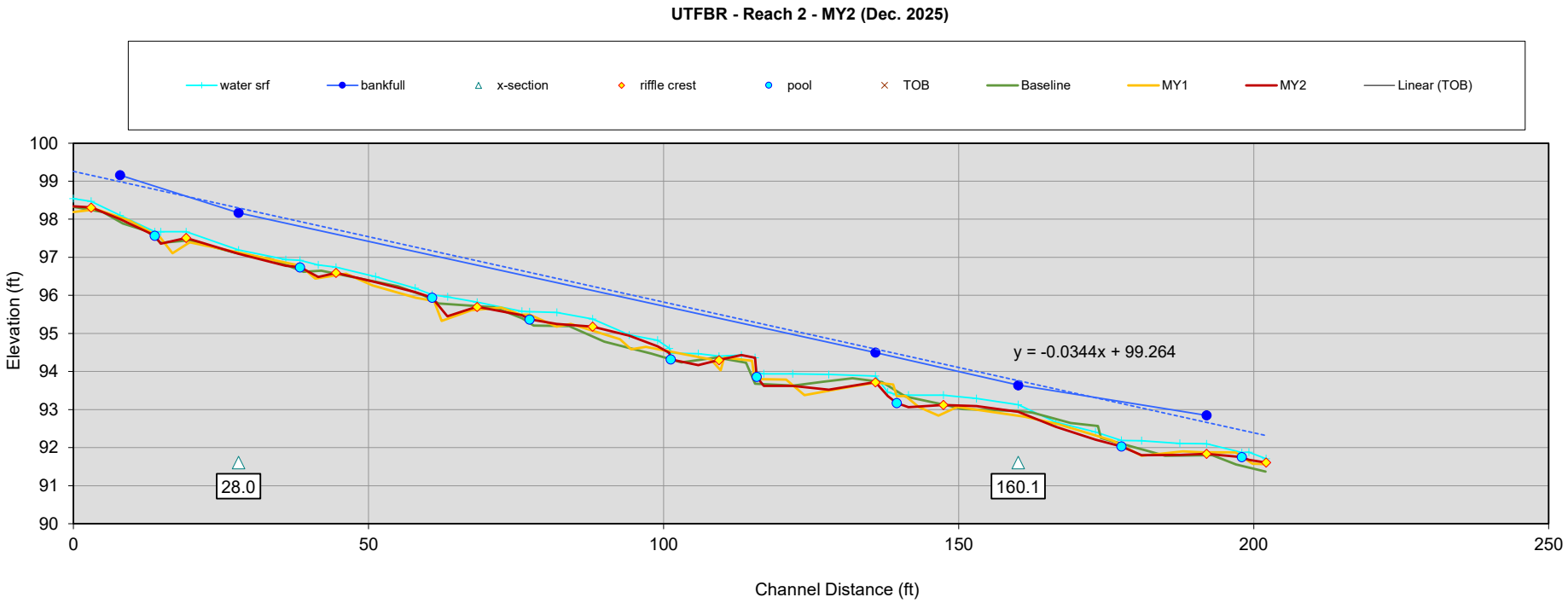
Pool Depth

Station	TW Elevation	Bankfull Elevation	Pool Depth	Ratio
12.00	98.75	99.12	0.37	0.84
46.40	96.24	96.85	0.61	1.38
62.50	95.15	96.17	1.02	2.32
101.60	93.32	94.53	1.21	2.75
135.20	92.43	93.12	0.69	1.56
149.50	91.93	92.52	0.59	1.33
Min			0.37	0.84
Mean			0.75	1.70
Max			1.21	2.75

Channel Slope

	Begin	End	Difference	Channel Slope (ft/ft)
Station Along Tape	0	153	153	**4.88%**
Elevation (ft)	99.64	92.17	7.47	

Longitudinal Profile



*Elevation is assumed, not tied to grid.

Function-Based Parameter Calculations from Field Survey

Project	HE-0001 Monitoring
Reach ID	UTFBR - Reach 2
Date	12/3/2025
Year	MY2

Green cells contain calculations, do not edit

Reach Data*

Stream Slope (%)	3.38%
Bankfull Width (ft)	6.74
Mean Depth (ft)	0.59
Reach Length (ft)	202.1

*Data from Reach 2 XS4

Bankfull and Top of Bank Regression Equations

Feature	Slope (ft/ft)	Y-intercept
Bankfull	-0.0344	99.264

Stream Type Classification

Entrenchment Ratio	2.34
Width/Depth Ratio	11.44
Channel Material Estimate (D50)	Gravel
Stream Type (Rosgen, 1996)	**E4b**

*Data from Reach 2 XS4

Riffle Data

Riffle Slopes

Head of Riffle (Sta.)	Head of Riffle (WS El.)	End of Riffle (Sta.)	End of Riffle (WS El.)	Riffle Slope (ft/ft)	Riffle Slope Ratio
3.00	98.47	13.80	97.67	0.074	2.19
19.10	97.67	38.40	96.92	0.039	1.15
44.50	96.74	60.80	96.02	0.044	1.31
68.40	95.82	77.30	95.57	0.028	0.83
88.00	95.38	101.20	94.48	0.068	2.02
109.40	94.40	115.80	93.97	0.067	1.99
135.90	93.88	139.50	93.39	0.136	4.03
147.40	93.38	177.60	92.19	0.039	1.17
192.00	92.10	198.00	91.87	0.04	1.13
		Min		0.028	0.83
		Mean		0.059	1.76
		Max		0.136	4.03

Pool Data

Pool Spacing

Station 1	Station 2	Length	Ratio
14.80	41.50	26.70	3.96
41.50	63.40	21.90	3.25
63.40	81.90	18.50	2.74
81.90	105.90	24.00	3.56
105.90	128.00	22.10	3.28
128.00	141.50	13.50	2.00
141.50	181	39.50	5.86
181.00	199.2	18.20	2.70
Min		13.50	2.00
Mean		23.05	3.42
Max		39.50	5.86

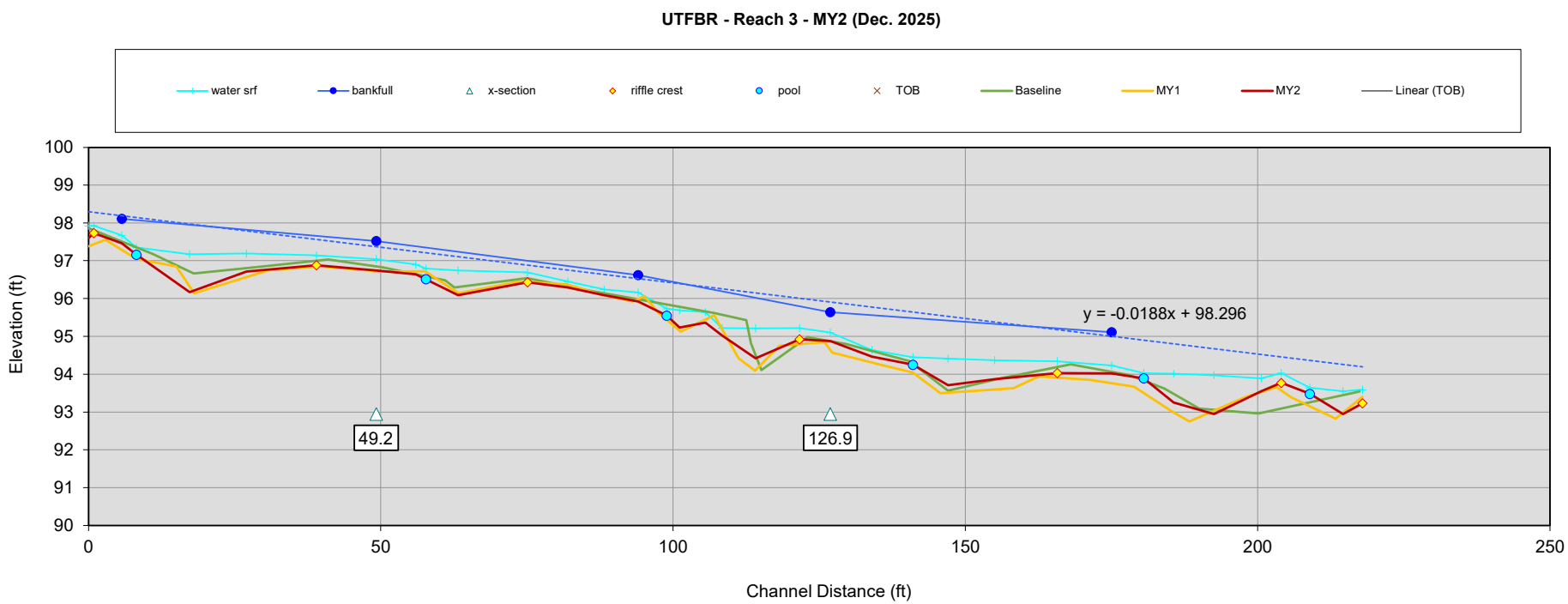
Pool Depth

Station	TW Elevation	Bankfull Elevation	Pool Depth	Ratio
14.80	97.36	98.75	1.39	2.36
41.50	96.48	97.84	1.36	2.30
63.40	95.45	97.08	1.63	2.77
81.90	95.25	96.45	1.20	2.03
105.90	94.17	95.62	1.45	2.46
128.00	93.52	94.86	1.34	2.27
141.5	93.06	94.40	1.34	2.27
181.00	91.80	93.04	1.24	2.10
199.2	91.68	92.41	0.73	1.24
Min			0.73	1.24
Mean			1.30	2.20
Max			1.63	2.77

Channel Slope

	Begin	End	Difference	Channel Slope (ft/ft)
Station Along Tape	0	202.1	202.1	**3.38%**
Elevation (ft)	98.54	91.71	6.83	

Longitudinal Profile



*Elevation is assumed, not tied to grid.

Function-Based Parameter Calculations from Field Survey

Project	HE-0001 Monitoring
Reach ID	UTFBR - Reach 3
Date	12/3/2025
Year	MY2

Green cells contain calculations, do not edit

Reach Data*

Stream Slope (%)	1.99%
Bankfull Width (ft)	10.41
Mean Depth (ft)	0.37
Reach Length (ft)	217.9

*Data from Reach 3 XS6

Bankfull and Top of Bank Regression Equations

Feature	Slope (ft/ft)	Y-intercept
Bankfull	-0.0188	98.296

Stream Type Classification

Entrenchment Ratio	4.10
Width/Depth Ratio	28.20
Channel Material Estimate (D50)	Gravel
Stream Type (Rosgen, 1996)	**C4**

*Data from Reach 3 XS6

Riffle Data

Riffle Slopes

Head of Riffle (Sta.)	Head of Riffle (WS El.)	End of Riffle (Sta.)	End of Riffle (WS El.)	Riffle Slope (ft/ft)	Riffle Slope Ratio
0.90	97.93	8.20	97.35	0.079	4.00
39.00	97.14	57.70	96.79	0.019	0.94
75.10	96.69	98.90	95.73	0.040	2.03
121.60	95.22	141.00	94.45	0.040	2.00
165.70	94.34	180.50	94.03	0.021	1.05
204.00	94.03	208.90	93.64	0.080	4.01
		Min		0.019	0.94
		Mean		0.046	2.34
		Max		0.080	4.01

Pool Data

Pool Spacing

Station 1	Station 2	Length	Ratio
17.30	63.20	45.90	4.41
63.20	114.10	50.90	4.89
114.10	147.00	32.90	3.16
147.00	192.50	45.50	4.37
192.50	214.60	22.10	2.12
Min		22.10	2.12
Mean		39.46	3.79
Max		50.90	4.89

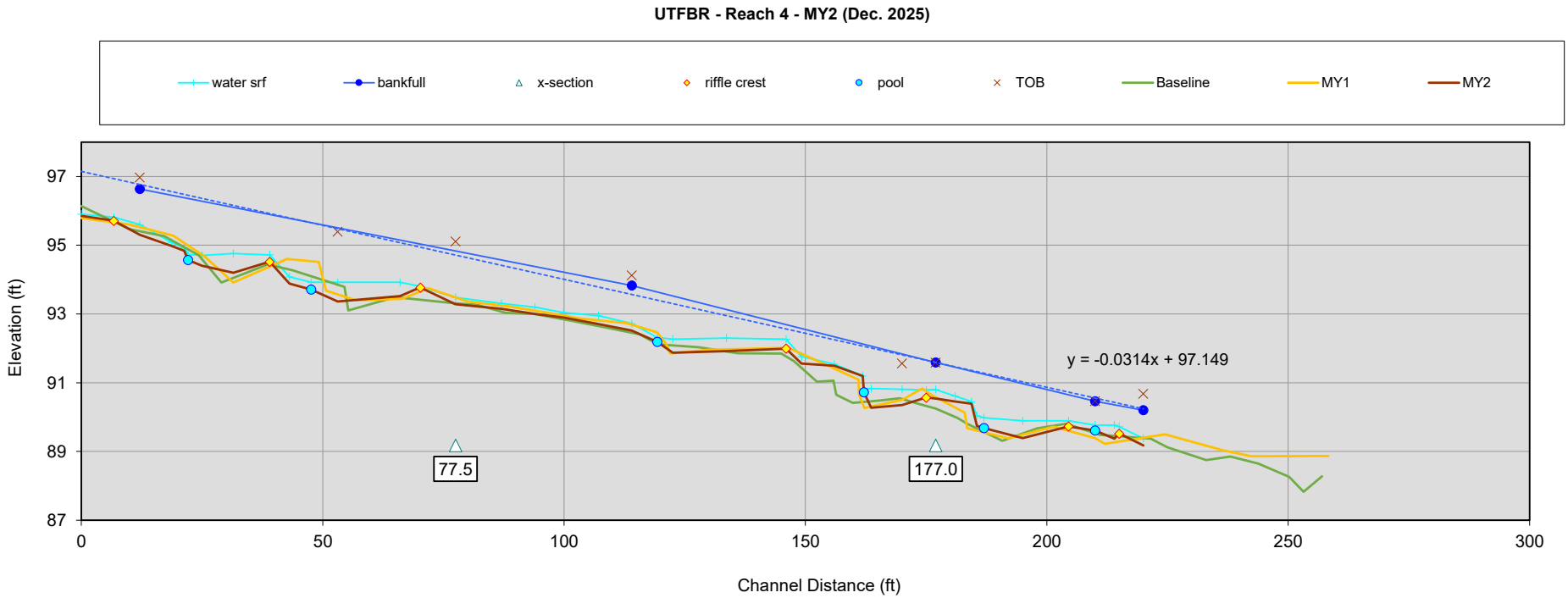
Pool Depth

Station	TW Elevation	Bankfull Elevation	Pool Depth	Ratio
17.30	96.17	97.97	1.80	4.87
63.20	96.09	97.11	1.02	2.75
114.10	94.42	96.15	1.73	4.68
147.00	93.71	95.53	1.82	4.93
192.50	92.95	94.68	1.73	4.67
214.60	92.95	94.26	1.31	3.54
Min			1.02	2.75
Mean			1.57	4.24
Max			1.82	4.93

Channel Slope

	Begin	End	Difference	Channel Slope (ft/ft)
Station Along Tape	0	217.9	217.9	**1.99%**
Elevation (ft)	97.92	93.59	4.33	

Longitudinal Profile



*Elevation is assumed, not tied to grid.

NOTE: The last ~38' of the profile was removed from profile because of ongoing road construction on I-26.

Function-Based Parameter Calculations from Field Survey

Project	HE-0001 Monitoring
Reach ID	UTFBR - Reach 4
Date	12/3/2025
Year	MY2

Green cells contain calculations, do not edit

Reach Data*

Stream Slope (%)	2.96%
Bankfull Width (ft)	8.97
Mean Depth (ft)	0.55
Reach Length (ft)	220

*Data from Reach 4 XS8

Bankfull and Top of Bank Regression Equations

Feature	Slope (ft/ft)	Y-intercept
Bankfull	-0.0314	97.149

Stream Type Classification

Entrenchment Ratio	3.19
Width/Depth Ratio	16.33
Channel Material Estimate (D50)	Gravel
Stream Type (Rosgen, 1996)	**C4b**

*Data from Reach 4 XS8

Riffle Data

Riffle Slopes

Head of Riffle (Sta.)	Head of Riffle (WS El.)	End of Riffle (Sta.)	End of Riffle (WS El.)	Riffle Slope (ft/ft)	Riffle Slope Ratio
6.70	95.81	22.10	94.73	0.070	2.37
39.00	94.72	47.60	93.92	0.093	3.14
70.20	93.80	119.30	92.31	0.030	1.02
146.00	92.27	162.10	90.82	0.090	3.04
175.00	90.79	187.00	89.98	0.068	2.28
204.50	89.89	210.00	89.77	0.022	0.74
		Min		0.022	0.74
		Mean		0.062	2.10
		Max		0.093	3.14

Pool Data

Pool Spacing

Station 1	Station 2	Length	Ratio
31.50	53.10	21.60	2.41
53.10	122.50	69.40	7.74
122.50	163.60	41.10	4.58
163.60	195.00	31.40	3.50
195.00	214.00	19.00	2.12
Min		19.00	2.12
Mean		36.50	4.07
Max		69.40	7.74

Pool Depth

Station	TW Elevation	Bankfull Elevation	Pool Depth	Ratio
31.50	94.20	96.16	1.96	3.56
53.10	93.36	95.48	2.12	3.86
122.50	91.87	93.30	1.43	2.60
163.60	90.27	92.01	1.74	3.17
195.00	89.39	91.03	1.64	2.97
214.00	89.37	90.43	1.06	1.93
Min			1.06	1.93
Mean			1.66	3.02
Max			2.12	3.86

Channel Slope

	Begin	End	Difference	Channel Slope (ft/ft)
Station Along Tape	0	220	220	**2.96%**
Elevation (ft)	95.9	89.38	6.52	

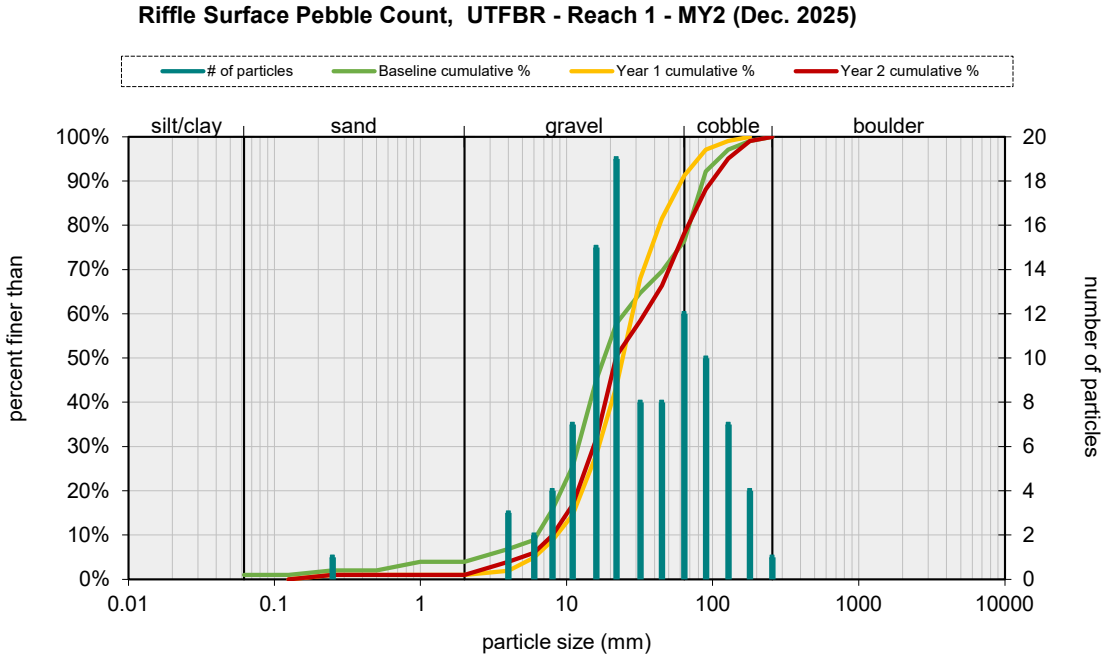
SEDIMENT DATA

Individual Pebble Count Reach 1

Riffle Surface

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	1
medium sand	0.25 - 0.5	
coarse sand	0.5 - 1	
very coarse sand	1 - 2	
very fine gravel	2 - 4	3
fine gravel	4 - 6	2
fine gravel	6 - 8	4
medium gravel	8 - 11	7
medium gravel	11 - 16	15
coarse gravel	16 - 22	19
coarse gravel	22 - 32	8
very coarse gravel	32 - 45	8
very coarse gravel	45 - 64	12
small cobble	64 - 90	10
medium cobble	90 - 128	7
large cobble	128 - 180	4
very large cobble	180 - 256	1
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		101
bedrock	----------	
clay hardpan	----------	
detritus/wood	----------	
artificial	----------	
total count:		101

Note: N/A



Size (mm)	
D16	11
D35	17
D50	22
D65	42
D84	78
D95	130

Size Distribution	
mean	29.3
dispersion	2.8
skewness	0.13

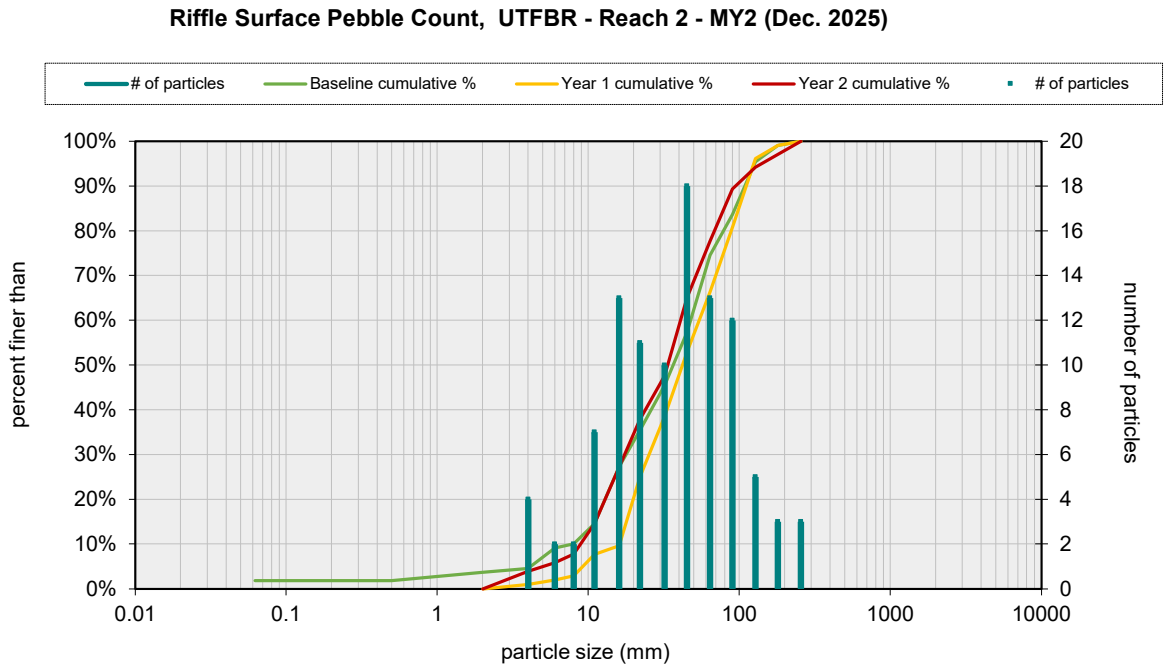
Type	
silt/clay	0%
sand	1%
gravel	77%
cobble	22%
boulder	0%

Individual Pebble Count

Riffle Surface

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	
medium sand	0.25 - 0.5	
coarse sand	0.5 - 1	
very coarse sand	1 - 2	
very fine gravel	2 - 4	4
fine gravel	4 - 6	2
fine gravel	6 - 8	2
medium gravel	8 - 11	7
medium gravel	11 - 16	13
coarse gravel	16 - 22	11
coarse gravel	22 - 32	10
very coarse gravel	32 - 45	18
very coarse gravel	45 - 64	13
small cobble	64 - 90	12
medium cobble	90 - 128	5
large cobble	128 - 180	3
very large cobble	180 - 256	3
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		103
bedrock	----------	
clay hardpan	----------	
detritus/wood	----------	
artificial	----------	
total count:		103

Note: N/A



Size (mm)	
D16	11
D35	20
D50	34
D65	45
D84	77
D95	140

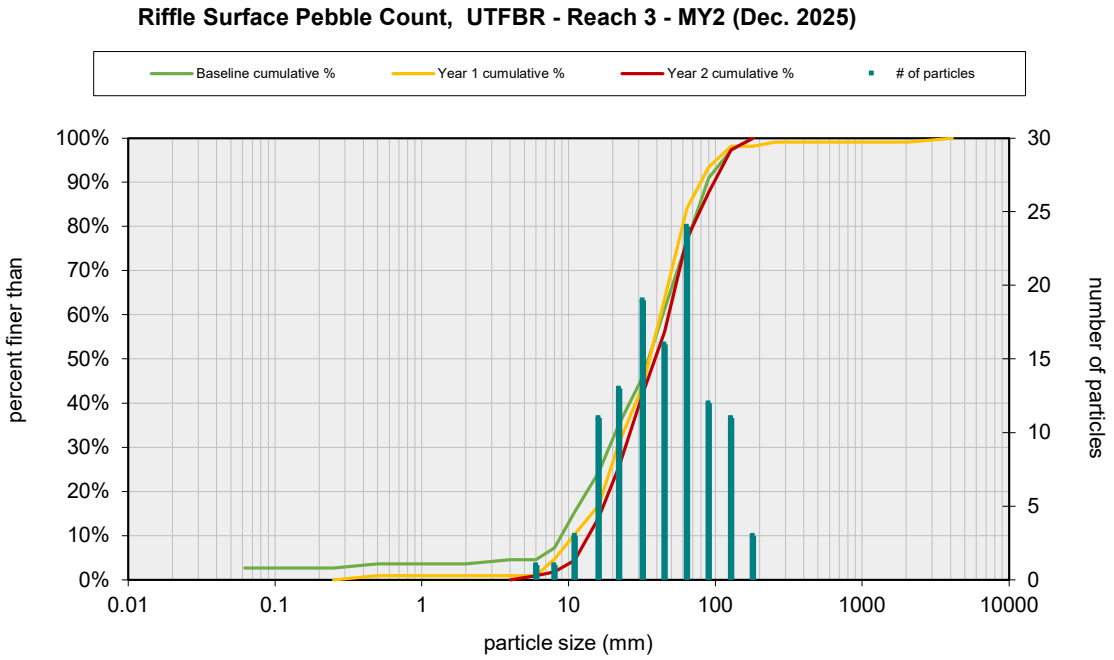
Size Distribution	
mean	29.1
dispersion	2.7
skewness	-0.07

Type	
silt/clay	0%
sand	0%
gravel	78%
cobble	22%
boulder	0%

Individual Pebble Count

Riffle Surface	nge (mm)		Count
silt/clay	0	- 0.062	
very fine sand	0.062	- 0.125	
fine sand	0.125	- 0.25	
medium sand	0.25	- 0.5	
coarse sand	0.5	- 1	
very coarse sand	1	- 2	
very fine gravel	2	- 4	
fine gravel	4	- 6	1
fine gravel	6	- 8	1
medium gravel	8	- 11	3
medium gravel	11	- 16	11
coarse gravel	16	- 22	13
coarse gravel	22	- 32	19
very coarse gravel	32	- 45	16
very coarse gravel	45	- 64	24
small cobble	64	- 90	12
medium cobble	90	- 128	11
large cobble	128	- 180	3
very large cobble	180	- 256	
small boulder	256	- 362	
small boulder	362	- 512	
medium boulder	512	- 1024	
large boulder	1024	- 2048	
very large boulder	2048	- 4096	
total particle count:			114
bedrock	----------		
clay hardpan	----------		
detritus/wood	----------		
artificial	----------		
total count:			114

Note: N/A



Size (mm)	
D16	17
D35	27
D50	39
D65	52
D84	80
D95	120

Size Distribution	
mean	36.9
dispersion	2.2
skewness	-0.03

Type	
silt/clay	0%
sand	0%
gravel	77%
cobble	23%
boulder	0%

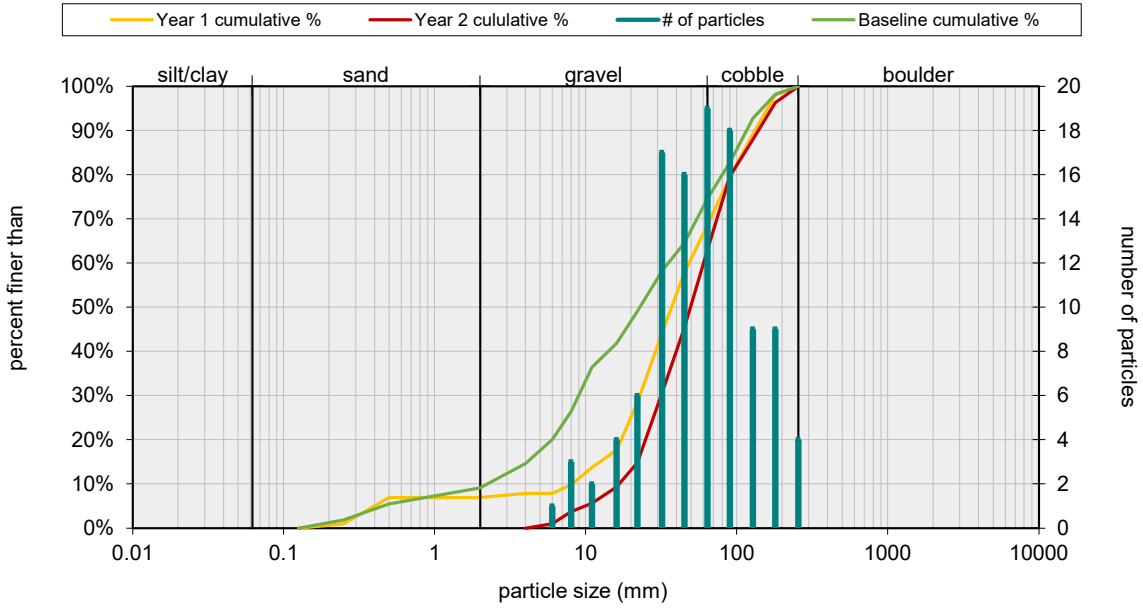
Individual Pebble Count

Riffle Surface

Material	Size Range (mm)	Count
silt/clay	0 - 0.062	
very fine sand	0.062 - 0.125	
fine sand	0.125 - 0.25	
medium sand	0.25 - 0.5	
coarse sand	0.5 - 1	
very coarse sand	1 - 2	
very fine gravel	2 - 4	
fine gravel	4 - 6	1
fine gravel	6 - 8	3
medium gravel	8 - 11	2
medium gravel	11 - 16	4
coarse gravel	16 - 22	6
coarse gravel	22 - 32	17
very coarse gravel	32 - 45	16
very coarse gravel	45 - 64	19
small cobble	64 - 90	18
medium cobble	90 - 128	9
large cobble	128 - 180	9
very large cobble	180 - 256	4
small boulder	256 - 362	
small boulder	362 - 512	
medium boulder	512 - 1024	
large boulder	1024 - 2048	
very large boulder	2048 - 4096	
total particle count:		108
bedrock	----------	3
clay hardpan	----------	
detritus/wood	----------	
artificial	----------	
total count:		111

Note: N/A

Riffle Surface Pebble Count, UTFBR - Reach 4 - MY2 (Dec. 2025)



Size (mm)	
D16	23
D35	35
D50	49
D65	67
D84	110
D95	170

Size Distribution	
mean	50.3
dispersion	2.2
skewness	0.01

Type	
silt/clay	0%
sand	0%
gravel	61%
cobble	36%
boulder	0%

bedrock 3%

BEHI/NBS DATA

Date:	12/3/2025
Investigators:	RM
Project:	HE-0001
Reach:	UTFBR Reach 1
Valley Type:	Colluvial
Bed Material:	Gravel

General Notes: Dominant BEHI/NBS score for Reach 1 remained Low/Low from Year 1 monitoring to Year 2 monitoring

Bank Erosion Hazard Index (BEHI)

Begin Station	End Station	Study Bank Height (ft)	BKF Height (ft)	Root Depth (ft)	Root Density (%)	Bank Angle (degrees)	Surface Protection (%)	Bank Material Adjustment	Stratification Adjustment	Bank Length	Total BEHI Score	BEHI Rating	NBS Rating	Notes
Right Bank														
0	23	0.5	0.5	0.5	10	30	90	-	-	23	14.33	Low	VL	-
23	109	0.7	0.6	0.7	20	50	90	-	-	86	16.49	Low	Low	-
109	135	1.6	0.5	1.1	30	80	70	-	-	26	28.74	Moderate	Moderate	-
135	153	0.5	0.5	0.5	30	30	90	-	-	18	11.79	Low	VL	-
Left Bank														
0	10	0.8	0.5	0.8	15	80	90	-	-	10	22.25	Moderate	Moderate	-
10	23	0.5	0.5	0.5	10	30	90	-	-	13	14.33	Low	VL	-
23	29	1	0.5	0.3	10	50	95	-	-	6	28.44	Moderate	Low	-
29	87	0.7	0.6	0.7	25	50	90	-	-	58	15.81	Low	Low	-
87	97	2	0.6	2	40	70	90	-	-	10	22.46	Moderate	High	-
97	153	0.8	0.5	0.8	20	45	90	-	-	56	18.84	Low	Low	-

Date: 12/3/2025
Investigators: RM
Project: HE-0001
Reach: UTFBR Reach 2
Valley Type: Confined Alluvial
Bed Material: Gravel

General Notes: Dominant BEHI/NBS score remained Low/Low from Year 1 monitoring to Year 2 monitoring

Bank Erosion Hazard Index (BEHI)

Begin Station	End Station	Study Bank Height (ft)	BKF Height (ft)	Root Depth (ft)	Root Density (%)	Bank Angle (degrees)	Surface Protection (%)	Bank Material Adjustment	Stratification Adjustment	Bank Length	Total BEHI Score	BEHI Rating	NBS Rating	Notes
Right Bank														
0	48	1.2	1	0.8	15	80	65	-	-	48	24.54	Moderate	Low	-
48	115	0.9	0.9	0.9	25	50	80	-	-	67	13.86	Low	Low	-
115	129	2	1	1.2	30	100	25	-	-	14	33.67	High	VH	-
129	202	1	0.9	1	15	70	80	-	-	73	17.93	Low	Moderate	-
Left Bank														
0	44	1.5	1	1	20	80	75	-	-	44	25.28	Moderate	Low	-
44	97	0.8	0.8	0.8	20	35	90	-	-	53	13.35	Low	Low	-
97	112	1.7	1.1	1.7	60	60	80	-	-	15	16.49	Low	Moderate	-
112	146	1.7	1.1	1.7	45	80	75	-	-	34	20.12	Moderate	Moderate	-
146	202	0.9	0.9	0.9	25	45	90	-	-	56	13.16	Low	Low	-

Date: 12/3/2025
Investigators: RM
Project: HE-0001
Reach: UTFBR Reach 3
Valley Type: Unconfined Alluvial
Bed Material: Gravel

General Notes: Dominant BEHI/NBS improved from Mod/Low in Year 1 monitoring to Low/Low in Year 2 monitoring

Bank Erosion Hazard Index (BEHI)

Begin Station	End Station	Study Bank Height (ft)	BKF Height (ft)	Root Depth (ft)	Root Density (%)	Bank Angle (degrees)	Surface Protection (%)	Bank Material Adjustment	Stratification Adjustment	Bank Length	Total BEHI Score	BEHI Rating	NBS Rating	Notes
Right Bank														
0	34	1.7	1	1	20	90	80	-	-	34	27.99	Moderate	High	Outer Meander
34	91	1	1	1	30	35	90	-	-	57	12.03	Low	Low	
91	113	1.4	1	1	20	70	65	-	-	22	24.13	Moderate	Moderate	
113	140	1	1	1	20	30	90	-	-	27	13.11	Low	Low	
140	179	2.3	1	2	25	75	70	-	-	39	25.48	Moderate	Moderate	
179	194	1.7	1	0.5	20	70	80	-	-	15	28.14	Moderate	High	
194	219	1	1	0.5	20	45	90	-	-	25	17.96	Low	Low	
Left Bank														
0	39	1	1	1	20	40	90	-	-	39	13.60	Low	VL	
39	99	1.2	1	1.2	20	45	85	-	-	60	17.07	Low	Low	
99	115	1.3	1	0.5	15	80	65	-	-	16	27.61	Moderate	Low	
115	126	1.8	1	0.5	15	80	60	-	-	11	32.52	High	High	Outer Meander
126	157	1.6	1	1.6	30	90	50	-	-	31	25.12	Moderate	Moderate	
157	195	1	1	0.5	15	45	90	-	-	38	18.24	Low	Low	
195	211	6	1	6	40	90	30	-	-	16	29.91	Moderate	Moderate	
211	219	1	1	0.5	10	70	70	-	-	8	21.51	Moderate	Moderate	

Date:	12/3/2025
Investigators:	RM
Project:	HE-0001
Reach:	UTFBR Reach 4
Valley Type:	Confined Alluvial
Bed Material:	Gravel/Bedrock

General Notes: BEHI reach was limited by road work
Dominant BEHI/NBS score remained MOD/LOW from Baseline to Year 2 monitoring

Bank Erosion Hazard Index (BEHI)

Begin Station	End Station	Study Bank Height (ft)	BKF Height (ft)	Root Depth (ft)	Root Density (%)	Bank Angle (degrees)	Surface Protection (%)	Bank Material Adjustment	Stratification Adjustment	Bank Length	Total BEHI Score	BEHI Rating	NBS Rating	Notes
Right Bank														
0	74	3.3	1.2	2.1	25	85	40	-	-	74	31.89	High	Low	
74	148	2.9	1.2	2	35	85	70	-	-	74	27.65	Moderate	Moderate	
148	169	2.3	1.2	2	35	75	60	-	-	21	24.37	Moderate	High	
169	221	1.3	1.2	0.8	20	45	50	-	-	52	20.76	Moderate	Low	
Left Bank														
0	53	1.5	1.2	1.2	25	65	70	-	-	53	21.09	Moderate	Low	
53	78	3.5	1.2	3.5	45	95	25	-	-	25	30.40	High	Low	Upturned tree
78	179	1.3	1.2	1.2	30	45	90	-	-	101	14.24	Low	VL	
179	221	1.4	1.2	1	30	55	80	-	-	42	18.85	Low	Moderate	

BENTHIC MACROINVERTEBRATE REPORT

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EPR NC DOT French Broad Tributary, Buncombe County, North Carolina.
Macroinvertebrate Survey. December 4, 2025

Ecosystem Planning and Restoration, LLC (EPR) hired Michael Baker International's (MBI) Asheville based macroinvertebrate laboratory to provide taxonomic identification, and calculation of baseline macroinvertebrate metrics for a UT to the French Broad River in Buncombe County, North Carolina. Four Qual 4 samples were collected by EPR staff on December 4, 2025. The approximate site coordinates are 35.505666, -82.576557 (site locations shown on included map below). Samples were delivered to Jason York, MBI's macroinvertebrate lab supervisor, for taxonomic identification on December 15, 2025. Sampling protocols and data analysis followed the guidelines described in the 2016 North Carolina Division of Water Resources Standard Operating Procedures for the Collection and Analysis of Benthic Macroinvertebrates (NC SOP).[1] Calculated metrics include the Total number of organisms (Total #), the North Carolina Biotic Index (NCBI), Taxa Richness, EPT Richness, and the percent of organisms with tolerance values ≤ 3 (% Intolerant). Each of the four sites was then assigned a bioclassification using Table 8: NCBI Thresholds for determining bioclassifications using Small Stream criteria from the NC SOP. A full taxa list is included in Appendix A. A summary of the results is shown in the table and graphs below:

EPR NC DOT FRENCH BROAD TRIBS DATA SUMMARY									
SITE	COLLECTION DATE	ROSGEN STREAM TYPE	D50-MM	TOTAL #	NCBI	TAXA RICHNESS	EPT TAXA RICHNESS	% INTOL (TV <3)	BIOCLASSIFICATION
R1	11/1/2023	C4b	18	96	2.21	22	12	80.9	EXCELLENT
	11/25/2024		18	149	2.67	20	13	58.39	EXCELLENT
	12/4/2025		24	96	2.84	23	13	73.96	EXCELLENT
R2	11/1/2023	C4b	36	164	3.05	28	12	61.39	EXCELLENT
	11/25/2024		36	133	3.17	27	15	64.66	EXCELLENT
	12/4/2025		42	171	2.72	30	17	73.1	EXCELLENT
R3	11/1/2023	C4	35	102	3.05	23	9	62.24	EXCELLENT
	11/25/2024		35	222	3.09	28	17	53.15	EXCELLENT
	12/4/2025		36	265	2.68	29	19	55.09	EXCELLENT
R4	11/1/2023	C4b	23	140	2.78	26	13	68.35	EXCELLENT
	11/25/2024		23	200	4.3	19	10	10	GOOD
	12/4/2025		37	217	2.32	35	20	77.42	EXCELLENT

[1] NC Department of Environmental Quality. 2016. Standard Operating Procedures for the Collection and Analysis of Benthic Macroinvertebrates. Division of Water Resources. Raleigh, North Carolina. February 2016.

797 Haywood Rd. Suite 201 | Asheville, NC 28806
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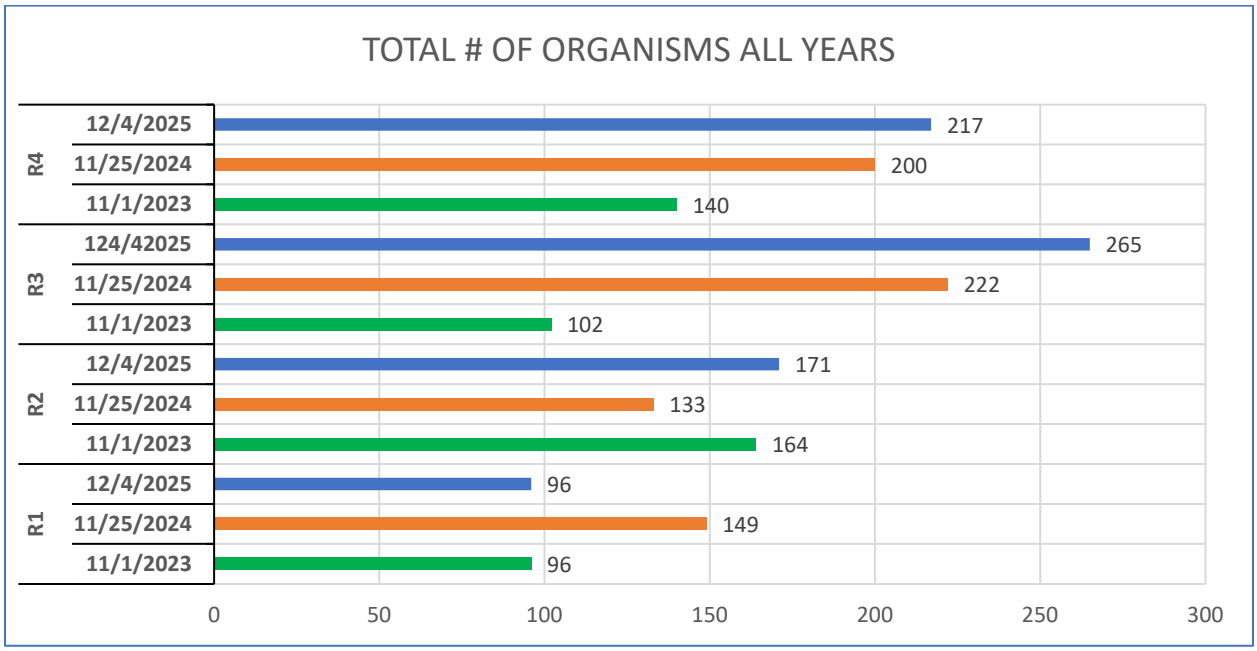
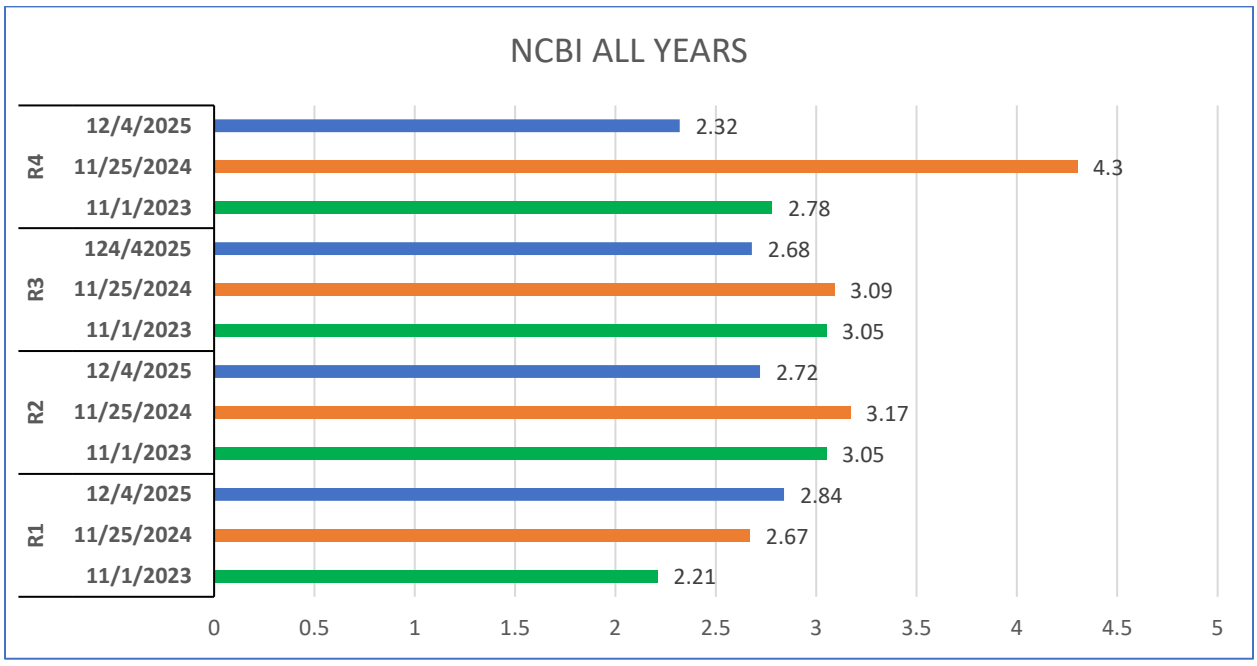

TOTAL # OF ORGANISMS ALL YEARS
R4
12/4/2025
11/25/2024
11/1/2023
R3
124/42025
11/25/2024
11/1/2023
R2
12/4/2025
11/25/2024
11/1/2023
R1
12/4/2025
11/25/2024
11/1/2023
217
200
140
265
222
102
171
133
164
96
149
96
0
50
100
150
200
250
300


NCBI ALL YEARS
R4
12/4/2025
11/25/2024
11/1/2023
R3
124/42025
11/25/2024
11/1/2023
R2
12/4/2025
11/25/2024
11/1/2023
R1
12/4/2025
11/25/2024
11/1/2023
2.32
4.3
2.78
2.68
3.09
3.05
2.72
3.17
3.05
2.84
2.67
2.21
0
0.5
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1.5
2
2.5
3
3.5
4
4.5
5

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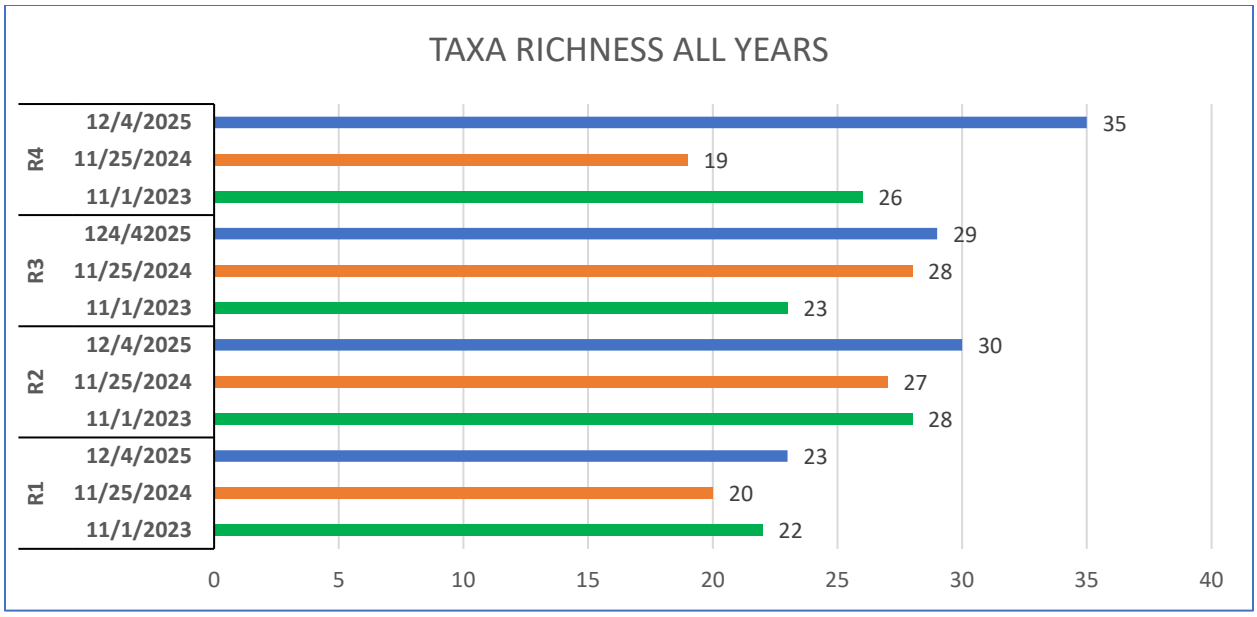
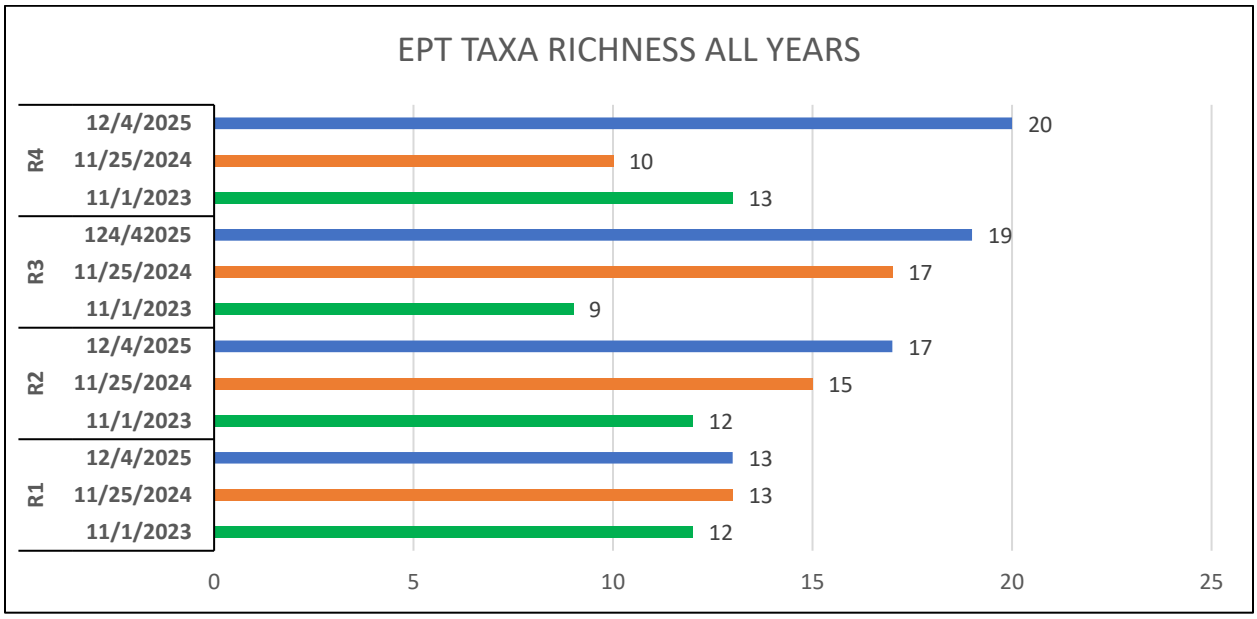
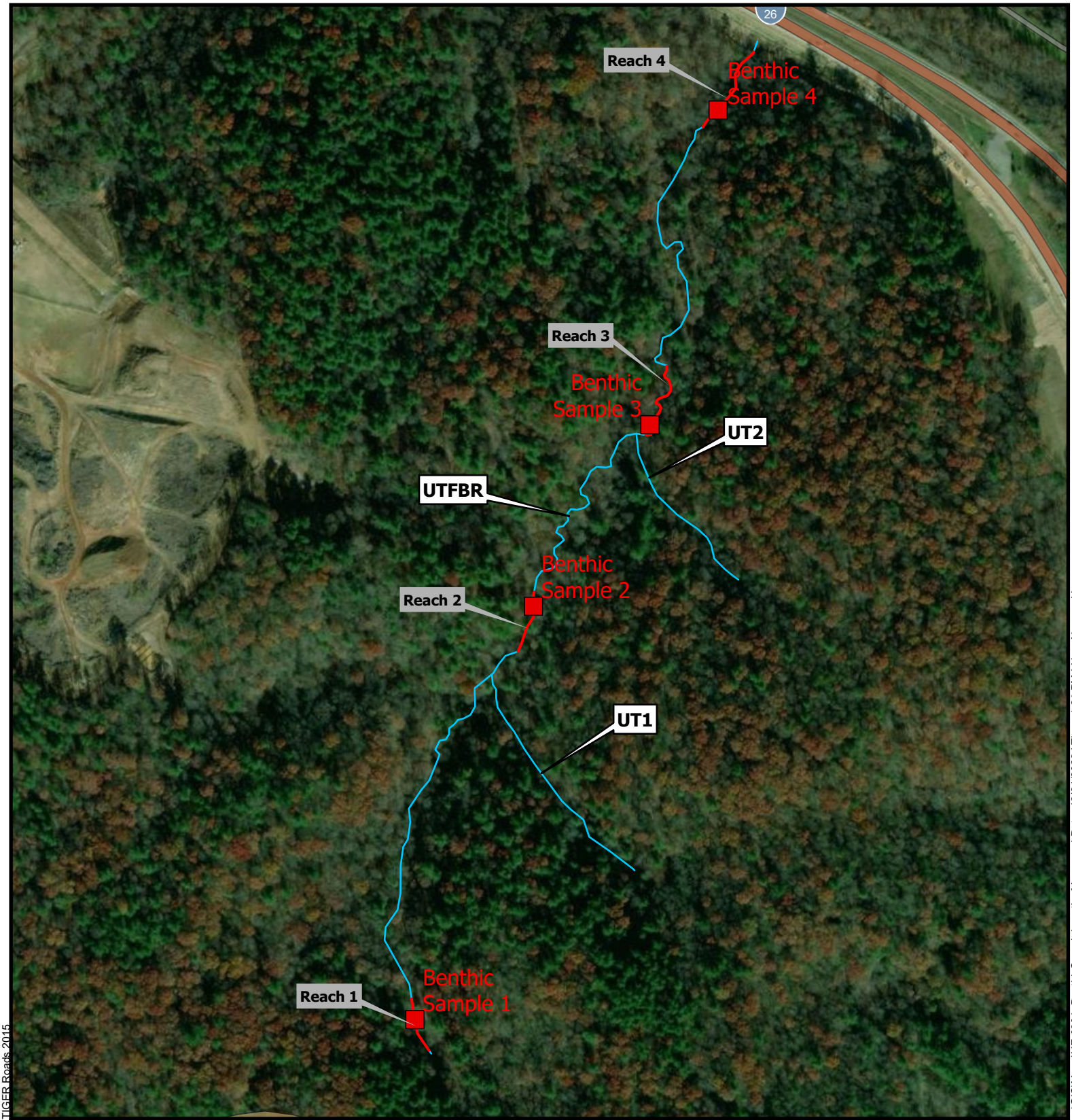
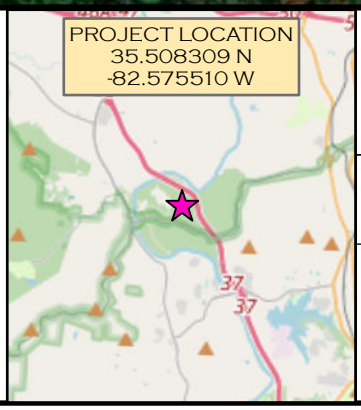




Questions about this report should be directed to:
Jason York
Macroinvertebrate Lab Supervisor
Jason.york@mbakerintl.com



Project Streams
Assessment Reach
HE0001_BenthicSampleLocations_01Nov2023



HE-0001 Monitoring

Benthic Macroinvertebrate Samples
Buncombe County, NC

Figure 1
Baseline
Monitoring Map

Sample Date:
12/4/2025

Prepared By:
Ecosystem
Planning &
Restoration

0 175 350 ft

1 inch = 350 feet

N

Sources: ESRI Aerial Imagery 2017, Open Street Map, TIGER Roads 2015

Path: L:\Projects\EPR0018_NCDOT_HE-0001_Monitoring\GIS\Maps\HE-0001_BenthicSampleLocationMap.aprx | Date: 12/21/2023 | Time: 1:34 PM | User Name: sking

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APPENDIX A
2025 TAXA LIST

NCDOT - UT to French Broad - Reach 1

FINALID	ORDER	FAMILY	GENUS	SPECIES	TOLERANCE	COUNT	NOTES
Maccaffertium meririvulanum	Ephemeroptera	Heptageniidae	*Maccaffertium*	*meririvulanum*	0.5	6	
Paraleptophlebia spp	Ephemeroptera	Leptophlebiidae	*Paraleptophlebia*	*spp*	1.2	25	
Leuctra spp	Plecoptera	Leuctridae	*Leuctra*	*spp*	1.5	2	
Paracapnia angulata †	Plecoptera	Capniidae	*Paracapnia*	*angulata*	0.2	1	TN TV NCBI Modified
Tallaperla spp	Plecoptera	Peltoperlidae	*Tallaperla*	*spp*	1.3	1	
Perlinella drymo	Plecoptera	Perlidae	*Perlinella*	*drymo*	1.3	1	
Ostrocera †	Plecoptera	Nemouridae	*Ostrocera*	*spp*	2	1	TN TV NCBI Modified
Lype diversa	Trichoptera	Psychomyiidae	*Lype*	*diversa*	3.9	1	
Diplectrona modesta	Trichoptera	Hydropsychidae	*Diplectrona*	*modesta*	2.3	4	
Rhyacophila appalachia/nigrita	Trichoptera	Rhyacophilidae	*Rhyacophila*	*appalachia/nigrita*	0	2	
Psilotreta spp	Trichoptera	Odontoceridae	*Psilotreta*	*spp*	0.5	4	frontalis
Pycnopsyche lepida gr	Trichoptera	Limnephilidae	*Pycnopsyche*	*lepida gr*	3.9	6	
Wormaldia spp	Trichoptera	Philopotamidae	*Wormaldia*	*spp*	2.4	12	
Elimia spp	Gastropoda	Pleuroceridae	*Elimia*	*spp*	2.7	11	
Hexatoma spp	Diptera	Tipulidae	*Hexatoma*	*spp*	3.5	2	
Nigronia fasciatus	Megaloptera	Corydalidae	*Nigronia*	*fasciatus*	6.1	1	
Cordulegaster spp	Odonata	Cordulegastridae	*Cordulegaster*	*spp*	5.7	2	
Sialis spp	Megaloptera	Sialidae	*Sialis*	*spp*	7	1	
Dixa spp	Diptera	Dixidae	*Dixa*	*spp*	2.5	1	
Pilaria †	Diptera	Tipulidae	*Pilaria*	*spp*	8.4	6	TN Family TV
Tribelos jucundum	Diptera	Chironomidae	*Tribelos*	*jucundum*	5.7	3	
Thienemannimyia gr	Diptera	Chironomidae	*Thienemannimyia*	*gr*	8.4	2	
Apedilum †	Diptera	Chironomidae	*Apedilum*	*spp*	5.69	1	TN TV NCBI Modified

NCDOT - UT to French Broad - Reach 2

FINALID	ORDER	FAMILY	GENUS	SPECIES	TOLERANCE	COUNT	NOTES
Paraleptophlebia spp	Ephemeroptera	Leptophlebiidae	*Paraleptophlebia*	*spp*	1.2	21	
Maccaffertium meririvulanum	Ephemeroptera	Heptageniidae	*Maccaffertium*	*meririvulanum*	0.5	1	
Ameletus lineatus	Ephemeroptera	Ameletidae	*Ameletus*	*lineatus*	2.4	4	cryptosimulans
Baetis †	Ephemeroptera	Baetidae	*Baetis*	*spp*	4.18	1	TN family TV. Damaged specimen
Eurylophella funeralis	Ephemeroptera	Ephemerellidae	*Eurylophella*	*funeralis*	2.5	1	
Acroneuria abnormis	Plecoptera	Perlidae	*Acroneuria*	*abnormis*	2.1	1	
Paracapnia angulata †	Plecoptera	Capniidae	*Paracapnia*	*angulata*	0.2	46	TN TV NCBI Modified
Tallaperla spp	Plecoptera	Peltoperlidae	*Tallaperla*	*spp*	1.3	8	
Leuctra spp	Plecoptera	Leuctridae	*Leuctra*	*spp*	1.5	2	
Eccoptura xanthenes	Plecoptera	Perlidae	*Eccoptura*	*xanthenes*	4.7	1	
Malirekus hastatus	Plecoptera	Perlodidae	*Malirekus*	*hastatus*	1	2	
Perlinella drymo	Plecoptera	Perlidae	*Perlinella*	*drymo*	1.3	10	
Psilotreta spp	Trichoptera	Odontoceridae	*Psilotreta*	*spp*	0.5	2	frontalis
Pycnopsyche lepida gr	Trichoptera	Limnephilidae	*Pycnopsyche*	*lepida gr*	3.9	5	
Diplectrona modesta	Trichoptera	Hydropsychidae	*Diplectrona*	*modesta*	2.3	9	
Rhyacophila carolina	Trichoptera	Rhyacophilidae	*Rhyacophila*	*carolina*	0.4	3	
Wormaldia spp	Trichoptera	Philopotamidae	*Wormaldia*	*spp*	2.4	6	
Elimia spp	Gastropoda	Pleuroceridae	*Elimia*	*spp*	2.7	3	
Pilaria †	Diptera	Tipulidae	*Pilaria*	*spp*	8.4	5	TN Family TV
Boyeria grafiana	Odonata	Aeshnidae	*Boyeria*	*grafiana*	3.8	1	
Nigronia fasciatus	Megaloptera	Corydalidae	*Nigronia*	*fasciatus*	6.1	1	
Ectopria nervosa	Coleoptera	Psephenidae	*Ectopria*	*nervosa*	4.3	1	
Cordulegaster spp	Odonata	Cordulegastridae	*Cordulegaster*	*spp*	5.7	1	
Lanthus spp	Odonata	Gomphidae	*Lanthus*	*spp*	1.6	4	
Dixa spp	Diptera	Dixidae	*Dixa*	*spp*	2.5	2	
Simulium spp	Diptera	Simuliidae	*Simulium*	*spp*	4.9	24	
Tanytarsus spp	Diptera	Chironomidae	*Tanytarsus*	*spp*	6.6	1	
Parametriocnemus spp	Diptera	Chironomidae	*Parametriocnemus*	*spp*	3.9	1	
Thienemannimyia gr	Diptera	Chironomidae	*Thienemannimyia*	*gr*	8.4	3	
Rheotanytarsus spp	Diptera	Chironomidae	*Rheotanytarsus*	*spp*	6.5	1	

NCDOT - UT to French Broad - Reach 3

FINALID	ORDER	FAMILY	GENUS	SPECIES	TOLERANCE	COUNT	NOTES
Ameletus lineatus	Ephemeroptera	Ameletidae	*Ameletus*	*lineatus*	2.4	1	cryptosimulans
Maccaffertium meririvulanum	Ephemeroptera	Heptageniidae	*Maccaffertium*	*meririvulanum*	0.5	9	
Paraleptophlebia spp	Ephemeroptera	Leptophlebiidae	*Paraleptophlebia*	*spp*	1.2	55	
Stenacron interpunctatum	Ephemeroptera	Heptageniidae	*Stenacron*	*interpunctatum*	6.4	1	
Eurylophella funeralis	Ephemeroptera	Ephemerellidae	*Eurylophella*	*funeralis*	2.5	3	
Teloganopsis deficiens	Ephemeroptera	Ephemerellidae	*Teloganopsis*	*deficiens*	2.6	1	
Leuctra spp	Plecoptera	Leuctridae	*Leuctra*	*spp*	1.5	1	
Paracapnia angulata †	Plecoptera	Capniidae	*Paracapnia*	*angulata*	3.3	69	NC Family TV
Eccoptura xanthenes	Plecoptera	Perlidae	*Eccoptura*	*xanthenes*	4.7	5	
Perlinella drymo	Plecoptera	Perlidae	*Perlinella*	*drymo*	1.3	11	
Acroneuria abnormis	Plecoptera	Perlidae	*Acroneuria*	*abnormis*	2.1	4	
Tallaperla spp	Plecoptera	Peltoperlidae	*Tallaperla*	*spp*	1.3	10	
Malirekus hastatus	Plecoptera	Perlodidae	*Malirekus*	*hastatus*	1	2	
Diplectrona modesta	Trichoptera	Hydropsychidae	*Diplectrona*	*modesta*	2.3	14	
Hydropsyche (H.) betteni	Trichoptera	Hydropsychidae	*Hydropsyche*	*(H.) betteni*	7.9	1	
Rhyacophila carolina	Trichoptera	Rhyacophilidae	*Rhyacophila*	*carolina*	0.4	1	
Wormaldia spp	Trichoptera	Philopotamidae	*Wormaldia*	*spp*	2.4	16	
Polycentropus sensu lato spp	Trichoptera	Polycentropodidae	*Polycentropus*	*sensu lato spp*	3.1	4	
Pycnopsyche lepida gr	Trichoptera	Limnephilidae	*Pycnopsyche*	*lepida gr*	3.9	4	
Nigronia fasciatus	Megaloptera	Corydalidae	*Nigronia*	*fasciatus*	6.1	2	
Sialis spp	Megaloptera	Sialidae	*Sialis*	*spp*	7	1	
Elimia spp	Gastropoda	Pleuroceridae	*Elimia*	*spp*	2.7	9	
Tipula spp	Diptera	Tipulidae	*Tipula*	*spp*	7.5	8	
Lanthus spp	Odonata	Gomphidae	*Lanthus*	*spp*	1.6	6	
Simulium spp	Diptera	Simuliidae	*Simulium*	*spp*	4.9	22	
Dixa spp	Diptera	Dixidae	*Dixa*	*spp*	2.5	1	
Dicranota spp	Diptera	Tipulidae	*Dicranota*	*spp*	0	1	
Parametriocnemus spp	Diptera	Chironomidae	*Parametriocnemus*	*spp*	3.9	2	
Pseudorthocladius †	Diptera	Chironomidae	*Pseudorthocladius*	*spp*	0	1	TN TV

NCDOT - UT to French Broad - Reach 4

FINALID	ORDER	FAMILY	GENUS	SPECIES	TOLERANCE	COUNT	NOTES
Ameletus lineatus	Ephemeroptera	Ameletidae	*Ameletus*	*lineatus*	2.4	1	cryptosimulans
Paraleptophlebia spp	Ephemeroptera	Leptophlebiidae	*Paraleptophlebia*	*spp*	1.2	30	
Maccaffertium meririvulanum	Ephemeroptera	Heptageniidae	*Maccaffertium*	*meririvulanum*	0.5	19	
Teloganopsis deficiens	Ephemeroptera	Ephemerellidae	*Teloganopsis*	*deficiens*	2.6	5	
Habrophlebia vibrans	Ephemeroptera	Leptophlebiidae	*Habrophlebia*	*vibrans*	0.3	2	
Eurylophella funeralis	Ephemeroptera	Ephemerellidae	*Eurylophella*	*funeralis*	2.5	1	
Serratella serratoides	Ephemeroptera	Ephemerellidae	*Serratella*	*serratoides*	1.7	2	
Diploperla duplicata	Plecoptera	Perlodidae	*Diploperla*	*duplicata*	2.8	2	
Eccoptura xanthenes	Plecoptera	Perlidae	*Eccoptura*	*xanthenes*	4.7	6	
Acroneuria abnormis	Plecoptera	Perlidae	*Acroneuria*	*abnormis*	2.1	7	
Tallaperla spp	Plecoptera	Peltoperlidae	*Tallaperla*	*spp*	1.3	17	
Perlinella drymo	Plecoptera	Perlidae	*Perlinella*	*drymo*	1.3	4	
Paracapnia angulata †	Plecoptera	Capniidae	*Paracapnia*	*angulata*	0.2	23	TN TV NCBI Modified
Pycnopsyche lepida gr	Trichoptera	Limnephilidae	*Pycnopsyche*	*lepida gr*	3.9	1	
Polycentropus sensu lato spp	Trichoptera	Polycentropodidae	*Polycentropus*	*sensu lato spp*	3.1	6	
Diplectrona modesta	Trichoptera	Hydropsychidae	*Diplectrona*	*modesta*	2.3	21	
Rhyacophila carolina	Trichoptera	Rhyacophilidae	*Rhyacophila*	*carolina*	0.4	10	
Psilotreta spp	Trichoptera	Odontoceridae	*Psilotreta*	*spp*	0.5	2	frontalis
Lepidostoma spp	Trichoptera	Lepidostomatidae	*Lepidostoma*	*spp*	1	1	
Wormaldia spp	Trichoptera	Philopotamidae	*Wormaldia*	*spp*	2.4	1	
Tipula spp	Diptera	Tipulidae	*Tipula*	*spp*	7.5	9	
Elimia spp	Gastropoda	Pleuroceridae	*Elimia*	*spp*	2.7	11	
Nigronia fasciatus	Megaloptera	Corydalidae	*Nigronia*	*fasciatus*	6.1	3	
Boyeria grafiana	Odonata	Aeshnidae	*Boyeria*	*grafiana*	3.8	1	
Lanthus spp	Odonata	Gomphidae	*Lanthus*	*spp*	1.6	3	
Sialis spp	Megaloptera	Sialidae	*Sialis*	*spp*	7	1	
Stenelmis spp	Coleoptera	Elmidae	*Stenelmis*	*spp*	5.6	2	
Simulium spp	Diptera	Simuliidae	*Simulium*	*spp*	4.9	11	
Rheotanytarsus spp	Diptera	Chironomidae	*Rheotanytarsus*	*spp*	6.5	2	
Tribelos jucundum	Diptera	Chironomidae	*Tribelos*	*jucundum*	5.7	1	
Polypedilum aviceps	Diptera	Chironomidae	*Polypedilum*	*aviceps*	3.6	1	
Ablabesmyia mallochi	Diptera	Chironomidae	*Ablabesmyia*	*mallochi*	7.4	2	
Cryptochironomus spp	Diptera	Chironomidae	*Cryptochironomus*	*spp*	6.4	1	
Parametriocnemus spp	Diptera	Chironomidae	*Parametriocnemus*	*spp*	3.9	2	
Pseudorthocladius †	Diptera	Chironomidae	*Pseudorthocladius*	*spp*	0	6	TN TV